

**REVIEW OF THE TWENTY-THIRD ACTUARIAL REPORT
ON THE CANADA PENSION PLAN**

**Conducted by the CPP Actuarial Review Panel
March 19, 2008**

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ACRONYMS USED IN THIS REPORT

AR17	Seventeenth Actuarial Report on the CPP
AR18	Eighteenth Actuarial Report on the CPP
AR21	Twenty-First Actuarial Report on the CPP
AR23	Twenty-Third Actuarial Report on the CPP
CPP	Canada Pension Plan
CPPIB	Canada Pension Plan Investment Board
CRA	Canada Revenue Agency
HRSDC	Human Resources and Social Development Canada
OCA	Office of the Chief Actuary
OSFI	Office of the Superintendent of Financial Institutions
QPP	Québec Pension Plan
OASDI	Old Age, Survivors and Disability Insurance (the U.S. Social Security program)

This report was prepared by a review panel of three independent actuaries, Mark Campbell of Towers Perrin, Patrick Flanagan of Eckler Ltd. and Thomas Levy of The Segal Company Ltd., all Fellows of the Canadian Institute of Actuaries.

EXECUTIVE SUMMARY

Terms of Reference

The panel conducted its review of AR23 in accordance with the following terms of reference:

“The Canadian peer reviewers will review the work of the Chief Actuary in completing the 23rd Actuarial Report on the Canada Pension Plan as at 31 December 2006 (23rd Report) and, following the review, provide a report to the Chief Actuary and the Government Actuary’s Department (GAD) [of the United Kingdom]. GAD will then provide its opinion of the peer review to the Chief Actuary.

The review report should contain opinions on the following questions:

1. Is the professional experience of the Chief Actuary and his staff who worked on the report adequate for carrying out the work required?
2. Has the work been completed in compliance with the relevant professional standards of practice and statutory requirements?
3. Did the Chief Actuary have access to the information required to perform the valuation, and were relevant tests and analysis on the data completed as might be expected?
4. Were the actuarial methods and assumptions used in completing the report reasonable?
5. Does the 23rd Report fairly communicate the results of the work performed by the Chief Actuary and his staff?

In providing opinions on the questions listed above, the Canadian peer reviewers will also provide such recommendations as the peer reviewers deem appropriate with respect to future actuarial reports on the Canada Pension Plan prepared by the Office of the Chief Actuary.”

Actuarial Report 23 (AR23)

AR23 was prepared as at December 31, 2006. It presents a best-estimate projection of pay-as-you-go contribution rates for the Plan, rising from 8.35% of contributory earnings in 2007 to 11.49% in 2060, then hovering thereafter.

It also presents a minimum contribution rate to be paid in 2010 and later of 9.82% of contributory earnings. This consists of a best-estimate steady-state contribution rate of 9.80% to finance the Plan without Bill C-36 and a contribution rate of 0.02% to fully fund the benefit improvements introduced by Bill C-36. Using this minimum contribution rate, AR23 projects ratios of assets-to-expenditures rising from 4.31 in 2007 to 5.48 in 2022, then staying fairly level until 2056 before dropping gradually to 5.17 in 2081. Under a continuation of the current 9.9% contribution rate, AR23 projects ratios rising steadily from 4.31 in 2007 to 5.59 in 2022 and then rising more slowly to 6.45 in 2080.

AR23 also presents the results of several sensitivity tests that show how different the results would be if particular assumptions, either individually or in combination, were varied.

All of the results are estimates. All but the sensitivity tests represent the Chief Actuary’s “best” estimates, with no deliberate margins of conservatism or other deliberate bias.

It is essential to recognize that these results are not predictions. They simply present what the outcome will be if all of the actuarial assumptions were realized. But those assumptions are about demographic and economic parameters for the next 75 years that are not amenable to accurate prediction. Readers of AR23 should look at the sensitivity tests to get a feel for the range of possible actual outcomes.

Opinions

Our opinions with respect to the five questions listed in the terms of reference are:

1. In our opinion, the professional experience of the Chief Actuary and the staff who worked on AR23 was adequate for carrying out the work required.
2. In our opinion, the work on AR23 complies with all relevant professional standards of practice and statutory requirements.
3. In our opinion, the Chief Actuary had access to the data he required to perform the valuation, and he completed such relevant tests and analysis on the data as might be expected.
4. In our opinion, the actuarial methods employed in AR23 are reasonable and the assumptions used in completing AR23 are, in the aggregate, reasonable, but towards the high-cost side of the reasonable range.
5. In our opinion, AR23 fairly communicates the results of the work performed by the Chief Actuary and his staff.

Recommendations

In the course of our actuarial peer review, we developed great respect for the staff of the Office of the Chief Actuary. Their professionalism, expertise, cooperation, preparation and commitment left us feeling that the financial forecasts of Canada's primary national retirement program are in good hands. In the spirit of seeking to help the Chief Actuary and his staff to continue improving their work, our report includes the following recommendations:

Recommendation 1: We recommend that the Chief Actuary explore with Human Resources and Social Development Canada (HRSDC) the possibility of providing the Office of the Chief Actuary (OCA) with additional data on participant utilization of the child-rearing dropout provision.

Recommendation 2: We recommend that the Chief Actuary continue his program of seminars with presentations from appropriate experts and continue to broaden the range of presenters and the range of viewpoints.

Recommendation 3: We recommend that OCA continue to work with its data providers to address items on OCA's list of data enhancement priorities.

Recommendation 4: We recommend that the Chief Actuary maintain the tradition of continual improvements to actuarial methods by such actions as

- applying more forward-looking stochastic analysis, and
- developing more plausible and consistent sensitivity tests for key assumptions.

Recommendation 5: We recommend that the Chief Actuary discontinue showing results such as the minimum contribution rate and balance sheet under differing investment portfolios. These comparisons inevitably show that the low-risk or risk-free portfolios are expected to produce the highest required contribution rates or worst funding status, while the high risk portfolios appear most favourable. The absence of a meaningful risk measure gives the impression that the assets should be invested solely in equities. Further, in our opinion the “risk-free” results are not meaningful for a plan that has no termination provision, no meaningful possibility of termination, and no possibility of the plan sponsor being involved in corporate-type transactions such as mergers, bankruptcy or liquidation. Indeed, if the contribution rates were established based on a risk-free portfolio, but the assets continued to be invested as at present, there would be a high probability that those rates would ultimately turn out to be excessive.

Recommendation 6: We recommend that “point-in-time” funded status updates be minimized or eliminated from the Chief Actuary’s report. Such updates are appropriate for systems that have full funding as an objective. However, the CPP’s primary funding objective is steady-state funding, with full funding only for benefit increases. If that objective is met, the CPP is projected to build up assets equal to only about 25% of Plan liabilities. The inclusion of items such as a balance sheet suggest to the casual reader that the CPP’s funding is hopelessly inadequate, which is simply not true. The meaningful measure is the adequacy and sustainability of the 9.9% contribution rate, not the funded percentage.

Recommendation 7: We recommend that the Chief Actuary report the expected progression of the minimum contribution rate over time assuming that the best-estimate assumptions are realized. This would help to allay CPP stakeholders’ concerns about the sustainability of the current contribution rate.

Recommendation 8: We recommend that the Chief Actuary maintain his programs of research and consultation with experts, with the goal of continual improvements in the process of setting best-estimate assumptions. Because of its strong impact on the financial operations of the Plan, we suggest that particular attention be given to research on the size and sustainability of the equity risk premium.

Recommendation 9: We recommend that the Chief Actuary continue to explore ways to address the needs of both the broad audience and more technical readers of his reports.

Recommendation 10: We recommend that the Chief Actuary explore ways to get formal feedback on his proposed assumptions from external experts prior to completion of the actuarial review, rather than after the report has been tabled in Parliament.

Recommendation 11: We recommend that the Chief Actuary obtain expert advice from statisticians or other sources to establish a consistent strategy for choosing near-term assumptions.

Recommendation 12: We recommend that the Chief Actuary take steps to ensure that he has the latitude to prepare appropriate reports for the purpose of section 115(2) on changes in the Canada Pension Plan Statute that would affect the projected costs and contribution rate, without undue constraints on the choice of actuarial assumptions. We further recommend that the terms of reference of future actuarial review panels be extended to include consultation with the Chief Actuary concerning appropriate assumptions for use in material interim actuarial reports under section 115(2).

SECTION 1 – INTRODUCTION

This report presents the results of an in-depth review we conducted into the Twenty-Third Actuarial Report on the Canada Pension Plan (AR23) and the detailed actuarial examination on which it was based. This is the fourth such review that has been conducted.

Rather than “re-inventing the wheel”, in this report we have borrowed extensively from the descriptive and explanatory portions of the previous review reports. The observations, conclusions and recommendations, however, are our own.

1.1 Terms of Reference

In accordance with our terms of reference, our review focused on the actuarial work done on the Plan. We were not asked to, and did not, review the merits of the current design, administration or investment arrangements of the Plan, but only how those aspects interact with, and are reflected in, the actuarial review.

The terms of reference for our review were as follows:

“The Canadian peer reviewers will review the work of the Chief Actuary in completing the 23rd Actuarial Report on the Canada Pension Plan as at 31 December 2006 (23rd Report) and, following the review, provide a report to the Chief Actuary and the Government Actuary’s Department (GAD) [of the United Kingdom]. GAD will then provide its opinion of the peer review to the Chief Actuary.

The review report should contain opinions on the following questions:

1. Is the professional experience of the Chief Actuary and his staff who worked on the report adequate for carrying out the work required?
2. Has the work been completed in compliance with the relevant professional standards of practice and statutory requirements?
3. Did the Chief Actuary have access to the information required to perform the valuation, and were relevant tests and analysis on the data completed as might be expected?

4. Were the actuarial methods and assumptions used in completing the report reasonable?
5. Does the 23rd Report fairly communicate the results of the work performed by the Chief Actuary and his staff?

In providing opinions on the questions listed above, the Canadian peer reviewers will also provide such recommendations as the peer reviewers deem appropriate with respect to future actuarial reports on the Canada Pension Plan prepared by the Office of the Chief Actuary.”

1.2 Procedures Followed

Our review was conducted as a close collaboration of the three panel members. The review work took place over the months from September 2007 through March 2008.

We received copies of some of the working papers in September 2007, in advance of the report. We received the report on October 29, 2007, the day it was tabled in Parliament. We received access to all other needed working papers on a timely basis after the report was tabled.

We interviewed the Chief Actuary and senior members of the Office of the Chief Actuary (OCA), a Division of the Office of the Superintendent of Financial Institutions (OSFI), for one and one-half days. We met with officials of the Department of Finance (Canada), Human Resources and Social Development Canada, the Demography Section of Statistics Canada and the Canada Pension Plan Investment Board (CPPIB). We also reviewed the papers presented to seminars conducted in 2006 by the OCA and the Régie des rentes du Québec, and other technical materials.

All of these officials responded promptly and fully to each request we made for information.

We made use of the historical documents that are maintained on the website of the Office of the Chief Actuary, which we found to be useful.

We held numerous meetings in person and by teleconference, and corresponded extensively by e-mail.

After reviewing all of the information, and after much discussion among ourselves, we were able to reach agreement on all of the opinions and recommendations presented in this report.

The Canada Pension Plan is a complex Plan that provides benefits on a variety of bases (part earnings-related and part flat-rate) on the occurrence of three different events (retirement, disability and death) and with different qualification criteria for each event. The actuarial computer model used to produce the results in AR23 is extremely complex. It projects the intertwining of the Plan provisions and current population statistics with projections of future demographic and economic experience.

In our work, we have tended to concentrate on what we consider to be the most important issues – in particular, the data used, the major methodology issues, and nine key actuarial assumptions. As described in section 4 (Data) of this report, we reviewed the sources of the data, and the processes used by the Chief Actuary to test and analyze the data, but our mandate did not include a detailed audit of the data. Similarly, we reviewed the procedures used by the Chief Actuary to test the actuarial computer model, but our mandate did not include a verification of the accuracy of the model.

1.3 The Canada Pension Plan

The Canada Pension Plan (CPP) is a social insurance program that provides monthly income benefits and some lump sum benefits upon retirement, death and disability of participants. Virtually all working Canadians outside Québec contribute to the Plan.

Before 1997, contribution rates were set at a level that created relatively little advance funding of benefits and the funds not used for immediate benefit payments and expenses were loaned to the provinces at federal government borrowing rates of interest. The Plan was amended in 1997 to

- require an increased measure of advance funding,
- add a sunset clause regarding the investment of CPP assets in provincial revolving 20-year bonds,
- require that the funds not used for immediate benefit payments and expenses or for investment in those provincial bonds be invested in a diversified portfolio of investments, and
- establish an Investment Board to control these investments.

In recent years, there have been several amendments, the most recent being Bill C-36, which introduced more favourable disability benefit eligibility requirements for

contributors with 25 or more years of contribution to the Plan, and implemented a full funding requirement for benefit improvements. Bill C-36 received Royal Assent on May 3, 2007 and provincial ratification was in progress on October 18, 2007, the date that AR23 was submitted to the federal Minister of Finance. For purposes of the report, the Chief Actuary assumed that provincial ratification would be completed in 2007 and the changes would come into force effective January 1, 2008. In fact, the effective date was March 3, 2008.

1.4 Statutory Actuarial Requirements

Section 115 of the Canada Pension Plan Statute requires that an actuarial review be conducted once every three years and that it report:

- projected pay-as-you-go contribution rates (i.e., each year's contribution rate is just sufficient to cover that year's benefit payments and expenses), and
- a contribution rate, calculated in a prescribed manner (the "default contribution rate").

Section 113.1 of the Canada Pension Plan Statute requires a financial review of the Canada Pension Plan every three years by the federal Minister of Finance and ministers of the included provinces. This review is to take into account the most recent report of the Chief Actuary under section 115 and two financing objectives – full funding for benefit improvements and steady-state funding for all other benefits. Section 115 states that projections must extend for at least 75 years into the future.

The federal government adopted the Calculation of Default Contribution Rates Regulation in 1998. This Regulation implemented the steady-state funding objective by prescribing a default contribution rate calculated as the lowest constant rate for which the projected ratio of Plan assets-to-expenditures 10 years after the end of the review period matches the corresponding projected ratio 60 years after the end of the review period. The Regulation has been updated to reflect Bill C-36, which added the requirement for full funding of post-1997 benefit improvements.

1.5 Actuarial Report 21 (AR21)

The previous full actuarial review of the Canada Pension Plan was conducted as at December 31, 2003 and was reported in AR21.

AR21 presented a best-estimate projection of pay-as-you-go contribution rates for the Plan rising from 8.27% in 2004 to 11.52% in 2060 and then declining to 11.32% in 2075.

It also presented a rounded best-estimate steady-state contribution rate to be paid in 2007 and later of 9.8% of contributory earnings. Using this steady-state contribution rate, it projected ratios of assets-to-expenditures rising from 3.08 in 2004 to 5.51 in 2023, then hovering for several decades before dropping gradually to 5.36 in 2078. The projected ratios in the key years 2016 and 2066 were 5.09 and 5.40 (these ratios are not precisely equal since the steady-state rate was rounded to the nearest 0.1% of contributory earnings). Under a continuation of the current 9.9% contribution rate from 2004 on, AR21 projected ratios rising steadily from 3.08 in 2004 to 5.71 in 2023 and then rising more slowly to 6.88 in 2075.

1.6 Improvements Since Actuarial Report 21

The actuarial review panel for AR21 made 12 recommendations arising from its review, plus numerous other observations or suggestions for improvement. The Chief Actuary has paid careful attention to all these findings. In preparing AR23, he has made numerous improvements in the work and reporting, and many of these improvements are a direct response to the recommendations, observations and suggestions of the prior actuarial review panel. Where the recommendations of that panel have not been fully adopted, the Chief Actuary has provided a discussion of the partial progress made and/or has explained and supported any discrepancies.

However, our terms of reference do not call for, nor did we make, a detailed evaluation of the appropriateness of the response of the Chief Actuary to the findings of the prior actuarial review panel.

1.7 Actuarial Report 23 (AR23)

AR23 was prepared as at December 31, 2006. It presents a best-estimate projection of pay-as-you-go contribution rates for the Plan rising from 8.35% in 2007 to 11.49% in 2060, then hovering thereafter.

It also presents a minimum contribution rate to be paid in 2010 and later of 9.82% (now rounded to the nearest 0.01%) of contributory earnings. This consists of a best-estimate steady-state contribution rate of 9.80% to finance the Plan without Bill C-36 and a contribution rate of 0.02% to fully fund the benefit improvements introduced by Bill C-36. Using this minimum contribution rate, AR23 projects ratios of assets-to-expenditures rising from 4.31 in 2007 to 5.48 in 2022, then staying fairly level until 2056 before dropping gradually to 5.17 in 2081. The projected ratios in the key years 2019 and 2069

are 5.41 and 5.37 respectively. Under a continuation of the current 9.9% contribution rate, AR23 projects ratios rising steadily from 4.31 in 2007 to 5.59 in 2022 and then rising more slowly to 6.45 in 2080.

AR23 includes a reconciliation of the changes to the minimum contribution rate between AR21 and AR23. The factors that increased the minimum contribution rate were:

- Bill C-36, which introduced a benefit improvement and implemented a full-funding requirement for benefit improvements,
- Improvements in methodology, and
- Changes in actuarial assumptions (primarily demographic assumptions).

On the other hand, the minimum contribution rate was reduced as a result of Plan experience in the period from 2004 to 2006 inclusive.

The impact of each of the above factors was relatively small. The positive impacts were nearly offset by the negative, so the minimum contribution rate was increased by only 0.05% – from 9.77% to 9.82%.

1.8 Interpretation of Results

AR23 presents:

- the projected pay-as-you-go contribution rates by year to 2036 and then every fifth year through to 2081,
- the minimum contribution rate,
- a number of sensitivity tests, which illustrate the results that would be obtained under various changes in actuarial assumptions,
- an estimate of the unfunded liability of the Canada Pension Plan obtained using a version of the accrued benefit actuarial cost method (which is commonly used with occupational pension plans),
- estimates of “actuarial balance” for various periods, which is the amount by which the 9.9% contribution rate exceeds (or falls short of) the minimum rate necessary for the Plan to exist for the defined period if the fund were allowed to become exhausted at the end of the period (a measure used in actuarial reports on the U.S. Social Security System), and
- a calculation of the internal rate of return of each cohort of participants (the projected rate of return each cohort can expect to achieve on its combined employee and employer contributions).

The minimum contribution rate is the most significant of these results. The federal Minister of Finance and ministers of the included provinces are to take it into account in their triennial financial review of the CPP. If the minimum contribution rate is higher than the legislated rate, and the federal and provincial governments do not take action, the default provisions in section 113.1 of the Canada Pension Plan Statute will apply to increase the legislated rate to the minimum contribution rate over a period of years. The other results are also useful because they provide information as to the long-term pattern of costs under the Plan, the unpredictability and variability of the costs, how these costs compare with the costs of occupational pension plans and the value-for-money each cohort of participants may receive. They also allow comparisons to be made with other countries' public pension plans.

All of the results are estimates. All but the sensitivity tests represent the Chief Actuary's "best" estimates, with no deliberate margins of conservatism or other deliberate bias.

It is essential to recognize that these results are not predictions. They are not necessarily accurate to one decimal place or even to one percent of contributory earnings. They simply present what the outcome will be if all of the assumptions were realized. The parameters involved (e.g., fertility rates, net migration rates, mortality rates, disability incidence rates, rates of labour force participation, retirement rates, rates of price increase, real rates of wage increase, real rates of return on investments, each from 2007 through to 2081) are not amenable to accurate prediction.

The estimates in AR23 and in previous reports are essential outputs to provide guidance in financing the Plan and in performing other planning and management tasks. Yet, no matter how carefully they are prepared, they are still only estimates. Thus, it is important that readers of the actuarial reports look at the sensitivity tests to get a feel for the range of possible actual outcomes.

1.9 Outline of this Report

Sections 2, 3 and 4 of this report address the first three questions in our terms of reference regarding Professional Experience, Professional Standards of Practice and Data.

Section 5 (Methodology) and section 6 (Assumptions) address question 4 in the terms of reference.

Section 7 addresses question 5 in the terms of reference.

Section 8 provides further important commentary.

The Executive Summary provides an overview of our findings.

SECTION 2 – PROFESSIONAL EXPERIENCE

In this section we address the following question:

“Is the professional experience of the Chief Actuary and his staff who worked on the report adequate for carrying out the work required?”

2.1 Background

The Chief Actuary submitted AR23 to the Minister of Finance on October 18, 2007; it was tabled in Parliament on October 29, 2007. The Chief Actuary is Jean-Claude Ménard, a Fellow of the Society of Actuaries (FSA, 1985) and of the Canadian Institute of Actuaries (FCIA, 1985). He accepted the position of Chief Actuary for the federal government on August 15, 1999, following 18 years (the last four as Chief Actuary) with the Régie des rentes, the agency of the Québec government responsible for the Québec Pension Plan. Mr. Ménard was responsible for preparing the Actuarial Reports on the Québec Pension Plan from 1990 to 1999. Few actuaries working in Canada can match his 26 years of experience in social insurance actuarial work.

The professionals who worked most closely with Mr. Ménard on AR23, and co-signed the report with him, are Michel Montambeault and Michel Millette, both Senior Actuaries in the Office of the Chief Actuary, a Division of OSFI.

Mr. Montambeault is a Fellow of the Society of Actuaries (1992) and of the Canadian Institute of Actuaries (1992). He has worked on actuarial reviews of the Canada Pension Plan and other programs in the Office of the Chief Actuary of OSFI for the last 18 years.

Mr. Millette is a Fellow of the Society of Actuaries (1986) and of the Canadian Institute of Actuaries (1986). He joined OSFI in May 2000, following 12 years of experience working on social insurance programs with Mr. Ménard at the Régie des rentes du Québec. He is also Senior Actuary (Canada Student Loans) in the Office of the Chief Actuary. He spends 50% of his time on Canada Pension Plan affairs and is responsible for the liaison with the staff of the Canada Pension Plan Investment Board.

The other professional staff who worked on AR23 are:

Name	Actuarial Designation	Years of Experience	
		In Actuarial Work	In Social Security
Louis-Marie Pommainville	FSA, FCIA	28 years	8 years
Alain Guimond	ASA	27 years	12 years
Sari Harrel	FSA, FCIA	8 years	5 years
Danita Pattemore	FSA, FCIA	7 years	4 years
Patrick Dontigny	ASA	12 years	12 years
Yu Cheng	ASA	10 years	8 years
Annie St-Jacques	5 exams	7 years	5 years

The three senior actuaries reviewed each other's work and co-signed the report.

2.2 Observations

There are very few actuaries working in Canada with experience in valuing and costing social insurance programs like the CPP and the QPP. The data sources, macro-economic modelling and range of assumptions involved in evaluating social programs are more complex than for employer-sponsored plans. Therefore, occupational pension plan experience is useful but not as useful as previous experience with social programs like the CPP and the QPP. Messrs. Ménard, Montambeault and Millette have considerable experience and understanding of the issues involved in evaluating the Canada Pension Plan, more than most other actuaries working in Canada.

The staff of the Office of the Chief Actuary is of sufficient size to spend adequate amounts of time on CPP matters, such as improving methodologies and data sources, performing inter-valuation studies, improving documentation and liaising with other government departments, all of which contribute to the quality of the work and of the report.

We are satisfied that Mr. Ménard and the staff who assisted him in preparing AR23 have the relevant experience and are qualified to carry out the assignment.

2.2.1 Continuity of Staff

Clearly, for each actuarial review of the CPP, it is desirable to have the work performed by a group of professionals who have had considerable previous experience with the process. We are pleased to observe that there appears to be a program of staff recruiting

and succession planning in place, there is a mix of more experienced and newer personnel on the staff of the OCA, and staffing continuity has been excellent.

2.2.2 Guidance From Experts

Because of the wide range and complexity of the assumptions and methodologies involved in actuarial reviews of the CPP, it is desirable for the Chief Actuary to seek out the advice and guidance of experts, including actuaries, demographers and economists, in order to help ensure that a wide range of analysis and opinion is considered and to improve the credibility of the actuarial reviews.

To this end, the Office of the Chief Actuary hosted an Inter-Disciplinary Seminar on March 24, 2006 and attended a seminar hosted by the Régie des rentes du Québec on September 26, 2006. The first focused on stochastic analysis of the U.S. OASDI program as well as the long-term outlook for mortality improvements, productivity, growth, real wage growth and inflation, and was addressed by two social security actuaries and two economists. The second addressed the evolution of migration patterns, life expectancy, retirement patterns, productivity and wage growth from 2006 to 2030, and was addressed by two demographers, two economists and one sociologist. These inputs and the discussion of them helped the OCA to crystallize best-estimate assumptions and methodologies for the development of AR23.

After the tabling of the last three triennial actuarial reports on the CPP (AR17, AR18 and AR21), OSFI engaged a panel of three independent actuaries to conduct a post-release review of the actuarial reports, similar to the review described in this report. The actuarial review panel reports for AR17, AR18, AR21 and this report have included a number of recommendations for improvements in, or revised approaches to, the processes, sources of data, methodologies and assumptions utilized in preparing actuarial reports on the CPP. This process provides a level of assurance to the public and also helps the Chief Actuary in gathering a range of views regarding the complex methodologies and assumptions involved.

2.3 Opinion on Professional Experience

In our opinion, the professional experience of the Chief Actuary and the staff who worked on AR23 was adequate for carrying out the work required.

SECTION 3 – PROFESSIONAL AND STATUTORY REQUIREMENTS

In this section, we address the following question:

“Has the work been completed in compliance with the relevant professional standards of practice and statutory requirements?”

3.1 Background

To address this question, we have considered each of the following:

- *Canadian Institute of Actuaries Rules of Professional Conduct*: The Chief Actuary and his co-signatories are Fellows of the Canadian Institute of Actuaries (CIA), the professional body governing the conduct and work of actuaries in Canada. The CIA promulgates “the professional rules and ethical standards with which a member must comply and thereby serve the public interest”. The *Rules of Professional Conduct* are the Institute’s highest level of guidance to its members. Failure to adhere to the rules results in disciplinary proceedings,
- *CIA Standards of Practice*: These standards govern the work performed by actuaries in Canada. There are *general* standards governing all areas of practice and *practice-specific* standards governing work in specific areas, namely: life insurance, property and casualty insurance, occupational pensions, workers’ compensation and actuarial evidence. There are no *practice-specific* Standards of Practice governing work on social security programs, so only the *general* Standards of Practice are relevant to this review,
- *International Actuarial Association Guidelines of Actuarial Practice for Social Security Programs*: The International Actuarial Association (IAA) is a worldwide association of professional actuarial organizations. The IAA promulgates guidelines of actuarial practice. These practice guidelines are not binding on actuaries in a particular country except to the extent that their national actuarial organization makes them so or the terms of the actuary’s engagement require their application. The CIA has not made the IAA *Guidelines of Actuarial Practice for Social Security Programs* binding on its

membership. However, since the IAA *Guidelines* provide guidance specific to social security programs, and since the Chief Actuary has voluntarily applied the IAA *Guidelines* to his work on AR23, we have considered the IAA *Guidelines* in this review, and

- *Canada Pension Plan*: This statute provides the terms of reference of the Chief Actuary when preparing an actuarial report in relation to the CPP. Section 113.1 identifies the actuarial information required by the Minister of Finance and ministers of the Crown of the participating provinces when recommending changes to CPP benefits or contribution rates, or both. Section 115 stipulates the timing, contents and certain other aspects of the Chief Actuary's triennial report.

In the sub-sections below, we consider each of these in turn.

3.2 CIA Rules of Professional Conduct

The following *Rules of Professional Conduct* of the CIA are relevant to this review:

- *Rule 1*: A member shall act honestly, with integrity and competence, and in a manner to fulfil the profession's responsibility to the public and to uphold the reputation of the actuarial profession.
- *Rule 2*: A member shall perform professional services only when the member is qualified to do so and meets applicable qualification standards.
- *Rule 3*: A member shall ensure that professional services performed by or under the direction of the member meet applicable standards of practice.

We are satisfied that the Chief Actuary and his staff have met the requirements of the CIA *Rules of Professional Conduct*.

Further to *Rule 2*, section 2 of this report expands on our assessment of the professional experience of the staff of the Office of the Chief Actuary. Under the auspices of *Rule 2*, the CIA has also promulgated Continuing Professional Development (CPD) requirements that are applicable to practising actuaries. These requirements oblige an actuary to obtain at least 100 hours of CPD over a two-year period, and the CPD activities should be relevant to the actuary's area of practice. The actuary must devote required minimum amounts of CPD time to each of the following topic areas: technical skills, professionalism, and business and management skills. At least 24 hours of CPD time must be obtained biennially by participating in "structured" activities such as

participating in professional meetings or seminars. We have reviewed the CPD records maintained by the Chief Actuary and his two co-signatories to AR23 and concluded that the CIA's CPD requirements have been fully met by all three signing actuaries.

Further to *Rule 3*, the next two sub-sections expand on our assessment of the Chief Actuary's compliance with the CIA *General Standards of Practice* and IAA *Guidelines of Actuarial Practice for Social Security Programs*.

3.3 CIA General Standards of Practice

The *General Standards* of the CIA are extensive and detailed. The topics covered include numerous matters relevant to AR23 such as:

- materiality,
- knowledge of the circumstances of the case,
- approximations,
- subsequent events,
- data – sufficiency and reliability,
- control procedures,
- reasonableness of results,
- documentation,
- actuary's use of another person's work,
- selection of assumptions,
- provision for adverse deviations,
- comparison of current and prior assumptions, and
- reporting.

The CIA standard on assumptions requires that the assumptions, in the aggregate, should be appropriate. We have concluded that the assumptions adopted for AR23 are, in the aggregate, within the reasonable range.

The CIA standard on provision for adverse deviations (such a provision is sometimes referred to as a margin for conservatism) states that the actuary “should not include a provision for adverse deviations if the related work requires an unbiased calculation.” Section 113.1 of the Canada Pension Plan Statute requires that the Chief Actuary determine the lowest constant contribution rate that, if maintained over the foreseeable future, results in projected asset/expenditure ratios that are generally constant. The Chief Actuary interprets this requirement as necessitating an unbiased calculation, and we agree.

Accordingly, the Chief Actuary uses assumptions that represent his “best-estimate” for each relevant variable. The consequence is that the overall valuation results, other than the sensitivity tests, are likewise the Chief Actuary’s “best estimates” and do not include any provision for adverse deviations.

In our view, the work on AR23 complies with the relevant portions of the CIA *General Standards of Practice*.

3.4 IAA Guidelines of Actuarial Practice for Social Security Programs

The *Guidelines of Actuarial Practice for Social Security Programs* of the IAA are international in scope. They cover the following topics

- scientific rigour,
- objectivity,
- quality of reports – transparency, explicitness, simplicity and consistency, and
- contents of reports.

The *IAA Guidelines* specifically call for the use of unbiased or “best-estimate” assumptions, so the Chief Actuary’s work is also in harmony with this guidance

The *Guidelines* with respect to the contents of reports are particularly extensive. Nearly one hundred different disclosures are recommended, ranging over areas such as data, assumptions, methodology, results, analysis, conclusions and professional attestations. AR23 provides all of the relevant recommended disclosures, and the work of the Chief Actuary and his staff thereon complies with all of the requirements of the *IAA Guidelines*.

3.5 Canada Pension Plan Statute

The *Canada Pension Plan* stipulates the frequency, approximate timing and certain contents of the Chief Actuary’s triennial reports to the Minister of Finance and ministers of the Crown of the participating provinces. In AR23, the Chief Actuary and his staff have complied with all of these statutory requirements.

3.6 Opinion on Professional and Statutory Requirements

In our opinion, the work on AR23 complies with all relevant professional standards of practice and statutory requirements.

SECTION 4 – DATA

In this section we address the following question:

“Did the Chief Actuary have access to the information required to perform the valuation, and were relevant tests and analysis on the data completed as might be expected?”

4.1 Background

Appropriate data are required for “current status” data inputs into the computer model, for “validation” (back-testing) of the model, and to develop appropriate actuarial assumptions for future years. Examples of such data are:

Purpose	Examples of Data	Source
current and past status data	<ul style="list-style-type: none"> • population by age and sex • earnings of contributors • contributions • benefits paid • assets • labour force 	<ul style="list-style-type: none"> • 2001 census, Statistics Canada estimates • HRSDC • CRA, HRSDC • HRSDC • CPPIB, HRSDC • Statistics Canada
validation data	<ul style="list-style-type: none"> • CPP financial transactions • benefit statistics • earnings statistics 	<ul style="list-style-type: none"> • CPPIB, HRSDC, CRA • HRSDC • HRSDC, CRA

Purpose	Examples of Data	Source
data for assumptions	<ul style="list-style-type: none"> • current mortality rates • future mortality improvement rates • fertility rates • migration rates • disability statistics • labour force participation • asset mix policy • economic indices • investment policy and performance • several topics 	<ul style="list-style-type: none"> • Statistics Canada Life Tables and historical deaths, Human Mortality Database • Statistics Canada, Social Security Administration 2006 Trustees Report (U.S.), Government Actuary's Department (U.K.) • Statistics Canada • Statistics Canada • HRSDC • Finance, Statistics Canada, OCA seminars, economic forecasts • CPPIB, large public and private pension plans • Statistics Canada, Canadian Institute of Actuaries, HRSDC, Bank of Canada, others • CPPIB • OCA seminars

The status and validation data, and the historical data used to develop assumptions, appear to be factual and up to date.

The data on benefits and earnings received from HRSDC are tested in detail for internal consistency and reasonableness. The data from other sources are reviewed for internal consistency and consistency with past data. Where applicable, the data for the inter-valuation period are compared with the projections of the same items from the prior valuation. Any irregularities are checked out with the data source and any data errors are corrected.

The Chief Actuary has advised us that he had access to sufficient data to complete his work, and in AR23 has provided his opinion that “the data on which this report is based are sufficient and reliable”.

4.2 Observations

We have the following observations:

- The Chief Actuary appears to have had access to the data he required.
- The data are extensive and appear to be reasonably complete and available on a timely basis.
- The data are tested for reasonableness by the Office of the Chief Actuary and any deficiencies are resolved before the data are used.
- The Record of Earnings (ROE) file of all workers who ever had a contribution to the CPP appears to be sufficiently complete (except for recent transactions) and accurate, including with respect to dates of birth, although there is some concern about the inability to verify survivorship with respect to those residing outside of Canada.
- The Canada Pension Plan Investment Board (CPPIB) now establishes a reference portfolio that is its baseline policy for asset allocations. The Chief Actuary made an assumption as to asset allocation targets based on the reference portfolio and on his judgement with respect to possible future changes in it. We understand that the CPPIB is currently preparing studies to assist in establishing and changing asset allocations, with the objective of minimizing the risk that investment experience will adversely alter the current relationship between contribution rates and benefits.
- Since 1991, the Bank of Canada and the Minister of Finance have jointly established inflation-control targets. These targets have been agreed on for five years at a time. The current target (target range: 1% to 3%; mid-point and monetary policy target: 2%) expires on December 31, 2011. There is currently no government policy in place regarding inflation-control targets after 2011 that the Chief Actuary can take into consideration when establishing his assumption regarding future inflation rates beyond 2011. In the view of a number of experts with whom we spoke, future inflation targets are likely to be similar to the current target, may be more likely to be reduced than increased, and will likely continue to be managed successfully.
- The CPP and QPP seminars have provided much useful information and improved in relevance over time (e.g., shift to longer-term focus). There is still room, however, to broaden the range of presenters and the variety of

viewpoints (e.g., engage presenters who are known to hold divergent views, or specifically encourage presenters to summarize the range of plausible viewpoints while still providing support for their own conclusions).

- The Office of the Chief Actuary maintains contacts with other Departments and Agencies such as the CPPIB, HRSDC, CRA, Statistics Canada and Finance Canada, and with external agencies such as the Régie des rentes du Québec, the Conference Board, the CD Howe Institute and the Institute for Policy Analysis at the University of Toronto. All of this provides helpful input.
- OCA has identified its priorities for data enhancement that could lead to improved analysis, particularly with respect to the utilization of the child-rearing dropout provisions.

4.3 Opinion on Data

In our opinion, the Chief Actuary had access to the data he required to perform the valuation, and he completed such relevant tests and analysis on the data as might be expected.

4.4 Recommendations

Recommendation 1: We recommend that the Chief Actuary explore with HRSDC the possibility of providing OCA with additional data on participant utilization of the child-rearing dropout provision.

Recommendation 2: We recommend that the Chief Actuary continue his program of seminars with presentations from appropriate experts and continue to broaden the range of presenters and the range of viewpoints.

Recommendation 3: We recommend that OCA continue to work with its data providers to address items on OCA's list of data enhancement priorities.

SECTION 5 – METHODOLOGY

In this section, we address the following question:

“Were the actuarial methods used in completing the report reasonable?”

5.1 Background

The results presented in AR23 are based on a macro-simulation model of the Plan’s operations, which projects the elements of income and outgo and the accumulation of the fund year by year up to the year 2081. Those projections are used to determine projected pay-as-you-go contribution rates and the minimum contribution rate based on the financing objectives set out in section 113.1 of the Canada Pension Plan Statute.

5.2 Macro-simulation Model

The macro-simulation model starts with current and past statistics on the population (numbers of people distributed by age and sex) and earnings (distributed by age, sex and broad earnings levels) of residents of Canada outside of Québec. The model projects each of the following, in turn, for each calendar year during the projection period:

- the number and characteristics (e.g., age, sex, earnings) of the population of Canada less Québec,
- the number and characteristics of eligible CPP contributors and beneficiaries,
- the amount of CPP contributions made and benefits received by eligible CPP contributors and beneficiaries, and
- the assets accumulating in the CPP fund.

Thus, the model combines the contribution income and benefit outgo described above with projections of investment return and expenses to arrive at total asset amounts.

The model projects anticipated experience in future years based on demographic and economic assumptions related to the CPP as a whole. These assumptions include demographic parameters such as fertility, migration and mortality, and economic parameters such as labour force participation rates, price inflation, wage escalation and investment returns.

As a matter of interest, the Record of Earnings (ROE), the data file for each individual who has ever had a contribution to CPP, is not used for the valuation itself. Certain

assumptions and adjustments are set based on a review of the ROE file, and certain back-testing is done against the ROE file. However, the benefit and contribution projections themselves are built on population forecasts. Thus, the fundamental valuation concept differs from that used for actuarial valuations of occupational retirement plans. Further, actuarial valuations of occupational pension plans effectively assume a constant population, which leads to a reasonably constant calculated cost. The CPP valuation, on the other hand, has a constantly changing population, which causes the steady-state rate to change over time. However, the Chief Actuary has demonstrated to our satisfaction that the minimum contribution rate does not have large fluctuations unless significant shifts occur in key assumptions and/or actual experience differs sharply and persistently from those assumptions.

The model is tested and calibrated using a back-testing procedure. Model output for years prior to the valuation date is compared against historical values. Discrepancies are investigated and resolved. Resolution may include the development of adjustment factors to better calibrate the model to historical experience. These experience adjustment factors are generally modest, but they serve the important function of “truing up” the projected results to past observed values, so that minor inadequacies in virtually any assumption do not unduly distort the overall results.

The model continues to rely principally on a *deterministic*, rather than *stochastic*, approach. That is, each run of the model produces

- a (deterministic) single set of projected results for each year up to 2081

rather than

- a (stochastic) probability distribution of possible results derived from projections of the expected results and of the underlying volatility of one or more of the parameters of the model (this allows estimates of probability to be assigned to ranges of outcomes, thereby increasing the information available).

However, stochastic considerations are reflected in the individual sensitivity tests, which are described in section 5.6.

5.3 Form of Output

The model produces five principal forms of output. These are

- projected demographic and financial results, including the pay-as-you-go contribution rates, the asset/expenditure ratios based on current statutory contribution rates, and other income and expenditure details for each of the first 30 years after the review date and thereafter every 5 years up to 2081,
- the minimum contribution rate,
- a comparison of current Plan assets to accrued liabilities based on the accrued benefit actuarial cost method, as well as normal actuarial costs,
- projected “actuarial balance” outcomes over various periods, and
- the internal rates of return for various year-of-birth cohorts of Plan members, each of which is the rate of return the report estimates will be realized by that cohort when comparing its projected benefits to its total (employee and employer) contributions to the Plan.

5.4 Actuarial Cost Methods

The actuarial cost methods used in AR23 are described in this section.

5.4.1 Pay-As-You-Go Method

When the CPP was initially established, it was financed by the “pay-as-you-go” method with a small reserve. Although that financing method was replaced in 1997, the projected pay-as-you-go costs provide useful information about the future financial status of the Plan. Section 115(1.1)(a) and (b) of the Canada Pension Plan require the Chief Actuary to present “pay-as-you-go” projections year by year for the first 30 years and thereafter every five years up to at least 75 years after the valuation date. In AR23, the projection extends to the year 2081.

5.4.2 Minimum Contribution Rate

The methods used to compute the minimum contribution rate involve a combination of “steady-state funding” and “full funding”. Thus, the “minimum contribution rate” is computed as the sum of:

1. the contributions determined by the steady-state method for all benefits other than benefit improvements resulting from changes to the Canada Pension Plan Statute that occurred after 1997, and
2. the contributions determined by the full-funding method for benefit improvements due to post-1997 changes to the Canada Pension Plan Statute.

The steady-state method produces a contribution rate that is at least equal to the lowest constant rate that, if maintained over the foreseeable future, results in projected asset/expenditure ratios that are generally constant. The asset/expenditure ratio for any year is the ratio of the projected assets at the end of the year to the projected expenditures in the following year. In practice, the steady-state rate is computed as the lowest level contribution rate, starting three years after the review date, that produces the same projected asset/expenditure ratios in the 10th and the 60th years following the review period. In AR23, the asset/expenditure ratios for 2019 and 2069 are used for this purpose.

Section 113.1(4)(d) of the Canada Pension Plan Statute requires that post-1997 benefit improvements be separately identified and funded on a “full funding” basis. That is, the contribution rate must be increased permanently to reflect benefit improvements that are deemed to be earned in the future, and there must also be a temporary increase in the contribution rate to liquidate any unfunded liability resulting from the benefit improvement. The temporary increase is to apply for a number of years that is consistent with common actuarial practice.

For this purpose, the Chief Actuary uses the accrued benefit method described in section 5.4.3, and amortizes any unfunded liability as a level percentage of contributory earnings over 15 years.

Over time, the accumulation of successive improvements could significantly complicate the process. If the full-funding requirement is interpreted rigidly, each future actuarial report would have to include a recalculation of the cost of each post-1997 benefit improvement, taking account of experience to date. That would require the maintenance of historical information about the parts of each benefit payment attributable to each benefit improvement, and a notional allocation of assets to each improvement for an extended period. It would be desirable to reduce or eliminate this complexity, without violating the spirit of the full-funding requirement. For example, this might be accomplished by basing the full-funding contributions only on the original projections for each benefit improvement (i.e., not tracking and recalibrating the full-funding cost of each benefit improvement at every successive valuation date). Alternatively, the Chief Actuary might recalibrate the full-funding contributions only for a short period of time until the original projections are either validated or improved; once these full-funding contributions are confirmed for a suitably lengthy period, there may be no need to continue tracking them thereafter.

5.4.3 Accrued Benefit Method

The accrued benefit actuarial cost method produces a comparison of current Plan assets to actuarial accrued liabilities for the members and beneficiaries presently covered by the Plan, and a calculation of the current service cost of the Plan (the cost of benefits accruing over the 12 months following the valuation date). In AR23, the unfunded liability at December 31, 2006 is shown, together with a projection of funded ratios for years up to 2050. The pattern of future current service costs is also projected.

The accrued benefit actuarial cost method used by the Chief Actuary is a variation of the method used by actuaries for occupational defined benefit pension plans. In the Chief Actuary's variation, the "accrued benefits" used in the calculation of the actuarial liability are those that would be payable if there were no future benefit accruals or new entrants, but the CPP otherwise continued unchanged. In valuations of occupational pension plans, on the other hand, actuaries assume continued future accruals, and the "accrued benefits" are computed by prorating projected benefits based on the ratio of past service to total service. The methodology used by the Chief Actuary produces a higher actuarial liability.

We feel that showing a projection of the funded ratios up to the year 2050 is of some value for technical readers such as actuaries, as is the description of stable future current service costs. However, we are concerned that most readers will be unduly distressed that there is no expectation that the CPP will ever be even one-third funded. For this reason, we suggest the Chief Actuary consider eliminating this section of the report. If funding ratio information is to continue to be provided, it should be put into the "big picture" context – the adequacy and stability of the steady-state contribution rate is the critical tool for judging the sustainability of the CPP, and the funding ratio is at most a measure of the fact that the funding level is projected to improve over time, consistent with the objectives of CPP funding reform.

5.4.4 Actuarial Balance Method

The Actuarial Balance method calculates, for each of several periods:

- the difference between (a) the sum of the beginning assets and the discounted present value of contributions for the period and (b) the discounted present value of the expenditures for the same period

divided by

- the discounted present value of the contributory earnings for all years in the period.

The resulting figure, referred to in each case as the “actuarial balance”, is actually the amount by which the current 9.9% contribution rate exceeds (or falls short of) the minimum rate necessary for the Plan to exist for the defined period if the fund were to become exhausted at the end of the period (a measure used in OASDI Trustees Reports on the U.S. Social Security System).

We believe that the “actuarial balance” results are marginally useful at best. If the Chief Actuary concludes that it continues to be useful to compare CPP and OASDI, then this information will necessarily continue to be produced, though it might be published separately. Otherwise, it may be overly technical and of little use. In any event, the notion of exhausting the fund at the end of the measurement period is contrary to the strategy used to develop the steady-state contribution rate.

5.4.5 Reconciliations

Detailed reconciliations are conducted of the current results on the pay-as-you-go, steady-state and accrued benefit methods against the results in AR21. These identify the principal causes of the changes in results from AR21 to AR23, and measure the impact of each on the results. The detailed reconciliations also serve as a check on the results of AR23.

5.5 Sensitivity Tests

In addition to the results based on best-estimate assumptions selected by the Chief Actuary, a number of *sensitivity tests* are produced. These show the results using alternative assumptions and thereby give information on the possible range of future actual results. Four sets of sensitivity tests are presented in AR23.

One set consists of two “combined” sensitivity tests: the “Younger Population Scenario” and the “Older Population Scenario”. The first is based on generally more optimistic and the second on generally more pessimistic assumptions than the best-estimate assumptions. Both of these tests were designed to test plausible *combinations* of the key assumptions (considering the interrelationship of the various parameters), in each case starting from a change in the fertility assumption.

Another set of sensitivity tests in AR23 examines one parameter at a time – the effect of changes, both lower-cost and higher-cost, in each of nine key parameters. These tests are discussed in more detail in section 5.6.

A third set of sensitivity tests shows the impact of one possible form of stock market volatility on the burgeoning CPP asset base, and in turn upon the steady-state contribution rate. This is accomplished by showing the effect of a two-year period of abnormally high or low stock market returns followed by a resumption of best-estimate returns. This test is conducted for 2009/2010. A range of nominal equity returns for those two years from +25% to -10% was evaluated to determine the impact on the minimum contribution rate. Variations by asset allocation were also shown. These latter variations inevitably show lower minimum contribution rates for higher equity allocations, but they do not give the reader any sense of the differing risk related to the alternative asset allocations. This is because the years of poor assumed equity returns are more than offset by the assumed resumption of best-estimate returns in all other years.

Finally, AR23 includes a sensitivity test of an economic slowdown followed by a partial economic recovery.

5.6 Individual Sensitivity Tests

The individual sensitivity tests examine the effect of changes, both lower-cost and higher-cost, in each of nine key assumptions (fertility, mortality, migration, labour force participation rate, price increases, real-wage differential, real rates of return, age-60 retirement rates, and disability incidence). In each case, except for the labour force participation rates and retirement rates, stochastic considerations were used to provide estimates of probability ranges of the underlying variable. The results were selected using a 95% confidence interval (two standard deviations), which is extremely wide. The resulting high-cost and low-cost values for each assumption were then used as inputs into the model to project revised (a) minimum contribution rates and (b) asset/expenditure ratios if there were no change in the current 9.9% rate.

The approach to the individual sensitivity tests used in AR23 is better than that used in AR21, but there is room for further improvement. Ideally, the report would show how much variation should be expected, with equal plausibility, in each direction and for each parameter. The approach followed for AR23 does not reflect that ideal. The assumed future volatility for each parameter has been determined solely by reference to historical volatility in the same variable, with the Chief Actuary's judgement used only to select the historical periods of greatest perceived relevance. Once the relevant historical period has been chosen for a given variable, the Chief Actuary assumes that future volatility will mimic historical volatility. In our view, the high-cost and low-cost values are not

balanced (i.e., equally plausible) for some of the assumptions considered, and the plausibility varies from one assumption to another.

Notwithstanding the above comment, we believe that the individual sensitivity tests are a valuable tool, if used with caution. They give the reader information that may be used to estimate the financial impact of a change in a particular best estimate assumption. However, the reader should be cautious in interpreting the information provided about the likely variations in the parameters.

We suggest that the Chief Actuary continue to seek guidance on ways to improve the individual sensitivity tests. As noted above, the sensitivity tests vary in their plausibility from one actuarial assumption to another, ranging from highly plausible to highly implausible. We suggest a more consistent approach, along the following lines:

- Based on historical analysis tempered by judgement, postulate distributions of results for *each* key assumption. Note that the use of judgement may lead to assumed future volatility that is not strictly a function of historical volatility.
- Select high-cost and low-cost values for each assumption that are of *equal* plausibility. This is the key element of the suggestion. We suggest targeting high-cost and low-cost values that each represent about a 10% probability of being surpassed. That is, the actual observed values should be expected to fall within the imputed range *about 80% of the time*.
- The resultant impact on the valuation results should be reported in each case, even if it is small. This will give users of the report a clearer sense of how much a future variation from an assumption is likely to affect the Plan's funding.

The hypothetical ideal would be to use an integrated model where all parameters are stochastically generated in an integrated fashion (e.g., if inflation rises, other economic and even non-economic parameters are varied stochastically in a consistent and plausible fashion). Given the complexity of the CPP model, and indeed of the reality it represents, this ideal is probably not attainable, even for a modest subset of the assumptions.

5.7 Opinion on Methodology

In our opinion, the actuarial methods employed in AR23 are reasonable.

5.8 Recommendations

Recommendation 4: We recommend that the Chief Actuary maintain the tradition of continual improvements to actuarial methods by such actions as

- applying more forward-looking stochastic analysis, and
- developing more plausible and consistent sensitivity tests for key assumptions.

Recommendation 5: We recommend that the Chief Actuary discontinue showing results such as the minimum contribution rate and balance sheet under differing investment portfolios. These comparisons inevitably show that the low-risk or risk-free portfolios are expected to produce the highest required contribution rates or worst funding status, while the high risk portfolios appear most favourable. The absence of a meaningful risk measure gives the impression that the assets should be invested solely in equities. Further, in our opinion the “risk-free” results are not meaningful for a plan that has no termination provision, no meaningful possibility of termination, and no possibility of the plan sponsor being involved in corporate-type transactions such as mergers, bankruptcy or liquidation. Indeed, if the contribution rates were established based on a risk-free portfolio, but the assets continued to be invested as at present, there would be a high probability that those rates would ultimately turn out to be excessive.

Recommendation 6: We recommend that “point-in-time” funded status updates be minimized or eliminated from the Chief Actuary’s report. Such updates are appropriate for systems that have full funding as an objective. However, the CPP’s primary funding objective is steady-state funding, with full funding only for benefit increases. If that objective is met, the CPP is projected to build up assets equal to only about 25% of Plan liabilities. The inclusion of items such as a balance sheet suggest to the casual reader that the CPP’s funding is hopelessly inadequate, which is simply not true. The meaningful measure is the adequacy and sustainability of the 9.9% contribution rate, not the funded percentage.

Recommendation 7: We recommend that the Chief Actuary report the expected progression of the minimum contribution rate over time assuming that the best-estimate assumptions are realized. This would help to allay CPP stakeholders’ concerns about the sustainability of the current contribution rate.

SECTION 6 – ASSUMPTIONS

In this section, we address the following question:

“Were the assumptions used in completing the report reasonable?”

6.1 Background

The actuarial review that is required to be made every three years under section 115 of the Canada Pension Plan requires that the Chief Actuary look back in time, to review the operations of the program, and also look forward, to make an estimate of its future operations. For the forward-looking part of the process, the Chief Actuary builds a model that incorporates the details of the benefit, contribution and investment elements of the CPP and reflects the expected behaviour of the factors that determine the year-by-year development of the benefit costs and the contribution and investment income. The model for a plan as complex as the CPP is necessarily complex itself. The assumptions incorporated into the model for a particular actuarial review reflect the Chief Actuary’s judgement, based on his interpretation of past experience and the available evidence about the likely course of future experience.

The nature of the actuarial process is to make projections (not predictions) about the future based on the evidence available and then to revisit and review them periodically. Where appropriate, the actuary makes “mid-course corrections” in the assumptions as the emerging experience of the plan deviates from the previous assumptions and the expectations for likely future experience change. In assessing whether to change an assumption and if so, by how much, the actuary must weigh:

- long-term historical data,
- shorter-term historical data,
- recent amendments to the Canada Pension Plan,
- policy (e.g., CPPIB investment policy, HRSDC administration policies and government policies on inflation control and immigration levels),
- academic research, and
- other external sources of relevant information.

The assumptions are intended to apply over the long-term future, so the actuary will normally give substantial weight to long-term historical data. However, where the actuary judges that more recent data for a particular assumption indicate a shift or a trend

that is likely to continue for the long-term future, the actuary will recognize that shift or trend in the assumption.

For many of the assumptions used in the model, the Chief Actuary has adopted an approach that actuaries describe as “select and ultimate”. Under this approach, the particular assumption gradually changes over a period of years (the “select period”) from one that initially is very close to actual recent experience to one that reflects the actuary’s best estimate of the long-term future (the “ultimate” assumption). The length of the select period can be different for different assumptions. The choice is based on the actuary’s judgement and depends partly on the nature of the parameter involved and partly on how significantly the ultimate assumption differs from recent experience.

The results of the actuarial process at any given time do not yield a “right” answer but should lie somewhere within a range that can be regarded as “reasonable”. Previous actuarial reports on the CPP have focused on several key assumptions. All assumptions used in those reports can be described as “best-estimate”, i.e., the assumptions were, in the judgement of the Chief Actuary, such that adverse or favourable deviations of actual future experience from each of those assumptions are about equally likely. AR23 follows this same approach.

The major actuarial assumptions in AR23 can be conveniently divided into two groups:

- “demographic” assumptions that deal with changes in the covered population (e.g., fertility, mortality and migration rates) and events (e.g., death, disability and retirement) that trigger the starting or stopping of CPP benefit payments or contributions, and
- “economic” assumptions that deal with such issues as employment, wages, prices and returns on investment.

6.2 Demographic Assumptions and Opinions Thereon

6.2.1 Fertility

Fertility rates varying by age and year are applied to the female population to project the number of births each year. The assumed age-specific fertility rates for 2007 are based on recent experience. The Chief Actuary assumes that fertility rates will continue to decline for women under age 25, remain at recently experienced levels for women aged 25-29, and trend upward for women at older ages. The fertility trends are based on historic cohort fertility rates by age of mother, not calendar-year fertility rates. As for some other assumptions, the approach used in AR23 (and in past actuarial reports on the

CPP) is to develop one fertility assumption for Canada and a separate one for Québec. The assumption is used to develop separate population projections for Canada and for Québec. From these, the projected population of Canada-less-Québec is derived.

The total fertility rate is a convenient way of summarizing a set of age-specific fertility rates. It indicates the average number of children that would be born to a woman in her lifetime based on those age-specific rates. The assumed total fertility rate for Canada in AR23 grades from 1.56 in 2007 to an ultimate total fertility rate of 1.60 in 2010 and later. The total fertility assumption for 2007 is slightly higher than that assumed in AR21 (1.52). Although the ultimate rate is unchanged at 1.60, the year in which it is reached in AR23 is earlier than that assumed in AR21 (2016).

The long-term fertility assumption depends on several factors that are difficult to predict. Fertility rates at all child-bearing ages declined sharply in Canada in the 1960s and early 1970s as the result of social, economic and medical factors, including improved contraception methods. Since the mid-1970s, fertility rates at ages under 30 have continued to trend downward, while the rates at higher ages have increased, so the average age of motherhood has increased. In the future, fertility rates could decline to the lower levels experienced in several other developed countries, or increase in the direction of the higher rates recently experienced in the U.S. The assumed rates in AR23 are between the centre and the high end of the range used by Statistics Canada in its projections (which run only to 2031). Compared to the projections for Canada performed by the United Nations, the assumed rates in AR23 are slightly higher before 2020 and lower in the period from 2025 to 2050.

The sensitivity tests for the fertility assumption are a low-cost ultimate total fertility rate for Canada of 2.10 and a high-cost ultimate rate of 1.10. The test results may be summarized as follows:

Ultimate Total Fertility Rate	Minimum Contribution Rate	Pay-As-You-Go Rates		
		2025	2050	2075
Lower-cost (2.10)	9.25	10.63	9.98	9.11
Best estimate (1.60)	9.82	10.67	11.29	11.40
Higher-cost (1.10)	10.45	10.71	13.00	15.10

The above table illustrates that changes in fertility can have a very large effect on the cost of the Plan. However, the individual sensitivity test results should be interpreted with caution. Readers should form their own opinion about the plausibility of the low-cost

and high-cost assumptions. Moreover, they should assume that changes in parameters are not likely to occur in isolation. For example, a radical change in fertility rates would likely be accompanied by other changes that would mitigate their impact (e.g., changes in average ages at retirement, levels of immigration or labour force participation rates).

Opinion on Fertility

In our opinion, the AR23 fertility assumption is reasonable.

6.2.2 Mortality

The mortality assumption for AR23 starts from the 2000-02 Life Tables for Canada and Québec, prepared by Statistics Canada. These mortality rates are projected to 2004 using the actual improvements in mortality experienced in the years 2002 to 2004. The rates of assumed improvement in 2005 to 2009 are extrapolated using the average annual rates experienced in Canada between 1989 and 2004. Rates of improvement for 2010 to 2028 are found by linear interpolation between the age-specific rates for 2009 and the ultimate age-specific rates for 2029 and later. For 2029 and beyond, the improvement rates for both sexes are set to 0.7% for all ages below 85, 0.6% for ages 85-89, and 0.4% for higher ages.

As recommended by the last actuarial review panel, the approach used to determine the ultimate rates has been changed since AR21. In AR21 and previous reports, the ultimate improvement rates were derived from U.S. mortality studies, adjusted to reflect Canadian experience. In AR23, the ultimate rates are based on the assumption that the decline in the rate of mortality improvement for Canadian females that has been observed over the past 30 years will continue for the next 30 years. The Chief Actuary makes the further assumption that the improvement rates for males, which are currently higher, will decline over the period to 2029 to the same as the improvement rates for females. As a result, the gap between male and female life expectancy is expected to narrow, though at a slower pace after 2029.

It is implicit in these assumptions that there will be no shocks affecting future life expectancies, either positively (e.g., a major advance in the treatment of heart disease or cancer) or negatively (e.g., an outbreak of a serious infectious disease).

The AR23 ultimate improvement rates are higher than those assumed in AR21. Compared to the rates used in the 2006 U.S. Social Security (OASDI) Report, the AR23 ultimate improvement rates for males are the same as the U.S. rates for males at ages 65

to 89, but lower than the U.S. rates for males at younger and older ages. For females, the AR23 ultimate improvement rates are the same as the U.S. rates at ages 15 to 89, but lower than the U.S. rates at younger and older ages.

The sensitivity tests for the mortality assumption were implemented by adjusting the rates of mortality improvement to obtain specified life expectancies in 2050. Based on the best-estimate assumptions, the average life expectancy at age 65 in 2050 would be 21.9 years for males and 24.2 years for females. The low-cost assumption is that those average life expectancies would be 17.8 years for males and 18.6 years for females. The high-cost assumption is that those average life expectancies would be 25.1 years for males and 27.9 years for females. The test results may be summarized as follows:

Life Expectancy in 2050	Minimum Contribution Rate	Pay-As-You-Go Rates		
		2025	2050	2075
Lower-cost (M 17.8, F 18.6)	9.16	10.40	10.24	9.74
Best estimate (M 21.9, F 24.2)	9.82	10.67	11.29	11.40
Higher-cost (M 25.1, F 27.9)	10.20	10.87	11.88	12.21

Opinion on Mortality

In our opinion, the AR23 mortality assumption is reasonable.

6.2.3 Migration

The rate of net annual immigration to Canada over just the last 30 years has varied from a low of 0.22% of the population to a high of 0.76%; the variations in the earlier years of the 20th century were even more extreme. This illustrates the extent to which migration varies from year to year in response to demographic, economic, social and political changes. In 2006, the net migration rate for Canada was 0.65% of the population.

The AR23 assumption is net annual immigration to Canada of 0.50% of the population from 2007 to 2015, then increasing linearly to 0.54% in 2020 and later. The initial rate of 0.50% was the average over the last 30 years. The Chief Actuary assumes a modest increase in net immigration rates from 2015 to 2020 as a response to expected future labour shortages. The same net migration assumption was used in AR21.

We question the appropriateness of the short-term net migration assumption, since the assumed rate for 2007 to 2015 is lower than either the actual rate for 2006 or the assumed

ultimate rate for 2020 and later. For a parameter such as this, we believe that the current year's rate is better estimated by the previous year's rate than from the average over the past 30 years.

The assumed net migration rates in AR23 are slightly lower than the “medium” rates used by Statistics Canada in its projections (which run only to 2031, after which the number of net migrants each year is assumed to remain constant).

The sensitivity tests for the net migration assumption are a low-cost annual net migration rate for Canada of 0.59% and a high-cost rate of 0.48%. The test results may be summarized as follows:

Average Annual Net Migration Rate	Minimum Contribution Rate	Pay-As-You-Go Rates		
		2025	2050	2075
Lower-cost (0.59%)	9.70	10.50	11.08	11.19
Best estimate (0.54%)	9.82	10.67	11.29	11.40
Higher-cost (0.48%)	9.92	10.76	11.53	11.66

Opinion on Migration

In our opinion, the AR23 net migration assumption is reasonable.

6.2.4 Disability Incidence

The assumption about the incidence of disability takes the form of rates that vary by age and sex. These can be summarized as an aggregate rate based on the current population distribution. The 2006 experience indicates aggregate rates of 2.80 new disabilities per thousand eligible male workers and 3.20 new disabilities per thousand eligible female workers. The AR23 assumption is that disability incidence will increase to produce aggregate rates for years 2011 and later of 3.10 for males and 3.50 for females. The ultimate aggregate rate for females is the same as that used in AR21, but that for males is lower than the rate of 3.25 used in AR21.

The use of historical data as the basis for assumptions about the future must always be done carefully. In this case, very little weight can be given to experience data for the years before 1995, when there were major changes in the administration of the disability provisions that led to a significant decline in disability incidence rates. The Chief Actuary must also take into account the effect of changes in the law, such as Bill C-36,

which relaxed the minimum qualifying period, effective January 1, 2008, for those with 25 or more years of contributions.

The sensitivity tests for this assumption are an ultimate low-cost rate per thousand eligible workers of 2.45 for males and 3.05 for females, and an ultimate high-cost rate of 3.75 for males and 3.95 for females. The test results may be summarized as follows:

Disability Incidence Rate in 2011	Minimum Contribution Rate	Pay-As-You-Go Rates		
		2025	2050	2075
Lower-cost (M 2.45, F 3.05)	9.68	10.51	11.13	11.25
Best estimate (M 3.10, F 3.50)	9.82	10.67	11.29	11.40
Higher-cost (M 3.75, F 3.95)	9.98	10.83	11.44	11.55

Opinion on Disability Incidence

In our opinion, the AR23 disability incidence assumption is reasonable.

6.2.5 Retirement Rates

The contributions to the Plan and benefits paid from the Plan are affected by the ages at which individuals retire. Contributions to the Plan by individuals, and by employers on their behalf, stop when the individual starts to collect a retirement pension, and neither contributions nor benefit accruals are resumed even if the individual returns to employment. The amount of an individual's retirement pension depends in part on the age at which it starts. The normal retirement age is 65. Pensions are reduced by 0.5% for each month by which the pension start age is below 65, or increased by 0.5% for each month by which the pension start age is after age 65.

The retirement rate represents the ratio of the number of individuals who elect to start receiving their retirement pension at a particular age to the total number of individuals who are eligible for a retirement pension at that age. Separate retirement rates are assumed for each year, each sex, and each age from 60 to 70 inclusive.

In AR23, the retirement rate at age 60 for males is assumed to increase from its 2006 level of 36.9% to 40.0% for years 2009 and later, while the rate at age 60 for females is assumed to increase from its 2006 level of 43.3% to 45.0% for years 2009 and later. These rates are significantly higher than the rates assumed in AR21. The change in assumption was made to reflect the trend in recent years toward more early benefit uptake

at age 60. The retirement rates at other ages were also adjusted to reflect an assumption that recent experience will continue.

Some observers suggest that, because of improvements in health and life expectancy together with the prospect of labour shortages associated with the retirement of the baby boomers, there could be a tendency for individuals to retire at older ages in the future. Others suggest that these considerations must be balanced against entrenched social expectations of earlier retirement, and features of the Plan that make it attractive for individuals to start receiving retirement pensions at the earliest possible age, even if they plan to return to work.

There is a sensitivity test for the retirement rate assumption. For the low-cost scenario, retirement rates were modified so that the retirement rates at age 65 would be 20% higher than the best estimate rates. For the high-cost scenario, retirement rates were modified so that the retirement rates at age 60 would be 20% higher. The model used for AR23 acknowledges that if there are changes in the retirement rates, there will also be changes in the labour force participation rates and in the number of CPP contributors in the age group 60 to 64. Accordingly, the assumption changes for this sensitivity test affected not only the projected benefit expenditures, but also the projected contribution income.

The test results may be summarized as follows:

Retirement Rate Assumption	Minimum Contribution Rate	Pay-As-You-Go Rates		
		2025	2050	2075
Lower-cost (20% higher at 65)	9.66	10.34	11.22	11.39
Best estimate	9.82	10.67	11.29	11.40
Higher-cost (20% higher at 60)	10.02	11.03	11.39	11.46

Opinion on Retirement Rates

In our opinion, the AR23 retirement rates assumption is reasonable.

6.3 Economic Assumptions and Opinions Thereon

6.3.1 Unemployment and Participation Rates

The development of projected numbers and profiles of contributors begins with the development of calendar-year labour force participation rates by age-sex group and the application of these rates to the projections of the total population in each of those groups. The participation rates are “cohort-based” to reflect expected changes in participation as a result of longer periods in education and training, the trend of postponing childbearing to later ages, better wages and more plentiful job opportunities as the labour market tightens, and a move toward later retirement.

The resulting labour force projections are then used in combination with projections of assumed net jobs created to give projections of employed and unemployed workers. The assumptions for net job creation are established so that the assumed rates of unemployment (a constant rate of 6.3% for Canada throughout the projection period, coupled with initial unemployment in Québec of 8.0% falling to 7.0% by 2020 and remaining at that level thereafter) are reached. The Chief Actuary adopted these assumptions to be consistent with unemployment remaining close to the current “natural” level throughout the projection period.

There are two sensitivity tests for this assumption, both expressed as changes in the post-2030 assumptions for Canada as a whole. One is the use of a low-cost ultimate assumed unemployment rate of 4.3% together with an ultimate aggregate labour force participation rate for ages 15 to 69 of 81% (a 7% upshift) and the other is a high-cost ultimate assumed unemployment rate of 8.3% together with an ultimate aggregate labour force participation rate of 71% (a 3% downshift). The results, not surprisingly, show more impact on the low-cost side, as summarized below:

Unemployment (U) and Participation Rates (PR) for Canada in 2030	Minimum Contribution Rate	Pay-As-You-Go Rates		
		2025	2050	2075
Lower-cost (U 4.3%, PR 81%)	9.41	9.91	10.83	11.41
Best estimate (U 6.3%, PR 74%)	9.82	10.67	11.29	11.40
Higher-cost (U 8.3%, PR 71%)	10.08	11.13	11.57	11.39

The rationale for the best-estimate assumed unemployment and participation rates seems to us both plausible and reasonable. The parameters adopted for these rates are within the consensus range of expert opinion.

Opinion on Unemployment and Participation Rates

In our opinion, the AR23 assumption as to the rates of unemployment and labour force participation are reasonable.

6.3.2 Real Wage Increases

Both contributions and initial benefits under the CPP are affected by wage increases. Subsequent benefit increases are affected by inflation. The wage increase assumption is separated into two parts: the inflation assumption (discussed in sub-section 6.3.3 below) and the real wage increase assumption (the portion above inflation, discussed here in sub-section 6.3.2).

In AR23, the real wage increase assumption is applied to both average annual earnings (AAE, used to project contributory earnings) and to average weekly earnings (AWE, an index used to adjust the Year's Maximum Pensionable Earnings in the CPP).

In AR23, the real wage increase reported for 2006 is 0.9%, but then the assumed increases grade from 0.2% in 2007 (based on the 30-year average annual increase in AAE) to 1.3% in 2015 and later (consistent with the expected tightening of the labour market in coming decades). We question the appropriateness of the short-term assumption for this parameter. In our view, it was unrealistic to assume that the rate would drop between 2006 and 2007, before starting its eight-year climb. For a parameter such as this, we believe that the current year's rate is better estimated by the previous year's rate than by the average over the past 30 years.

The sensitivity tests for the real wage assumption are a low-cost scenario of an ultimate rate in 2015 and later of 1.9% versus a high-cost scenario of 0.5%. The results of these tests are shown below:

Real Wage Increases in 2015	Minimum Contribution Rate	Pay-As-You-Go Rates		
		2025	2050	2075
Lower-cost (1.9%)	9.34	10.01	10.20	10.28
Best estimate (1.3%)	9.82	10.67	11.29	11.40
Higher-cost (0.5%)	10.41	11.57	12.80	13.00

Historical data from the *CIA Report on Economic Statistics* shows average annual real wage increase over the last 83 years (1924-2006) of 1.37% but over the last 25 years (1982-2006) of only 0.1%. The consensus of expert opinion seems to be that real wages have stagnated in recent decades due to weak labour conditions, but that tightening labour markets should result in a return to more normal outcomes. The Chief Actuary's assumption is somewhat low within the range of expert opinion.

In our opinion, the increase in the long-term assumption from 1.2% in AR21 to 1.3% in AR23 is a cautious move in the right direction. We believe that a slightly higher rate would better reflect an expectation that labour will revert to receiving a more constant share of productivity gains in the future, as has been the case historically and unlike the experience of recent decades.

Opinion on Real Wages

In our opinion, the real wage increase assumption in AR23 is reasonable but somewhat low within the range of expert opinion, particularly before 2015. The results shown in the table above indicate that, if a higher assumption had been used, the minimum contribution rate would have been lower.

6.3.3 Price Increases

The rate of price inflation is a necessary assumption for an actuarial review of the CPP. CPP contributions, benefit payments and investment returns are all affected by inflation. However, the extent and timing of these effects are not uniform. The net result is that an increase in the inflation assumption results in a decrease in the pay-as-you-go rates and steady-state contribution rate, and vice versa.

The price increase assumption in AR23 is 2.0% in 2007-2011 (consistent with recent inflation), gradually increasing to 2.5% in 2016 and later. This reflects an expectation that the Bank of Canada will maintain and achieve its inflation control targets during the initial period, but that in the long run there will be challenges arising from energy prices, tight labour markets, and so on.

The sensitivity tests for this assumption are a high-cost scenario with an ultimate price increase rate of 3.4% and a low-cost scenario with an ultimate rate of 1.3%. The results of these tests may be summarized as follows:

Price Increases in 2016	Minimum Contribution Rate	Pay-As-You-Go Rates		
		2025	2050	2075
Lower-cost (3.4%)	9.66	10.49	11.02	11.19
Best estimate (2.5%)	9.82	10.67	11.29	11.40
Higher-cost (1.3%)	10.13	11.01	11.73	11.76

Inflation in Canada was extremely volatile during the 20th century, with long runs of both very high and very low inflation. The present system of Bank of Canada five-year inflation control targets has been in effect only since 1991. Since this framework was introduced, however, it has been remarkably successful at keeping the inflation rate in Canada generally within a range of +/-1% around the policy target. Our inquiries lead us to believe that this framework will continue for a long time and that there is no reason to expect an upward revision to the current target of 2%. Indeed, the experts with whom we consulted suggested that any change is more likely to be a decrease than an increase, and that the recent monetary policy history is so consistent as to suggest that it will persist.

Our review of the opinions of some economists and financial forecasters found a concentration of views of long-term inflation rates around 2%. Thus, we see the decrease in the long-term assumption from 2.7% in AR21 to 2.5% in AR23 as a cautious move in the right direction. The ultimate price increase assumption used in AR23 remains, however, towards the high side of the reasonable range.

Opinion on Price Increases

In our opinion, the price increase assumption used in AR23 is within, but towards the high side of, the reasonable range. The results shown in the table above indicate that, if a lower assumption had been used, the minimum contribution rate would have been higher.

6.3.4 Real Rate of Return on Investments

If the CPP were totally unfunded (i.e., if the contributions each year were just enough to cover that year's benefit payments and expenses), then the costs would be equal to the pay-as-you-go rates and no assumption for the rate of investment return would be required. However, under the steady-state contribution rate approach to financing the Plan, a sizeable fund will accumulate (eventually exceeding six years' benefit payments, according to AR23) and the rate of investment return becomes a material factor in the cost of the Plan. The CPP assets totalled \$114 billion at the end of 2006 and are projected to grow exponentially over the coming decades.

As with assumed increases in employment earnings and benefit payments, part of the assumed nominal rate of investment return is attributable to general price inflation. Here we focus on the real rate of investment return (i.e., net of the rate of inflation).

The best-estimate real rate of return assumption in AR23, before deducting administrative expenses but net of investment expenses, is 3.8% in 2007, increasing gradually to 4.2% in 2025 and later. The ultimate rate reflects a “building block approach” whereby:

- Long-term Government of Canada bonds are assumed to return 2.8% per year in real terms (higher than current yields, but lower than long-term average real returns);
- Canadian and foreign equities are assumed to return 2.3% per year higher than long Canada bonds (resulting in a lower-than-historical total real equity return of 5.1%);
- Real estate and infrastructure investments are assumed to behave like an investment that is split 50/50 between long Canada bonds and Canadian/foreign equities (consistent with the CPPIB expectations for the behaviour of these investment categories); and
- The actual CPP portfolio earns additional risk premiums by making fixed income investments in other than Government of Canada bonds (e.g., an additional 40 bps earned on provincial bonds and an additional 100 bps earned on corporate bonds, consistent with the spreads available over the last two decades given the maturities and credit quality in which the CPPIB is expected to invest).

In arriving at the assumed long-term rate of return for the CPP assets, the Chief Actuary notes that the CPPIB “reference portfolio” for 2007 includes a 35% allocation to fixed income investments. However, the CPPIB does not adopt long-term asset mix targets. In the absence of such long-term targets, the Chief Actuary postulated an assumed ultimate fixed income allocation of 40%, reflecting his expectation that the future maturation of the CPP fund would lead to this increased fixed income commitment.

In addition, the Chief Actuary makes other assumptions to produce shorter-term expected real rates of return. These other assumptions include a projection that equity returns will be moderate during the next decade because of the abnormally high returns in recent years, and that rollovers of the non-marketable provincial bonds currently held in the CPP fund will evolve in line with historical experience and be eventually eliminated altogether by 2037.

The sensitivity tests for this assumption are to increase or decrease the rate of return on all of the CPP assets by 1.5%. The results of these tests are summarized below and show the extreme sensitivity of the minimum contribution rate to this assumption (pay-as-you-go rates are not shown since they are unaffected by the assumed real rates of return on CPP assets):

Real Rate of Return	Minimum Contribution Rate
Lower-cost (5.7%)	9.02
Best estimate (4.2%)	9.82
Higher-cost (2.7%)	10.72

Real rates of return on Canadian equities have been about 7.0% over the last 83 years (1924 to 2006), and the Canadian equity risk premium relative to returns on long Canada bonds has been about 3.9% over the same period. There is considerable debate, however, about the sustainability of these returns, particularly given the environmental changes that have occurred during the last century (changes in laws and regulations, globalization, incipient climate change, shifts in the relative returns to labour and capital, and so on).

The real rate of return assumptions adopted by the Chief Actuary are within the reasonable range but his assumed equity risk premium is lower than the historical average for both Canadian and international markets, and lower than the risk premium postulated by many experts. However, it should be noted that there is a wide range of expert opinion on this issue and much debate about both the relevance of the past and the prospects for the future. We suggest that the Chief Actuary undertake further research and consultation concerning the size and sustainability of the equity risk premium. Such analysis should not be confined to the Canadian marketplace, since the CPP fund will be increasingly invested in non-Canadian assets. Also, the analysis should not be confined to a review of the past, since the future may differ substantially.

Also, the assumed ultimate asset mix is a little more heavily weighted to fixed income investments than what we would expect. The CPP fund will never become “mature” in the same sense as an occupational pension plan. Until the CPPIB and Chief Actuary agree on a stochastic analysis that leads to a clear direction for change in the CPPIB “reference portfolio”, we feel that the anticipated shift to fixed income investments remains speculative. However, this item, on its own, only reduces the expected total fund return by about 0.1% per year.

Finally, the assumptions do not include any allowance for the CPPIB outperforming the market indices for their reference portfolio. We understand that CPPIB staff compensation includes a significant reward for such outperformance, which may lead to higher real rates of return.

Opinion on Real Rate of Return

In our opinion, the 4.2% assumption for the ultimate annual real rate of investment return on assets is within, but towards the low side of, the reasonable range. The results shown in the table above indicate that, if a higher assumption had been used, the minimum contribution rate would have been lower.

6.4 Assumptions in the Aggregate and Opinion Thereon

The Chief Actuary's actuarial assumptions are best estimates, based on his review of past experience and his judgement about the likely course of future experience. In our review of the major actuarial assumptions, we concluded that each of them is in the reasonable range.

In this section, we explore the effect of varying the Chief Actuary's assumptions in two respects. One variation would affect the short-term assumptions about migration and real wage increases. The other would affect the long-term assumptions about real wage increases, price increases and real rates of return.

For both migration and real wage increases, the Chief Actuary based his short-term assumption on the average experience of the last 30 years. As a result, the net migration rate is assumed to drop from its actual level of 0.65% in 2006 to 0.50% in 2007-2015, after which it climbs to an ultimate level of 0.54% of the population for 2020 and later years. Similarly, the real wage increase rate is assumed to drop from 0.9% in 2006 to 0.2% (the 30-year average) in 2007, after which it climbs gradually to its ultimate level of 1.3% in 2015 and later years. This technique produces a discontinuity between the 2006 and 2007 rates that may not have a significant effect on long-term average costs, but does affect the short-term projections. Instead of basing the 2007 rates on average 30-year experience, an alternative approach would be to use the 2006 experience as a predictor of the rates for 2007, as suggested in the set of alternative assumptions described below.

With respect to long-term assumptions, we found that six of the nine major assumptions are near the centre of the reasonable range. Based on the expert opinions that we reviewed, the Chief Actuary's long-term assumptions about real wage increases and the

real rate of return were towards the higher-cost side of the reasonable range, while his assumption about price increases was towards the lower-cost side of the reasonable range.

An alternative set of assumptions is described below. We should emphasize that our purpose was not to establish a “better” set of assumptions, but rather to determine the extent to which the results, and in particular the minimum contribution rate, would be affected by the selection of an alternative set of assumptions that is also within the reasonable range. The alternative assumptions are:

- The net migration rates are 0.65% in 2007 (instead of 0.50%), grading to an (unchanged) ultimate assumed rate of 0.54% in 2020 and later years.
- The real wage increase assumption is 0.9% in 2007 (instead of 0.2%), grading to an ultimate assumed rate of 1.5% per annum (instead of 1.3%) in 2015 and later years.
- The price increase assumption is an assumed rate of 2.0% per annum in all years (instead of 2.0% from 2007-2011, grading to an ultimate assumed rate of 2.5% in 2016 and later years).
- The real rate of return assumption is 3.8% in 2007 (unchanged), grading to an assumed ultimate rate of 4.7% per annum (instead of 4.2%) in 2025 and later years.

At our request, the Chief Actuary ran the model with the four alternative assumptions, and no other changes. Overall, the use of the alternative assumptions would reduce the projected pay-as-you-go costs and the minimum contribution rate. The results may be summarized as follows:

Assumptions	Minimum Contribution Rate	Pay-As-You-Go Rates		
		2025	2050	2075
Chief Actuary’s best estimate	9.82	10.67	11.29	11.40
Alternative	9.44	10.31	11.06	11.14

Based on these results, it is our opinion that the assumptions used by the Chief Actuary are towards the high-cost side of the reasonable range. But the results also show that the range of results that may be produced by reasonable assumptions is not narrow. There is a high degree of uncertainty inherent in the parameters about which assumptions must be made, so it is possible to have two sets of projected pay-as-you-go costs and minimum

contribution rate, both based on reasonable assumptions, that differ by more than several tenths of one percent of contributory earnings.

Opinion on the Assumptions in the Aggregate

In our opinion, the assumptions used in completing AR23 are, in the aggregate, reasonable, but towards the high-cost side of the reasonable range.

6.5 Recommendations

Recommendation 8: We recommend that the Chief Actuary maintain his programs of research and consultation with experts, with the goal of continual improvements in the process of setting best-estimate assumptions. Because of its strong impact on the financial operations of the Plan, we suggest that particular attention be given to research on the size and sustainability of the equity risk premium.

SECTION 7 - COMMUNICATION OF RESULTS

In this section, we address the following question:

“Does the 23rd Report fairly communicate the results of the work performed by the Chief Actuary and his staff?”

7.1 Background

AR23, as tabled in the House of Commons on October 29, 2007, is a bound soft-cover book, separately published in English (132 pages) and French (139 pages). It consists of the following sections:

	Number of Pages In English
Complete index, listing all the sections, tables and charts	4
I. Executive Summary	4
II. Methodology	1
III. Best-Estimate Assumptions	7
IV. Results	18
V. Reconciliation with Previous Report	2
VI. Uncertainty of Results	20
VII. Conclusion	1
VIII. Actuarial Opinion	1
Appendix A – Financing the Canada Pension Plan	9
Appendix B – Summary of Plan Provisions	6
Appendix C – Detailed Reconciliations with Previous Report	4
Appendix D – Assumptions and Methods	50
Appendix E – Acknowledgements	1

AR23 is also available from the OSFI website at

www.osfi-bsif.gc.ca/app/DocRepository/1/eng/oca/reports/PPP/cpp23_e.pdf.

7.2 Observations

AR23 is a very informative document. It includes a great deal of detail, a comprehensive Executive Summary and many useful tables and charts. The overall conclusions are clearly set out.

The actuarial review panel for AR21 suggested a radical change in presentation, whereby the Chief Actuary would produce a two-volume report. One volume would be intended for a broad audience, and would contain only the high-level results of the actuarial review. The other volume would address the needs of a more technical audience of actuaries, economists, demographers, policy analysts, etc., and would provide more extensive details of the Plan provisions, data, methodology and assumptions.

The Chief Actuary recognizes the dual nature of the audience, but did not implement the two-volume suggestion for valid practical reasons. However, he did change the layout of the report to include the high-level results in its main body, while placing the more technical information in appendices. Thus, the form of the report continues to be a compromise, containing more detail than is needed by the broad audience, and less than may be desired by technical readers.

We suggest that the Chief Actuary continue to explore ways to address the needs of each segment of his audience. For example, if the report indicated that technical readers could obtain detailed information from a specified website at the same time that the report is released, it might be possible to gear the entire report more toward the needs of the broad audience.

We believe that the changes made since AR21 enhance readers' understanding of the uncertainty inherent in the Chief Actuary's best estimate of the future contribution rates.

7.3 Opinion on Communication of Results

In our opinion, AR23 fairly communicates the results of the work performed by the Chief Actuary and his staff.

7.4 Recommendations

Recommendation 9: We recommend that the Chief Actuary continue to explore ways to address the needs of both the broad audience and more technical readers of his reports.

SECTION 8 – OTHER ISSUES AND RECOMMENDATIONS THEREON

In this section, we address three other issues that we considered in our review. These are:

- the use of external guidance in selecting assumptions,
- the strategy for near-term or “select” assumptions, and
- peer review of interim reports.

8.1 External Guidance in Selecting Assumptions

AR23 is a vitally important document. Its audience is not only the federal and provincial governments, who are responsible for the governance and administration of the CPP, but also the millions of present and former contributors who rely on the CPP for their financial security. The assumptions used in the report should be, and be seen as, the best available unbiased estimates of future events.

The Chief Actuary has developed rigorous processes for the selection of assumptions. All decisions on assumptions are made in consultation with his internal staff, including two other actuaries who co-sign the report. He draws upon the expertise of officials from other government departments and agencies who participate with him in interdisciplinary seminars, and he devotes a considerable amount of time to keeping abreast of experts’ views on demographic and economic matters. He also reflects the comments and advice contained in the report of the actuarial review panel that reviewed the previous actuarial report. However, after the Chief Actuary has chosen the assumptions, they are not subject to external review or challenge until after the report is tabled in Parliament.

While these processes have worked well to date, we believe that there is merit in establishing a more formal process for obtaining external input before the actuarial assumptions are selected. One approach, as recommended by past actuarial review panels, is for the Chief Actuary to establish an advisory panel, consisting of actuaries, demographers and economists, to provide input to him in the selection of the actuarial assumptions for the periodic actuarial reports. An alternative approach would be to change the terms of reference of the actuarial review panel so that the part of the review dealing with the assumptions is completed before the report is released, with the remainder done on a post-release basis. We note that the recommendations from the prior actuarial review panel were cited as influencing changes made from AR21 to AR23. We believe it would have been preferable for those changes to have been made in AR21.

Likewise, any recommendations we make with which the Chief Actuary concurs should have been reflected in AR23, not deferred to a valuation three years from now.

Our recommendation should not be taken as a criticism of the Chief Actuary nor as a suggestion to reduce or remove his authority to make the final decisions with respect to actuarial assumptions. Our goal is to give him the opportunity to improve his work by subjecting it to scrutiny by experts with a different perspective before his report is published. This should contribute to enhanced public confidence in Canada's public retirement income system.

We acknowledge that our recommendation could delay the preparation of the Chief Actuary's report. On the other hand, it would reduce the time required for the post-release review. Since no action is taken on the Chief Actuary's report until that review has been completed, the practical effect of any delay should be minimized.

Recommendation 10: We recommend that the Chief Actuary explore ways to get formal feedback on his proposed assumptions from external experts prior to completion of the actuarial review, rather than after the report has been tabled in Parliament.

8.2 Strategy for Near-Term or “Select” Assumptions

As noted in section 6.1 of this report, many of the actuarial assumptions are in a form that actuaries describe as “select and ultimate”, whereby the assumption changes over a period of years (the “select period”) from one based on recent experience to one that reflects the actuary's best estimate of the long-term future (the “ultimate” assumption).

We found that the Chief Actuary used a consistent approach to the selection of the ultimate assumptions, and the justification for each ultimate assumption was well documented in the report. However, there was less consistency in approach and documentation for the near-term or select assumptions. For example, one near-term assumption might be based on the experience in a particular recent period (e.g., the last 30 years), while a different recent period was used for another assumption. Also, the rationale for these differences in approach was not always apparent from the documentation we received.

Recommendation 11: We recommend that the Chief Actuary obtain expert advice from statisticians or other sources to establish a consistent strategy for choosing near-term assumptions.

8.3 Preparation of Interim Actuarial Reports

In addition to the triennial actuarial reports required by section 115(1) of the Canada Pension Plan Statute, the Chief Actuary is required by section 115(2) to prepare a report whenever Parliament is asked to consider a change in the Statute that would affect the projected costs and contribution rate. Unlike the triennial reports, the reports required by section 115(2) have not been subject to external peer review.

We have no reason to believe that there has been any error or bias in interim reports produced to date. Nevertheless, as a matter of good governance, we believe that reports on Plan changes should be peer reviewed before they are acted upon. From the contributors' point of view, such reports are as important as, or perhaps more important than, the triennial reports. Legislators depend on the results of section 115(2) reports to make decisions that could result in an immediate increase (or decrease) in the contribution rate. Peer review would increase public confidence in the Chief Actuary's results.

We note that the report required by section 115(2) is to be prepared "using the same actuarial assumptions and basis" as were used in the most recent triennial report. Such a provision may be unduly restrictive. Changes in benefit provisions are often accompanied by behavioural changes that should be reflected by the actuary in the selection of assumptions (often without the benefit of relevant historical data). For example, a change in the early retirement eligibility conditions or pension amounts might be expected to alter significantly the pattern of ages at which contributors choose to start their retirement pensions. If the effect of behavioural changes is not taken into account, the estimated cost of the change in benefit provisions could be seriously misstated. We believe that the Chief Actuary should have the freedom to take account of changes in actuarial assumptions in a report on changes in benefit provisions.

In addition, if there are known events that occurred since the date of the most recent triennial report and that have a significant financial effect, the Chief Actuary should not be prevented from reflecting them in a report prepared for the purpose of section 115(2).

Recommendation 12: We recommend that the Chief Actuary take steps to ensure that he has the latitude to prepare appropriate reports for the purpose of section 115(2) on changes in the Canada Pension Plan Statute that would affect the projected costs and contribution rate, without undue constraints on the choice of actuarial assumptions. We further recommend that the terms of reference of future actuarial review panels be

extended to include consultation with the Chief Actuary concerning appropriate assumptions for use in material interim actuarial reports under section 115(2).

SIGNATURES

This report is respectfully submitted on March 19, 2008 by,



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