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## Session 67PD
## Technical Concerns: Does Your Stomach Turn Over Your Turnover Assumption?

**Track:** Pension
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*Turnover plays a major role in the funding of pension plans. It can be based on a variety of criteria. At issue, what happens when an established pattern is interrupted or does not yet exist?*

*Recently, the Society of Actuaries has released a Turnover Study. While not a complete recipe for the selection of this assumption, it does have some added insight into the process. Hopefully this recent release, along with some general guidance, can aid in this sometimes onerous task. An overview of this Study, and some general uses of it, should help in the selection of this assumption.*

**Mr. Thomas P. Edwalds:** I am the research actuary for health and pensions at the Society of Actuaries. In that capacity I have responsibility for oversight of the recently published *Turnover Study* whose author, Steve Kopp, is here. Our two panelists are key movers in the area of turnover assumptions. Before Roger Vaughn's paper was published in 1991, there had been little published since the Sarason Tables in the 1950s about employee turnover, and this is a critical assumption both for pension plan valuations and, more recently, for Financial Accounting Standard *(FAS) No. 106* calculations. Roger is currently at Aon Consulting, where he has oversight responsibility for their pension practice, and when he published the paper in the Pension Forum in 1991 he was the chief actuary at Booke & Company.



**Note:** The charts referred to in the text can be found at the end of the manuscript.

**Mr. Roger L. Vaughn:** When I was on the Pension Research Committee back in the late 1980s through about 1991 or 1992, turnover assumptions came up in some of our discussions and also turned up in the research we had undertaken. We discussed some studies we had done in the late 1970s at what was then Booke & Company. Then, with Judy Anderson's encouragement and some of the others, we updated those studies to the end of the 1980s. We have some interesting results from these studies. We had a hundred turnover tables on various databases; some were grandfathered, takeover accounts from other actuaries, and some were experience studies of specific accounts; most were usually some blend. There is really no genesis or documentation for practically any of them, and many of them were variations of the old T Tables published in the early 1950s. So reflecting the pressure to reflect explicit assumptions, a lot driven by FASB at the time, we wanted to make sure we could try to develop some turnover tables that would stand on their own and not be explicitly balanced out by some other assumption inside the valuations and also to have something that would be simple and easy to calibrate to a given account. This was important, particularly for clients who might not be big enough to have their own specific experience-based studies that would be relevant.

Our approach, at first, was to make sure we had quality data. We worked with data that we knew, and so we screened our accounts to make sure we had good data through the whole period. We were looking at a three year period at this point in the late 1980s: 1987–89, contrasted to 1979–81 in the earlier study. So, we wanted to have good, precise records, but in order to screen out noise, we also looked at accounts and employee experience, where there were no material changes during the observation period in terms of acquisitions, mergers, windows, and other elements that might have tainted or contaminated the database that we were using. Our tables developed out of this process. We, also, tried to regress or analyze the data to see how sensitive the select period would be versus the ultimate tables.

We had one other variable: to look at industry-specific experience. So, we looked at hospitals, banks, and manufacturing organizations, separately and together. Out of the composite, we developed the Vaughn Table or V Table (Table 1). The data in this case include about 79,000 employee life years. We eliminated the first year of employment, so we got rid of the new hires. They had to have at least one year of service, and we stopped at age 55. We wanted to block out the retirement patterns. So, this is age 20–55 with at least one year of service. Then after pulling out the select period we actually went to the fourth year and beyond. So, we have three-year select-and-ultimate, and this is the ultimate table. We blocked the data into five five-year age brackets and got a neat pattern from upper teens in the 20–24 bracket to less than 5% out at 50–54.

TABLE 1
V SELECT & ULTIMATE TABLE
Number of Employee Exits per 100

| Age | Years of Service | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 or more |
| 20 | 29.8 | 25.0 | 21.0 | 18.6 |
| 21 | 29.4 | 24.5 | 20.5 | 17.6 |
| 22 | 29.0 | 24.0 | 20.0 | 16.6 |
| 23 | 28.6 | 23.5 | 19.5 | 15.6 |
| 24 | 28.2 | 23.0 | 19.0 | 14.6 |
| 25 | 27.8 | 22.5 | 18.5 | 13.6 |
| 26 | 27.4 | 22.0 | 18.0 | 12.6 |
| 27 | 27.0 | 21.5 | 17.5 | 11.6 |
| 28 | 26.6 | 21.0 | 17.0 | 11.1 |
| 29 | 26.2 | 20.5 | 16.5 | 10.6 |
| 30 | 25.8 | 20.0 | 16.0 | 10.1 |
| 31 | 25.4 | 19.5 | 15.5 | 9.6 |
| 32 | 25.0 | 19.0 | 15.0 | 9.1 |
| 33 | 24.6 | 18.6 | 14.6 | 8.7 |
| 34 | 24.2 | 18.2 | 14.2 | 8.3 |
| 35 | 23.8 | 17.8 | 13.8 | 7.9 |
| 36 | 23.4 | 17.4 | 13.4 | 7.5 |
| 37 | 23.0 | 17.0 | 13.0 | 7.1 |
| 38 | 22.6 | 16.6 | 12.6 | 6.9 |
| 39 | 22.2 | 16.2 | 12.2 | 6.7 |
| 40 | 21.8 | 15.8 | 11.8 | 6.5 |
| 41 | 21.4 | 15.4 | 11.4 | 6.3 |
| 42 | 21.0 | 15.0 | 11.0 | 6.1 |
| 43 | 20.6 | 14.7 | 10.7 | 5.9 |
| 44 | 20.2 | 14.4 | 10.4 | 5.7 |
| 45 | 19.8 | 14.1 | 10.1 | 5.5 |
| 46 | 19.4 | 13.8 | 9.8 | 5.3 |
| 47 | 19.0 | 13.5 | 9.5 | 5.1 |
| 48 | 18.6 | 13.2 | 9.2 | 4.9 |
| 49 | 18.2 | 12.9 | 8.9 | 4.7 |
| 50 | 17.8 | 12.6 | 8.6 | 4.5 |
| 51 | 17.4 | 12.3 | 8.3 | 4.3 |
| 52 | 17.0 | 12.0 | 8.0 | 4.1 |
| 53 | 16.6 | 11.7 | 7.7 | 3.9 |
| 54 | 16.2 | 11.4 | 7.4 | 3.7 |

**Average Ultimate Termination Rate=7.8%**

The T Tables, T–5 and T–9, both have a concave down shape (Chart 1). When you contrast these two sets of observations or tables, what you notice is that the new table fundamentally clashes with both the T Tables, and so it's hard to get an algorithm to move the T Tables up or down to fit to this curve (Chart 2). When we spread out the three industry-specific studies across hospitals, manufacturing, and banks, the banking group had a slightly higher turnover, but you'll notice that the

basic fundamental shape of the curve is consistent in all three industry groups (Chart 3). Out of concern that some bigger clients might be biasing this, we took a look at the banks, for example, and exploded the turnover rates for each of the five banks individually. There was some dispersion. The two banks that are most out of line were the smallest banks in the study and so were outliers because of the thinness of the data. Fundamentally all five organizations' turnover patterns in the ultimate table followed the same pattern.

Then we went back and addressed the select period. In this case, the select period is the first three years of observation, excluding the first year of hire. It's between year one and two, two and three, and three and four. Looking at that combined, it fell consistently and neatly (Chart 4). This was about 32,000 life years of observation here in these first three years, and shows a very neat, positive correlation with age. In fact no concavity up or down, just fairly straight. When we exploded that for each of the three years individually we saw a fairly consistent pattern and what you would expect to see (Chart 5). In the later years where the data got a little thinner, you got some gyrations in the 40s and 50s. The bulk of the new hires in this whole block of exposure was for the younger ages, and so you get some aberrations in the older ages. Then we took a little actuarial license, fitted these curves with the old hand method of fitting a curve and smoothed them down to create the first year, second year, and third year select rates. We left the ultimate rates unsmooth (Chart 6). Intuitively and logically it fit a pattern of what you'd expect to see. Looking vertically up at any age block you see a neat progression down from the first to the second year and then the subsequent years after that until the ultimate period. We didn't see any need when we analyzed the data to go beyond three years of select. A five-year select is overkill. The patterns fit together quite neatly.

We wanted to do two other outside validations of what we saw here because we recognized this came out of some of our clients. We had liberally edited which clients we wanted at the end of this, which five manufacturing organizations, which five banks, and which five hospitals in order to control against mergers and acquisitions, anomalies, and changes in the workforce that might have influenced this up or down. So, we did two different types of independent, or what I call credibility, checks. One was to compare these notes to information from a public utility. We had 111,000 employees observed in a public utility from the West Coast. We saw very low turnover rates. The actual turnover in the ultimate period for this 111,000 employee group as an average was something like 4% or so. Our ultimate turnover averaged 7.8%. Remember, our goal was to try to find some simple, easy way for an actuary to take this table and move it from one group to the other.

If you know the experience of the group, you can take the table and move it proportionately up or down. It's pretty simple. The ratio is 7.8% to the actual turnover. We took the experience we had observed in studying the hospitals, banks, and manufacturing employees' turnover patterns, and took the ratio of their turnover in that block or period to the public utility, plotted the graphs, and it uncannily matched the heavy liability years. There's a perfect overlay. In the younger ages the V Table is a little bit higher than the slope of this utility, but it would have been hard to get data that would fit any better.

Now, we needed another test, because actuarial projections make assumptions that cut across decades. We'll take someone in their 20s or 30s and project what their termination patterns will be for the next 10, 20, or 30 years. You've got to go through up cycles and down cycles. In the late 1980s, in the southeast, which is the time period these data were based on, it was a fairly strong, robust economy. This was coming at the tail end of the Reagan-Bush era. There was low unemployment, and low inflation. We took the same five hospitals and the same five banks and went back nine years and looked at the three-year turnover experience under the exact same definition, same criteria, same screening selection. In fact we were able to get the same five to match up in order to do a comparison of almost an entire decade.

Now, the late 1970s were the tail end of the Carter era, which had quite a misery index: very sluggish economy, high inflation, and high unemployment. These were a very different set of employment facts, patterns, not only in the southeast, but across the country. When we overlaid just the banks and the hospitals, combined for this period, we got a pattern in the late 1970s where the younger ages had just slightly higher turnover than in the late 1980s, but in the upper ages it turns the other way (Chart 7). Again, it is a little hard to get this unsmooth raw data to fit as neatly. We had a lot of discussion to try to rationalize why you'd have the same turnover pattern in a weak economy as you'd have in a robust economy. One theory that held is that you have a certain structural turnover regardless of the economic environment.

In good times people voluntarily will move to another job. Spouses change jobs. Spouses drop out. People drop out for certain periods of time to raise families, other things. In bad times, companies lay you off, and you go find another job maybe involuntarily. For whatever reason the pattern here fit exactly in two different economic time periods, which then gives some comfort in taking these tables and using them to project pension results for 50 years into the future. To that point, we see the rising need for explicitness in the assumptions for *FAS No. 87* and *FAS No. 106*, especially. It would take a simple adjustment to this to make it fit any company, even a company without enough employees to have their own

experience studies and turnover tables to customize. This will work fairly well for most situations, and I'm pleased to say we've used variations of this table now for nearly two decades, obviously tweaking and adjusting as needed. It gave us a base to begin with. Nothing had been published since the early 1950s at the point we did this in 1991. So, we tried to, in a very simple, direct, and controlled manner, raise the bar with respect to designing and selecting termination tables, recognizing some degree of selectivity in initial hire but mostly falling back on attained age of the employees.

Also, even when we looked at males and females, the turnover was not materially different between the two, so we kept the unisex termination table for this purpose. We'll move to the more sophisticated research and what Steve has done to take this whole process forward.

**Mr. Edwalds:** In response to Roger's paper, the Society of Actuaries decided to sponsor its first-study ever of employee turnover and retirement rates and collected data from pension consultants from approximately 40 large pension plans. Through a competitive bid process, we retained Steve Kopp from the University of Western Ontario. He's an FSA and is also an instructor and academic counselor at the university.

**Mr. Steve J. Kopp:** I am here to give you a brief overview of the turnover rate study of pension plans that our university was chosen to work on. Phase II was a study of employee turnover and retirement rates. It was performed in conjunction with the Pension Section and Health Section of the Society of Actuaries, and it was overseen by the Non-Mortality Decrements Task Force of which Tom was a member.

It took about a year-and-a-half for the study to be completed, from May 1996 to November 1997. It is a paper that contains about 100 pages. Now, before you think that's too long, 40 of those pages are appendices and graphs, and the other 60 make up the study, but it is double spaced. The bottom line is that there's a lot of information in the study and we did a lot of analysis of the data.

I'd like to start off by giving a description of the data. Phase I of this project was done by the University of Iowa, which collected the data, did data checks, and created the database. The data came from 41 large pension plans. Two plans gave data in a totally different format than the other 39, and we couldn't find a way to merge those two plans in with the others, so we kept them out and analyzed them separately. If I have time, I'll show you the results of those two plans. One plan had great data inconsistencies. Their termination rates were 60–70%, and there was great inconsistency in it, so we deleted it. It was only 0.1% of total exposure, so since it had no real impact, we just decided to leave it out. In the end we used data

from 38 of these 41 large pension plans. The data covered the years 1989–94. Many of the 38 plans gave data for all five of those years. Some only gave data for one year. But we had over 296 lines of data representing 3 million life years of exposure. This is a significant data set. We had a lot of very credible data. The 38 plans were broken further down into eight industry codes. Roger talked about the three industry codes, hospitals, banks, and manufacturing.

This dataset had eight different industry codes from the banking service industry up to utilities and manufacturing. The dataset included seven different regions from all across the United States, and there was at least one plan that's from Ontario, Canada. There were three compensation types: hourly employees, salaried employees, or a combination of both. Twenty-two out of the 38 plans were a combination of hourly and salaried employees. They also determined whether the plan was centered in a large city or a small city. The data also indicated whether plan members were male or female, and approximately 69% of the exposures were male, and 31% were female.

We got the data in May 1996. We thought it'd take us three months to analyze it. The very first day that we sat down with some of our statisticians, who are people who work in our statistics lab who were going to actually do the number crunching, and we looked at the data. The census date was January 1, 1994. They didn't have an early retirement window or a plan amendment. People were eligible to retire with either reduced or unreduced benefits, their age, years of service with the company, whether they're eligible for retirement benefits, their sex. All plans were coded with a number. The researchers were basically blind as to who the companies were. We showed them the number of employees, their total salary, total benefits, and a record number code.

So, how many people age 53 with 30 years of service in 1993 terminated? Answer: We don't know. Isn't that interesting? We were going to do a decrement study of the number of terminations or retirements, and that's a piece of information that's missing. Right off the bat we thought maybe we bit off a bit more than we could chew. But, that's not a difficult task because I'll give you an example. In 1993, there were 53-year-olds with 30 years of service for this particular plan, and they're males. One hundred sixty two were there on January 1, 1993. We did what's called a matched cell technique where we just simply matched up a cell to its following year cell. So, one year later it's 1994. Those 53-year-olds are now 54-year-olds. They had 30 years of service on January 1, 1993. One year later they have 31 years of services. So, the people in this cell match up to the people in the previous cell, and there are 146 of them left a year later. It's very simple mathematics. You don't have to be an actuary to do this: 162 minus 146 is 16, 16 people who terminated in the year of 1993 at this particular age and with that

number of years of service. That's fine. That's how we determine the number of terminations.

Then we made a startling discovery. Also in 1993 there were 53-year-olds with 14 years of service. There were 38 of them in this category who were male on January 1, 1993. One year later, 1994, that same group had 49 of them. Simple mathematics: 38 minus 49 is minus 11. So, minus 11 people terminated. That means there are more people there a year later than were there at the start of the year. That means 11 people were hired. So, that immediately was a problem, and it shouldn't be a big problem, except they hired 11 people who were 53 with 15 years of service. I thought when you hired a person they had zero years of service with your company. So, that was a major problem. I immediately e-mailed and followed with a phone call to Tom Edwalds saying, "We have a problem, Houston." We have negative decrements. A lot of time was spent on determining how big a problem this was and what to do about it, this negative decrement problem, that is, having more people at the end of the year than you had at the beginning of the year, which are new hires, that's not a big deal. Newly hired people with 15 years of service is. You can find these problems throughout the data. So, that was a problem, and we did analysis, and about 9% of the 296 cells had this negative decrement problem which meant the other 91% had the same problem as well. You didn't know whether out of the 16 people who terminated in this cell, were there actually 16 terminations, or were there 20 terminations and four new hires. So, the net number was 16. So, even the "91% good cells" were what we call polluted as well, and that was a major problem.

So, Tom dealt with the Non-Mortality Decrements Task Force. They didn't expect this problem at all. They thought you'd take the beginning of the year number, subtract the end of the year number, and that gives you the number of decrements. It was decided to go ahead with the analysis despite this problem. So, let me point out one more time what these problems were. Decrement information was not given. The data did not give the number of terminations or retirements that we used in that cell technique. That's not really a problem. We do, however, have this negative decrement problem. It occurred when there were more members in a matched cell at the end of the year than were there at the start of the year, leading to an increment as opposed to a decrement. The net result of all this is: it was decided to go ahead with the study anyway, despite this result. The study ended up not calculating termination rates. Roger's paper dealt with termination rates, that these are the percentage of people who terminated employment in a particular age. We did not calculate termination rates or retirement rates. Instead, we calculated what we referred to as net decrement ratios; and what are they defined to be? I tried to make it as simple as I could. It's the net change over one-year periods, say from age $x$ to $x$ plus 1, of all types of decrements, so that's people who terminated,

people who retired and left employment, deaths, or disabilities. Those are the four decrements that a person would leave employment for minus any new entrants. These are the new hires, either the new hires with zero or one years of service or the new hires who were credited with their past years of service. Then we divided that net number by the number of individuals who started out at age *x*. So, that would be our exposure number.

What all this means basically is we did not know the number of new entrants, terminations, retirements, deaths, or disabilities at each age. We just knew the net change. The net change was 16. Well, that could have been 20 terminations and four new entrants or it could have been 19 terminations, one death, two disabilities, and six new entrants. So that's very important to realize. We failed in one of our goals, which was to come up with termination rate tables. We came up with net decrement ratio tables. So, as long as the actuary or the user of the table realizes that, it's not a real big problem.

Let's see what the data looked like. After we dealt with these problems we just basically created our decrement tables. We excluded anyone in the study who had zero years of service because the net decrement problem was absolutely terrible for zero-years-of-service and one-year-of-service people. So, we eliminated the zero-years-of-service people. We kept the one-year-of-service people in. And we eliminated any plans and their appropriate plan years where those plans offered early-retirement windows. We didn't want to pollute the data further by keeping in early-retirement windows because they will have an effect on termination rates, not as much on termination rates but certainly on retirement rates. So, all of that has been taken out of these tables.

We basically look at the ages from 22–72, as the core working years of an individual, assuming that they went to college or university and started work at age 22. So, it starts out about 15%. That's the net decrement ratio, net termination ratio, at age 22. There's a bit of a hump up to about 16% at age 25. This could be people just starting out. They're not sure if they like the company or the company's not sure if they like them. They give them a one- or two-year grace period and decide to terminate them or the employee decides to leave. Once you get over that hump the ratios fall down to about 7%, almost like an ultimate rate, at age 41, and it remains there till age 52. There's a little bit of a blip at 48 which might be those employees who started at age 18, got their 30 years of service, and then retired early, although we consider them terminations under our definition.

The other thing to notice, too, is the rates are ungraduated. This is just the raw rate. The one interesting thing we found is that the chart is fairly smooth. So, we didn't graduate the rates in the end. One of the phases of the plan was to graduate the

rates, but we didn't here. So, we left the ratios as they are. Then at age 52, it starts to make a slow rise, and at 55 it jumps. These are the termination ratios, right up to about 29% at age 64. Now, I had a big problem with this. I thought in my limited knowledge of termination rates that termination ratios would continue heading downward, not to zero but close to zero. All of a sudden they took this wrong turn and headed upward to 29% at age 64. Now, there may be reasons for that, but you have a 64-year-old who's just a year away from retirement, and all of the sudden he or she decides to leave. I have a hard time believing that employers are that cruel, that they're going to terminate people just before they're ready to retire. I had a problem with this, but the task force did not, and so that was fine, but that's what the results showed.

On the retirement side of things they start around 9% at age 50. We didn't consider that anyone could retire at an age less than 50, even though maybe there should have been some 48 people, and it slowly makes its way up, starts to jump at age 57 or 58, reaches a peak at age 65 and 66, which you would expect. That's the normal retirement age. It then drops a bit as some people refuse to face reality that if you can't work anymore, just go enjoy life. Then it starts to go up at age 72 when you're kind of not quite forced out, but that's the age where maybe tax breaks in saving for retirement are no longer there. So, you might as well retire because you can't save for retirement anymore.

One of the other things is we figured rates by gender, and we figured there'd be a difference. There's a difference in termination ratios. Female is not as smooth, especially because there's less exposure there in the female table. The female ratios are higher than the male ratios by 4.5% on average. So, males started at 12%. Females close to 20% termination rates. And I guess that kind of makes sense. Perhaps females are more in the part-time positions than full-time positions. Perhaps a lot of the females will take time out from their careers to raise a family. They're the caregivers more than males. So, the difference here was expected. It does start to narrow as you get into the age 55 range, and there's not really any difference at that point, but there's a lot less exposure at that point as well. So, graphs are not as smooth, and there is a difference between males and females, which was not unexpected.

There's not much difference for genders at retirement ages, at the young ages, 50–55. Females may retire a little more. The ratio's a bit higher (55–62), and then there are small exposures out here. So, it's hard to really draw any credible conclusion. So, there's not as much difference between males and females at the retirement ages, more so at the termination ages.

Those are some of the major results. They are called the base tables. These take into consideration all 38 plans, all ages, all years of experience, or years of service, whether they're eligible or not for retirement, and all that. It was all just plunked into that analysis.

Now, one of the other things I want to talk about briefly is the analysis of those four variables we talked about: industry code, region, compensation type (hourly or salaried), and the city size. One of the main objectives of this study was to analyze the variables and to determine if any of these variables had a significant impact on the net decrement ratios. That is, would any of these variables warrant a separate table? One of the major results was analyzing these variables, to see which ones were significant and which ones warranted a separate decrement table, separate from the base table. How we ended up analyzing this was through a multiple regression or ANOVA type analysis, using SAS program and statistical packages basically. In order to properly analyze the impact of these variables we needed to take into account the interaction between variables. This was done in Section 6 of the report.

In Section 5 we looked at each variable separately, and one of the things we found was that Industry Code 8, the financial services sector, had net decrement ratios or termination ratios 60% higher than all the other industry codes. We were thinking that Industry Code 8 should have a separate table because their ratios were much, much higher than any of the other seven industry codes. Then we started thinking, is industry code really higher or is it just because they may have a higher percentage of female employees? Females have higher net decrement ratios than males do. So, maybe that's why Industry Code 8 is high. And we also found the northeast region to have high net decrement ratios, too. Were a lot of the groups that were Industry Code 8 located in the northeast? So, was it really due to Industry Code 8 having high termination ratios or was it due to other factors that caused Industry Code 8 to look to be the worst? We had to take into account all four of those variables, plus a gender variable, and roll it into one analysis, and the best way to take that analysis is to do multiple regression.

We did multiple regression with repeated measures. We used the 38 plans. Now we had 296 lines of data reduced to 38 pieces of data. If you know your statistics, we had six regressor variables. Degrees of freedom were at about 31. So, it was 296 lines of data down to 31 degrees of freedom. We really had to squeeze it quite a bit, but the net decrement ratio was the response variable. We did it by age group as well. We grouped termination rates into four age groups and retirement into two age groups. We included a gender variable because we figured that gender made a difference. We wanted to bring in a variable for that. It was given as a percentage of female members of each plan. We also included a variable for representing the

years of service that a person had, and we did an analysis by years of service. There seemed to be three levels for years of service. I forget exactly what the plateaus were, but we included that, and it was given as the average years of service for each plan for each age block.

Now, because we only had 38 plans, and we had eight industry codes, there were not enough data in each cell to produce credible data. So, we squeezed the eight industry codes down to the five. The seven regions were combined into four. The three compensation types were left alone, as were the two types of cities. We did that basically in order to get significant variables. That gave us eight industry codes. We left Industry Code 8 by itself, but we combined Industry Codes 5 and 6, for example, because they seemed to have similar results.

Here's what you're mainly interested in, though. We did this regression, and we did it several times and tweaked it until we were happy with the results. We ended up getting multiple regression equations that contained the significant variables. Now, compensation type turned out not to be significant. Termination rates did not vary whether you were hourly or salaried, which I thought was kind of strange, but it just wasn't significant. So, that was taken out. The other variables were put in the equation for each of the four age groups and the two age groups for retirement. Then you had this regression equation with intercept coefficients and slope coefficients and so on. You plugged in some values, and you often got negative numbers for your net decrement ratio. We already talked about the negative decrement problem, and to get a negative result in the end was possible mathematically, but it's not possible in the real world. So, we had to do some tweaking. It also wasn't very convenient for the actuary to use, so we came up with a system of pluses and minuses. The statisticians did their analysis, and I double-checked the results after telling them what I wanted. Then I decided I wanted to develop a system of pluses and minuses based on the industry codes, similar to life insurance underwriting. Maybe that's worth 10 points if you're Industry Code 6. Maybe it's minus 13 points if you're Industry Code 8 or something like that. It was calculated based on what industry code, region, percentage that are female, average plan duration, and other factors. It's done in a very convenient way, so the resulting value that you get after using these pluses and minuses is a number based on a scale of 100 that you can then multiply by the base table. Those are the ratios that you use for the particular plan that you're evaluating.

Following is an example of the age 30-39 block. This was the final equation. You started off with a factor of 125. Then you looked at industry code. So, you would look at your plan. Industry Code 8 had no effect, as it turned out. Industry Code 6 and 7, which were the utilities, confirms what Roger said. You did your utilities in

your study, and they had lower rates, same thing as it turned out, so you would subtract 45 points.

**Age 30-39**

| | Industry Code | Location | City Size | Gender |
|---|---|---|---|---|
| Adjustment Factor=125 | -60 (11) | -30(CA) | -5(large) | -30% female |
| | -10 (18) | -15 (NC/SE) | | -30(small) |
| | -50 (12/3) | -40 (NE) | | |
| | -35 (14/5) | -15 (NW/SC/US) | | |
| | -45 (16/7) | | | |

**Duration**

-10 (average duration-82)

1) Code 8, Region NC, small city, 26% female, avg. yrs. of service=7.2

   125+10-15+30(0.26)-10(7.2-8.2)=167.8(1.678 x basetable)

2) Code 6, region SC, large city, 40% female, avg. yrs of service=9.4

   125-45-15-5+30(0.40)-10(9.4-8.2)=60 (0.60 x basetable)

There's a location variable depending on whether you're in north, central, southeast, or northeast California. The other regions were northwest, south central, and there were some plans that just didn't fit any in any particular region. All these regions and industry codes were given in the paper. So, you know what Industry Codes 2 and 3 are. City size. Gender was a big variable, and duration was a variable. Let me give you an example of how to use this because it looks complicated when you look at it, but it's very simple.

Let's suppose you have a plan. You look at the plan. The characteristics of this plan are: in Industry Code 8, the financial services. It's in the north central region of the United States. They're primarily located in a small city, and 26% of the members in this plan, in this age category, are female, and the employees in this age category have an average of 7.2 years of service for this company. You start off with 125. It's Industry Code 8. Add in 10 for Industry Code 8. It's north central, so subtract 15. It's in a small city, so add 30. They have 26% female, so 0.26 times the 30. And they have 7.2 years of service, so 7.2 minus 8.2 times minus 10. The net result is 167.8. What does that number mean? What it means is you take the base table numbers, for termination ages, multiply by 1.678, and that gives you the rates that you should be using for this particular plan that you're evaluating.

So, that's how the regression equation is used. You can read the report if you're really interested in how we got the regression equations, but these are the final results.

Roger did a comparison, too. Tom mentioned that the only thing that had been published before Roger's paper in 1991 was the T Tables, the Sarason T Tables. Even though there were three authors, Sarason is the one listed who gets credited as the T Table author. They were published in 1950. They are tables of termination rates from all causes. They're actually fairly similar to our termination table, showing that any termination due to withdrawal, transfers, death, or disability are the causes of termination. They didn't have to worry about new hires or new entrants. It appeared in the *Actuary's Pension Handbook* in 1955. There are 11 tables in total, providing actuaries with a wide range of choices, and they have been used by pension actuaries since 1955 to calculate employee benefit costs for pension and retiree medical plans. I would guess that they're still in use today, some 40 years later. In 1955, an employee worked at a company for his or her whole life. Nowadays people are changing jobs frequently in some cases. It's a different environment that we work in, both in Canada and the United States, than it was in 1955, but it is still interesting to compare our base table termination rates to the Sarason Tables to see the differences.

Our table shoots up to 29% at age 64, but the T Tables slope down and then they make this loop up at age 64. So, I compared our table to the T–1, T–3, T–5, and the T–9, and our tables have, in most cases, much higher termination ratios than the T–1, T–3, and T–5. That's not really surprising because it's 40 years later, and employer and employee loyalty is just not the same as it used to be. So, it's not surprising they're higher. The first table that it was lower than was the T–9 table. If you want to put things in terms of a T Table because you're used to them, our termination rate tables are probably the closest to the T–9 Table. I'm not sure if any of you use the T–9 Table. But, again, at age 50–51, our tables take a turn, and the T Tables continue down to some ultimate level. So, that's the comparison with the Sarason T Table, and that is in the report as well.

At the very start, I talked about two of the original 41 plans provided data was in a format that was very different from the other 39 plans. So, we thought why not just analyze those two other large plans? Here's the difference. They gave us the decrement information and exposure at each age and by sex. For age 22 females, they said 12 people terminated, and five people died, and one person was disabled, and so on. So, they actually gave us the decrement information by age and sex. They gave the number of members who left employment due to termination, retirement, death, or disability, and we didn't have to worry about whether they hire new people with 15 or 30 years of service all of the sudden. So, we were able to determine termination and retirement rates based on these two groups. We actually were able to get rates as opposed to ratios. You might be wondering, whether there was enough data to make it credible? For termination ages there was almost 527,000 years of exposure. In our termination rates study, termination rates of our

chart had over two million life years of exposure. These two groups in themselves were 25% of the total exposure in the main study. That's a lot of exposure and these are very credible results.

For the retirement exposures it was about 126,000 life years of exposure, certainly not as much as termination but still very credible data. It was well worth the effort to look at the results. Our net decrement ratio table started at 15%. Here it starts at about 8.3%, so much lower, almost half in this case, which actually makes sense because when you look at these two plans they were both Industry Code 6 which were utilities and communication services. Industry Code 6 had lower termination ratios anyway. So, at least it was consistent. They had lower rates because they were in an industry code and a region that had good termination results. There's the little hump again, at age 22–25, while there's that feeling-out period, and then a steady decline, very smooth as well, right down to age 65 where it wasn't quite zero but got down closer to zero. They didn't take the turn upwards. That confirmed what I had thought all along; it was down close to zero.

For the retirement side of things, again, there's less exposure, especially at the older ages. Retirement started at age 50, but just a few retired at that age. Then it starts to go up at age 55, kind of the early retirement age, levels to age 59, then making a slow, steady increase, shoots up to almost 100% at age 65–66. Then there's only a handful of people still working, and finally they're out of the workforce by age 72. Then they can be hired back as consultants. Without knowing much about terminations or retirement rates, you would expect what these results gave us, a slow, steady incline up to age 64, then a large spike at age 65. Many people retire at that point in time.

Some final thoughts; and these final thoughts are directed towards actuaries who are happy that this study was done. It's a great study. We did a lot of work on it, and we got some very important results, but there's a lot of caveats to it, too. I would like to forewarn any actuaries who are thinking of blindly using these tables. The results of the study give net decrement ratios, not termination or retirement rates. So, they don't really give you the qx's like a mortality rate would because they're giving you a net change over a one-year period. Thus, the tables in the study should really be used only as a guide or a starting point for calculating your termination or retirement rates. In other words, don't take the numbers and just use them or use the regression formulas to make your adjustments to the table. If you have no idea what termination rates are for the plan you're evaluating, you should use this as a guide or a starting point.

If that's your starting point, what do you use to get to your end point? You're all trained to use your judgment. We're not just robots here. Use your judgment along

with the plan. Another point that we make in the paper, is not only to use your judgment but if you have an idea or have some history of the plan you're evaluating that's helpful in making an evaluation. For instance, if you've done it over and over again, and you know that this is a company that has high turnover anyway, maybe you should adjust the termination tables upwards. Or if a plan has good company loyalty and a low turnover history, then make the appropriate adjustment for that. Use the tables as a guide or starting point, and then use your judgment thereafter.

**Mr. Edwalds:** Could you explain how we determined what was a termination age and what was a retirement age?

**Mr. Kopp:** Originally, when we first came up with the study, we used age 55 as a break point. Anyone who left the study at under age 55 was a termination no matter what. Anyone who left the study at age 55 or higher was a retirement. Well, there was this gray area, 50–64, where some people are terminated or leave and other people retire. So, we had to figure out a way to determine who was a retiree and who was a termination. We decided that anyone who left the study under age 50 was a termination. Joe Applebaum pointed out later that maybe you should have made it 48 because some people who started at 18 with 30 services of service might be retirees, but it was 50. Under 50 they were termination. Sixty-five or over, they were a retirement. So, the gray area is 50–64. We looked at whether a person was eligible. So, if they're between age 50–64, and they had an N in the eligibility column, I mean they were not eligible for retirement benefits, and if they left the study, they were considered a termination, figuring that no one's going to retire if they're not eligible for retirement benefits. We looked at the N here. If there was an R here, for example, it means they were eligible for retirement benefit at a reduced pension as opposed to an unreduced pension. Whether it was an R or a U in the eligibility column, these people would be considered retirements because they were over 50. We didn't just arbitrarily choose people. We used the data to show that.

**Mr. Edwalds:** I would like to point out that, since this was the first-ever retirement and turnover study that the Society of Actuaries had done, we designed a data request in such a way that we thought we'd get responses. So, rather than asking for ideal data, we asked for data we thought people had, and that's why we went with census data rather than exposure and decrement data in our request. We did ask for plans to let us know if there had been a merger or spin-off during the year and, if so, to give us beginning and end-of-year census. It's not clear that happened when we looked at the data. Some of the net decrement problem would be due to layoffs and the rehiring of people that had been laid off which is why the past service credits would be so high, but we definitely want to do a follow-up study where we would be asking for data in a better format where we actually would have the

exposures and decrements rather than just the beginning and end-of-year census. So, that's our plan for the future.

**Mr. Fred C. Lindgren:** Steve, in your study, if the actual world was such that a whole bunch of participants retired at exactly age 65, would that show up in your study as half of them going out at 64 and half of them going out at 65 or would they all show as a spike at 65?

**Mr. Kopp:** That's an excellent question, and really the underlying question is whether the data given were on age last birthday or age nearest birthday. I spent an entire month grappling with that because it turned out that there was a difference. If we chart the age-last-birthday groups and the age-nearest-birthday groups, the age-last-birthday groups had higher termination ratios than the age-nearest-birthday groups, and we thought that should not be a deciding factor. There are two things we got out of that. (1) It was due to one group. There was one large group representing almost 13% of the exposures that had really high termination ratios that was distorting the results, and, (2) we had to come up with a method to take the age-last-birthday groups and put them in an age-nearest-birthday basis which is what we did. So, to answer your question if everyone retired at age 65, they would show up in the study as having retired at age 65. It wouldn't be half at 64 and half at 65.

**Mr. Josiah Lynch:** I have a number of observations. On the matter of people being hired with 15 years of service, that can easily arise from people returning from maternity leave during the period, people going off of leave-of-absence, somebody returning to employment without incurring a break in service, returning from active military service, and also recovering from disablement. So, it's not that uncommon a phenomenon. On the question of not eligible, Code N in 1993 and the Code R in 1994, I believe you'd find a fairly significant proportion of people would have an N in 1993 and not be there in 1994 because they became eligible for an R during the year, so they weren't there at the end of the year, so they never showed up as R. Another observation is on the high turnover rates in the 60s, up to age 64. Under some circumstances, including a high turnover rate, this would be considered a disaster because this is the period of highest liabilities, but since most costing systems include a way of costing benefits if the person does quit with heavy benefits, this would not be the kind of a problem I thought it might be.

**Mr. Joel I. Rich:** Did you find the negative decrement problem or did you look at this in those two groups that you actually had good data for?

**Mr. Kopp:** There was no negative decrement problem for the two groups because they actually gave us the number of terminations at each age. I forget how many. I

think those two groups gave us five or six years' worth of data, so there's no negative decrement problem there.

**Mr. Rich:** But they didn't give you actual head counts or something that you could look back at.

**Mr. Kopp:** No, they gave us census data, but they did state for people who are 30 years old with five years of service that two people terminated in 1993. So, we had that actual data.

**Mr. Rich:** I'd be interested in hearing some of the discussion that you had right after you found out that you had this problem with the data. Do you go forward or go back and try to figure out why you had this problem.

**Mr. Kopp:** The researcher, John Mereu, who has been an actuary for some 45-odd years, and I were both very concerned that we weren't getting the results that we wanted which was just pure termination rates, or the pure qx's. At the same time I was thinking, we're not just going to throw this project away because we have lots of data. We can still make useful conclusions here. John, on the other hand, thought we actually should just toss everything out. We really debated whether to toss everything and have the Society of Actuaries just ask all the contributors to give better data, or data in a better format, next time. It's not that the data weren't good, so we thought why don't we just get rid of 9% of the cells that have polluted results? But then the other 91% were kind of polluted anyway, and the final result was let's just go ahead. You need to make it clear to actuaries and readers of the paper and users of these tables that they're not really termination rates; they're net decrement ratios, that's all.

**Mr. Edwalds:** Obviously when the situation came up, we were sort of alarmed because we thought we had covered the big differences and had figured that even though we weren't asking specifically for a breakdown of decrements and how you could tie it back together, we thought, the biggest ones at younger ages will be terminations, older ones, or retirements. We could estimate things like deaths and disabilities from other tables. We also didn't expect the rehire problem, other than for mergers and acquisitions, to be large. We did discuss whether we could, in fact, proceed with the study and produce something meaningful. That's why we decided to produce the net decrement ratios rather than attempt to produce turnover and retirement-rate tables. We also felt very strongly that since we had received data from a number of consultants, we wanted to make sure that there was an end product to show them that because we asked all these actuaries to volunteer their time to assemble some data and send it to us, even if it was something that was relatively convenient for them, we at least wanted them to see what their efforts on

our behalf had produced. So that was a major concern. We wanted an end product they could look at and decide whether they would be willing to do it again and maybe be a little more precise in reconciling the cells.

**Mr. Steven D. Bryson:** Steve, I take from your description that all of these plans covered private industry and there weren't any that were publicly held. Is that true?

**Mr. Kopp:** I'm not 100% certain of that actually. I think they just covered private industry. The people who handled the first phase at the University of Iowa would know more about that.

**Mr. Edwalds:** Yes, we did ask only for large private plans.

**Mr. Bryson:** Okay. Is anybody doing any investigation of government employee turnover?

**Mr. Edwalds:** Well, in a repeat study we are hoping to include that as one of the categories.

**Mr. Lynch:** Many public plans require their own experience studies to be done every three to five years, and so, as a result, it's less necessary for the Society to come up with numbers for them.

**Ms. Kimberley B. Spove:** I don't have a question, just an interesting observation. If you look at the chart that Steve did on the termination rates for the ones that he had the cleaner data on, it looks like if you adjust it down a little bit, it compares very closely to the ultimate table from Roger's study.

**Mr. Kopp:** I never did a comparison to those two plans with Roger's tables, although there is a section of the report that does compare our base table with Roger's. Well, I shouldn't say the base table. We did do a select-and-ultimate. In one section we did a select-and-ultimate with five years and ten years, and we compared the five-year with Roger's, and I actually have the charts, but I don't put much stock in our select-and-ultimate tables. I have them in the report, but it would have been interesting to do as you suggested, take the two other plans and compare them to Roger's. I agree looking at Roger's report that they're probably very similar.

**Mr. Jeffrey C. Rose:** You said a number of times that you have some concern about the way the table turned up, specifically the termination rates after age 60, but the others you talked to did not share the same concern. I was curious what their reasoning was for that. I guess on the post-retirement medical side it may have a

bigger impact if we're able to support higher rates of termination before people would become eligible for the benefits.

**Mr. Kopp:** In our discussions and our conference calls I don't really remember what the reasons were. It seemed that Bart Prien basically said, "It's okay to have the tables turn up like that." I don't know. Do you remember?

**Mr. Edwalds:** I think that was also a consequence of the fact that we had already decided that we weren't producing actual tables of termination and retirement rates; we were trying to put out the data that we had collected. That was part of it. Certainly one of the things that we felt was probably in there is a certain set of people that had already taken early retirement and were taking another job. They weren't eligible for a retirement benefit from the plan that we collected the data from. They're essentially already collecting their benefit or had a substantial deferred benefit that was awaiting them upon retirement, so that even though in our data they wouldn't show up as a retirement from the plan that we're measuring, they were people that were retiring. When calculating liability for a plan that has such people in it, obviously, if somebody's going to be leaving that plan without a pension to collect, it's not a liability of that plan. It's somebody else's liability. That seemed to be a lot of what was in there. I think a lot of those higher age terminations did have relatively low years of service, if I recall correctly.

**Mr. Kopp:** That is correct, actually. In that gray area, ages 50–64, where the termination table went upwards, if you looked at the years of service, most of them didn't have the 30 years of service or 25 years of service. They were lower-years-of-service employees.

**Mr. Rose:** Steve, do you have the information for years-of-service analysis with you to show? It plateaued at about three levels.

**Mr. Kopp:** When we did the termination ages, the analysis by years of service did appear to be three plateaus. The first level was applied to years of service 1–8 and had net decrement ratios around 15%. So, people who had been with the company 1–8 years had net decrement ratios, approximately termination ratios of 15%. The second level was 9–11 where the net decrement ratio dropped to 10%. Then the third level, which would be your ultimate level, went from durations 12 to 28, where net decrement ratios were about 4%. So, I guess in a select-and-ultimate table the ultimate part would start at duration 12. So, it'd be an 11-year select-and-ultimate table, and the ultimate rate would be around 4%, which I think is a bit higher than Roger's ultimate rate, or maybe his was close to 4%, too.

**Mr. Kopp:** It's close to Roger's result. But prior to the 12 years of service, we have the two other plateaus.

**Mr. Vaughn:** Back to the issue of retirement rates and particularly the misuse of the tables for *FAS No. 106* type valuations.

**Mr. Vaughn:** In the plans where you had good data, the termination rates at the older ages dropped smooth all the way to 65 which is what you intuitively expect. Joe commented earlier how people are crossing the threshold and becoming eligible during the period that you're observing and are, in fact, retiring. I'm just concerned that we have the qx's or the decrements for terminations increasing all the way up to age 65; it would create more problems.

**Mr. Kopp:** I guess I really don't have an answer to that. I mean I have concerns with the table turning up as much as it did, and some reasons have been pointed out as to why the termination rates might go up a little bit, but I didn't think they'd go up as much. I pointed that out in the report in a few spots. The gray area is ages 50–64. The reason the termination rates are going up is people who are identified according to our definition as terminations were really retirements, as Tom mentioned. So, the other thing to remember is, the other two plans were a certain industry code. They were Industry Code 6, which was the utilities. Actually, I'll tell you exactly what Industry Code 6 was. It's right here in the report. They were utilities and communication services. They had low termination rates anyway. You've got to take that into consideration. Whereas our base tables covered all groups, all different compensation types, all different regions, and all different industry codes. So, if you have Industry Code 6, and in the north you could use the other two plans as a better table, at least for the ages 50–64, as it makes its way slowly down to zero, than the base table, I guess. So, to answer your question, if you're going to use the base tables, use the 50–64 range with caution.

**Mr. Lloyd A. Katz:** One of the interesting aspects of your study is the shape of the curve. It doesn't look like the Crocker-Sarason. After looking at the two plans you did, I was wondering why the Crocker-Sarason Table doesn't look that bad at the beginning and ending ages. Would it be reasonable to use those values and then redraw the curve for a valuation?

**Mr. Kopp:** You're talking about the Sarason Tables T–3 and T–5?

**Mr. Katz:** Its not even T–3 or T–5, or even T–8 or T–9. You could use them at a couple early ages and a couple late ages, and then try to redraw a curve that more closely matches the observed pattern.

**Mr. Kopp:** I have to admit I never thought about that. That's an interesting thing — to mix the two tables so that the tail end, the young age and the older ages use the Sarason Tables. We had a lot of exposure at the young age. For the older ages, the exposure wasn't as high. So, at the tail ends, the exposure might not be high enough to make the tail ends credible. That's usually a problem in most mortality studies. So, perhaps use the Sarason Table for those tail ends, the young and old, and then interpolate our table between the two. That's something that an actuary can think about doing.

**Mr. Edwalds:** One thing I recall about the Sarason Tables is that the ultimate rates were actually based on a mortality. I believe, that was the 1951 Group Annuity Mortality (GAM).

**Mr. Edwalds:** So they all converge down to that level on the T Tables.

**Mr. Kopp:** Actually, that is true. I read a report on their tables that said after age, 55, they used the GAM, which is a mortality table as opposed to a termination rate table. You have to take that into consideration, too. That's a good point.

**Mr. Edwalds:** I thought that the base tables actually followed the shape of Roger's tables pretty well. Since Roger had been using quinquennial ages, the major difference between the shape of the base tables that Steve found and the ones that Roger had was at those higher ages where we had the funny turn that Steve referred to and at the very low ages where we had the little hump, and in the quinquennial age analysis that little hump would have disappeared. So, I really felt that basically we were confirming what Roger had found—the shape was concave, up, as opposed to concave, down, but that it did exhibit a shape different from the T Tables and more similar to the Vaughn Tables.

**Mr. Paul T. Richmond:** If you use the decrement ratios, you'd be reflecting a restoration liability associated with your plan. What I mean is what is the liability associated with people who leave an organization for a temporary period of time and then return? So, if we use just the decrement ratios that you provided, we'd be increasing the liability over and above, but maybe that's the right thing to do because people do leave for a period of time and then come back.

**Mr. Kopp:** I agree with that. I mean, when we first did the table and had these net decrement problems, my honest opinion at that time was we're going to get results that are just useless. But since working on the study, and certainly since the study has been completed, I've thought exactly what you have pointed out—that we're really calculating what the net changes are in a pension plan's history. That includes people who leave because they've been fired or have found another job,

people who leave due to retiring, people who leave because they've been disabled and had to leave the workforce, or people who have died. It also takes into consideration those people who have been hired back for whatever reasons—military service, maternity leaves, and so on. Maybe that's what you want in your study because one of the things we were going to do in the study was take these ratios, graduate them, make an assumption to mortality and factor out the deaths, just to get the pure and only terminations. In the end, you're getting everything. This is the net result of 38 or 40 typical plans, which includes hiring back people with years of service. Perhaps, in the end, the tables are more useful than just a straightforward termination table. I changed my tune over the last year-and-a-half since the study started.

**Mr. Vaughn:** I agree that restoration liability seems to reflect it by having the negative decrements built in. So, it is a useful way of using the data.

**Mr. Lynch:** While I have this panel of experts here, (and this is unrelated to turnover) let's consider the idea of recovery from disablement. In connection with *FAS No. 106* and *FAS No. 112* costing, I experimented briefly with a fifth decrement, as a negative decrement, which isolated return from disablement, but I could never find much interest in it among my clientele, so I just dropped it. Are there any thoughts on the subject of the value of a recovery decrement isolated out from the actual positive decrements?

**Ms. Karen Steffen:** I'm a public plan actuary, so I do a lot of these with big groups. I have a couple comments and observations first, and then I'll answer Joe's question. I see the concave curve, like in Mr. Vaughn's study, in all the work that I do, given that big governments represent similar types of employment. I have seen the tail at the end at the older ages. I think that's maybe more of a data problem. There are people who are coded as terminations because that's how they're reported by the employer, but they're either applying for disability or retirement, or I suspect in the corporate sector they're deferred retirements. They leave employment but, for whatever reason, don't want to take the reduced benefit. They wait until they can come back and get a full retirement. Joe brought up a question about return to work; I've actually tried that with a major state plan where we've tried to look at return to work. It's a very complicated actual formula to build those back in, and the data were very poor. This was a fairly good-sized state, but not one of the largest ones. The data were fairly credible, and I just didn't think it was worth the trouble. It's like any other gain and loss. You take it in when you have return-to-work experience.

**Mr. Kopp:** Yes, those are some good points, and, again, the upturn in the termination table rates is partially due to people who have been designated or

identified as terminations who actually retire. Someone actually mentioned a person earlier who had an N in the eligible for retirement column in 1993, and then in 1994 it turns to an R, but they've left. They would have been counted as a 1993 termination, even though they actually retired because at the end of the year they were eligible. So, that could be one of the flaws of our methodology in the study. That gray area is still a gray area because some of the terminations really are retirements. We've mentioned them as well. You made some good points.

**Ms. Steffen:** One other observation. We usually use a fairly significant select-and-ultimate table, (five year) in most of the bigger systems, and I'm now coming to the conclusion that pure duration rates on both withdrawal and salary inflation is really what we're seeing happen. Age is really not a factor anymore.

**Mr. Edwalds:** Actually, I have a quick response to that. I think that in the paper, the ten-year select-and-ultimate table that he put together did confirm that even though we're showing all these different rates, the differentials by age in the select period were not that pronounced.

**Mr. Richard S. Raskin:** I just wonder if you could be getting people because of QDROs, or were they taken out somehow?

**Mr. Kopp:** I'm not sure what they are.

**Mr. Raskin:** When a person who's married has his benefits split and part of it going to the spouse, most companies reflect that as another person. Sometimes that can then appear as another body.

**Mr. Kopp:** No, we didn't specifically look at that. We did find some companies that had two lines of data for people who are 53 with 10 years of service and were male. All of a sudden there were two lines of data there. We ended up checking our program to make sure we combined those two into one, so they were treated as one line of data. Maybe it was due to the reasons you mentioned, but, we never looked into it, and never even thought to, and I'm not sure that we could have any way because the data weren't coded in a way to show whether there was a domestic relations order.

**Mr. Vaughn:** Let's go back to the comment about the age duration-based turnover and that age is not as relevant. When we looked at the first three years of turnover we saw a real strong correlation between age, ranging from above 25% in the lower age brackets to almost 10% in the 50–55 age group. So, I'm a little perplexed as to how you can build strictly duration-based tables exclusive of age. Is that what you said? I thought it was.

**Ms. Steffen:** That's what we're seeing in a lot of the data.

**Ms. Judy Feldman Anderson:** Since we are talking about continuing to study turnover at the SOA, I think one of the factors that we don't have a good feel for is how turnover parallels changes in the economy. One of the hopes in doing ongoing turnover studies is that we'll be able to follow that along and see what trends develop.

**Mr. Kopp:** We did break the data into 1989–92 and 1993–94. We split it up, the first four years and the last two years, to see if there was any trend. I'm not sure what the economy was doing in the United States in those two particular timeframes, but we didn't find much. There was no significant difference between the 1989–92 period and the 1993–94 period, but future studies may show termination ratios changing.

**Mr. Lynch:** The question about QDROs raised the question in my mind. I'm assuming the study was limited to defined-benefit plans.

**Mr. Kopp:** Yes.

CHART 1
T-5 AND T-9 TABLES

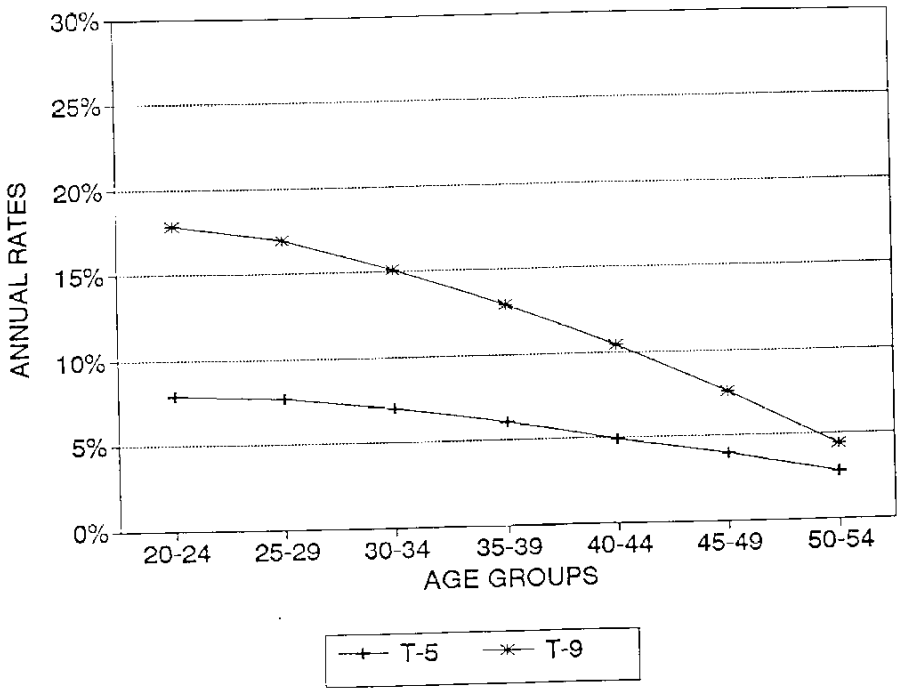

CHART 2
V ULTIMATE TABLE VERSUS T-5 & T-9 TABLES

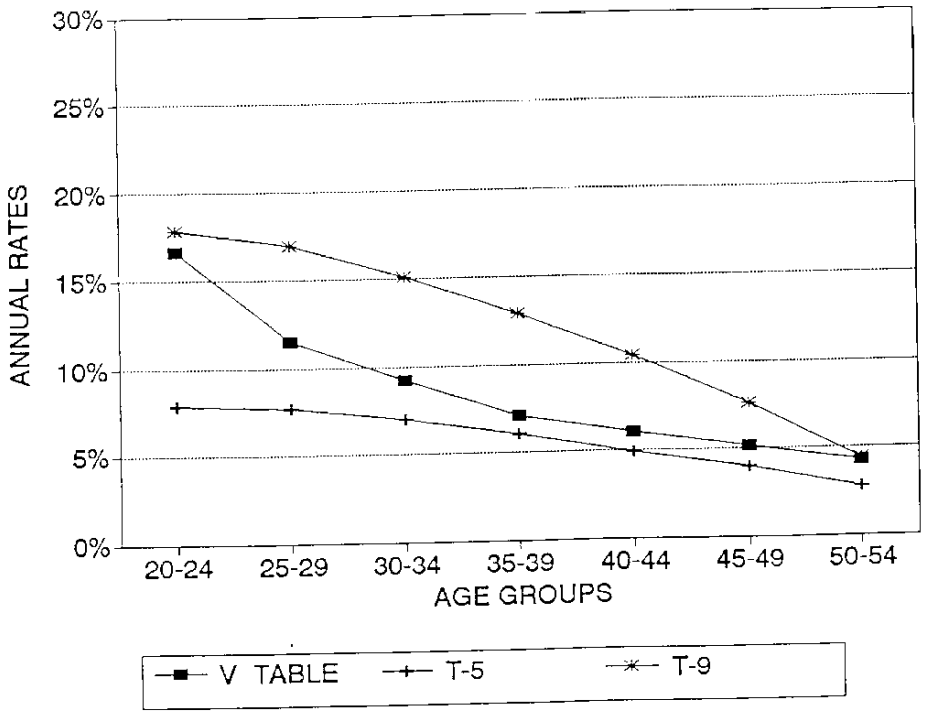


CHART 3
INDUSTRY DATA VERSUS V ULTIMATE TABLE

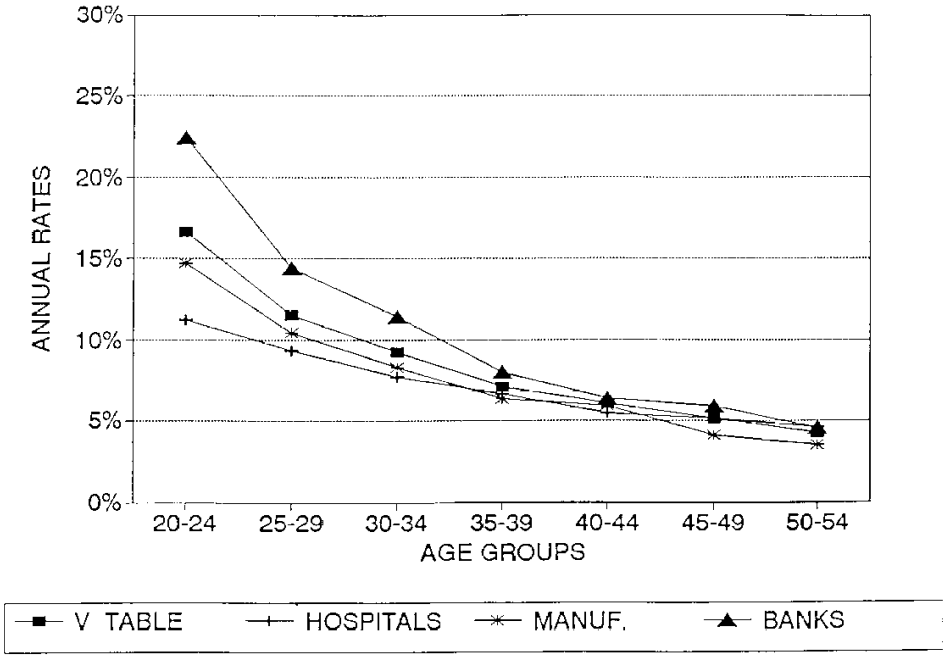

CHART 4
1987–89 SELECT EXPERIENCE
Years 1, 2, & 3 Combined

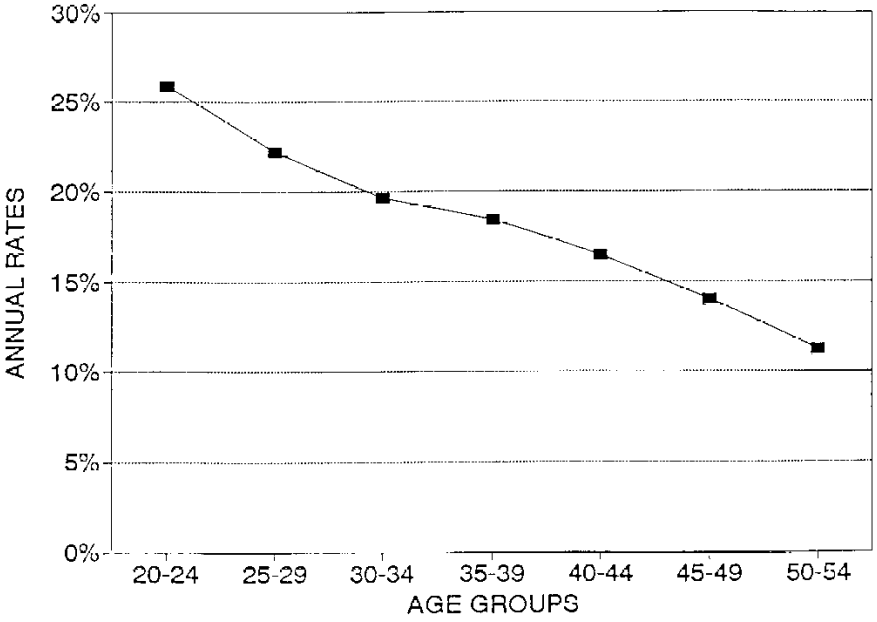


CHART 5
1987–89 UNADJUSTED DATA
3 YEAR SELECT-AND-ULTIMATE

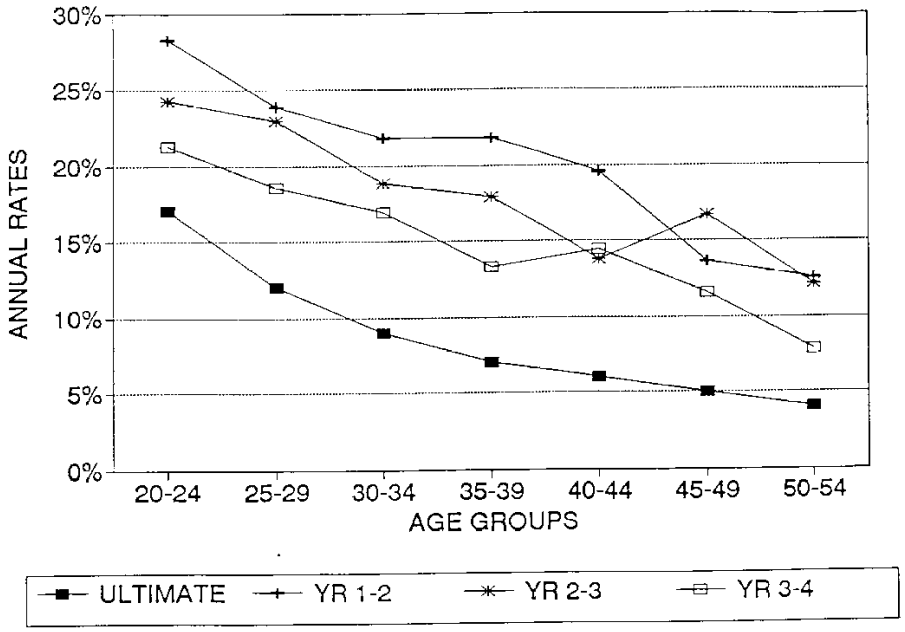

CHART 6
SMOOTHED SELECT-AND-ULTIMATE RATES

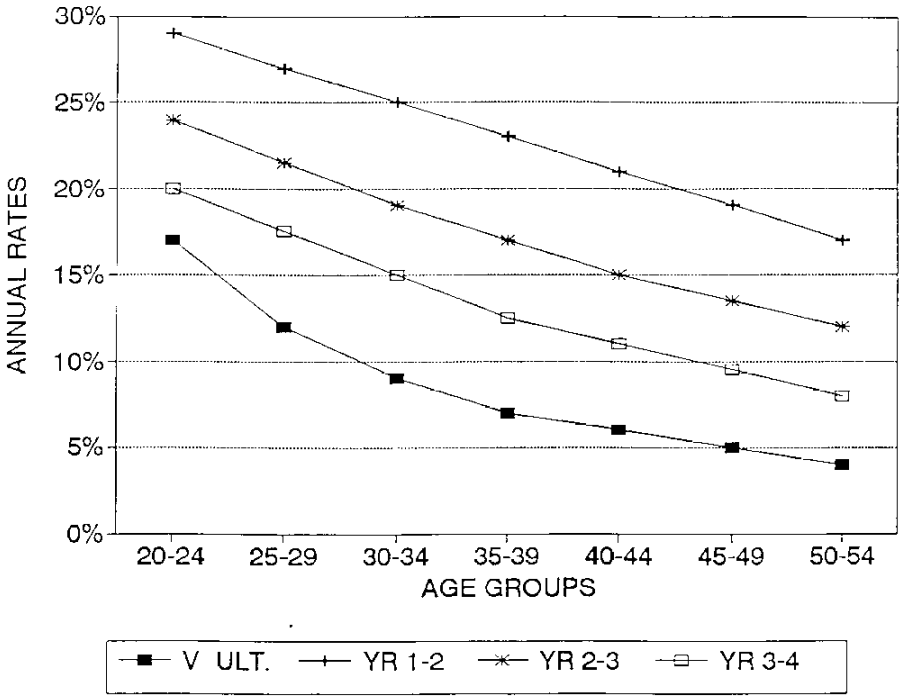


CHART 7
1987–89 EXPERIENCE VERSUS 1978–80 EXPERIENCE
ULTIMATE RATES