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Assumption Selection in Light of Actuarial Standard of Practice No. 27

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Summary: The Actuarial Standards Board (ASB) recently released ASOP No. 27, "Selection of Economic Assumptions for Measuring Pension Obligations." The new standard introduces four key concepts when selecting assumptions:

- *the concept of a best-estimate range,*
- *the requirement that an assumption must be selected from within its best-estimate range,*
- *the use of measurement-specific factors to adjust the range or select the specific assumption from within the range, and*
- *the concept that each specific assumption must be its own best estimate.*

Ms. Caren Levitt Bianco: Bruce and I gave this presentation at the SOA meeting in Palm Springs in May 1997, and we were asked to speak again. When I was preparing for that presentation, my mother asked me what I'd be speaking on. I said, "Actuarial assumptions." You could pretty much see her eyes glaze over. I realized at that point that the actuarial assumption selection is not on the forefront of everybody's agenda. It did prompt me to do a little search on the Internet under the topics of actuarial assumptions, and I came up with 1,500 hits. I thought maybe people are thinking about actuarial assumptions. So I scrolled down to where the hits were. The very first hit on the list was the actuarial reports for the academic employees for the University of Saskatchewan.

As I scrolled down further, I saw more police and fire and municipality actuarial reports. I did notice some law firms that had legal issues associated with actuarial

assumptions. Perhaps they are defending clients against attacks by the IRS against their actuarial assumptions or a dispute about actuarial assumptions. That is one of the major reasons why I think that actuarial assumptions are becoming more and more important in the industry.

Ms. Bianco: We'll be talking about who is affected by actuarial assumptions, the importance of these assumptions, the guidance we already have, what to do when we have a conflict, and then we'll look at specific procedures and case studies. Bruce will be covering the demographicic assumptions, and I'll be talking about economic assumptions. *ASOP No. 27* only covers economic assumptions. We just threw in the demographic as a bonus.

Let's discuss who is affected. We select assumptions to calculate funding amounts, expensing level, etc., but our choices affect many different parties. They affect plan participants because you need to have enough assets to cover the liabilities as planned. They affect the client. We don't want the client to have any surprises in gains and losses. They affect shareholders and share price fluctuations—the recent stock market volatility notwithstanding. Assumptions affect the government because the Pension Benefit Guaranty Corporation (PBGC) premiums could differ or tax deductions could be different based on different assumptions. They affect our own firms and the actuaries' reputation in the industry. We always need to remember that the Employee Retirement Income Security Act of 1974 (ERISA) requires that the enrolled actuary protect the interests of plan participants.

We talk about the importance of assumptions. If you have bad assumptions, no matter how refined and sophisticated the program is that calculates liabilities, the results are going to be bad. Various assumptions with small differences can have huge impacts on liabilities. One example might be early retirement. If you change your early retirement assumption on *Financial Accounting Standard (FAS) No. 106* liabilities, that could have a huge impact. Another example is if assets and liabilities are almost the same, and if there is a small change in the liability, the difference is going to change greatly. There is a lot of leveraging. There are increased legal challenges.

At the May Society meeting I attended a session on expert witnesses. Every single case that was discussed at that session had to do with differences in opinion on assumptions. There's also increased governmental intervention, such as in the case of current liability interest rates. If we can't be responsible for setting assumptions on our own, the government will do it for us, and they may not do it the right way. It's also important to the integrity and reputation of our industry. The majority of us take our assumption selection very seriously, but there are always those few that will not.

There's not a huge amount of guidance, and I think that's by choice. The actuary's job requires a huge amount of judgment. Not every situation can fit into a set mold. Each mold would need to be very flexible in order to fit every situation. The more rules we have the harder it is to have a mold that will fit every situation. So that's why I think that we don't have a lot of guidance, but we actually do have some guidance.

The ASB has a few promulgations. There's *ASOP No. 4*, and there's *ASOP No. 27*, which was recently issued. The Financial Accounting Standards Board (FASB) has promulgations on *FAS No. 87, 88, 106*, and *112*. ERISA has something to say also.

ASOP No. 4 covers measuring pension obligations. It gives general recommendations for economic, demographic, funding, and asset valuation method assumptions. It was issued in 1990, and very shortly after that it was determined that we needed more specific guidance. Part of it was superseded in 1996 by *ASOP No. 27*. *ASOP No. 27* only covers economic assumptions. There will be three more standards issued. One is on demographics, one is on funding, and one is on the asset valuation method. Then *ASOP No. 4* will be rewritten as an umbrella standard.

ASOP No. 4, as it pertains to assumption selection, says that actuarial assumptions individually and in the aggregate should reflect the actuary's best judgment. We shouldn't give undue weight to recent experience. For example, if bonds have increased in value, that's usually because interest rates have declined, and can we expect interest rates to continue to decline? Another example would be if a client has had a lot of terminations. Would you expect that client to continue to have that level of employee terminations, particularly if they're not replacing those employees? We should consider actual experience, future trends, and information from other sources, whether they're specific or nonclient specific. You need to look at everything.

We also need to consider if there are any plan changes that might affect our assumptions. An example of this would be one of the legal cases I've heard about in that expert testimony session. It had to do with a company that amended its plan to enhance early retirement subsidy. The actuary, when costing that, did not show the effect of the fact that more people are going to take early retirement. Instead they just cost it out using the same old retirement incidence. It's kind of obvious that if you're amending your plan to change your early retirement, you would have that increased incidence.

ASOP No. 27 provides guidance in the selection of economic assumptions. It was issued in December 1996 and became effective July 15, 1997. Under it, the

actuary should consider the following factors when selecting economic assumptions. We need to consider the purpose of our measurement. For example, is it for a plan termination or for an ongoing plan? The characteristics of the obligation should be measured. Is it an open or a closed group? What is the pattern of payments over time? Are they volatile? You might see some volatility, particularly if you have a lump-sum option or if you have smaller plans. Is the assumption material? Don't spend 200 hours defining an assumption that really doesn't make much of a difference. Look at recent and long-term economic data. When it's appropriate, we can use knowledge that occurred after the measurement date. What that means is that economic assumptions generally should reflect the actuary's best knowledge based on the measurement date. However, if we learn of something that occurs after the measurement date that's specific to our client that could affect economic assumptions, we can use that. An example would be if we knew that the client was going to be diversifying more into equities, but we also knew they weren't going to be doing it until the first quarter or after the measurement date, then we can still use that knowledge. Another example would be if we knew that the owner had died and a lump sum was going to be paid during the year. *ASOP No. 27* says that you can use that knowledge.

ASOP No. 27 also requires that each assumption be within the actuary's best-estimate range. It does not require that you actually set these ranges. You just have to be able to demonstrate that if you were to access the best-estimate range, it would be within that range. It also requires that the assumptions be consistent among each other. For example, if you're using one inflation assumption for the interest rates, you should use that same inflation assumption for salary scale.

ERISA also provides some guidance. In particular, for a single employer plan, ERISA states that the assumptions need to be either individually reasonable assumptions (in other words, explicit assumptions), or they could be implicit assumptions or assumptions that produce the same contribution as if they were individually reasonable. ERISA was written in 1974 back when the computer systems weren't what they are today. This provision was in there in order to make it easier for actuaries to do their job. You could do a sample to show that the implicit assumptions could produce the same results as explicit assumptions and then cut corners and use the implicit assumptions so it is easier to do the calculation. That's less of an issue today with systems that we have. However, there still are situations where you might be dealing with spreadsheet valuation and this might be more useful than having termination rates or early retirement rates. You can use some type of single decrement age. This provision has been used recently to reduce PBGC variable premiums. Use a low interest rate or a very conservative interest rate and then more aggressive demographic assumptions. When you calculate your

PBGC variable premium, you get a lower premium. That loophole will probably get closed and is frowned upon in general.

What other guidance do we have? We have a lot of guidance on *FAS No. 87, 88, 106*, and *112*. There are Actuarial Standards of Practice, and there's also Actuarial Compliance Guidelines. It's funny to think that I usually have less trouble determining my economic assumptions for FASB purposes, and yet there's all this guidance. The FASB itself gives a lot more guidance. I don't see as much on the funding side. We really aren't going to be talking about the FASB; we'll keep it to core credit material.

What happens when there's a conflict? Your client wants you to use one assumption and you want to use another, or you can't justify the assumption that the client wants to use. I think this really gets interesting. I had one client conflict in the last few years where it was a company that was predominantly invested in bonds (70%/30%) and wanted to use a 10% return on asset assumptions. It also paid expenses from the trust. When you have that situation you must determine how your client is justifying the assumption? In this case, the client said,"Look at our returns over the last few years." The returns have been very high, but mainly because interest rates have declined over that period. That argument really didn't hold water in my court. It was very difficult to describe it to the client to get him to understand that that really wasn't a good argument.

Their second argument was that they were going to be moving much more into equities across the next year, and in a year they'd be maybe 60% in equities and only 40% in bonds. Based on *ASOP No. 27,* we were able to use that argument to help justify the 10% return. The third argument was that their investment managers outperform the market. I will get into that later, but that's not an acceptable argument.

The second thing you want to do when you have a conflict is to see how far out of the range of reasonableness the assumption is. In the case of my example, based on the new asset mix and the best-estimate range, we were able to justify a 9.6% return asset assumption. We were not too far off the 10% but when there's $300 million in assets, it's not too close either. You can also look at the materiality. How much is it really worth? What is that 40 basis points on $300 million? Is that material to a large company? It may not be.

If you still have a conflict, you'd want to check with the peers within your own firm, or pick up the phone and call another colleague. See what they think. Would they be as alarmed about the difference in assumptions as you are? You'd also want to check your firm's formal policy on conflict resolution. Most firms do have that.

My company does have a written document that explains what to do if there is a conflict. It pretty much matches what we have here.

The next step would be to check with your firm's senior actuary or the senior actuary in your office and run it by that person if you haven't done that already. If there's still a conflict, my company would reassign the case to someone else within the firm that maybe didn't have a conflict with the assumption. That's there in writing. Assuming that's not the case, and that there is nobody else in the firm that wouldn't have a problem with it, then we would resign from the case. When I had my presentation reviewed internally, one of my colleagues came up to me and said, "Is that a joke on the conflict page. We would never resign from a paying client's case, would we?" I said, "There it is in writing, and I'm sure it doesn't happen very often." Generally, we can reach a resolution.

What are the specific pension assumptions? We have a number of economic and demographic assumptions. Economic assumptions like inflation, investment return, discount rate, and salary scale are the ones that we mostly see. Other economic assumptions include wage base, cost-of-living assumptions, account growth and account conversion. Demographic assumptions include mortality, turnover retirement, disability and recovery, spouse demographics, optional benefit forms, and new entrants.

ASOP No. 27 goes into some specific procedures. It talks at length about the building block method where each economic assumption has one or more components to it. There's inflation and then a real rate of return on assets. The salary scale has inflation, general productivity, and merit and promotion components.

The inflation component is the building block or the base of all the other components. It is in almost every economic assumption. To calculate inflation, *ASOP No. 27* says we can use as a basis, the consumer price indexes in the past, the implicit price deflator, the inflation forecast, or yields on government securities. Then we can back out the real return on those securities. *ASOP No. 27* also permits the use of select-and-ultimate inflation rates. The *ASOP No.* does not give a whole lot of guidance on how many years you should look back toward. Do you go back 10 years or 60 years? We leave that all up to actuarial judgment. An example of how we would develop the interest rate under the building block approach is pretty straightforward. You take inflation, and then you break up your assets into various asset classes. They can be very specific or they could be more broad. For each asset class, you calculate a real rate of return. It doesn't give a lot of guidance on how you calculate the real rates of return. When I had the conflict with my client, they wanted to look at a real rate of return over the last ten years or seven years,

which is the whole bull market, and that clearly would be unacceptable. When you're doing a weighted average, you would take the percentage of assets in each class and multiply it by risk premium. Then either add that or multiply it by inflation to get your total return.

Another method that's sanctioned in the *ASOP No. 27* is the cash-flow matching method. Under this method you would construct a bond portfolio that has maturities that match each of the benefit payments. Then you would adjust that. You would adjust it for inflation because current inflation may not be the same as what we're assuming future inflation would be. You would also adjust it for various mismatches. You'll have mismatches because there are uncertainties on what the projected benefit payoff stream is going to be. There will be reinvestment of dividends and maturities. There will be called securities and there will be called future contributions. Those all serve to lower the cash-flow matching method rate. The cash-flow matching method is probably quite a bit more work than just using the weighted-average building-block approach. I'm not sure how much it would actually buy once you make all your adjustments or the risk adjustments.

There are also other considerations in selecting your interest rate. One consideration is the purpose of the measurement. For example, is the plan terminating or is it an ongoing plan? What's the company's investment policy now and possibly a year from now? Is it going to change? What is reinvestment risk when contributions are going to be made? You would also want to consider investment volatility. Companies that invest very heavily in equities, and perhaps companies that have lump sum options, but invest in highly variable risky investments might find that during a business downturn, when investments are low, they may be laying off employees. If they are all taking lump sums, that may be a drain on the assets and assets might need to be sold off at a loss. So it's perfectly acceptable to adjust your interest rate downward for that.

Investment manager performance is another consideration. *ASOP No. 27* is very specific about this. You're not permitted to assume that a particular investment manager will outperform the market. However, *ASOP No. 27* goes on to say that net of investment fees that these investment managers charge you can assume that an investment manager will underperform the market. So in my client's example, you can point to the investment manager, and you can lower the assumption 20 basis points. We really didn't do that.

We also need to consider investment expenses. Are they an explicit assumption, or is that something that should be included as a deduction off of your interest rate? Also administrative expenses are another consideration. If there's no specific assumption for that, you may want to have an adjustment on your interest

assumption for that. It would seem that the two are unrelated. You may just want to have a separate assumption for administration expenses if those payments are being made out of trust assets. You also want to look at cash-flow timing. How would our benefit payments and contributions affect the liquidity needs of the trust? This is particularly true if you have large lump sums that you might be projecting to come out in the near future. You also want to consider the tax status of the trust. If it's a nonqualified trust, then the investment earnings are going to be subject to taxation. Either we should use an after-tax interest rate or have a specific tax assumption.

Let's discuss salary increases. You look at inflation, and then the various components of it, like productivity, merit, and promotion. You would look at the historical wages and anticipated productivity of the company. You could also break up the salaries by age and service and see how those increased from year to year. You'd want to look at historical national wage and productivity increases in order to determine the productivity portion of salary increases. Social security has an assumption of general productivity of 0.5–1.5% per year. Productivity is, in general, the standard of living increase across periods of time. I like to think of it in terms of toys. My father-in-law is very fond of reminding us of how he had one truck when he was growing up in the depression. That was his only toy. All the kids got together with their trucks and that's how they played. When I was growing up, I had a toy chest and a closet with some toys, but not a huge amount. Children today have even more, and we would probably be arrested for child abuse if our children had only one truck. It seems like everything is taking over. However, when I asked my 7 year-old just how many beanie babies are enough, she answered that she wanted to have them all. Therefore, while we the standard of living has increased substantially in this century, there is room for even more growth.

The standard of living is increasing. However, many people feel that our children may not live at the same standard as we do.

I also want to look at competitive forces. What kind of industry is your client in? Are they in an industry that's really tight for employees or is there a surplus? What is the competition giving for salary increases? There's also collective bargaining. Are the employees collectively bargained? That may affect what kind of salary increase assumption you might assume.

You also want to look at compensation volatility. How volatile are different components of the compensation package? Base pay probably is not as volatile as bonuses and overtime. You may even want to consider using an average bonus or overtime assumption.

You also want to look at where the current packages can be sustained. One of my clients insisted that we use –0.5% productivity for them. If you project that out 30 years, nobody would want to work for this client, and not many people want to work for them now. As a reality check, project out 10, 20, 30 years and see how reasonable the assumption selection is; it could be very useful. In particular if you select-an-ultimate assumption. If the client is having a particular problem right now in its business, and is not giving salary increases, that doesn't mean that they're never going to give another salary increase, although they may feel that might be the case. You might want to have some type of select-and-ultimate assumption open, where for the next five years they may have a –0.5% productivity, but after that it's going to come back to normal.

You can also have a separate scales for different employee groups, or different pieces of the compensation package. For example, if your company is moving more toward the bonus structure, you may see lower base pay increases but higher bonus increases. You should also have different increase assumptions for age or service. Clients have sometimes said, "If you have an aged-based scale, isn't that discriminatory? Isn't that age discrimination?" I actually prefer to use an age-based scale. When somebody is young, that's when they're going to get the biggest salary increases. As they get older, the salary increases are usually toned down because they've plateaued with the level of their experience. They're not growing quite as rapidly, and are not gaining as much experience. You can do the service as a proxy for that as well, but with people switching jobs mid-career and moving laterally to similar jobs, you may be overestimating their salary increases. For example, somebody with 10 years of service may get the same amount of salary increases as somebody else who has ten years of experience, but may have just come over to the organization. That person that switched jobs mid-career is more likely to get a salary increase that is similar to someone their same age as opposed to someone with the same amount of service. If we were able to track work experience in our valuation data, that would probably be the proxy for salary increases.

Since we don't track experience, the next best thing is age. I bet there are some people here that remember when some clients had different salary increase assumptions by sex. That's probably justifiable from a statistical analysis. Women may not hold the same positions as men and might not get the same increases. It has been a long time since I've seen that. I guess that would be politically incorrect. To calculate salary increases, you could use the same approach that we use for calculating interest rates. We used the building block method where you take into consideration inflation, productivity, and merit. You can also use static pay distribution where you look at a particular scatter of employees, compare different cells, and do a ratio; for example you could compare the 29-year-old average pay against the 30-year-old average pay or the ten years of service against the 11 years

of service and do a ratio. Any time you do a static pay distribution, you need to have a very, very large group because you can get some strange results on the edges of that distribution. If you do have a large enough group, and you do have a compelling reason to use this method, you may want to do some type of extrapolation on the edges where you have a credible group. Otherwise you can see some really strange results. I've seen some 60-year-olds with 15% increases, just because there happen to be some executives at the outer edges that had large salaries that really brought up the averages.

When you're choosing your other assumptions, you can use a similar or the same methodology that's discussed in *ASOP No. 27*. The assumptions should be consistent with one another. Your inflation, in particular, should be consistent between assumptions. *ASOP No. 27* does not cover any assumptions that we're told we have to use, such as the current liability interest rate, or the PBGC variable premium rate. You have to use them so don't apply any of this to it.

I'd like to conclude with a quote from Mark Twain. "History doesn't repeat itself but it rhymes." When we set assumptions, we should always look at the past, but use it with judgment. One thing we can be sure of is that the future is not going to be exactly like the past. But can we learn from the past? Absolutely.

Mr. Cadenhead: The reason why we're including demographic assumptions in this talk is even though *ASOP No. 27* is titled "Selection of Economic Assumptions," it doesn't specifically deal with demographic assumptions. There's still a lot that it can tell us about the selection of demographic assumptions. This particular talk is entitled "Assumption Selection" in light of *ASOP No. 27*, not specifically economic assumption selection. Many of the principals are the same. Each assumption should be reasonable on an individual basis. We know that when the ASB came out with their standards for demographic assumptions, they would follow the same principals. Given that we know that, you could argue that we do have somewhat of a standard already in place. It is something to guide us in the selection of demographic assumptions. It may not have the same force as it does with respect to economic assumptions, and it may not be officially effective yet, but it is something that we can use.

The most interesting of all assumptions is mortality. Let's talk a little bit about the different considerations in selecting mortality assumption, and look at the effect of some of the newer tables compared to the 1983 Group Annuity Mortality Table (GAM). First, what are the different considerations? There is the purpose of the calculation, the type of plan population, how to reflect mortality improvement, and the fact that mortality has improved substantially over the years. The purpose of the calculation means different things in different situations. First of all, for current

liability, we must choose GAM 83; we don't have any other choice than that. For purposes of current liability, that's our assumption. Other areas where we do have choices or where our choice will influence our selection of assumptions would be pricing life insurance versus an annuity. I'm not an insurance company actuary. I wouldn't price an insurance product for a living, but I do have opportunity from time to time to estimate for a client the cost of a plan termination. What's the cost of securing a nonqualified pension benefit? Are they for the purpose of an annuity or investing in life insurance contracts? It's important to come up with a mortality assumption underlying that. It's important to realize in this case that high mortality is different from what's conservative for annuity purposes, which is lower mortality. If you purchase an annuity for an entire pension plan, or for a portion of your pension plan, the insurance company is going to assume that you probably have a mix of some healthy and some not-so-healthy participants, and it will price accordingly using the group annuity tables. However, if you go to purchase an individual annuity contract, perhaps securing a nonqualified benefit, the insurance company will assume that because you're going to purchase an annuity, you're more likely to be healthier than average and you will use an individual table, which is likely to have a lower mortality rate and be more costly.

The same concept applies to a plan termination versus an ongoing plan. We are talking about the same group of people, but on the plan termination side, the insurance company has one shot to get it right and to build in its profit. The company is going to make sure that they take account of any future mortality improvements and build in a little conservatism. If you're in the situation of an ongoing plan, and you're a little bit off on the mortality assumption, you have some time to make it up in the future. You can afford to be more to the middle rather than the conservative end of your best-estimate range if you have a range of mortality assumptions. If you have a plan termination situation, and you offer participants the option of taking a lump sum, then you run the risk of having some antiselection. In particular, the less healthy participants are much more likely to take the lump sum. Many people take the lump sum anyway, but the ones left over taking the annuity are likely to be healthier than average for your group and the insurance company may cost that accordingly.

Other important factors are the type of population, different mortality experience by industry, and hourly employees versus salaried employees. Hourly employees tend to have higher mortality than salaried employees do. With the recent rule changes to calculation of current liability and the fact that we have a standard table, it kind of gives the impression that there is one right mortality table that's good for everybody, which of course is really not the case. Even though we're required to use GAM 83 for current liability purposes and maybe plan populations for which

it's very reasonable to use a table with higher mortality rates, there are probably populations for which GAM 83 is not conservative enough.

There are other cases where type of population matters. Obviously healthy participants will have much lower mortality than disabled participants. That's something important to take account of. To which extent should we reflect mortality improvement? Mortality has continued to improve over time, particularly in the last century. Every few years or so we seem to have a new table issued.

There are two problems associated with going to a client and saying it's time for a new mortality table. One is because mortality is improving and it generally makes liabilities go up and it's not something that clients are often thrilled about seeing. Second, you can't point to actual experience and say look, we've had a lot of mortality losses; therefore it's time to change your mortality assumption. The reason that you can't do that is because GAM 83 closely matches what we're actually seeing in terms of experience today. Does that mean it's the right assumption? Much of our cost does not depend on mortality experience over the next couple of years, but mortality well out into the future. Today's 40-year-old or 50-year-old contributes a lot to liability and it matters how they're going to die in another 30 or 40 years, especially in terms of calculating the liability. So if GAM 83 is matching today's experience, that means that it's already outdated. It's predicting mortality that's too high for people who aren't expected to die for many years into the future.

How can we address that problem? One way is to keep using the newer tables as they come out. Another way would be to apply a projection scale from existing tables, projected out to a future year. Both of those are kind of rough justice approaches in that each one produces a static table; therefore, you may have mortality that's a little bit too low for today's 80-year-old and a little bit too high for an 80-year-old 40 years down the road. You're kind of hoping that it balances out and that you get the right answer. A way to avoid this problem is to use a generational table. Mortality for today's 80-year-old will be different from mortality for an 80-year-old 40 years in the future. That future mortality rate could be projected using the projection scale to generate a lower mortality table. In effect, you have a separate static table for each age cohort. It is a little more complicated to do the calculations that way, but with improvements in technology, that shouldn't be as much of an issue. It is not nearly as much of an issue as it used to be.

From the Floor: What do you do if you're using entry-age normal, and you want to use a generational table? Are people doing that?

Mr. Cadenhead: It will still work with the entry-age normal method. I think using entry-age normal is no reason not to use a generational table. For any individual participant, you have a single mortality table to apply. For different participants you have different tables. But if you're looking at the calculation for an individual person with the one table, the calculations all still work.

Let's look at an example comparing the effect of some of the newer mortality tables to GAM 83 (Table 1). We see in the two left-hand columns, the two static tables that are the Uninsured Pensioner (UP) 94 table and the GAM 94 with the load to the mortality rate. The first line shows a population that's 50% male and 50% female measured in terms of liability. For this first group, the UP 94 table doesn't produce much of a liability increase at all (0.4%). This is just a sample population; obviously the results will depend on the actual age distribution and distribution of participants by sex. This is reasonably representative. Under the UP 94 table, liabilities for female participants actually go down a little bit, and they increase somewhat for male participants. It increases a little bit more for the GAM 94 table because you have loads to the mortality rate. The second line shows a more typical situation where you have a population that's weighted by liabilities more for males than females. I think there are two reasons. First, your liability is tied up in retirees, retirees reflect not only today's workforce but workforces in previous years which for the populations covered by pension plans tend to be more heavily male than female.

TABLE 1
EFFECT OF MORTALITY CHANGES

	UP 94	GA94	UP94 Generational	GAR94	UP94 Generational	GAR94
	Any Time		In 1997		In 2002	
50% Female	0.4%	1.7%	3.4%	4.7%	4.3%	5.5%
20% Female	1.3%	2.8%	5.1%	6.5%	6.2%	7.5%

But even looking at today's population, even if a workforce is split 50/50, the participants that contribute most heavily through liabilities (older, higher paid participants) still tend to be more heavily male than female.

I'm going to focus on the bottom line going across as a more typical result that you can see from switching from GAM 83 to one of these other tables. The middle column shows the effect of going to a generational table—the generational version of UP 94 or the Group Annuity Reserving (GAR) 94, which is the generational version of the GAM 94 table. We see a bigger increase in liabilities. It is about 5% for the UP 94 and 6.5% for GAR 94, but that's if we make the switch in 1997. If

instead we wait five more years for mortality to improve, or for five more years of projected improvement, and then make the switch in the year 2002, you'll find that the increase has gotten a bit bigger—it's 6.2% and 7.5%. So the sooner you make the change the less of a jolt it will be. The nice thing about going to a generational table is that once you make the change, you're essentially done. That's not to say that there will never be another mortality table, but even if a new table comes out, it's not likely to cause a big jump in liabilities; in fact, it may even cause liabilities to go down. So it's going to be easier to keep current. You don't have to go back to clients saying it's time for a new table because your costs are going to go up.

From the Floor: What is the improvement built into the generational table?

Mr. Cadenhead: It varies by age, based on projection scale AA. It varies by sex as well. Now I'd like to move to the topic of turnover. Most standard turnover tables tend to be aged based. Service has an important impact on turnover, and I'll share with you one actual experience I had with a client that had a defined-contribution, profit-sharing plan with six contribution schedules that varied depending on when the employee was hired. Longer service participants were getting the higher contribution rate. Our assignment in this case was to project what future costs would be under the plan. We were projecting future forfeitures for nonvested participants and future contributions for ongoing participants.

We actually did a turnover study before we did this assignment because turnover was a very significant piece of this study. What we found for this client was that before age 60, age had very little effect on turnover, but service had a huge effect. Now if we ignored the effect of service, we might have gotten a slight age effect because the older participants also tended to be the longer service participants. By adjusting for service, there was really no effect left over for age. If we had ignored that and just used an age-based table, we would have greatly underestimated cost because we would have assumed turnover that was too high among the longer service participants getting the higher contribution rates and turnover that was too low among the participants getting the lower contribution rates.

The typical way to deal with the effected service is to use select-versus-ultimate assumptions. You might use a select assumption that might be an additional rate of turnover added on to your ultimate turnover rate or multiplied by or replacing your ultimate rate entirely for a period of a few years. I have a table that shows the effect of that, but let's first discuss a couple of other considerations. From time to time, I'm going to talk about comparing pension valuation to retiree medical valuation because many pension actuaries get involved in that type of work. It's illustrative to kind of weigh the relative impact of the different types of assumptions. Turnover is important for pension valuation. There is a difference between benefits that

depends on whether you stay through retirement or if you leave prior to retirement. However, the difference is not as significant as it is on the retiree medical side. In a typical retiree medical plan, if you leave prior to retirement eligibility, you get nothing. If you stay to retirement, you get a fairly generous benefit. So the turnover assumption will have a much bigger impact, and changes in that assumption will have a bigger impact on cost changes.

How do you test the reasonableness of the turnover assumptions? I'll throw out a couple of ways. The standard approach is to look at past experience by grouping cells of participants by age and appropriate service and seeing how many of those participants actually left. It's a fairly data-intensive approach, but that gives you a good idea of whether or not the turnover table that you're using is a reasonable table.

Another approach that you might use, which is a kind of simplified approach, is to look at your age/service data that is on the Schedule B. We will take each of those cells and project it forward five years, with turnover and with other decrements as appropriate. The resulting age/service scatter is going to be missing the column for people with less than five years of service, but it should look like what you're projecting the age/service distribution to be five years down the road. If that's substantially different from the distribution that you have today, it doesn't mean that your turnover assumption is unreasonable, but you should ask yourself whether that is what you really intend to project. Or should you take a look at your turnover assumption?

The example in Table 2 is for a sample plan population. It is a final pay plan, 1.5% of pay times years of service, based on actual client data but scaled to obscure the results. This baseline case has an ultimate age base turnover rate. There is no select turnover. In this case, the accrued liabilities are about $143,000, and the normal cost is about $8,000. The expected turnover is distributed to about 130 participants, which is about 6% of the population. Let's say that we notice that turnover among the shorter service participants is high, and we want to reflect that. What happens if we add a select turnover assumption? Ten percent for the first year grading down to 1% in year ten. In this case, accrued liability goes down very slightly. Normal cost has a little bit more substantial decrease in terms of percentage, but it is still not a very big decrease. The number of participants expected to leave goes way up. Those tend to be the shorter service participants who weren't contributing as much, and the younger participants who weren't contributing as much to liabilities and to normal cost to begin with.

TABLE 2
SELECT VS. ULTIMATE TURNOVER

	Accrued Liability	Normal Cost	Expected Turnover	Turnover as % of Population
Baseline	142,618	7,920	132	5.76%
With Select Turnover	141,984	7,653	196	8.53%
50% of Ultimate Turnover with Select Turnover	149,534	8,306	130	5.65%

You might ask, what's the big deal then? Is this an example of an assumption that's not really significant that we can afford to ignore? Perhaps, but it pays to take one further look at this situation. It might tell you something about how you're applying your current turnover assumption. Let's say we had 130 people leaving in an average year, and we think that maybe our baseline assumption is a good assumption. We should ask ourselves whether that really is the right 130 people? The third line in Table 2 shows what would happen if we took our ultimate turnover rate and cut it in half and add that same select table to it. In this case, we wind up with the same amount of people leaving, 130, but the effect on liabilities is pretty substantial. We have a big increase in our accrued liability and a bit of an increase in our normal cost. So I'd say the comparison is not between line one and line two, but between line one and line three in assessing whether or not your assumption is reasonable.

Retirement. The big issue is whether we should use a single retirement age or retirement rates? There might be some populations for which a single retirement age is appropriate: perhaps for the small plan population for which there is not a lot of experience, or a plan that doesn't provide early retirement benefits, in which case everybody has to retire at normal retirement age or later. For most larger plans that offer early retirement benefits, it probably makes sense to use retirement rates. We'll take a look at some examples of the effect on some of the liability measures to try to make that point.

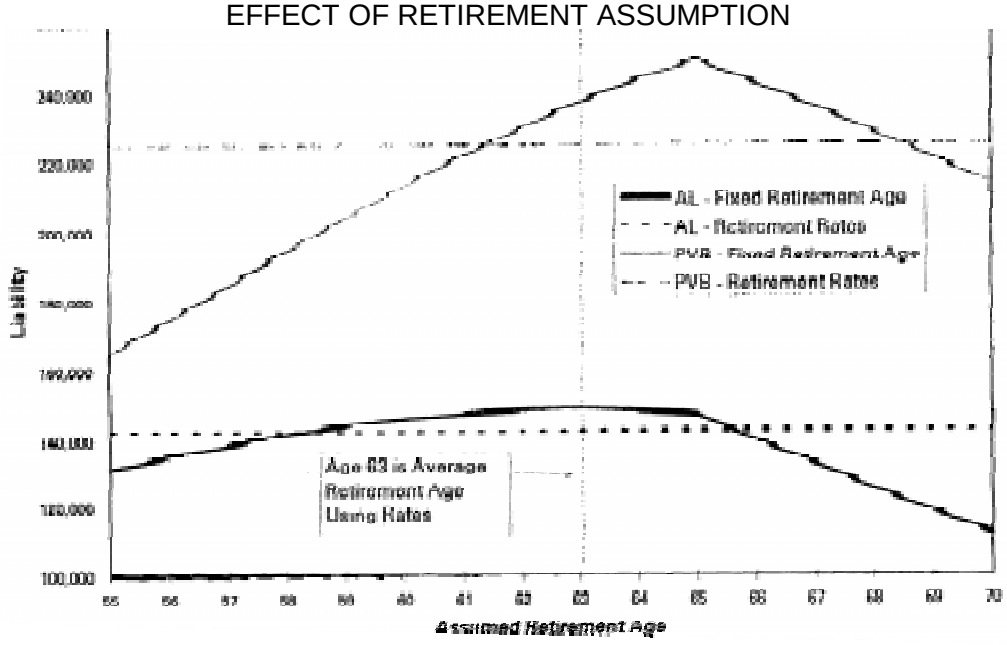
Again, we are comparing the effects on pension versus retiree medical. Retirement assumption is important for pensions, but even more so for retiree medical. For many plans, benefits payable to people who are not yet 65, or not yet near the Medicare eligibility age, are much more costly to the employer than post-65 benefits. Your retirement assumption will be very important in determining how many of those costly pre-Medicare years you have. Cash flow from retiring active participants is an important consideration. So if you have a plan that pays lump sums, or a plan that doesn't have many retirees but has a number of people

becoming eligible for retirement, you need to help the plan sponsor assess their liquidity needs. Cash flow is very sensitive to the retirement age assumption.

Chart 1 reflects the same sample plan that we looked at in the last example. It compares two liability measures: projected unit credit accrued liability and projected benefit obligation (PBO). Those are the bottom two lines. The present value of benefits is on the top two lines. The dash line shows the accrued liability for this plan population assuming a set of retirement rates. You see the same $142,000 or so that we saw in the prior example. The solid line shows the liability that we would get if we used each of the 16 possible different single retirement age assumptions from age 55 to age 70. One of the interesting things that we see here is that the accrued liability is not very sensitive in this case to our retirement age assumption. It is a little bit sensitive, but not much.

What's going on there is we have a final pay plan. The longer the person stays, the higher their benefit is going to be. On the other hand, we have somewhat of an early retirement subsidy. In this case, the early retirement reductions are 5% per year from age 65, so that the early retirement subsidy is partially canceling out the fact that you're losing those future projected salary increases resulting in accrued liability that's not very different until you get to age 65 when the increase in early retirement benefits shuts off and then past 65 the retirement age has a bigger effect.

CHART 1
EFFECT OF RETIREMENT ASSUMPTION



The present value of benefits is something that's going to be a lot more effective. What you've got going on there is not only the effective salary increases, but the effective increases in service that heavily outweigh the early retirement subsidy. Another thing that I meant to add to this chart but I didn't have time to do it was the effect on the accumulated benefit obligation (ABO) or the current liability. That's also something that comes into play, and it is very important in pension funding. We're going to see the opposite kind of effect because in current liability you don't reflect future salary increases and you don't reflect future service, but you do reflect the early retirement subsidy. So the earlier the retirement age, the higher the liability, and it grades down.

The point of this chart is that there is no single retirement age that's going to give you the right answer. It might give you close to the right answer for your accrued liability, but then some of your other liability measures could be off. So it pays to use retirement rates where that's really an appropriate assumption.

Chart 2 shows the effect on cash flow. This is a population with no retirees, so the only cash flow is coming from actives retiring. That kind of exaggerates it a little bit. The earlier the retirement age the much bigger the cash flow is because you already have a bunch of people who are over that age. If you assume they all retire right away, you're going to have a big cash flow hit. A single retirement age is going to have that kind of problem in that it assumes that everybody who is past that age is going to go out right away and start collecting a benefit. That's probably not what you really expect since some people have already passed that age and they haven't retired.

Chart 3 shows an individual participant who is currently age 50, with 20 years of service, and pay of $50,000. It would be the same plan. Based on the different possible retirement ages, we see the same pattern for PBO and PVB.

CHART 2
EFFECT OF RETIREMENT ASSUMPTION ON CASH FLOW

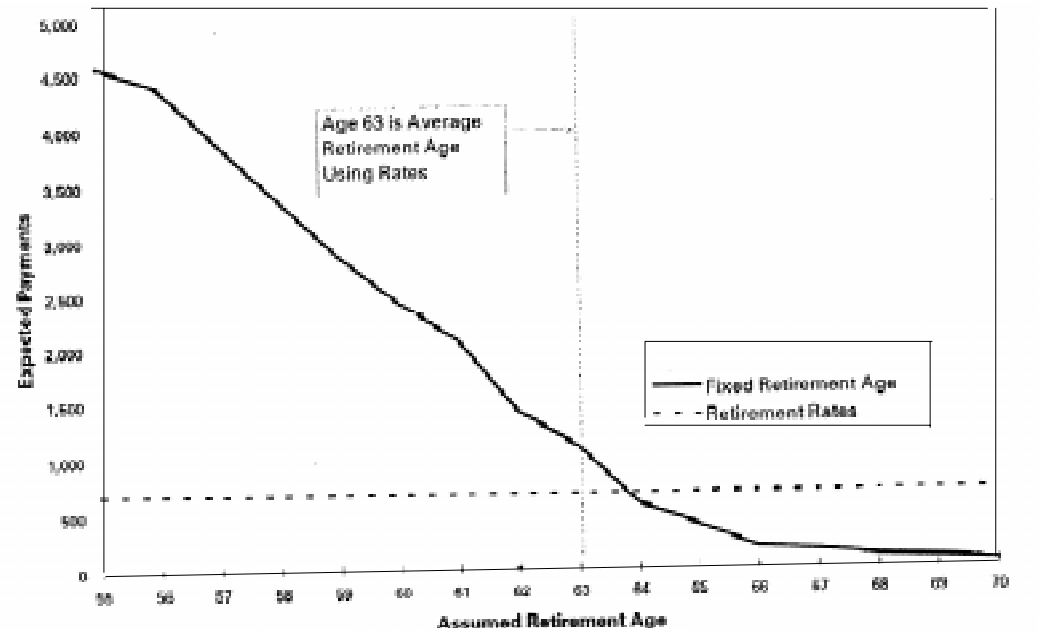


CHART 3
LIABILITY BY RETIREMENT AGE–AGE 50

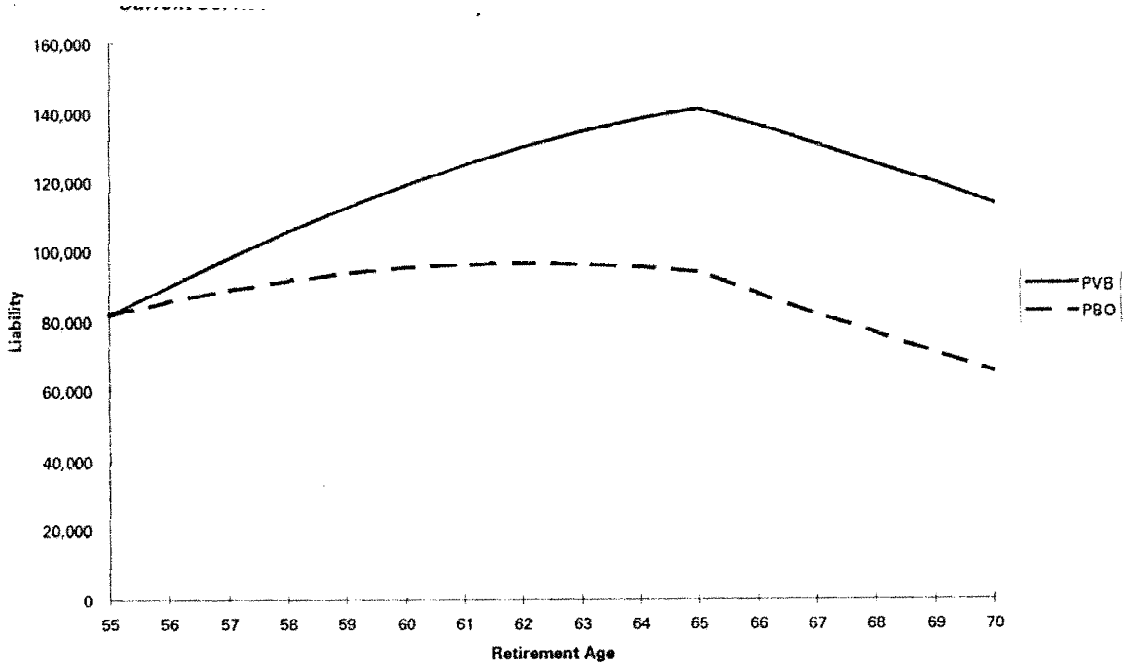


Chart 4 introduces a little bit of a wrinkle. Let's add an unreduced benefit at rule of 85 for this participant. In this case, the liability is going to jump way up when the early retirement factor shuts off. If you have that kind of a provision in your plan, that's something you may want to make your retirement assumption sensitive to. Otherwise you run the risk of missing out on that big jump in liabilities.

CHART 4
LIABILITY BY RETIREMENT AGE-UNREDUCED BENEFIT

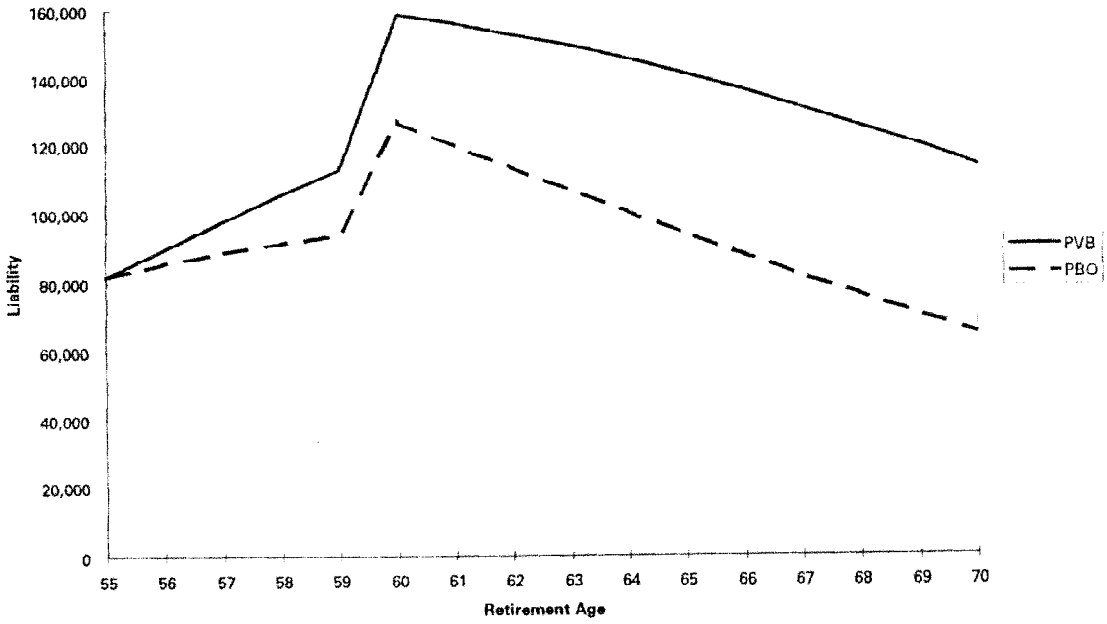
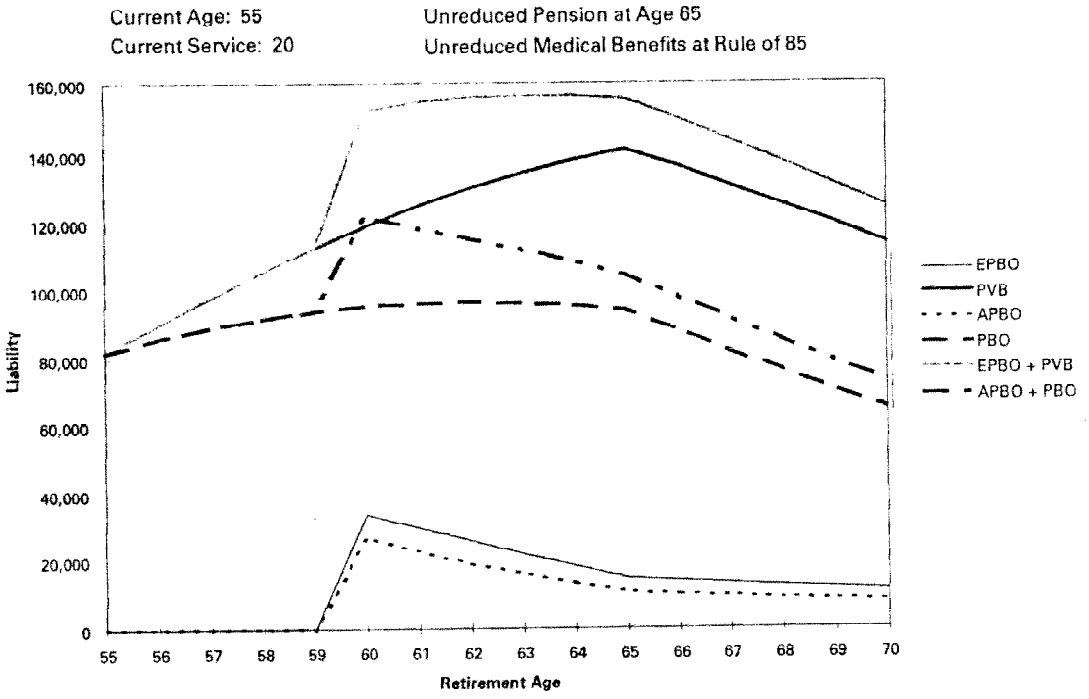


Chart 5 is very busy and goes back to the original pension plan. It is a retiree medical plan that kicks in at rule of 85. The point of this chart is to show that factors external to the pension plan may also have a strong influence on behavior. The bottom two lines are the accumulated postretirement benefit obligation (APBO) and the expected postretirement benefit obligation (EPBO), or present value of benefits for retiree medical. We see the jump up when the person first becomes eligible at age 60 and then grades down over time, and it is less rapid after age 65. The dash line and the solid line on top are the sum of the two or the liability for total postretirement benefits. That's the kind of thing that will influence behavior. It's not just what you're getting out of a pension plan, but it's what you're getting from all your plans. It also reflects what you're losing by leaving work. Anyway, the point here is if you were to look at the pension plan provisions, you might miss this factor. Even if you were to look at actual experience, like retirement by age, you might miss the fact that rule of 85 is significant because it doesn't have any significance for the pension plan, but it does for the retiree medical plan.

CHART 5
EXTERNAL PENSION PLAN FACTORS



I'll go a little bit more quickly now through the remaining assumptions. Disability has two key assumptions: incidence and mortality. Incidence is going to depend heavily on the type of industry that you're covering and whether there are a lot of disabilities on the job. It will also depend on your definition of disability. The stricter the definition, the fewer people there are that will meet that definition and the lower the incidence. Mortality for disabled participants is going to vary. Conversely, the stricter your definition of disability, the more disabled the people will be who meet that definition; therefore, your rate of mortality for disabled participants will be higher.

There is the issue of materiality here. Again, this assumption will have a significant impact on liability. For some plans it may not, particularly for plans that don't provide a disability benefit, or that only provide continuing accrual at current salary levels. By ignoring disability you may slightly underestimate or overestimate, depending on how you compensate for that, but it's not likely to have as big an impact as the situation where you have a very generous disability benefit like an immediate unreduced benefit. That's a situation where you really should have a disability assumption and you are probably going to make a big impact on your liabilities.

On the issue of pension versus retiree medical, sometimes a disability benefit is picked up in the retiree medical plan and falls under *FAS No. 106*. In those cases, the disability assumption is going to be very significant because disabled participants not only start receiving the benefits younger, but they also tend to receive higher benefits and need more care.

Spouse demographics is not something that we spend much time thinking about when doing a typical pension valuation because it tends not to have much of an effect. We need to know what percentage are married, and what the age difference is. It has an effect on cost in your preretirement death benefit, and if you have a subsidized joint survivor benefit, then it becomes a little bit more important. Again, it's another assumption on the retiree medical side, that can be much more significant. Many plans provide full benefits to spouses of retirees, so we need to know how many spouses we're expecting to have. Also, the age of the spouse is going to be important because again, those pre-65 years are a lot more expensive than the post-65 years. Even if we we're assuming all of our participants retire at 65, and therefore we miss out on those expensive years, we still may have some spouses coming in at those more expensive pre-65 years, and that's going to be very sensitive to our age difference assumption.

New entrants cannot be reflected in the pension valuation, but there are appropriate uses for this assumption, particularly if we're projecting future valuation results for a client, or if we're doing an asset/liability modeling study, or just looking at the effects of change in legislation like we did back when the Retirement Protection Act (RPA) was passed. In this case, the typical thing to do might be to pick a plan population size or target size, and fill in new entrants each year to meet that target population size. If you're just projecting out a year or two, you might just throw in a single cell of new entrants that all look the same age with the same service. If you're going to project it out more than just a few years, and your projections show all the new entrants at the same age or with the same amount of service and the same pay, it is going to give you a very skewed population down the road, and you'll get some unreasonable results. So if you're really going to use those far off results, then you probably want to get a little more refined and maybe look at your current distribution of new entrants by age, service, salary, and spread out your new entrants each year.

Let's discuss the form of payment assumption. There are two situations where that can be significant. The first situation is if you have a subsidized benefit, like a free joint-and- survivor benefit. You can reflect that rather than just assume everyone takes the life annuity. If you have a situation where 415 limits are important, that's becoming increasingly rare for larger plans, but it is still an issue. In that case the 415 limit, because it's the same limit that applies to a life annuity or joint survivor,

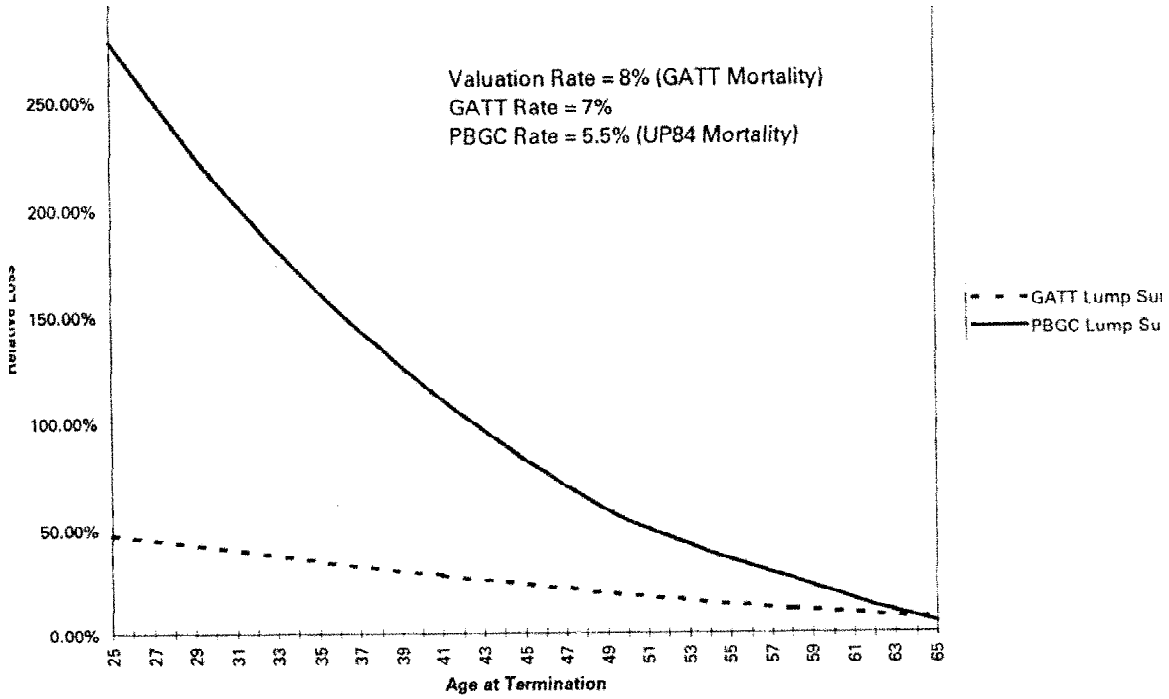
in effect can create a free joint-and-survivor benefit. That is not going to be particularly significant if you're valuing a nonqualified plan that picks up the excess. In addition, you can have a plan that pays a lump sum. The number of people who take lump sums will be very important because, in general, your lump-sum basis is going to be more conservative than your ongoing investment return assumption. Even if you're using General Agreement for Tariffs and Trade (GATT) rates, your assumption for long-term, 30-year Treasury yields will probably be something less than what you assume your assets will return if your assets are invested in a mix of equities and fixed income.

Chart 6 shows the loss upon termination at each different termination age from age 25 to age 65. It shows what happens if you ignore a plan's lump-sum provision and just assume that everybody takes a life annuity deferred to age 65. Here we're using our regular valuation interest rate of 8% and GATT mortality. I wouldn't actually use unisex mortality, but this is just for simplicity. The bottom line shows the loss if your plan actually pays out GATT rates based on a 7% interest rate. In the earlier ages, the loss is as much as 50% of the value of the benefits, grading down to 8% or 9% at age 65.

I'm comparing the lump-sum payment to what our assumptions would say the liability should be for someone who's terminating. What is the present value of accrued benefits at 8% versus the present value of accrued benefits at 7% or versus PBGC deferred and immediate rates with an immediate rate of 5.5%? For the PBGC assumption, we see that at those deferred rates, the loss is a lot more substantial.

Now our higher liability participants tend to be 45 and older. There's still quite a bit of a loss even at that end. Now somebody might argue, "What if the plan pays PBGC rates? I know the client has to adopt GATT assumptions sometime soon, so why should we reflect this cost in our valuation when we know that's not really going to be the cost?" I had two responses to that. Number one, you should be valuing only what the plan actually says now. If your plan says it pays out at a PBGC rate, that's what you should be valuing. Number two, there is no guarantee, until an amendment is actually adopted, that the client will adopt the GATT rate. Sure they have to adopt that as a minimum, but in many cases, clients don't want the negative PR from cutting way back on the lump-sum benefits, if that's something the participants perceive as valuable. Therefore we're grandfathering a more generous basis. Until the plan amendment is actually in effect, you can't assume that the plan is actually going to be less generous in the future than it is right now. That covers the specific demochartic assumptions.

CHART 6
LOSS UPON TERMINATION IF LUMP SUMS
ARE NOT REFLECTED IN THE VALUATION



Let's now talk about the effect of different choices of assumptions in different situations. I'm going to look at interest rate sensitivity, the effect of the choice of assumptions on cost-of-plan changes, the effect on cash flow, and the timing of assumption changes.

First, there is interest rate sensitivity or sensitivity of liabilities to changes in interest rates or duration. We measure of the length of the liability, like a weighted average payment date. The longer the liability, the further off the payment, and the more sensitive it will be to interest rate changes. For an older, more mature population, liabilities aren't going to swing as much when interest rates change as they will for a younger population. It also depends a lot on the type of the plan. If you have a plan that pays lump sums, like a cash-balance plan or just a regular final pay plan that upon termination pays out a lump sum at a fixed interest rate, the liabilities will be much less sensitive to changes in interest rates. Instead of paying out annual payments over someone's period of retirement, you'll be paying out a single lump-sum amount representing the whole liability, and you'll be paying it out more likely at the date of termination. Because the payment date is a lot closer, there's a lot less sensitivity of changes in interest rates.

Let's say you have a plan that pays out lump sums based on the GATT interest rates; it is not a fixed interest rate, but one that varies. In that case, if you're changing your investment return assumption because of a change in your assumed underlying inflation, then you probably also want to change your assumed 30-year Treasury rate, or the assumed lump-sum basis, in the same direction. Therefore, your lump sum, instead of being a fixed amount, is going to be an interest-sensitive amount, and it will behave more like an annuity when you're costing liabilities. Therefore, it will have a longer duration than you otherwise might expect.

The same idea applies to the salary increase assumption. If you're changing your investment return assumption because of a change underlying inflation, you might want to change the salary increase assumption in the same direction. That can have an offsetting effect. A decrease in interest rates, might increase liabilities, but a decrease in the salary increase assumption will lower the liabilities. Now the salary increase assumption only acts up until retirement age, so it doesn't have the same impact as the interest rate assumption or the investment return assumption, which acts through the preretirement period and beyond into retirement. So it's not going to have a full offsetting effect. If you had a plan that also had a cost-of-living provision, and you moved that as well, then the combination of the cost-of-living provision and the salary increase can fully offset the effect of the change in interest rates.

When your costing plan changes, it is very important to pay careful attention to assumptions that impact those changes. For example, if you're looking at an early retirement improvement or taking away an early retirement benefit, in order to assess the cost of that, you probably want to assume that participants will react to that change in assumption. If the retirement benefit becomes more generous, then people are more likely to retire early and take that generous benefit. Consider whether you have a change to your lump-sum conversion basis. Say you go from PBGC rates to GATT rates, and prior to that 80% of participants were taking the lump sum and 20% were taking the annuity. With the lump sum becoming less generous, you might expect more will take the annuity than the lump sum. Also, in the case of a disability benefit, I had a case where a client changed his definition of disability from a more generous definition to a Social Security definition. He wanted to know how much that was going to save.

We took a look at the disability incidence assumption we were using. It is already lined up well with Social Security definitions, so you have a savings but it's not going to show up in this particular example. We weren't using the right assumption before, but now it's the right assumption.

Table 3 is an example of the importance of assumptions on costing out cash-balance plans. This is a real life example. In this case we had a client who was going from a final pay plan to a cash-balance plan. The first column shows liabilities, PBO, and service cost under the final pay plan using an age-related salary scale like the one Caren talked about. The second column shows what would happen if we used the uniform salary increase assumption. The age-weighted scale had higher increases at the earlier ages, but lower increases at the later ages where the higher liability participants were concentrated. This resulted in lower PBO and lower service cost. Look at what happens under the cash-balance plan. We see that the age-weighted assumption also results in lower liabilities on the cash-balance side, but not to the same extent. There are two reasons for that. Number one, a cash-balance plan is like a career average plan. The benefit is based on what you earn over your entire career, not just in the last few years. The salary increases over the last few years are not as important. Number two, benefits under a cash-balance plan tend to be relatively more generous for younger participants than they are under a traditional defined-benefit plan. Those younger participants were applying a higher salary increase under the age-weighted scale, so they're having more of an effect.

TABLE 3
EFFECT OF AGE-WEIGHING

	Final Pay		**Cash Balance**		**Change Relating to Plan Design**	
	Age-related Scale	Uniform Increase	Age-related Scale	Uniform Increase	Age-related Scale	Uniform Increase
PBO	$9,578	$10,636	$9,260	$9,696	(318)	(940)
Service Cost	664	752	646	674	(18)	(78)

The key number is this reduction in liability when going from a final pay plan to a cash-balance plan. If we just looked at that under a uniform salary increase assumption, we might go to the client and say, "Look, you can save $1 million dollars." If we used the more realistic age-rated assumption, the savings is actually much less. That's also something that would be useful in looking at benefit illustrations. There obviously has been some publicity recently about participants finding out how much they're losing in a conversion to a cash-balance plan and they are upset about that. If you project somebody all the way to retirement age using a flat salary increase assumption, and if you compare that final-pay plan to what they get on their cash-balance plan, it's almost inevitable that they're going to lose out. Look at a more realistic salary increase assumption, and at different earlier ages (maybe not all the way out to age 65). The loss to the participant will not be as substantial because of going to a cash-balance plan. It doesn't mean that there

won't be a loss. It's still an issue to deal with, but these are the types of things to consider when communicating with a client and participants.

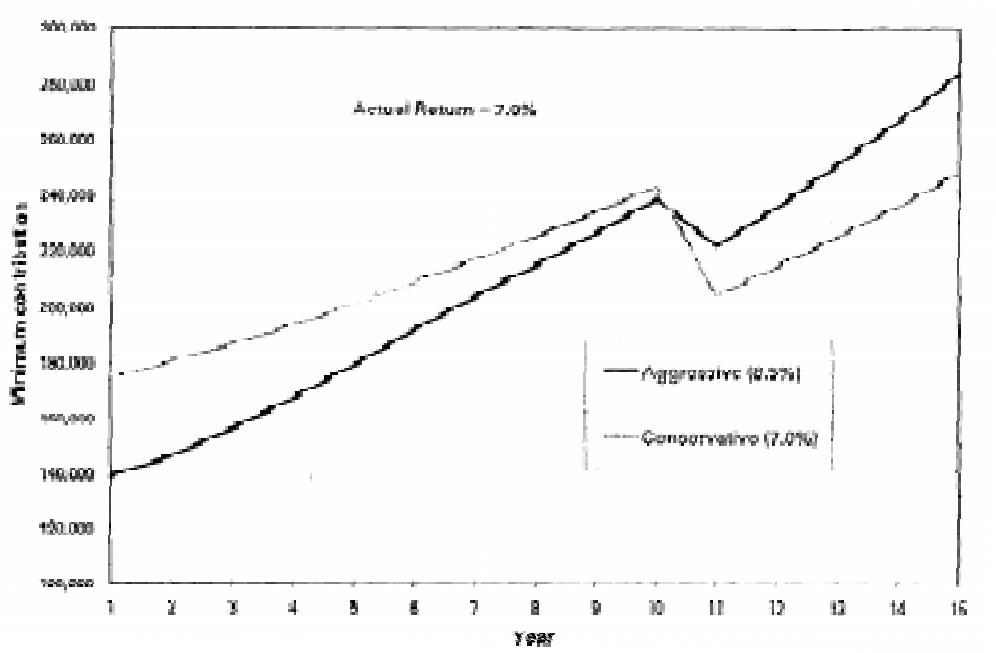
Cash flow is sensitive to retirement age and to the form of payment assumption, in particular, the lump-sum assumption. If you ignore your lump sum when cash flow is important, then you're going to greatly underestimate your liquidity needs.

Just going back to the issue now that Caren touched on. Obviously there are some assumption changes that clients are not going to be too happy about. This is where the timing of assumption changes comes in. It's important to note that as actuaries we don't change the future. We can't make an assumption and have it actually turn out the way we assumed it would. We're just trying to get our best handle on it. We want to make sure that we kind of keep our clients on track when they're considering a bad change; for example, change that will increase cost as in the case of the newer mortality tables.

There might be some opportunity to ease that in. For example, a good change, such as a change to an age-weighted salary increase assumption that lowers liabilities, might offset the liability increase, particularly if we're changing mortality tables. We might also consider making changes after good years despite what happened. Returns still have been pretty good over the past few years. It might be a good opportunity to assess whether or not our assumptions are appropriate and whether there's any changes that should be made, like a change to a new mortality table. There is anticipating changes versus reacting to changes. It's a lot easier to make the change early than it is later on after you've experienced actuarial losses. If you're using an immediate gain method, you have created all these big five-year amortization bases. We must then go to a client and say, "we want to make your costs even higher."

Chart 7 shows a sample plan population or a different sample population. Say a client was invested in fixed-income securities. We believe 7% is our reasonable return assumptions and 8.5% is our aggressive assumption, but the client wants to be at 8.5%. If actual experience turns out to be 7% over the years, and we're amortizing our unfunded liability over ten years, then the aggressive assumptions are going to produce a lower contribution starting out. Sometime during year nine, there's going to be a crossover point. If you wait until you have a few years of bad experience under your belt, and then go to the client and say it's time to make a change, then the hit from going in this case to 8.5% to the 7% return assumption is even more substantial, and you don't catch up until even much later. So it's a lot easier to just get in there with the right number to begin with and keep in mind that we really don't have control.

CHART 7
EFFECT OF DIFFERENT ASSUMPTIONS ON CONTRIBUTIONS



I'd just like to say in closing that selection of assumptions is an important responsibility; it is one that affects plan participants, sponsors, and other parties. It is one to take seriously. Fortunately we have good guidance, ASOP in particular helps us in selecting assumptions. It is something we can point to when clients say why do we have to use this assumption? There still may be times when we're asked to kind of push against the outer edge what we consider reasonable. Again, I'd like to reiterate that in those circumstances it is important to remember that we can't change the future. We're just trying to measure it. Just as we look to the long term to decide what assumptions are reasonable, we should also look to the long-term impact of our choices.