LIVING TO 100 SYMPOSIUM*

Lake Buena Vista, FL
January 7-8, 2008

General Session 2: Social Insurance Perspectives and Implications Q&A

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BRUCE SCHOBEL: I know that we always study mortality by gender and by age. I mean these things are pretty objective. They don't change generally. But I think mortality by income level is a little more troubling and I think that it raises questions. People move around within income classes during their lifetimes. Obviously they don't move drastically. You don't wake up one morning and find that you're Bill Gates, unless you actually are. But people do move around. A guy, who is low income in his 20s, may be much higher income in his 50s and vice versa. And I think that if you try to study mortality by income class, I wonder if you're really getting meaningful results and how do you correct for that kind of movement? It's very different from studying mortality by gender and I wonder if you could comment on that. How do you know that you're really getting useful information?

JEAN-CLAUDE MENARD: I thank you Bruce for your excellent question. They are very useful for one thing. First, the way we develop. We didn't look at the movement of workers from one class of income to another during their lifetime. What we use is a program in Canada, the Guaranteed Income Supplement, that is paid to seniors with low income. And so we didn't look at the past history of the person, but we found that if you are a single male with low income, your life expectancy at age 65 is 13 years. On the other end of the spectrum, if you are a female, married and you receive a reduced old age security benefit because you have high income, the life expectancy is 23 years. Why is it useful if we have to move the normal retirement age from 65 to 66? Obviously, the people that will be hurt the most are the people with the lower life expectancy. That's the reason why we have done that study at first. Of course, it's imperfect and the other thing is that we adjust that recently because we had a recent access to the Old Age Security database. We intend to do this at least once every five years to see if there are some differences, and if there are some patterns over time. But that's in my view, the first reason to have done that. And to show that when you look at the average, there's a wide range among significant groups of people.

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STEPHEN C. GOSS: Just to add a little comment. We've taken a look at the variation by income, marital status and even education. And these are sometimes tricky propositions because causation is sometimes a little bit difficult to sort out. How much of the variation in mortality for example, that we see across income groups, whether it's specific income levels at a given age versus lifetime income, which might be actually more predictive, or across marital status or education is because people have found themselves into those groups, and that actually improves your mortality status? Or how much of it is just a mutual selection consideration or a correlation amongst these? People, who become married, typically are people who you might have expected would have lived longer, and is it because they got married, that they have lower death rates, or is it because they're stronger, tougher people, that they were more attractive and ended up getting married? Education is very similar. The advantages that people find themselves to be able to get a higher education at younger age, are probably some of the same advantages that will allow them to have lower mortality rates in the future. So these are important areas, but the question of causation versus just correlation is I think, a serious one.

DOUG ANDREWS: Two questions. The first one just follows along on this question of income. I guess it's more a question of how much information about me Jean-Claude is able to get. I understand 65 up, the records that you explained you're using, but for those that are under 65, are you able to get access to information on income? Or is it only income on which Canada pension plan contributions are paid? Or only earned income, or does it include investment income, etc.?

JEAN-CLAUDE MENARD: We were very fortunate to go over the legal hurdles to now have access to the CRA Canadian Revenue Agency data file and we have the tax records of everyone. Of course, it will need time and the resources to process that. The idea for us is to see what could be the impact of the $600 billion dollars in RSPs and how this could impact the retirement and the future retirement income of Canadians. We were so fortunate with the data we now have, and we don't have any personal information in the sense that we don't have the social insurance number. We have a transformed SIN, that is the same in the CRA database, in the Old Age Security database and in the Canada Pension Plan database and with that, we could do a lot of analysis. Let's say that before the next, not the next Old Age Security Report that will be produced in May, but the other one in three years, we would like to have a better assessment of the cost of the Guaranteed Income Supplement. Right now, it's $6 billion dollars a year, and of course, it's highly related to income of Canadians and all Canadians have saved it for their retirement.

DOUG ANDREWS: Thank you. My second question is for Adrian. It's very interesting to see the cohort effect that you've analyzed and there's been tremendous controversy regarding the defined benefit funding crisis, and were the actuaries to blame? I've been one of the defenders of the actuaries that the sponsors were making the decisions; the actuaries were only providing advice and that some of these things were investment markets and so on. But when I see the cohort effect, I wonder whether the actuaries were

taking that into account or not and if maybe in that area, the actuaries were to blame for the DB funding crisis. Could you comment on that?

ADRIAN GALLOP: It's probably a bit hard to say what the actuaries were doing and I don't actually have to value any pension fund schemes. But I think one of the problems is that when people are using the tables produced by the CMI, they were split into assured lives, for ages up to 60-65 and then there were pensioner lives tables and those start from age 60 onwards. So if you look at historical data for age 65 and over, the cohort effects weren't so strong in the pensioner data 10-15 years ago, because the cohort effects relate mainly to people born around 1931 who were just coming up to 65 then. Thus the effects weren't being shown in the pensioner data at that time. So, it's possible. In our projections, we've been talking about cohort effects and including them in our projections since about the 1990s. The first one I think was 1991 or 1992 based projections. So people who were looking at those would know that we were projecting the cohort effects. But again, there is argument between people as to whether this cohort effect was actually causing large mortality improvements and whether it will persist into the future. And as it happens, it has done and we think it will continue to carry on into the future as far as doing our projections. But maybe some actuaries didn't think it would carry on a long time into the future.

DAVID MORRIS: When I think about mortality improvement, the thing I think of most is changes of lifestyle, improvements in medical care, disease control and so forth. There's this whole other area of things that have affected mortality that I think of as having better mortality thrust upon us by society and that is, everything from the elimination of the use of DDT to the advent of seat beat laws and better vehicles in general. That area seems like it has much less potential for continued improvement in the future, than does the medical area. Have any of you quantified the relative impacts of that type of thing and built that into the projections that you're putting forward?

STEPHEN C. GOSS: My reaction on that is of the area of accidents, which is one area for a cause of deaths that we do isolate. That's I think of teens and 20s and 30s there's a fair amount of that, but that's actually at a fairly low level of death rate and I'm not sure that we would find that deaths from accidents, because of seat belts has really made an awful lot of impact. I think you're right, it's probably almost exclusively our area of potential in the future is in things we can do in terms of diseases for a reduction of death. Isolating things like DDT is probably a little bit more difficult because things like DDT, environmental causes that affect us, especially at younger ages, are cumulative and may tend to show up in lots of ways later that we're not well able to isolate. I think, by the way, Adrian's experience with the cohort is extremely fascinating and I would just observe on the cohort concept that the difference between the cohort effect that Adrian's seeing and what Jean-Claude and I see, by way of period effects, is not really a matter of there's this special cohort that had this dramatic lower death rates, and the surrounding cohorts had higher death rates. It's really just that a level shift occurred, with that cohort, whereas as we've seen in the U.S. and Canada and many other countries, there's level shifts that tend to occur in fits and starts, sort of on a period basis, all ages getting better in terms of mortality improvement at a given point in time. So it's really a very

difference and I think this is an area that is going to be fascinating to pursue further with the research.

JEAN-CLAUDE MENARD: We did not.

LEONID GAVRILOV: I was struck by the picture for American women life expectancies. So there's some kind of leveling off of life expectancy now. But when you make forecasts for the future, there is a really bold increase in life expectancy. And so my question is what makes you so optimistic about this and what are the assumptions that you project such discontinuity , where you have a leveling off of life expectancy now and then suddenly for projections you make very bold forecasts for improvement? What is behind this assumption for the U.S.?

STEPHEN C. GOSS: If you recall, on the life expectancies at birth for the United States, we actually have a real deceleration for life expectancy of births for both males and females. And that's largely because we see a substantial deceleration at the younger ages. At 65, I think compared to the last 15-20 years, you will see, if you look at our charts, that we actually have a somewhat of a deceleration for males, simply because we've had very, very strong mortality improvement for males since 1982 , but we have an acceleration for females. We also have sort of a general deceleration of our mortality improvement occurring throughout the next 75 years and actually beyond. I think probably of the three of us, Adrian is the one who really does not tend to have some, had deceleration occurring in the longer term. I'm not sure about Canada. We do project not terribly optimistic, but there will be deceleration on an ongoing basis into the future. And that's a point of much debate. I, by the way, just want to say I'm so glad to hear you say this, because we have an awful lot of demographers who are on our case all the time, about not having nearly as much mortality improvement. So it's nice to hear that there is a body of opinion here. Some on the other side. Thanks.

JEAN-CLAUDE MENARD: Maybe one brief comment in this actuarial report comparing 2006 to the 2003 report. The biggest change from one report to another was the life expectancy and specially, my area of concern, although I'm glad for my father and mother, because they are in this age group of 65 to 84—especially my father. The amazing increases or reduction in mortality rates for males between 65 and 84 in the past 15 years, if we project that with a stochastic method in 25 years, a male will live longer than females in Canada, and so we are not there yet. However, if trends continue, we might in the next report in 2009, we might have to revisit again, even if we have increased significantly the life expectancy from one report 2003 to 2006, we might have to do it again. But I would like to just point out that there's a self-default provisions in the Canada pension plan. In other words, if the contribution rate or if the contribution is stated in this report, is higher than 9.9 percent, there are two things. If the provinces don't agree, the half of the increase of the difference is included in the contribution rate and the benefits are frozen for three years. No inflation. That means that I have to be very careful about the distant future. It's one thing to say to my father that he won't receive any indexation for three years because he is living longer but it's another issue to say that, because his grandson will live forever, then yes, to obvious benefit frozen. So

we have to be very careful to I would say, in the first 25 years of projections are important, but to go beyond that, there are some real issues for Canadians if we are going too far too rapidly.

GARY MOONEY: If I have an accurate picture in my mind of the trends, it appears that in the U.S. and Canada, that there is a deceleration in mortality improvements and that makes me nervous. In particular with respect to potential advances in medical science, whether it's gene therapies, nanotechnology and so on. The realization of some of the things that Cynthia was talking about yesterday, and you're projecting out 30, 50 and more years, aren't you concerned or nervous about these types of improvements as well?

STEPHEN C. GOSS: For 65 and over we're actually projecting mortality rates of improvement that are very similar to the average experience of the prior century. And the average experience to the prior century incorporates some pretty dramatic changes; antibiotics coming on and antibiotics were pretty much a pure good. They really cut back infectious diseases. I think it was Adrian's slide that showed that they went down to zero in the U.K. and everywhere else and that's pretty good stuff. Better potable water, adequate nutrition for everybody in the country. We had some really great stuff happening in the last century, and to have the same rate of mortality improve on an average occurring over the next century, as we had over the last century, I would suggest as perhaps a challenge, so really we do not have that much deceleration at 65 and over relative to the past century. The genetic stuff, I think is going to be very, very interesting, because what we have to really look for in terms of things that will improve mortality in the future, are things that we can apply that will really be net positive. I mean there are some things like chemotherapy, radiation therapy, which can be good in some cases, but they also have some very negative effects. But we have pure good technologies that we can apply in the future. Understand the human genome and not saying what the amino acids are, is great for a start, but actually finding out how all the genes interact, and do what they do to us, and being able to take advantage of that, I think, could be many decades in the future. But we'll see.

JEAN-CLAUDE MENARD: Although it's a challenge definitely. Although I don't know what exactly the science will bring to us in the next 75 years, we were fortunate three years ago to have Adrian Gallop at one of our interdisciplinary seminar where we invite experts and these experts provide us views on different assumptions and Adrian was kind enough to use the Canadian data from 1926 until now, to produce Canadian life expectancies based on U.K. methodology. And this paper is available on our web site and you could see that in this report, the projected life expectancies are a little bit smaller than the one suggested by Adrian. So without even knowing the, let's see the possibilities of science again, that we might have to revisit our assumptions in the next report, because especially males are in the age group where it, makes a difference in the 65 to 84 group. So what we have seen in the past fifteen years is something that we have to take into account.

GARY MOONEY: And just one quick question for the U.K. versus Canada and the U.S. The U.K. rate of mortality improvement is more aggressive than in Canada and the States

and I'm wondering if Adrian can point to some underlying reasons for that? Are there some areas of improvement to be realized in the U.K. that perhaps have already been realized in Canada or the U.S. or what?

ADRIAN GALLOP: The assumptions are based on looking at the past trends, so it's something that's already in the past trends. That's the first thing. Secondly, if you compare U.K. life expectancy to other countries in Western Europe, it is toward the lower end as compared to Switzerland or France, say. There is a year difference or more, so we think we might be able to catch up to the other Western European countries. So those are the two main things

GARY MOONEY: Do you see that as just a lag effect then?

ADRIAN GALLOP: Yes and also things like the effects of smoking prevalence; smoking prevalence in the U.K. being different to smoking prevalence in other countries.

MIKE COWELL: I'm mostly responding to Bruce Schobel first question following up on Jean-Claude's example with a huge differential between the high income Canadian female and the low income male. And the fact is, and we have statistics to demonstrate this, that people of higher levels of education and higher levels of income take better care of themselves. They don't smoke. They generally exercise more and more careful in their eating habits. They get regular medical checkups. They do all those things that extend what control they do have over their life expectancy and 40-50 years ago, it was very hard to find out about people's smoking habits. We had a huge change. It's extremely hard to find out about people's exercise and diet habits and income and education are simply convenient proxies. So even though it might sound politically insensitive to use words like income and education, they are the best proxies we have for what currently are enormous differentials. And if we ignore them, then we're running the risk of not providing our knowledge and experience to help people like Jean-Claude's low income, 65 year old male at least achieve some potential toward the high income female.

ANNA RAPPAPORT: I know the three of you as representatives of the government systems have done some of the best work on mortality and had the most experts that anybody has. So I want to ask you a question that really isn't so much a question for you all, but it's a question for many others, which you might have insight on. One of the big questions for people that are guaranteeing mortality risk particularly in the private sector, is how do you study and think about the potential for discontinuities? How do you identify and think about the issue of extreme cases? The equivalent of a 100 year event in the hurricanes, because if we're thinking about particularly reinsuring mortality risk, as an example, and that's a huge issue. Do you have any insights about what are good ways to think about discontinuities and the 100 year event when it comes to mortality improvement?

STEPHEN C. GOSS: In our experience in the U.S. we did have those two periods with rather extraordinary increase in life expectancy, one of which was the Medicare/Medicaid period. Now that's obviously a once in a lifetime; once in a millennium kind of thing that

you're going to be able to bring that kind of advance and the access to medical care. I think that's probably not what Anna is really referring to. I would think it's probably more things like the experience of when antibiotics came to the fore. If and when we have sudden spurts and availability of something coming out of the human genome project, there will be things that will occur occasionally, and we do not attempt and I don't think any of us try to attempt or sort of predict when the spurts will occur. There will clearly be spurts when we'll have significant improvements in mortality here and there. The real key is at what pace will these kinds of advances occur? Will it be at the rate of 1 percent per year mortality improvement? .7 percent per year mortality improvement at the ages that matter most, the way we have it? And there are other people who are projecting 2 and 2-1/2 percent improvement in mortality. All of these are possibilities. The very, very high one, I think would require that we have tremendous advances occurring in the future or radical changes in lifestyle. But even the radical changes in lifestyle would just give us a level shift. We'd have to have incredible increases out of the human genome project and others to be able to sustain for 75 years anything like 2 percent, I think.

JEAN-CLAUDE MENARD: About discontinuity, I look at the life expectancy at birth versus the number of centenarians in a country. And this is in my view a correlation that could be done if you want to see if the country as a whole is a homogeneous country. The number of centenarians in Japan, compared to the life expectancy in my view, makes sense, and also in Canada. But I was particularly struck yesterday by the number of centenarians in India. With a life expectancy at birth about 65, which means that if the number of centenarians there in India is right, it means that they have a very heterogeneous country and it could always be the case for United States. So then in some countries, yes, discontinuities are probably more likely to happen than other countries. That's the only thought I have at this time.

ADRIAN GALLOP: I think the thing you need to do would be some kind of stochastic projections, that's really the only way you're going to get these kind of big shifts; most of the projections that we are doing involve some kind of smoothing future mortality rates.

STEVEN MAKIN: I have one general point to make and then one specific question for you Adrian. The general point is that I was involved in some research activity in 2007, which we presented to the U.K. Actuarial Profession. One of the findings in particular in relation to the U.S. was that whilst, yes you do have period effects in your mortality, we found that the cohort effects were dominant. So maybe that's the first time that someone suggested that in this conference. The paper if anyone is interested is called *Two Dimensional Mortality Data: Patterns and Projections"* and you can find it on the Faculty and Institute web site. The question for Adrian, in the heat map that you showed with, for males, sort of the male projection, for young lives you do an age period projection and for older lives you're doing an age cohort projection, which kind of leaves up a triangle in the middle. How did you fill in the missing triangle? Was it something quite clever or was it pragmatic?

ADRIAN GALLOP: We interpolate between the highest age horizontal rate improvements and the lowest age diagonal rates if you follow me. It's a fairly pragmatic method. We could try and do cohort projections right down to the lowest ages, but it's very difficult to tell what's happening with those young ages and we don't know whether they'll exhibit cohort effects when they get to age 40 and 50, when these effects are usually first shown in the data.

BOB HOWARD: I just wanted to comment on the cohorts as well. I did some research on data on mortality.org looking at several countries. I graduated the raw mortality rates and looked at improvement rates and I found what looked like a cohort for males in virtually every country except the U.S. I looked at about 16-18 countries. Japan was unusual in that they had a cohort effect, but it was about 20 years earlier than for the other countries. And among females, I think I found a cohort really only at the U.K. It didn't seem to be anywhere else. I've got a question on the cohorts for Adrian. I wonder if you've been able to look at smoker distinct data, to see if the cohort effect was as evident for smokers and non-smokers separately, or did you see it only in the aggregate data?

ADRIAN GALLOP: We've only looked at aggregate data because we don't really have historical data split by smoker and non-smoker. There isn't any in the population data because it's not something that is recorded on the death certificates.

BOB HOWARD: Well, what about CMI?

ADRIAN GALLOP: The CMI subdivide, but I think the smoker and non-smoker definition doesn't go back a long way but it is possibly an area for research if someone can look into it.

JAY SIEGEL: The fundamental issues in making projections are the main decision points. They are the degree of disaggregation, the basic methodology, and the expression of or measurement of uncertainty. Now a lot of work went into your projections and yet I know that, within a half hour, I could have produced the fundamental results that you have by simply looking briefly at the historical record. In other words, you go to a great deal of trouble to make your projections. Why? The fundamental basis for the disaggregation is primarily your answer to the question, what does the user need? You produce sex and age detail because that's what you've got to produce for the users. You don't have to produce marital status and income. Now, your decision on disaggregation—and that is my question to you—how do you make the decision as to the level of disaggregation and, further on, the method of projection? You cannot hope to produce more accurate projections by choosing additional levels of disaggregation because you can't make accurate projections of the disaggregates, i.e., income, marital status. You have no good basis for doing that. So there's a tension as to where you draw the line. My offhand sense of it is that you look at income and marital status and other variables such as education, and conclude that using them will improve the projections. Maybe a conversion of the educational classes to the higher attainment group will result

in a higher life expectancy. But to put that into the system quantitatively is difficult. So the question then is how do you decide on the level of disaggregation?

On the methodology—the key issue is, are you mathematical determinists, demographic determinists, or are you sociological analysts? That is, do you go, Lee-Carter, which is mainly a sort of mathematical determinism with a touch of analysis, or do you go with Oeppen-Vaupel, who are more clearly mathematical/demographic determinists or Fries and Olshansky, who are closer to biological determinists or even sociological analysts. So the question here is, where do you draw the line between mathematical determinism, that is, just simply looking at a long-term record, and using refinements that recognize new and emerging trends?

I'll leave the third issue on uncertainty out of my further discussion because of time.

ADRIAN GALLOP: I think in terms of the U.K. projections, we are probably somewhere between the mathematical and the other determinists. Basically, I think what drives the U.K. projections are what we're using for the target rates of improvement 25 years into the future. We're now trying to involve more people, not just mathematicians, but also demographers and others to give us some idea as to what they think will be happening over the next 25 years and then we have to make a decision about what we think is going to happen. The other thing as you said, is that we try to illustrate the uncertainty involved in all of these projections, because one thing we know is that the projections aren't going to turn out in fact.

JEAN-CLAUDE MENARD: Our predictions are purely mathematical first. Thank you for and I agree with your observations about disaggregation. However, disaggregation is not done to get a better global projections, it's more like the Guaranteed Income Supplement for example, the benefits is paid based on marital status than the marital status is important to better assess the cost of the Guaranteed Income Supplement.

STEPHEN C. GOSS: On disaggregation, we do disaggregate a little bit more explicitly on the cause of death. Principally, just by way of giving guidance of looking at past trends and the various causes in the future. Like Jean-Claude, we disaggregate on marital status, because it matters. Because we pay benefits differentially based on marital status, so we really kind of have to do that on our projections. Race and ethnicity and some other aspects, we don't really differentiate. We do actually have differentiation and mortality status implicit in our projections, by income level also. Because of persistence of beneficiaries and increasing average benefit levels. The one thing about the mathematical. Mathematical projections of mortality improvement are, we all do that to a degree, but the one thing we've always focused on is you've got to look at the conditions of the past, what caused the rates of improvement in the historical period versus the conditions you anticipate in the future, just because you've had a 1 percent or 2 percent or 0.2 percent improvement in mortality in the past, you have to look at what the conditions were that prevailed then and do you think those same conditions or different conditions will prevail in the future. You can't put a ruler on past experience and extrapolate on that basis.