



Presentation to the SOA Annual Meeting
Actuarial Valuation of the Canada Pension Plan –
Modeling Uncertainty and Properly Disclosing the Results
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(Slide 1)

Good morning, by way of introduction, I am Jean-Claude Ménard, Chief Actuary of the Canada Pension Plan, the Old Age Security Program and federal public sector pension plans in Canada. Thank you for inviting me here today to talk about the actuarial valuation model of the Canada Pension Plan.

Table of Contents (Slide 2)

The first part of my presentation will focus on describing the Canada Pension Plan and how the valuation model works. The second part will focus on how to properly report the results. I will conclude by describing how the quality of the CPP valuation work performed by my office is monitored through two peer review processes that serve to promote transparency of the CPP valuation report and to ensure that stringent national and international actuarial standards of practice are applied.

Canada Pension Plan (Slide 3)

The Canada Pension Plan, which came into force in 1966, is a national career adjusted earnings defined benefit plan. Virtually all members of the Canadian labour force between the ages of 18 and 70 with employment earnings are included, with the exception of those covered by the Québec Pension Plan, which is a sister plan to the CPP that is virtually identical in form.

The CPP is financed by employees' and employers' contributions and in the future, also by investment earnings. The Plan provides mostly retirement benefits, but also acts as an insurance plan, providing disability and survivor benefits for those who qualify.

The CPP was recently amended in order to modernize the Plan. The amendments provide greater flexibility for older workers, expand pension coverage, and improve fairness in the retirement provisions. These amendments come into force in 2011 and will be fully implemented by 2016. Today, I will only focus on the current provisions of the Plan.

Cash Flow Formula (Slide 4)

The CPP valuation model is used to project the cash flows in the future and comprises several component models that work together to give the final projections. The valuation model takes into account assets, investment income, contributions and expenditures.

The net cash flows are defined as the difference between the contributions and the expenditures. The assets at the end of a year are the sum of the assets at the beginning of the year plus the year's cash flow,



all increased by investment income as per the last iterative formula. That formula provides the basis for valuing the Plan's assets.

Cash Flow: The Big Picture (Slide 5)

Projecting the cash flows requires projecting various target populations to which we associate various averages amounts. The demographic model is used to project contributions and expenditures by starting with the general population and then projecting the labour force. The labour force is then used to project the contributors to the Plan and its various types of beneficiaries.

From the financial model we project various macroeconomic variables that in turn allow for the projection of average wages and contributory earnings. The average contributory earnings combined with the number of contributors produce the total contributory earnings. Applying the contribution rate of 9.9% to this amount gives the total contributions.

The average pensionable earnings are used to project the average amount of benefits (by benefit type) that, when combined with the number of beneficiaries, produce the total benefit costs.

Benefit costs and administrative expenses together give total expenditures. Lastly, the net cash flow is obtained from the difference between contributions and expenditures.

Demographic Model (Slide 6)

The first step in the demographic model is to project the general population to each mid-year. With the current population as the starting point, the following year's population is composed of those who survived from the prior year, surviving new net migrants from the prior year, and newborns. Newborns are projected from both the general and migrant populations. To project the overall population, the model uses assumptions about mortality, migration, and fertility.

Contributions (Slide 7)

CPP contributions are required over an individual's contributory period; that is, from age 18 to the earliest of age 70, age of pension take-up, or death, less certain exemption periods for disability and childrearing. Contributions result from the contribution rate of 9.9%, split equally between employees and employers, that is applied to annual earnings between the Year's Basic Exemption (YBE) and the Year's Maximum Pensionable Earnings (YMPE). Individuals who are self-employed contribute to the Plan at the full 9.9%.

Contributions Model (Slide 8)

Projecting the contributions of the CPP requires a substantial number of assumptions. The major assumptions are listed in the chart. To project the contributions, the starting point is the general population. The model then applies the first five major assumptions to obtain successively the labour force, the number of employed persons, the number of earners, and finally the number of contributors. On the financial side (shown on the right) the model starts with average employment earnings and projects the average pensionable and contributory earnings using the last four major assumptions listed.

Next, total contributory earnings are derived from the product of the number of contributors and average contributory earnings. Total contributions are then determined by applying the contribution rate of 9.9%.

Expenditures (Slide 9)

As its name implies, the Canada Pension Plan is a plan that mainly provides retirement benefits. As can be seen, the number of retirees and the amount of retirement expenditures account for close to 75% of all beneficiaries and expenditures. The second largest proportion corresponds to survivor benefits.

Retirement Benefit Calculation (Slide 10)

A monthly retirement benefit is payable to any individual who contributed to the CPP. The basic monthly benefit is equal to 25% of the average career adjusted pensionable earnings and is actuarially adjusted for early and late retirement. Pensionable earnings are adjusted in line with wage increases, and the benefit, once in pay, is indexed in line with inflation.

For every projection year, the model calculates the initial monthly benefit for males and females based on age at take-up. To determine the initial benefit, the proportion of individuals eligible to a retirement pension, that is, all contributors aged 60 and over, is determined. From those eligible to retire, it is then necessary to determine the proportion that will elect to retire at given ages. This gives the number of new retirees.

The projected earnings and contributory period are used to determine the benefit. The same methodology is applied to calculate the survivor and disability benefits.

Finally, the total initial monthly retirement benefit is calculated as the product of the number of new retirees, the monthly base pension benefit, and the actuarial adjustment factor for early or late retirement.

Total Retirement Expenditures (Slide 11)

In the CPP model, total retirement benefits are the sum of the retirement benefits for new pensioners and pensioners in pay who survived the preceding year. The total benefits for new pensioners are based on the average number of months a pension was received during the first year, while retirement benefits for pensioners in pay take into account specific CPP beneficiaries' mortality and pension indexation.

Survivor Benefit Calculation (Slide 12)

A monthly survivor benefit is payable to the spouse of a deceased contributor if eligible. The survivor monthly benefit varies with the age of the surviving spouse, the survivor's disability status, and the presence or absence of dependent children. The monthly benefit is composed of a flat rate and an earnings-related benefit for those aged less than 65 or an earnings-related benefit only for those aged 65 and over. The benefit is also indexed in line with inflation. Similar to the determination of retirement benefits, aggregate data based on year, age, and sex are used for survivor benefits.

From this chart, you can see that the methodology used to determine the total initial survivor benefits is similar to the retirement benefit methodology. The differences are in the assumptions required at the

population level and in the reduction factor also based on age. The survivor benefit requires mortality and marital status assumptions.

Total Survivor Expenditures (Slide 13)

Total survivor benefits are the sum of the survivor benefits for new survivor beneficiaries and beneficiaries in pay who survived the preceding year. The total benefits for new survivors are based on the average number of months a benefit was received during the first year as a survivor, while survivor benefits for those in pay reflect specific CPP survivors' mortality and indexation.

Disability Benefit Calculation (Slide 14)

A monthly disability benefit is payable to an individual who contributed to the CPP for a certain period of time and meets the CPP disability criteria. The monthly benefit is equal to the sum of a flat rate and 75% of the base pension amount. The benefit is also indexed in line with inflation. As for the determination of retirement and survivor benefits, aggregate data are used for disability benefits.

The methodology used to determine the total initial disability monthly benefit is also similar to that used for retirement benefits. The main difference is that a disability incidence rate instead of an election rate assumption is needed.

Total Disability Expenditures (Slide 15)

As for retirement and survivor benefits, total disability benefits are determined based on new beneficiaries and in-pay beneficiaries who survive from the preceding year, except that "survival" is based on specific CPP disability mortality and recovery rates.

Other benefits flow charts for child and death benefits are provided in the annex.

Assets Projection (Slide 16)

Since the CPP is partially funded, it requires a projection of assets in addition to the projection of expenditures. Rates of return assumptions for the various asset classes of the investment portfolio are developed on a real basis using historical data, the current state of the economy, and future expectations. The anticipated inflation is added to the real rates of return to give nominal rates of return assumptions. These rates, when combined with the asset mix, produce the portfolio nominal rate of return for each year.

From the derivation of the contributions, expenditures, and the rates of return, the formula shown earlier can be used to project the assets of the CPP through time. Once that is done, the results can be analyzed and the Plan's sustainability evaluated.

Reporting the Results (Purpose of the Actuarial Report) (Slide 17)

Once valuation results are produced, the next crucial part of the valuation process is to report those results. The CPP actuarial report must be prepared every three years, must inform contributors and beneficiaries of the current and projected financial status of the Plan, and in particular, must specify certain information. This includes specifying two key contribution rates that reflect the dual financing objectives of the Plan.

The first objective is *steady-state funding* that replaced the original pay-as-you-go financing of the Plan in order to build a reserve of assets and stabilize the ratio of assets to expenditures over time. The second objective is to fully fund changes to the CPP that increase benefits or add new benefits. The sum of the steady-state and the full funding rates gives the minimum contribution rate for the Plan, which must also be specified in the report. This rate is the lowest rate that is sufficient to sustain the Plan with respect to the dual financing objectives without further increase.

Projected Asset/Expenditure Ratio (Slide 18)

The following chart summarizes the main results of the last CPP actuarial valuation as at the end of 2006. The evolution of the asset/expenditure ratio is shown under both the legislated and minimum contribution rates. The minimum contribution rate is 9.82% of contributory earnings for years 2010 and thereafter.

With the legislated contribution rate of 9.9%, the assets are expected to increase significantly over the next decade and continue to increase moderately thereafter, with the ratio of assets to the following year's expenditures growing from 4.1 in 2006 to 5.5 by 2019 and 6.0 by 2050. These results show that the Canada Pension Plan is financially sustainable over the long term.

International Actuarial Standards of Practice (IASP 1) of the International Actuarial Association (IAA) (Slide 19)

Now, I would like to take the opportunity to discuss some elements that should ideally be included in an actuarial report of a social security program.

Generally speaking, actuarial reports on social security programs should include or make reference to all relevant and material information while taking into account the purpose of the report and to whom it is addressed.

The International Actuarial Association has developed International Actuarial Standards of Practice, in particular IASP 1, "Guidelines of Actuarial Practice for Social Security Programs" that provide a general list of information that should be included in reports on the projected financial status of a social security program. For your reference, the link to these Guidelines is provided at the bottom of the slide. Please note that this standard should be used as a complement to local requirements.

According to the IAA Guidelines, the following 11 points list the main items that should be included in an actuarial report of a social security program. I am please to inform you that the CPP actuarial report is in accordance with these Guidelines in addition to the General Standards of Practice of the Canadian Institute of Actuaries. I will next speak in some detail about the IAA Guidelines, drawing heavily from its specific wording.

IAA Guidelines – Executive Summary, Introduction, Program Provisions (Slide 20)

The first element of information to be included in actuarial reports is an executive summary. The executive summary states the purpose of the report, including a reminder that projections are dependent upon the underlying data, methodology and assumptions, identifies the program being valued and the key

assumptions used, and discloses the main results and conclusions. This has the advantage of allowing the reader to get the big picture of the report in only a few pages.

Next, the introduction provides general information such as to whom the report is addressed, what are the starting and ending dates of the projection period, reference to relevant preceding reports, and the date of the next report.

Financial projections of a social security program depend on the provisions of the program. Written reports should accordingly include a description of the provisions of the program that are materially relevant to the projections, for example, regarding coverage, financing, and benefits.

IAA Guidelines – Data, Assumptions, Methodology (Slide 21)

The actuary should attempt to obtain reliable and sufficiently complete data for the valuation. The actuary should assess and comment on the accuracy, sufficiency and reliability of the data and mention any limitations of the results caused by insufficient or unreliable data.

The report should also indicate the three main areas in which data were used for the purposes of the financial projections:

- 1) starting point of the projection period;
- 2) analysis of past experience as a basis for determining the assumptions used for the financial projections; and
- 3) validation of the projection methodology.

For the assumptions, the actuary should include a description of the rationale used for the determination of all assumptions and should take steps to explain any material impact that changes in assumptions from the preceding report have on the financial projections.

The description of the methodology employed for the financial projections should be sufficient for an actuary or other person with relevant expertise to properly assess the results of the report.

IAA Guidelines – Results (Slide 22)

The actuarial report should include all relevant results of the demographic and financial projections. This implies there being sections on the data, methodology and assumptions, which would normally include:

- population by age groups, sex, and in total;
- dependency ratios;
- employment, contributory, and pensionable earnings by age groups and sex, and averages; and
- covered payroll and workforce.

In addition, it is important to include a section on cash flow financial projections to disclose the:

- contribution rate;
- pay-as-you-go rate;
- amount of contributions required;

- investment earnings and other income;
- total income, benefits, administrative expenses, and total expenditures and assets, if any.

Alternatively or in addition, it may be appropriate to show the results in relation to another measure, such as the administrative expenses of the program as a percentage of benefits paid.

IAA Guidelines – Analysis of Projection Results (Slide 23)

Another important section to include is an analysis of the results. Indeed, according to the Guidelines, the actuary should present:

- a sensitivity analysis, showing the effects on the main projection results of varying key assumptions;
- a reconciliation of results with the previous report, with an explanation of significant changes;
- explanations of any trends in the financial projections, for example, from ageing of the population, maturing of the program, or recent changes to the program; and
- the effect on the financial projections of any events subsequent to the start of the projection period.

IAA Guidelines – Conclusion, Actuarial Opinion (Slide 24)

The conclusion in the report should reiterate the report's objective and ensure readers will have a sound understanding of both the future financial status of the program and the associated uncertainties in making the projections. If applicable, the conclusion should also provide an indication of the eroding effect of inflation.

There should be a separate section providing an actuarial opinion on the sufficiency and reliability of data, the reasonableness of assumptions, the appropriateness of the methodology and its consistency with sound actuarial principles, and finally the report's compliance with, and departures from, any local standards and guidelines and the IAA Guidelines of Actuarial Practice.

Lastly, the date and the actuary's name, signature and position held should be included in the actuarial report.

Although much information is required by the Guidelines to be included in actuarial reports, the end result is an improvement in transparency and disclosure, which benefits all stakeholders.

Peer Review Processes (Internal and External) (Slide 25)

To conclude, I would like to speak about how at the CPP we attempt to minimize the possibility for omissions and errors, and how we continually try to improve our work.

First, before the tabling of the report before Parliament, the Office of the Chief Actuary's staff conducts an internal peer review of the assumptions, methodology, runs, and the report.

Second, after the tabling of the report, an external independent peer review endorsed by federal, provincial, and territorial finance ministers takes place. The external peer review panel consists of actuaries enrolled

with the Canadian Institute of Actuaries and Fellows of the Society of Actuaries who are selected by the UK Government Actuary's Department (GAD). In addition, the GAD subsequently provides an opinion on the work done by peer reviewers. This same process will also be followed for the next valuation report.

Peer Review Process (External) (Slide 26)

The role of the external peer review panel is to provide opinions on:

- professional experience of the Chief Actuary and his staff;
- compliance with professional standards and statutory requirements;
- accessibility to information required to perform valuations;
- reasonableness of actuarial methods and assumptions; and
- communication of results through the actuarial report.

The peer review panel also provides recommendations for future reports. This process helps to improve the report's content, the methodology used to produce financial projections, and the development of assumptions.

For those of you who are interested, this presentation is available on the SOA's Web site and contains additional slides in the annex. Those slides present information on a data reporting system used for the CPP to provide more information to its stakeholders. There are also additional slides on other uses of the CPP model, the best-estimates assumptions of the last report and, as mentioned earlier, a few slides describing the CPP model for child and death benefits.

Thank you for your attention. I would be pleased to answer any questions.