

**REVIEW OF THE 27TH ACTUARIAL REPORT
ON THE CANADA PENSION PLAN**

**Conducted by the CPP Actuarial Review Panel
7 March 2017**

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TABLE OF CONTENTS

Page

EXECUTIVE SUMMARY	1
SECTION 1 – INTRODUCTION.....	6
1.1 TERMS OF REFERENCE	6
1.2 PROCEDURES FOLLOWED.....	7
1.3 THE CANADA PENSION PLAN	8
1.4 STATUTORY ACTUARIAL REQUIREMENTS	9
1.5 26 TH ACTUARIAL REPORT	10
1.6 IMPROVEMENTS SINCE THE 26 TH ACTUARIAL REPORT	10
1.7 27 TH ACTUARIAL REPORT	10
1.8 INTERPRETATION OF RESULTS	11
1.9 OUTLINE OF THIS REPORT	12
1.10 RECOMMENDATIONS	13
SECTION 2 – PROFESSIONAL EXPERIENCE.....	14
2.1 BACKGROUND.....	14
2.2 OBSERVATIONS	15
2.3 OPINION ON PROFESSIONAL EXPERIENCE	16
2.4 RECOMMENDATIONS	16
SECTION 3 – PROFESSIONAL AND STATUTORY REQUIREMENTS.....	17
3.1 BACKGROUND.....	17
3.2 CANADIAN INSTITUTE OF ACTUARIES (CIA) <i>RULES OF PROFESSIONAL CONDUCT</i>	18
3.3 CANADIAN INSTITUTE OF ACTUARIES (CIA) <i>GENERAL STANDARDS OF PRACTICE</i>	19
3.4 INTERNATIONAL ACTUARIAL ASSOCIATION (IAA) <i>ISAP 2 FINANCIAL ANALYSIS OF SOCIAL SECURITY PROGRAMS</i>	20
3.5 CANADA PENSION PLAN STATUTE	20
3.6 OPINION ON PROFESSIONAL AND STATUTORY REQUIREMENTS.....	20
SECTION 4 – DATA	21
4.1 BACKGROUND.....	21
4.2 OBSERVATIONS	23
4.3 OPINION ON DATA.....	24
4.4 RECOMMENDATIONS	24
SECTION 5 – METHODOLOGY	25
5.1 BACKGROUND.....	25
5.2 MACRO-SIMULATION MODEL.....	25
5.3 FORM OF OUTPUT	26
5.4 ACTUARIAL COST ANALYSES	27
5.4.1 <i>Pay-As-You-Go Basis</i>	27
5.4.2 <i>Minimum Contribution Rate</i>	27
5.4.3 <i>Actuarial Balance Sheet</i>	28
5.4.4 <i>Internal Rates of Return</i>	29
5.4.5 <i>Reconciliations</i>	29

**Review of the 27th Actuarial Report
on the Canada Pension Plan**

5.4.6	<i>Sensitivity Tests</i>	29
5.4.7	<i>Individual Sensitivity Tests</i>	30
5.5	OPINION ON METHODOLOGY	31
5.6	RECOMMENDATIONS	31
SECTION 6 – ASSUMPTIONS		32
6.1	BACKGROUND.....	32
6.2	DEMOGRAPHIC ASSUMPTIONS AND OPINIONS THEREON.....	33
6.2.1	<i>Fertility</i>	33
6.2.2	<i>Mortality</i>	35
6.2.3	<i>Migration</i>	36
6.2.4	<i>Disability Incidence</i>	37
6.3	ECONOMIC ASSUMPTIONS AND OPINIONS THEREON.....	38
6.3.1	<i>Labour Force</i>	38
6.3.2	<i>Price Increases</i>	40
6.3.3	<i>Real Wage Increases</i>	42
6.3.4	<i>Real Rate of Return on Investments</i>	43
6.4	ASSUMPTIONS IN THE AGGREGATE AND OPINION THEREON	46
6.5	RECOMMENDATIONS	46
SECTION 7 – COMMUNICATION OF RESULTS		47
7.1	BACKGROUND.....	47
7.2	OBSERVATIONS	47
7.3	OPINION ON COMMUNICATION OF RESULTS	48
7.4	RECOMMENDATIONS	49
SECTION 8 – OTHER MATTERS RELATED TO AR27 AND RECOMMENDATIONS THEREON.....		50
8.1	EXPENSES	50
8.1.1	<i>CPP Operating Expenses</i>	50
8.1.2	<i>CPPIB Expenses</i>	50
8.2	EXTERNAL GUIDANCE IN SELECTING ASSUMPTIONS	52
8.3	RECOMMENDATIONS	53
SECTION 9 - ACTUARIAL ADJUSTMENT FACTORS.....		54
9.1	FORTHCOMING ACTUARIAL STUDY.....	54
9.2	OPINION ON PROFESSIONAL REQUIREMENTS	54
9.3	RECOMMENDATIONS	55
SECTION 10 - 28TH ACTUARIAL REPORT		56
10.1	ACTUARIAL ASSUMPTIONS	56
10.2	ASSUMED INVESTMENT POLICY	56
10.3	TARGET BENEFIT PLAN IMPLICATIONS.....	57
10.4	LARGE INVESTMENT RISKS.....	57
10.5	NEED FOR PEER REVIEW.....	57
10.6	RECOMMENDATIONS	58
SIGNATURES		59

ACRONYMS USED IN THIS REPORT

AAE	Average Annual Earnings
AR26	26 th Actuarial Report on the CPP
AR27	27 th Actuarial Report on the CPP
AR28	28 th Actuarial Report on the CPP
AWE	Average Weekly Earnings
CIA	Canadian Institute of Actuaries
CPP	Canada Pension Plan
CPPIB	Canada Pension Plan Investment Board
CRA	Canada Revenue Agency
ESDC	Employment and Social Development Canada
GAD	Government Actuary's Department
IAA	International Actuarial Association
ISAP	International Standard of Actuarial Practice
OCA	Office of the Chief Actuary
OSFI	Office of the Superintendent of Financial Institutions
OASDI	Old Age, Survivors and Disability Insurance (the U.S. Social Security program)
QPP	Québec Pension Plan
RRQ	Régie des rentes du Québec
YMPE	Year's Maximum Pensionable Earnings

EXECUTIVE SUMMARY

Authors

This report was prepared by a review panel of three independent actuaries: Robert L. Brown, Mark W. Campbell and Pierre Plamondon, all Fellows of the Canadian Institute of Actuaries.

Terms of Reference

The panel conducted its review of the 27th Actuarial Report on the Canada Pension Plan in accordance with the following terms of reference:

“The Canadian peer reviewers will review the work of the Chief Actuary in completing the 27th Actuarial Report on the Canada Pension Plan as at 31 December 2015 and, following the review, provide a report to the Chief Actuary and the United Kingdom Government Actuary’s Department (GAD). 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 27th 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.”

Review of the 27th Actuarial Report on the Canada Pension Plan

27th Actuarial Report (AR27)

AR27 was prepared as at 31 December 2015. It presents a best-estimate projection of pay-as-you-go contribution rates for the Plan, rising from 9.13% of contributory earnings in 2016 to 11.80% in 2065, and then hovering thereafter.

It also presents a minimum contribution rate to be paid from 2019 and thereafter of 9.79% of contributory earnings, down from 9.84% in AR26. The full funding rate in respect of the 2008 amendments to the Plan (providing enhanced eligibility for disability benefits for long-term contributors) is now deemed to be 0.0% since its value is less than 0.02%.

Using this minimum contribution rate, AR27 projects ratios of assets-to-expenditures decreasing slightly from 6.5 in 2016 to 6.4 by 2028, and to be the same fifty years later in 2078. Under a continuation of the current 9.9% contribution rate, AR27 projects ratios of assets-to-expenditures remaining relatively stable at a level of 6.5 from 2016 to the early 2030s and then rising slowly to reach 7.4 by 2090.

AR27 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 present the Chief Actuary's "best estimates", with no deliberate margins of conservatism or other intentional 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 are realized. These assumptions are about demographic and economic parameters over the next 75 years that are unknowable and, therefore, not amenable to precise prediction. Readers of AR27 should look at the sensitivity tests to understand that the range of potential results is wide, and could even be wider than is illustrated by the sensitivity tests.

Opinions

With respect to the five questions listed in the terms of reference it is our opinion that:

1. The professional experience of the Chief Actuary and his staff who worked on AR27 was adequate for carrying out the work required.
2. The work on AR27 complied with all relevant professional standards of practice and statutory requirements, except that the forthcoming actuarial study on the derivation of the actuarial adjustment factors should have been published at the same time as AR27.
3. 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. The actuarial methods used in completing AR27 were reasonable and the assumptions were also reasonable, both individually and in the aggregate.
5. AR27 fairly communicated the results of the work performed by the Chief Actuary and his staff.

Recommendations

We compliment the Chief Actuary and the staff of his Office who prepared AR27 on their competence, commitment and professionalism. They were unfailingly helpful in clarifying issues raised by the review panel and in providing additional information. 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 terms of reference for future peer review panels allow the appointment of one non-Canadian actuary as a peer reviewer. This actuary should belong to an Actuarial Association that is a Full Member of the International Actuarial Association. Also, such Actuarial Association should routinely require that the actuary comply with the relevant professional requirements (in this case, the Rules of Professional Conduct and the Standards of Practice of the CIA) when performing work in another country.

Review of the 27th Actuarial Report on the Canada Pension Plan

Recommendation 2: We recommend that the OCA focus some of its continuing professional development activities on investment-related issues to enhance its investment expertise.

Recommendation 3: We recommend that the OCA continue to work with its data providers to address items on the OCA's list of data enhancement priorities. In particular, we recommend that the \$99,999 limit on employment earnings from a single employer in the Record of Earnings file be lifted.

Recommendation 4: We recommend that the Chief Actuary's sensitivity tests show the impact of a three-year economic downturn followed by a three-year recovery so that at the end of six years (two valuations hence) one could revert to the best-estimate assumptions.

Recommendation 5: We recommend that the Chief Actuary seek additional expert input to help establish the best-estimate actuarial assumptions and the range of variability examined in the sensitivity tests. Specifically, the Chief Actuary should poll demographic and economic experts for their views on key assumptions, including a plausible range of variability therein that approximates an 80% confidence interval. The Chief Actuary should consider this input but retain responsibility and control over the final assumptions that are chosen.

Recommendation 6: We recommend that the Chief Actuary strive to more closely model the actual CPPIB investment portfolio to form a better assumption as to the real rates of return that should be anticipated.

Recommendation 7: We recommend that the section of the report dealing with the actuarial balance sheet mention:

- the assets-to-liabilities ratio is not an absolute measure of the Plan's financial sustainability, the CPP can tolerate fluctuations of this ratio below and above 100% and still be on solid financial ground, and the actuarial balance sheet is complementary to the minimum contribution rate as a measurement of the long-term financial sustainability of the Plan;
- since 2011, the CPP actuarial balance sheets appear in the notes to the Public Accounts of Canada, which reinforces the necessity to present this information in CPP actuarial reports.

Recommendation 8: We recommend that the Chief Actuary continue to analyze the incremental investment expenses incurred over time to implement the CPPIB's active management strategy in order to assess whether added value is being consistently and reliably earned over the long term.

Recommendation 9: We recommend that the Chief Actuary:

- continue the CPP-related seminars with presentations from an array of appropriate experts covering a range of viewpoints, and
- maintain effective two-way communication with the CPPIB, with the goal of achieving continual improvements in the process of setting best-estimate assumptions.

Recommendation 10: Any future actuarial report that includes a review of the actuarial adjustment factors should be accompanied by an actuarial study that provides the details of such review.

Recommendation 11: AR28 should be subjected to a peer review process similar to that applied for AR27.

SECTION 1 – INTRODUCTION

This report presents the results of an in-depth review we conducted into the 27th *Actuarial Report on the Canada Pension Plan* and the detailed actuarial examination on which it was based. This is the seventh such review that has been conducted.

This report follows closely the format of previous review reports. The observations, conclusions and recommendations, however, are entirely 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. Our review of those aspects was confined to how they interact with, and are reflected in, the actuarial work.

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 27th Actuarial Report on the Canada Pension Plan as at 31 December 2015 and, following the review, provide a report to the Chief Actuary and the United Kingdom Government Actuary’s Department (GAD). The 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 27th 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.”

We note that the terms of reference stipulate a panel of “Canadian peer reviewers”. Yet the pool of qualified and interested Canadian peer reviewers is small. For example, two of the current peer reviewers have served four times on peer review panels. Relaxing the terms of reference to allow for one non-Canadian peer reviewer could expand the pool of qualified reviewers and increase the breadth of perspectives brought to each review.

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 2016 through March 2017.

We received AR27 on 27 September 2016, the day it was tabled in Parliament. We received the working papers underlying the report on 31 October 2016 and we received an updated edition of AR27 (with minor revisions) on 13 February 2017.

We interviewed the Chief Actuary and 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 from Employment and Social Development Canada (ESDC), Service Canada, the Economic Analysis and Forecasting Division of the Department of Finance Canada, the Demography Division of Statistics Canada, the Canadian Economic Analysis Department of the Bank of Canada, and various functional areas within the Canada Pension Plan Investment Board (CPPIB). In all, we submitted over 120 requests for information or clarification to the various parties plus further oral questions at the time of our meetings. All of these parties responded promptly and fully to each request we made or provided reasons why such response was not possible.

We reviewed the papers presented at the CPP Seminar held in Ottawa on 25 September 2015, and at the QPP seminar held in Québec City on 29 October 2015.

Further, we reviewed the following documents:

- a presentation by the Chief Actuary to Statistics Canada (December 2015) on Population Projections,
- a document prepared by Finance Canada for the Office of the Chief Actuary on the Long-term Economic Outlook (March 2016), and
- three presentations by the CPPIB (early 2016).

Review of the 27th Actuarial Report on the Canada Pension Plan

We also studied with interest two recent publications of the OCA:

- “Canada Pension Plan Retirement, Survivor and Disability Beneficiaries Mortality Study: Actuarial Study No. 16” (June 2015), and
- “Old Age Security Program Mortality Experience: Actuarial Study No. 17” (June 2016).

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 reviewed the *Rules of Professional Conduct* and the applicable *Standards of Practice* of the Canadian Institute of Actuaries, and the applicable *International Standards of Actuarial Practice* of the International Actuarial Association.

We reviewed key provisions of the statute establishing the Canada Pension Plan.

We held several 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 agreed 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 AR27 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, the key actuarial assumptions, and the quality of the reporting by the Chief Actuary. 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 CPP is a social insurance program that provides monthly income benefits and some lump sum benefits upon the 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 manage these investments.

We also reviewed the potential material impact of amendments in 2007 to expand eligibility for disability benefits for long-term contributors starting in 2008.

A second tier CPP was introduced in 2016 and its valuation was reported in a separate AR28. While our review mandate did not include AR28, we did read the report and have some limited comments toward the end of this review.

1.4 Statutory Actuarial Requirements

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

- projected pay-as-you-go contribution rates (that is, each year's contribution rate is just sufficient to cover that year's benefit payments and expenses), and
- a contribution rate, calculated by combining
 1. a contribution rate, calculated in a prescribed manner, in respect of steady-state funding excluding changes that require full funding for post-1997 benefit improvements, and
 2. a contribution rate, calculated in a prescribed manner, in respect of full funding for post-1997 benefit improvements.

Section 113.1 of the *Canada Pension Plan* requires a financial review of the Plan every three years by the federal and provincial Ministers of Finance. 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 where the cost equals or exceeds 0.02% of contributory earnings, and steady-state funding for all other benefits. Section 115 states that projections must extend for at least 75 years into the future.

The *Calculation of Contribution Rates Regulations, 2007*, describes two funding objectives:

1. The steady-state funding objective by prescribing a contribution rate calculated as the lowest constant rate for which the projected ratio of Plan assets-to-expenditures 10

Review of the 27th Actuarial Report on the Canada Pension Plan

years after the end of the review period matches the corresponding projected ratio 60 years after the end of the review period.

2. The incremental full funding objective that requires full funding of post-1997 benefit improvements.

1.5 26th Actuarial Report

AR26 was prepared as at 31 December 2012. It presented a best-estimate projection of pay-as-you-go contribution rates for the Plan, rising from 8.78% of contributory earnings in 2013 to 11.50% in 2060, and then hovering thereafter.

It also presented a minimum contribution rate to be paid from 2016 and thereafter of 9.84% of contributory earnings. The full funding rate in respect of the 2008 amendments to the Plan (providing enhanced eligibility for disability benefits for long-term contributors) was deemed to be 0.0% since its value was less than 0.02%.

Using this minimum contribution rate, AR26 projected ratios of assets-to-expenditures rising from 4.7 in 2013 to 5.3 by 2025, and to be the same fifty years later in 2075. Under a continuation of the current 9.9% contribution rate, AR26 projected ratios of assets-to-expenditures rising from 4.7 in 2013 to 5.4 in 2025 and then rising more slowly to 5.9 in 2075.

1.6 Improvements Since the 26th Actuarial Report

The actuarial review panel for AR26 made eight recommendations arising from its review, plus numerous other observations or suggestions for improvement, which the Chief Actuary has taken into account. In preparing AR27, the Chief Actuary 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 differences.

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 27th Actuarial Report

AR27 was prepared as at 31 December 2015. It presents a best-estimate projection of pay-as-you-go contribution rates for the Plan rising from 9.13% in 2016 to 11.80% in 2065, then hovering thereafter.

It also presents a minimum contribution rate to be paid of 9.79% (rounded to the nearest 0.01%) of contributory earnings for years 2019 and thereafter. This consists of a best-estimate

steady-state contribution rate of 9.79% to finance the Plan without the 2008 amendments and a contribution rate of 0.00% (any contribution rate less than 0.02% is deemed to be zero pursuant to the *Calculation of Contribution Rates Regulation, 2007*) to fully fund the benefit improvements introduced by the 2008 Plan amendments.

Using this minimum contribution rate of 9.79%, AR27 projects ratios of assets-to-expenditures falling slightly from 6.5 in 2016 to 6.4 by 2028, and to be the same fifty years later in 2078. Under a continuation of the current 9.9% contribution rate, AR27 projects ratios remaining steady at 6.5 from 2016 to the early 2030s and then rising to 7.4 by 2090.

AR27 includes a reconciliation of the changes to the minimum contribution rate between AR26 and AR27. The principal factors that reduced the minimum contribution rate were:

- better experience over the period 2013 to 2015 than anticipated, especially regarding benefits and investment returns,
- changes in assumptions regarding benefits.

These reductions in the rate were somewhat offset by:

- higher projected life expectancies at age 65
- lower assumed real wage increase,
- lower inflation expectations, and
- changes in investment assumptions.

The total effect of the reductions to the minimum contribution rate was greater than the effect of the increases, so the minimum contribution rate in AR27 dropped to 9.79% from 9.84% in AR26. Also, the full funding rate that was deemed to be 0.0% in AR26 remains at that level (because it continues to be less than 0.02%). That is, the minimum contribution rate remains equal to the steady-state contribution rate, and the improvement in benefits resulting from the 2008 amendments is financed entirely by the steady-state approach.

1.8 Interpretation of Results

AR27 presents:

- the projected pay-as-you-go contribution rates and asset-to-expenditure ratios by year to 2045 and then every fifth year through to 2090, under both the current legislated contribution rate and the minimum contribution rate,
- the minimum contribution rate calculated at the current valuation date and how that rate is projected to evolve over the next four triennial valuation reports, assuming that the Chief Actuary's best-estimate assumptions are realized,
- a number of sensitivity tests, which illustrate the results that would be obtained under various changes in either future experience or actuarial assumptions,
- a CPP balance sheet showing estimates of the assets as a percentage of the liabilities under an open group approach as at 31 December 2015 and 2025,

Review of the 27th Actuarial Report on the Canada Pension Plan

- a calculation of the internal rate of return of various cohorts of CPP participants (that is, the projected rate of return each cohort is expected to achieve on its combined employee and employer contributions).

The current minimum contribution rate is the most significant of these results. The federal and provincial Ministers of Finance 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 agree on a course of action, the insufficient rates provisions in Section 113.1 of the *Canada Pension Plan* will apply to automatically increase the contribution rate and freeze benefits. The other results are also useful because they provide information as to the long-term pattern of costs under the Plan and the unpredictability and variability of the costs if the assumptions are changed or not realized. They also allow comparisons to be made with other countries' social security programs.

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

It is essential to recognize that these results are not predictions. They simply present what the outcome will be if all of the assumptions are realized. The assumptions involved (for example, regarding 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 projected from 2016 for 75 years) are forecasts of unknowable future events and, therefore, are not amenable to precise prediction.

The estimates in AR27 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 understand that the range of possible actual outcomes is wide, and could even be wider than illustrated by the sensitivity tests.

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 and Statutory Requirements, and Data.

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

Section 7 (Communication of Results) addresses question 5 in the terms of reference.

Section 8 (Other Issues and Recommendations Thereon) provides further important commentary.

Section 9 (Actuarial Adjustment Factors) comments on the evaluation that was made with respect to the actuarial adjustment factors used for early and late retirement.

Section 10 (28th Actuarial Report) offers some comments on AR28.

The Executive Summary provides an overview of our findings.

1.10 Recommendations

Recommendation 1: We recommend that the terms of reference for future peer review panels allow the appointment of one non-Canadian actuary as a peer reviewer. This actuary should belong to an Actuarial Association that is a Full Member of the International Actuarial Association. Also, such Actuarial Association should routinely require that the actuary comply with the relevant professional requirements (in this case, the Rules of Professional Conduct and the Standards of Practice of the CIA) when performing work in another country.

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

AR27 as submitted by the Chief Actuary to the Minister of Finance, was tabled in Parliament on 27 September 2016. The Chief Actuary is Jean-Claude Ménard, a Fellow of the Society of Actuaries (1985) and of the Canadian Institute of Actuaries (1985). He accepted the position of Chief Actuary for the federal government on 15 August 1999, following 18 years (the last four as Chief Actuary) with the Régie des rentes du Québec (RRQ),¹ the agency of the Québec government responsible for the Québec Pension Plan (QPP). Mr. Ménard was responsible for preparing the actuarial reports on the QPP from 1990 to 1999. Few actuaries can match his 35 years of experience in social security actuarial work, especially with respect to the Canadian context.

The professionals who worked most closely with Mr. Ménard on AR27, 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 is also Senior Actuary (Old Age Security Program) in the Office of the Chief Actuary. He spends his time on Canada Pension Plan and Old Age Security Program affairs. He has worked on actuarial reviews of the Canada Pension Plan and the Old Age Security Program in the Office of the Chief Actuary for the last 27 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 security programs with Mr. Ménard at the RRQ. He is also Senior Actuary (Canada Student Loans Program, Employment Insurance) in the Office of the Chief Actuary. He spends 40% of his time on Canada Pension Plan affairs and is responsible for the liaison with the staff of the Canada Pension Plan Investment Board.

¹ Effective 1 January 2016, the RRQ and the Commission administrative des régimes de retraite et d'assurances (CARRA) merged to become the single agency named Retraite Québec.

The professional staff who worked on AR27 are:

	Actuarial designation	Years of experience in actuarial work	Years of experience in social security
Jean-Claude Ménard	F.S.A., F.C.I.A.	37 years	37 years
Michel Millette	F.S.A., F.C.I.A.	37 years	29 years
Michel Montambeault	F.S.A., F.C.I.A.	33 years	27 years
Louis-Marie Pommainville	F.S.A., F.C.I.A.	37 years	17 years
Alain Guimond	5 actuarial exams	36 years	21 years
Patrick Dontigny	A.S.A.	21 years	21 years
Assia Billig	Ph.D., F.S.A., F.C.I.A.	20 years	9 years
Yu Cheng	A.S.A.	19 years	17 years
Sari Harrel	F.S.A., F.C.I.A.	17 years	14 years
Annie St-Jacques	F.S.A., F.C.I.A.	16 years	14 years
Christine Dunnigan	F.S.A., F.C.I.A.	14 years	5 years
Mathieu Désy	F.S.A., F.C.I.A.	10 years	7 years
Myriam Demers	A.S.A.	7 years	2 years
Thierry Truong	F.S.A., A.C.I.A.	3 years	6 months
Maxime Delisle	A.S.A., C.E.R.A.	1 year	1 year
Shayne Barrow	4 actuarial exams	1 year	1 year

The three senior actuaries reviewed the work of the staff and co-signed the report.

2.2 Observations

There are very few actuaries working in Canada with experience in valuing social security programs like the CPP and the QPP. The data sources, macroeconomic modelling and range of assumptions involved in actuarial valuations of social programs are more complex than for employer-sponsored pension 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 valuing the Canada Pension Plan.

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, evaluating the cost of new benefits and liaising with other government departments and other social security actuaries, all of which contribute to the quality of the work and of the report.

We are pleased to observe that staff levels are being maintained and 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. We would also note that staff are moved from one technical area to another in their primary work

Review of the 27th Actuarial Report on the Canada Pension Plan

and/or peer review work. Thus, staff are gaining in-depth knowledge of the entire workings of the Plan and the actuarial models.

We are satisfied that Mr. Ménard and the staff who assisted him in preparing AR27 have the relevant experience and are qualified to carry out the actuarial valuation.

Notwithstanding this, we note that the investment program being followed by the CPPIB is becoming more complex and more sophisticated over time. Also, the assets under management by the CPPIB continue to increase and this growth will accelerate under the adoption of the additional CPP. Compared to the base CPP (the sole focus of AR27), the additional CPP will be financed much more heavily by investment income than by current contributions (which is the reverse of the base CPP). To respond to the increasing size, complexity, sophistication and importance of investment-related issues within the base and additional CPP, we believe that the investment expertise of the Chief Actuary and his staff should be progressively enhanced over time.

2.3 Opinion on Professional Experience

In our opinion, the professional experience of the Chief Actuary and his staff who worked on AR27 was adequate for carrying out the work required.

2.4 Recommendations

Recommendation 2: We recommend that the OCA focus some of its continuing professional development activities on investment-related issues to enhance its investment expertise.

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 education, qualification, 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: insurance, occupational pension plans, actuarial evidence, workers’ compensation, and post-employment benefit plans. At the time we did our peer review, there are no specific standards of practice governing work on social security programs. However, an Exposure Draft of such standards has been circulated for commentary. We reviewed this Exposure Draft and compared its requirements to the work done by the OCA. We note that these Standards are very similar in intent to *ISAP 2* (see below).
- *International Actuarial Association International Standards of Actuarial Practice for General Actuarial Practice (ISAP 1) and Financial Analysis of Social Security Programs (ISAP 2)*: The International Actuarial Association (IAA) is a worldwide association of professional actuarial organizations. The IAA promulgates model standards of actuarial practice. These standards 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. As of the date of this review report, the IAA has issued two International Standards of Actuarial Practice that are relevant to this review: *ISAP 1 General Actuarial Practice* and *ISAP 2 Financial Analysis of Social Security Programs*. The CIA has not made either of these IAA *International Standards of Actuarial Practice* binding on its membership. However, since these IAA standards provide guidance specific to social security programs, and since the Chief Actuary has voluntarily applied these standards to his work, we have considered both *ISAP 1* and *ISAP 2* in this review.

Review of the 27th Actuarial Report on the Canada Pension Plan

- *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 federal and provincial Ministers of Finance 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 Subsections below, we consider each of these in turn.

3.2 Canadian Institute of Actuaries (CIA) Rules of Professional Conduct

The following *Rules of Professional Conduct* of the CIA are particularly 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 technical skills and professionalism. 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 of the Chief Actuary and his two co-signatories to AR27, as well as the professional staff of the OCA who are Fellows of the Canadian Institute of Actuaries, and confirmed that they all met the CIA's CPD qualification requirements as of 22 September 2016, the date that the AR27 report was completed.

Notwithstanding the foregoing finding, the reader should note that Recommendation 2 in the preceding Section suggests an increased focus on investment issues in OCA's future CPD activities.

Further to *Rule 3*, the next two Subsections expand on our assessment of the Chief Actuary's compliance with the CIA General Standards of Practice and the IAA *ISAP 1* and *ISAP 2*.

3.3 Canadian Institute of Actuaries (CIA) General Standards of Practice

The *General Standards of Practice* of the CIA are extensive and detailed. The topics covered include numerous matters relevant to AR27 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, individually and in the aggregate, should be appropriate. We have concluded that the assumptions adopted for AR27 were reasonable, both individually and in the aggregate, and are therefore appropriate.

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* requires that the Chief Actuary determine the lowest constant contribution rate that, if maintained over the foreseeable future, results in specified projected asset-to-expenditure ratios that are 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 assumption. 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 AR27 complies with the relevant portions of the CIA *General Standards of Practice*.

Review of the 27th Actuarial Report on the Canada Pension Plan

3.4 International Actuarial Association (IAA) ISAP 2 Financial Analysis of Social Security Programs

The IAA *ISAP 1 on General Actuarial Practice* is now subsumed by the CIA *General Standards of Practice*. In our view, the work on AR27 complies with the CIA *General Standards of Practice*.

ISAP 2 Financial Analysis of Social Security Programs was approved in 2013. We have reviewed AR27 to see if the work thereon complies with *ISAP 2*. The topics covered by *ISAP 2* include the following:

- Appropriate Practices — Data, Assumptions, Consistency with the Financing Method, Independent Peer Review
- Communications — Report on Financial Analysis, Actuarial Opinion
- Possible Report Content (in an Appendix, strictly speaking not part of *ISAP 2*)

With the exception of our finding in Section 9 with respect to the actuarial adjustment factors, we concluded that the work of the Chief Actuary and his staff complies with all these requirements. In particular, we note that:

- The Chief Actuary's use of best-estimate assumptions (called "neutral assumptions" in *ISAP 2*) is required under *ISAP 2* when the actuary is empowered to select the assumptions, as was the case under AR27.
- The Chief Actuary's use of an open group valuation methodology is required under *ISAP 2* in order to be "consistent with the financing method" specified under the *Calculation of Contribution Rates Regulations, 2007*.

The appendix to *ISAP 2* that outlines possible report content is particularly extensive. Fifty different disclosures are suggested, ranging over areas such as methodology, data, assumptions, results and analysis. AR27, in conjunction with previous actuarial reports, provides all the relevant suggested disclosures.

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 federal and provincial Ministers of Finance. In AR27, 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 AR27 complied with all relevant professional standards of practice and statutory requirements, except that the forthcoming actuarial study on the derivation of the actuarial adjustment factors should have been published at the same time as AR27.

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. Data from ESDC and CRA normally flow to the OCA through Service Canada. Examples of such data are:

**Review of the 27th Actuarial Report
on the Canada Pension Plan**

Purpose	Examples of Data	Source
Current and past status data	population by age and sex	2011 census, Statistics Canada estimates
	earnings of contributors	CRA, Service Canada Records of Earnings (ROE)
	contributions	CRA
	benefits paid	ESDC, Statistics Canada
	assets	CPPIB
	labour force	Statistics Canada
Validation data	CPP financial transactions	CPPIB, ESDC, CRA
	benefit statistics	ESDC
	earnings statistics	ESDC, CRA, Statistics Canada
Data for assumptions	current mortality rates	Statistics Canada Life Tables and historical deaths, Canadian Human Mortality Database (CHMD)
	future mortality improvement rates	Statistics Canada, CPP/OAS mortality, Social Security Administration <i>Trustees Report</i> (U.S.), Office for National Statistics (UK)
	fertility rates	Statistics Canada
	migration rates	Statistics Canada
	disability statistics	ESDC
	labour force participation	Finance, Statistics Canada, OCA seminars, economic forecasts
	asset mix policy	CPPIB, large public and private pension plans
	bond yields	CPPIB, PC Bond Analytics
	economic indices	Statistics Canada, Canadian Institute of Actuaries, ESDC, Bank of Canada, others
	investment policy and performance, asset allocations and operating expenses	CPPIB, other large Canadian pension funds
	various topics	OCA seminars, QPP seminars

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

The valuation data on benefits, earnings and contributions received from ESDC are tested in detail by OCA for internal consistency and reasonableness. The data from other sources are reviewed by OCA for internal consistency and consistency with past data. 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 AR27 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 and internal consistency by the OCA and any deficiencies are resolved before the data are used.
- The Record of Earnings (ROE) file of all workers who ever made a contribution to the CPP appears to be sufficiently complete (except for recent transactions) and accurate, including dates of birth.
- The Service Canada’s Master Benefit File appears to be sufficiently complete, 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) has a Reference Portfolio that is its baseline policy for determining asset allocations. Actual asset allocations can and do deviate systematically from the Reference Portfolio as the CPPIB seeks to achieve incremental returns at reasonable risk. When the CPPIB decides to deviate from the Reference Portfolio it conducts a risk-budgeting analysis to determine that the deviation is justified on an expected risk-adjusted basis. The Chief Actuary made assumptions as to future asset allocations based on the Reference Portfolio, the risk-budgeting policy, the current actual asset allocation, the asset allocations of other large Canadian pension funds, and his judgement with respect to possible future CPPIB asset allocations.
- The CPP and QPP seminars have provided much useful information and improved in relevance over time (for example, shift to longer-term focus). These seminars should continue to engage presenters who are known to hold divergent views and encourage presenters to summarize the range of plausible viewpoints while still providing support for their own conclusions.
- The OCA maintains contacts with other Departments and Agencies such as the CPPIB, ESDC, CRA, Statistics Canada, Finance Canada and the Bank of Canada, and with external agencies such as Retraite Québec, the Conference Board, the CD Howe Institute, and

Review of the 27th Actuarial Report on the Canada Pension Plan

the University of Toronto's Policy and Economic Analysis Program. All of this provides helpful input.

- The OCA has identified its priorities for data enhancement that could lead to improved analysis.

One of the OCA's data enhancement priorities pertains to the current limit of \$99,999 that applies to employment earnings from a single employer in the ROE file. In 2016, the YMPE cap on employment earnings under the provisions of the base CPP was \$54,900, well below this \$99,999 limit. Under the newly adopted additional CPP, the YMPE will be raised by 14%, partially closing this gap. As nominal wage growth continues, the gap will close further. Even today, for a current worker with multiple employers, the \$99,999 limit can already be surpassed. Clearly, the limit will need to be lifted.

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 3: We recommend that the OCA continue to work with its data providers to address items on the OCA's list of data enhancement priorities. In particular, we recommend that the \$99,999 limit on employment earnings from a single employer in the Record of Earnings file be lifted.

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 AR27 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 2090. Those projections are used to determine projected pay-as-you-go contribution rates and the minimum contribution rate based on the financing objective set out in Section 113.1 of the *Canada Pension Plan*.

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 (for example, 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,
- the investment income,
- the expenses, and
- the assets accumulating in the CPP fund.

Thus, the model combines the projections of the contribution income and benefit outgo with the projections of investment income and expenses to arrive at total projected 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 assumptions such as regarding fertility, migration and mortality, and economic assumptions such as regarding labour force participation rates, price inflation, wage escalation and investment returns.

The Record of Earnings (ROE), the data file for each individual who has ever made a contribution to the 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 of grouped data. Thus, the fundamental valuation concept differs from

Review of the 27th Actuarial Report on the Canada Pension Plan

the person-by-person seriatim used for actuarial valuations of most occupational pension plans. Further, actuarial valuations of occupational pension plans effectively assume a closed population. The CPP valuation, on the other hand, projects a constantly changing population and the Plan is implicitly assumed to continue in perpetuity.

The model is 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. This ensures that the use of grouped data, or minor inadequacies in the assumptions, do not unduly distort the overall results. We are of the opinion that these adjustments are reasonable.

The model relies principally on a deterministic, rather than a stochastic, approach. That is, for each year in the projection period, each run of the model produces:

- a (deterministic) single set of projected results

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 assumptions of the model (this allows estimates of probability to be assigned to ranges of outcomes, thereby increasing the information available).

The results of stochastic analysis appear in the individual sensitivity tests, which are described in Subsection 5.4.7.

Moreover, once an assumption reaches its ultimate value, each subsequent year’s projected results are based on that assumption. There is no provision in the model for assumptions to deviate from the ultimate value. As a consequence, the model gives the impression of smooth changes in most of the model outputs, without reversals. It is likely that future experience will be more varied than is reflected by the projections.

5.3 Form of Output

The model produces the following outputs which are discussed in Section 5.4:

- projected demographic and financial results, including the pay-as-you-go contribution rates, the asset-to-expenditure ratios based on the current statutory contribution rate, and other income and expenditure details for each year up to 2045 and thereafter every fifth year up to 2090,

- the current minimum contribution rate, which in AR27 is also the steady-state rate, as well as projected minimum contribution rates for each of the next four triennial actuarial reviews,
- a CPP balance sheet showing estimates of the assets as a percentage of the liabilities under an open group approach as at 31 December 2015 and 31 December 2025,
- 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 historical and projected benefits to its total (employee and employer) contributions to the Plan,
- reconciliations of AR27 results with the results in AR26, and
- sensitivity tests showing the results of applying alternative assumptions.

5.4 Actuarial Cost Analyses

The actuarial cost analyses presented in AR27 are described in this Section.

5.4.1 Pay-As-You-Go Basis

When the CPP was initially established, it was financed on a “pay-as-you-go” basis with a small reserve. Although that financing approach was replaced in 1997, the projected pay-as-you-go costs provide useful information about the future financial status of the Plan. Paragraphs 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 AR27, the projection extends to the year 2090.

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

The steady-state method produces a contribution rate that is the lowest constant rate that, if maintained over the foreseeable future, results in projected asset-to-expenditure ratios that are generally constant. The asset-to-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

Review of the 27th Actuarial Report on the Canada Pension Plan

after the review date (called the “review period”), that produces the same projected asset-to-expenditure ratios in the 10th and the 60th years following the review period. The use of these years is stipulated in the *Calculation of Contribution Rates Regulations, 2007*. In AR27, the asset-to-expenditure ratios for 2028 and 2078 are used for this purpose.

Paragraph 113.1(4)(d) of the *Canada Pension Plan* requires that post-1997 benefit improvements be separately identified and funded on a “full funding” basis. That is, the steady-state contribution rate must be augmented 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; the Chief Actuary has chosen 15 years for this purpose and we concur that this accords with common actuarial practice in Canada.

The full funding rate is deemed to be 0.0% in AR27 because its calculated value is less than 0.02% (amounts smaller than 0.02% are rounded down to zero pursuant to the *Calculation of Contribution Rates Regulations, 2007*). As a result, all improvement in benefits since 1998 are financed entirely by the steady-state approach.

5.4.3 Actuarial Balance Sheet

An actuarial balance sheet compares Plan assets to actuarial liabilities for contributors and beneficiaries under the present Plan provisions as at 31 December 2015 and 31 December 2025 on an open group basis. In an open group actuarial balance sheet, it is assumed that the Plan is ongoing into the future, and the balance sheet takes into account future contributions of current and future members as well as benefits of future members. Benefits and contributions are discounted at the assumed rate of return. Under the open group approach, the assets are 100.1% of the liability at 31 December 2015 and 99.8% of the liability at 31 December 2025.

We concur with this paragraph in Appendix A of AR27: *“The Plan is intended to be long-term and enduring in nature, a fact that is reinforced by the federal, provincial, and territorial governments’ joint stewardship through the established strong governance and accountability framework of the Plan. Therefore, if the Plan’s financial sustainability is to be measured based on its asset excess or shortfall, it should be done on an open group basis that reflects the partially funded nature of the Plan, that is, its reliance on both future contributions and invested assets as means of financing its future expenditures. The inclusion of future contributions and benefits with respect to both current and future participants in the assessment of the Plan’s financial status confirms that the Plan is able to meet its financial obligations over the long term.”*

5.4.4 Internal Rates of Return

AR27 shows internal rates of return by cohort, which are stable for cohorts born after about 1970. Earlier cohorts can expect to receive even higher value from the CPP. This is because they began their contributions before the current partial funding regime was implemented.

5.4.5 Reconciliations

Detailed reconciliations are conducted of the current results against the results in AR26. These identify the principal causes of the changes in results from AR26 to AR27, and measure the impact of each on the results. The detailed reconciliations also serve as a check on the results of AR27.

5.4.6 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 uncertainty of the valuation results.

The first area examined for sensitivity is that of investment policy. AR27 shows the impact of six alternative asset allocations, compared to the best-estimate asset allocation, on the minimum contribution rate. This shows that the minimum contribution rate is expected to decrease as more investment risk is taken, but that this expected decrease comes at the price of escalating risk (measured in AR27 by the standard deviation of one-year portfolio returns).

The next sensitivity test presented in AR27 shows the impact of portfolio return volatility on the growing CPP asset base and, in turn, on the minimum contribution rate. This is accomplished by showing the effect on three different asset allocations (lower-risk, best-estimate and higher-risk) of abnormally high or low portfolio returns in 2018 followed by a resumption of expected returns thereafter. A range of portfolio returns for 2018 are developed based on a one in 10 year event and a one in 50 year event.

Unfortunately, this material fails to highlight for the reader the differing risk related to the alternative asset allocations. This is because the single year of poor assumed returns is offset by the assumed resumption of expected returns in all other years. For the higher-risk portfolio in particular, those future returns are all expected to be more favourable than for the best-estimate asset allocation. The result is a projected minimum contribution rate for the higher-risk portfolio that tends to be lower than the best-estimate asset allocation, and is only marginally higher than the best-estimate asset allocation even after a one in 50 year event. This section of AR27 might have been improved by examining the impact of more or longer bouts of capital market underperformance, which would not be out of the ordinary over a 75-year projection period. This would highlight the genuinely higher risk of more aggressive asset allocations.

Review of the 27th Actuarial Report on the Canada Pension Plan

Other sensitivity tests in AR27 examine one assumption at a time. The tests illustrate the effect of changes, both lower-cost and higher-cost, in each of eight key assumptions (16 tests in total). These tests are discussed in detail in Subsection 5.4.7.

AR27 then presents projections in the context of high and low economic growth. This combines optimistic and pessimistic assumptions as to the economic assumptions of participation rates, unemployment rates, age of retirement benefit take-up, and real wage increases.

Another set consists of two “combined” sensitivity tests: the “Younger Population Scenario” and the “Older Population Scenario”. Both of these scenarios are presented to test possible combinations of key demographic assumptions (considering the interrelationship of the various assumptions) that provide a reasonable range of possible future outcomes. The assumptions that are combined are: fertility, mortality, net migration and participation rates.

5.4.7 Individual Sensitivity Tests

The individual sensitivity tests examine the effect of changes, both lower-cost and higher-cost, in each of eight key assumptions: fertility, mortality, migration, labour market (which combines participation, unemployment and retirement rates), price increases, real wage increases, real rates of return, and disability incidence rates. Except for the sensitivity tests that examine the impact of changes in the labour market and mortality rates, stochastic considerations are used to provide estimates of low-cost and high-cost scenarios within an 80% probability range for each assumption. That is, alternative scenarios are presented using the respective assumption at its projected 10th and 90th percentile. It is also true that any stochastic analysis has to be augmented by considerable professional judgement. In many cases one needs to consider if there has been a “regime” switch. For example, what information is provided about the prospects of future inflation from data prior to 1991 before the Bank of Canada took on its “inflation target” objective? This is reinforced by very recent announcements about raising the level of immigration significantly (which were unknown to the OCA at the time of the valuation). If these are adopted, what information would past immigration levels provide?

The resulting high-cost and low-cost values for each assumption are used as inputs into the model to project revised (a) minimum contribution rates (b) pay-as-you-go rates, and (c) asset-to-expenditure ratios if there were no change in the current 9.9% contribution rate. The report sometimes also shows the first year that expenditures exceed contributions. There is a lot of material presented on this in AR27 that might be pared back by just focusing on the impact on the minimum contribution rate, as is the case with the other sensitivity tests.

Sixteen individual sensitivity tests are run. In seven of those cases, the resulting minimum contribution rate exceeds 9.9%, a rate that would entail a review of benefits and contributions by the Ministers of Finance.

The approach to the individual sensitivity tests used in AR27 is the same one that was used in AR26. Each report shows how much variation should be expected, with roughly equal plausibility (with the possible exception of the mortality sensitivity test), in each direction and for each assumption or set thereof.

We believe that sensitivity tests are a valuable tool, if used prudently. 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 assumptions. In particular, the reader should be aware that actual outcomes can range more widely than is shown by the sensitivity tests and that the likelihood of doing so may be even higher than is projected. This is due to the inherent unpredictability of many of the key assumptions rather than any defect in the Chief Actuary's analysis.

We note that:

- Determining a plausible range for future variability is difficult and subjective.
- Past variability is not an unfailing guide to future variability.
- The future is inherently unknowable so it is prudent to take into account a range of expert opinion when making projections. This will help both in setting best estimates and also in setting ranges for any sensitivity analysis.

Over time, the sensitivity tests have evolved from “largely subjective with uneven comparability” to “largely objective with better comparability”, but the OCA may need to reintroduce more subjectivity while still striving for greater comparability.

5.5 Opinion on Methodology

In our opinion, the actuarial methods used in completing AR27 were reasonable.

5.6 Recommendations

Recommendation 4: We recommend that the Chief Actuary's sensitivity tests show the impact of a three-year economic downturn followed by a three-year recovery so that at the end of six years (two valuations hence) one could revert to the best-estimate assumptions.

Recommendation 5: We recommend that the Chief Actuary seek additional expert input to help establish the best-estimate actuarial assumptions and the range of variability examined in the sensitivity tests. Specifically, the Chief Actuary should poll demographic and economic experts for their views on key assumptions, including a plausible range of variability therein that approximates an 80% confidence interval. The Chief Actuary should consider this input but retain responsibility and control over the final assumptions that are chosen.

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 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,
- short-term historical data,
- evidence that a “regime switch” has taken place,
- recent amendments to the *Canada Pension Plan*,
- policy (for example, CPPIB investment policy, ESDC 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 regime switch or a trend that is likely to continue for the long-term future, the actuary will recognize that switch or trend in the assumption.

For many of the assumptions used in the model, the Chief Actuary has adopted a method 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 assumption 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", that is, 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. AR27 follows this same approach.

The Chief Actuary spends time gathering expert opinions on the report assumptions from a variety of sources. The review panel did the same. This is a difficult and sometimes frustrating exercise. If one visits, say, five experts, one can expect to come away with five answers sometimes covering a wide spectrum of possibilities. How one decides what the best estimate should be is not based on absolute science. There is no mathematical formula that guarantees that one arrives at the "best" estimate. The most one can do is to arrive at an estimate that is "reasonable", or at least "not unreasonable". One should remember this background when judging the work of the Chief Actuary (and the review panel for that matter).

The major actuarial assumptions in AR27 can be conveniently divided into two groups:

- "demographic" assumptions that deal with changes in the covered population (for example, fertility, migration and mortality rates) and events (for example, 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

Cohort fertility rates varying by age and year are applied to the female population to project the number of births each year. The Chief Actuary assumes that recently observed fertility rates for females under age 30 will decrease slightly in the near future, while fertility rates observed from ages 30 to 50 will increase. The fertility trends are based on historical fertility rates by age of mother. As for some other assumptions, the approach used in AR27 (and in past actuarial reports on the CPP) is to develop one fertility assumption for Canada and a separate one for Québec. These assumptions are then used to develop separate population projections for Canada and for Québec. From these, the projected population of Canada less Québec is derived. The ultimate fertility rate assumed for Canada is 1.65, while for Québec it is 1.68.

Review of the 27th Actuarial Report on the Canada Pension Plan

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 the age-specific rates in a given calendar year. The assumed total fertility rate for Canada in AR27 increases slightly from the 2011 level of 1.61 to an ultimate level of 1.65 in 2019. AR27 assumed an ultimate total fertility rate that is the same as that in AR26 (1.65), but the year in which the ultimate rate is reached in AR27 is later than that assumed in AR26 (2019 versus 2015).

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 increased until 2008 and have fluctuated since then, probably due to the financial crisis of 2008 (fertility rates tend to decrease when unemployment rises). As a result, the average age of motherhood has increased. In the future, fertility rates could decline to the lower levels experienced in several other developed countries (for example, Japan and Italy at 1.4), or increase in the direction of the higher rates recently experienced in the U.S. (1.9) or France (2.0). The assumed ultimate rate of 1.65 in AR27 is the same as the Statistics Canada medium assumption of 1.65. The United Nations' assumed rates are 1.58 in 2025 and 1.67 in 2045. Finally, the World Bank projects a rate of 1.72 in 2020.

The sensitivity tests for the fertility assumption are a low-cost ultimate total fertility rate for Canada of 2.00 and a high-cost ultimate rate of 1.30. These rates define the range of values that are expected to occur with 80% probability. The test results may be summarized as follows:

Ultimate Total Fertility Rate from 2019	Minimum Contribution Rate	Pay-As-You-Go Rates	
		2025	2050
Lower-cost (2.00)	9.40	10.52	10.59
Best-estimate (1.65)	9.79	10.52	11.17
Higher-cost (1.30)	10.22	10.52	11.83

The above table illustrates that changes in fertility can have a relatively large effect on the cost of the Plan. However, all the individual sensitivity test results should be interpreted with caution. Readers should form their own opinion about the plausibility of the lower-cost and higher-cost assumptions. Moreover, they should realize that changes in assumptions 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 (for example, changes in average ages at retirement, levels of immigration or labour force participation rates).

Opinion on Fertility

In our opinion, the AR27 fertility assumption is reasonable.

6.2.2 Mortality

For this report, the mortality rate projections start from the 2011 mortality rates of the Canadian Human Mortality Database (CHMD).

General population mortality rates are adjusted to account for the specific mortality experience of CPP retirement and survivor beneficiaries. Mortality rates for disability beneficiaries are based on actual experience for that segment of population.

Mortality rates for years 2012 to 2031 are derived by applying the cumulative annual mortality improvement rates to mortality rates for the past 15 years ending in year 2011. Annual mortality improvement rates (MIRs) are analyzed by age, sex and period. The historical MIRs are graduated using a best-fit log-linear regression. For ages 65 and over, the annual MIRs for 2012 to 2014 are further projected using the trends derived from the administrative data on Old Age Security (OAS) beneficiaries, representing 98% of the general Canadian population.

Mortality improvement rates for males at most ages are currently higher than those for females but are assumed to decrease to the same level as female rates from 2032 onward. The mortality assumptions of the 27th CPP Report produce higher life expectancies for males and females than those of the 26th CPP Report. The gap between male and female life expectancy continues to shrink but does not disappear.

The AR27 ultimate mortality improvement rates are the same as those assumed in AR26 at ages up to 84, higher at ages 85-99 and lower after age 100. Compared to the improvement rates used in the U.S. Social Security (OASDI) *2015 Trustees Report*, the AR27 ultimate improvement rates for males and females under 65 are lower than the U.S. rates but higher for males and females aged 65 to 99 (but the U.S. starts with significantly higher mortality rates). As to CPP assumptions versus UK assumptions, the CPP assumed mortality improvement rates are lower at all ages for both males and females than those assumed in the UK.

The sensitivity tests for the mortality assumption are implemented by adjusting the assumed rates of mortality improvement through deterministic methods. Based on the best-estimate assumptions, the life expectancy at age 65 in 2050 would be 23.3 years for males and 25.6 years for females. The low-cost assumption is that those life expectancies would be 20.9 years for males and 23.2 years for females. The low-cost assumption postulates no future mortality improvement after the year 2032. Thus, we are given cost estimates for constant, non-improving life expectancy after 2032. The high-cost assumption is that those life expectancies would be 25.8 years for males and 27.9 years for females. The test results may be summarized as follows:

**Review of the 27th Actuarial Report
on the Canada Pension Plan**

Life Expectancy at Age 65 in 2050, With Future Improvements	Minimum Contribution Rate	Pay-As-You-Go Rates	
		2025	2050
Lower-cost (M 20.9, F 23.2)	9.46	10.51	10.83
Best-estimate (M 23.3, F 25.6)	9.79	10.52	11.17
Higher-cost (M 25.8, F 27.9)	10.10	10.53	11.49

Opinion on Mortality

In our opinion, the AR27 mortality assumption is reasonable.

6.2.3 Migration

The rate of net annual migration to Canada since 2001 has varied from a low of 0.47% of the population to a high of 0.69%, assuming the net flow of non-permanent residents equals zero. Variations in the earlier years of the 20th century were much more extreme. Migration varies from year to year in response to demographic, economic, social, political and administrative changes. Historically, this has been the most volatile component of change in the Canadian population. Over 2013 to 2015, the average net migration rate for Canada was 0.61% of the population (assuming the net flow of non-permanent residents equals zero).

The migration rate for Québec is calculated and projected on its own. For Québec, the ultimate net migration rate is 0.43% (average over 10 years) starting in 2016.

Historically, the average annual net flow of non-permanent residents was assumed to be equal to zero because of the large variations (both positive and negative) in this variable and the small weight they carry in terms of contributions to the CPP. This is the assumption in AR27.

The AR27 assumption for net annual migration to Canada, assuming a net flow of non-permanent residents of zero, rises from the 0.55% level experienced in 2015 to 0.62% in 2016 and beyond. This ultimate rate is higher than the ultimate net migration rate of 0.60% assumed in AR26 due to recent experience and the new increased government target. (However, October 2016 announcements about possible very large increases in immigration targets were not known to the Chief Actuary at the time of setting the migration assumptions for AR27).

Statistics Canada considers migration to be a major driver of population growth. The assumed ultimate net migration rate in AR27 (0.62% in 2016) is higher than the medium projection rate used by Statistics Canada in its projections (0.59% in 2029-30 and beyond). We are comfortable with this variance.

Statistics Canada has mentioned to the peer reviewers that postcensal estimates indicate that the number of emigrants appearing in general information sources is underestimated in Canada. Statistics Canada uses indirect techniques for estimating more precisely the number of

emigrants and this results in a number of projected emigrants that is higher than the number projected by the OCA, with a resulting lower net migration rate projected by Statistics Canada. It is suggested that the OCA consider, in future actuarial reports, the adjustments made by Statistics Canada to better estimate the number of emigrants.

The sensitivity tests for the net migration assumption are again based on an 80% confidence interval. The assumptions are an ultimate low-cost annual net migration rate for Canada of 0.66% and a high-cost rate of 0.58%. The test results may be summarized as follows:

Ultimate Average Annual Net Migration Rate from 2016	Minimum Contribution Rate	Pay-As-You-Go Rates	
		2025	2050
Lower-cost (0.66%)	9.72	10.47	11.03
Best-estimate (0.62%)	9.79	10.52	11.17
Higher-cost (0.58%)	9.86	10.57	11.31

Opinion on Migration

In our opinion, the AR27 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, sex and year. These can be summarized as an aggregate rate based on the current population distribution. The experience indicates aggregate rates for 2015 of 2.95 new disabilities per thousand eligible male workers and 3.71 new disabilities per thousand eligible female workers. The AR27 assumption is that disability incidence will experience aggregate rates for years 2020 and later of 3.10 for males and 3.65 for females. The adjusted ultimate rates in AR26 were 3.30 for males and 3.75 for females for years 2017 and beyond.

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 those introduced by the 2007 Plan amendments, which relaxed the minimum qualifying period, effective 3 March 2008, for those with 25 or more years of contributions.

The sensitivity tests for this assumption are an ultimate (2020 and beyond) low-cost rate per thousand eligible workers of 2.30 for males and 2.80 for females, and an ultimate high-cost rate of 3.90 for males and 4.50 for females. This is again based on an 80% probability range. The test results may be summarized as follows:

**Review of the 27th Actuarial Report
on the Canada Pension Plan**

Ultimate Disability Incidence Rate from 2020	Minimum Contribution Rate	Pay-As-You-Go Rates	
		2025	2050
Lower-cost (M 2.30, F 2.80)	9.62	10.39	10.97
Best-estimate (M 3.10, F 3.65)	9.79	10.52	11.17
Higher-cost (M 3.90, F 4.50)	9.97	10.65	11.38

Opinion on Disability Incidence

In our opinion, the AR27 disability incidence rate assumption is reasonable.

6.3 Economic Assumptions and Opinions Thereon

6.3.1 Labour Force

6.3.1.1 Retirement Rates

The contributions to the Plan and benefits paid from the Plan are affected by the ages at which individuals start their CPP pension. Prior to the implementation of the 2009 Plan amendments, contributions to the Plan by individuals, and by employers on their behalf, stopped when the individual started to collect a retirement pension, and neither contributions nor benefit accruals were resumed even if the individual returned to employment. The Plan's normal retirement age is 65, the earliest commencement age is 60, and the latest commencement age is 70 (although participants who fail to apply for their benefits on a timely basis can start their benefits even later). Prior to the implementation of the 2009 Plan amendments, pensions were reduced by 0.5% for each month by which the pension start age was below 65, or increased by 0.5% for each month by which the pension start age was after age 65.

The 2009 Plan amendments to the CPP, effective 1 January 2012, removed the need for those under age 65 to cease working for the month before and the month of benefit commencement (the Work Cessation Test). Those who choose to receive the retirement benefit while continuing to work must still participate in the CPP by making continuing contributions (matched by their employer) until age 65, and they receive commensurate benefit increases. Between ages 65 and 70, pensioners who are working can opt to contribute to the CPP and, if so, their employers must also contribute, with commensurate benefit increases to the pensioner.

Further, the early and late retirement pension adjustment factors were changed to factors that do not involve a subsidy. From 2016, the Pre-65 Downward Monthly Adjustment Factor is 0.6% and the Post-65 Upward Monthly Adjustment Factor is 0.7%. In accordance with subsection 115(1.11) of the *Canada Pension Plan*, the Chief Actuary must recalculate the pension adjustment factors and specify them in every third triennial report, starting with this triennial

report (AR27) as at 31 December 2015. This was done and the 0.6% early retirement reduction factor and the 0.7% late retirement addition factor were deemed to be suitable.

These new and larger adjustment factors were expected to encourage participants to ask for benefits at a later age, but the removal of the Work Cessation Test has offset this in part.

In AR27, 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.

For cohorts reaching age 60 in 2016 and thereafter, the retirement rates at age 60 are assumed to be 34% (males) and 38% (females). The retirement rates at age 65 are assumed to be 42% (males) and 39% (females). The rates result in a projected average age at take-up of 62.9 in 2030, which is slightly higher than was observed (62.4) over the decade ending in 2015.

Some observers suggest that, because of improvements in health and life expectancy together with the prospect of tight labour markets 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 early retirement.

There is no separate sensitivity test for Retirement Rates, however they are part of a combined variable called "Labour Market" for which there is a sensitivity test.

6.3.1.2 Unemployment and Participation Rates

The assumptions for net job creation are established so that the assumed rate of unemployment, 7.1% in 2016, decreases to a constant 6.2% from 2025 onwards for Canada (compared to an ultimate assumption of 6.0% from 2023 onwards in AR26). This is in line with various economic forecasts and reflects moderate economic growth.

The development of projected numbers and profiles of contributors begins with the development of calendar year labour force participation rates by age-sex groups and the application of these rates to the projections of the total population in each of those groups. The projections are done separately for Canada and Québec. The participation rates are "cohort-based". The participation rates for all age groups are expected to increase due to:

- the attractive employment opportunities resulting from labour shortages
- the aging of cohorts with stronger labour attachments, especially for women and individuals with higher education attainment, and
- a shortage of retirement savings encouraging longer labour force attachment.

Review of the 27th Actuarial Report on the Canada Pension Plan

Under the best-estimate scenario, the participation rate of those aged 15 to 69 is expected to increase from 74.3% in 2016 to 77.5% in 2035. These rates are consistent with similar rates produced by other Canadian economic forecasters.

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.

A deterministic model is used to generate the low-cost and high-cost scenarios for these assumptions. A probabilistic range is not used for these assumptions since the pressures from an expected tight labour market as the baby boom retires seem unlike any labour situation experienced in the past (i.e., a regime switch). Instead, the low-cost ultimate assumed unemployment rate is 4.2% starting in 2025 together with an ultimate aggregate labour force participation rate for ages 15 to 69 of 82.7% starting in 2035. By 2035 retirement rates at age 60 are assumed to gradually decrease to levels that are 20 percentage points lower than the best estimates, i.e., 14% and 18% for males and females respectively. This results in an increase in the projected average age at take-up from 62.7 to 63.7 in 2040. The high-cost ultimate assumed unemployment rate is 8.2% starting in 2025 together with an ultimate aggregate labour force participation rate of 73.7% starting in 2035. By 2035, retirement rates at age 60 are assumed to gradually increase to levels that are 20 percentage points higher than the best estimate, i.e. 54% and 58% for males and females. This results in a decrease in the projected average age at take-up from 62.7 to 61.7 in 2040.

The test results may be summarized as follows:

Labour Market	Minimum Contribution Rate	Pay-As-You-Go Rates	
		2025	2050
Lower-cost	9.47	9.88	10.60
Best-estimate	9.79	10.52	11.17
Higher-cost	10.14	11.20	11.69

Opinion on Unemployment and Labour Force Participation Rates

In our opinion, the AR27 assumptions as to the rates of unemployment, labour force participation and retirement rates are reasonable.

6.3.2 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 offsetting. The net result is that an increase in the inflation assumption results in a decrease in the pay-as-you-go rates and minimum contribution rate, and vice versa.

The price increase assumption in AR27 is 1.6% in 2016, and 2.0% thereafter. 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. In October 2016, it was announced that the Bank of Canada and the Minister of Finance agreed to extend the targets for another five years to 2021. The target rate will continue to be 2%, with a range of 1% to 3%. The Chief Actuary assumed that the current 2% target would continue to be renewed in the future.

In the long term, there may be upward challenges such as pressure from U.S. inflation and potential tight labour markets. Other research shows that an aging population, such as we have in Canada, will put downward pressure on inflation.

The sensitivity tests for this assumption are a high-cost scenario with an ultimate price increase rate of 1.5% in 2017 and beyond and a low-cost scenario with an ultimate rate of 2.5%, in 2017 and beyond. This is again based on an 80% confidence interval. The results of these tests may be summarized as follows:

Price Increases from 2017	Minimum Contribution Rate	Pay-As-You-Go Rates	
		2025	2050
Lower-cost (2.5%)	9.67	10.42	11.01
Best-estimate (2.0%)	9.79	10.52	11.17
Higher-cost (1.5%)	9.93	10.61	11.35

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 targets has been in effect since 1991. Since this framework was introduced 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%.

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 2.2% in AR26 to 2.0% in AR27 as appropriate.

Opinion on Price Increases

In our opinion, the AR27 price increase assumption is reasonable.

Review of the 27th Actuarial Report on the Canada Pension Plan

6.3.3 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 Subsection 6.3.2) and the real wage increase assumption (the portion of wage increases above inflation), which is discussed here.

In AR27, 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).

There are five main factors that influence increases in the real wage: changes in general productivity, the extent to which changes in productivity are shared between labour and capital, changes in the compensation structure offered to employees, changes in the average number of hours worked, and changes in labour's terms of trade (i.e. the difference in the way the prices of goods produced by workers (measured by the GDP deflator) compare to shifts in the prices of goods consumed by workers (measured by the CPI)). The most important of these factors in setting the real wage increase assumption is growth in productivity. An aging population is expected to have a dampening effect on productivity growth.

The real increase in AAE is assumed to be the same as the real increase in AWE. An ultimate real wage increase of 1.1% has been assumed in years 2025 and thereafter for the best-estimate projections.

The University of Toronto's updated forecasts (August 2016), provided after the real wage assumption was set for AR27, projected ultimate real wage increases of 1.4% starting in 2025.

The OCA's ultimate assumption of 1.1% in AR27 is lower than the ultimate assumption of 1.2% in AR26.

The sensitivity tests for the ultimate real wage increase assumption with respect to 2025 and beyond are based on an 80% probability range. This gives a low-cost scenario of 1.8% (from 2025) versus a high-cost scenario of 0.4% (from 2017). The results of these tests are shown below:

Ultimate Real Wage Increases	Minimum Contribution Rate	Pay-As-You-Go Rates	
		2025	2050
Lower-cost (1.8%)	9.31	10.28	10.05
Best-estimate (1.1%)	9.79	10.52	11.17
Higher-cost (0.4%)	10.32	10.95	12.51

Opinion on Real Wage Increases

In our opinion, the AR27 real wage increase assumption is reasonable.

6.3.4 Real Rate of Return on Investments

If the CPP were totally unfunded (that is, if the contributions each year were just enough to cover that year's benefit payments and operating expenses), then the CPP contribution rate would be equal to the pay-as-you-go rate 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 is projected to accumulate (eventually reaching in excess of seven years' benefit payments if the current contribution rate is maintained) and the rate of investment return becomes a material factor in determining the contribution rate for the Plan. The CPP assets totalled \$285 billion at the end of 2015 (33% higher than expected in AR26) and are projected to grow 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 (that is, net of the rate of inflation).

The best-estimate real rate of return assumption in AR27, net of investment expenses, rises from 0.4% in 2016, to 3.0% in 2017 and then rises slowly to an ultimate assumption of 4.0% in 2025 and later. This produces an average real rate of return over the 75-year projection period of 3.9%. The ultimate rate reflects a "building block approach" whereby, in real terms:

- Long-term Government of Canada bonds are assumed to yield 2.6% per year starting at the end of 2024.
- Marketable bonds (government and corporate bonds of varying duration) are assumed to return 2.7% per year for 2025 and thereafter.
- Canadian and foreign developed market equities are assumed to return 2.1% per year higher than the yield on long Government of Canada bonds (emerging market equities 3.1% higher). This results in a lower-than-historical equity risk premium and an ultimate total real equity return of 4.7% per year for Canadian and foreign developed market equities (5.7% per year for emerging market equities).
- Real estate and infrastructure investments are assumed to provide a return calculated as 50% of the return on corporate bonds and 50% of the return on Canadian equities, resulting in a real return of 4.2% per year.
- The actual CPP portfolio also holds non-marketable provincial bonds of steadily diminishing duration and importance since this component of the portfolio (9% of the total) is being gradually wound down by 2042. These bonds are assumed to earn varying returns over the intervening period consistent with the actual make-up of the portfolio and the Chief Actuary's expectations for future changes in bond yields.

Review of the 27th Actuarial Report on the Canada Pension Plan

OCA characterizes the asset mix of the CPPIB as at 31 December 2015 to be 52% equities, 28% fixed income securities and 20% in real estate and infrastructure. The CPPIB does not adopt long-term asset mix targets. The Chief Actuary postulates an assumed ultimate allocation of assets as 55% equities, 20% fixed income securities and 25% real estate and infrastructure, reflecting the CPPIB's planned near-term increase in commitment to real estate and infrastructure.

The Chief Actuary also assumes that annual investment management expenses will equal 1.0% of total CPPIB assets. This is 0.8% higher than the estimated 0.2% cost of passively implementing the assumed asset mix. However, this 0.8% increment in cost is assumed to be exactly offset by the added value produced by the CPPIB, resulting in an assumed net cost of 0.2%. The Chief Actuary is using this approach (of no net value added or lost) until a long-term track record by the CPPIB has been established.

The sensitivity tests for this assumption are to increase or decrease the rate of return on all of the CPP assets to reflect an 80% confidence interval. This gives a range from 2.2% to 5.6% with 80% probability. The results of these tests are summarized below and show the 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 (5.6%)	8.54
Best-estimate (3.9%)	9.79
Higher-cost (2.2%)	11.05

The Chief Actuary's assumed real rate of investment return is within the reasonable range but somewhat low within that range. Reasons for this include:

- The CPPIB investment portfolio is complex and sophisticated, spanning multiple asset classes and sub-classes. The OCA models this using a simplified approach that collapses the actual complexity into three broad asset classes: (a) equities (with an adjustment for emerging market equities versus developed market equities) (b) fixed income, and (c) real estate and infrastructure. A more complex model would tend to attribute higher expected returns to certain asset classes or sub-classes, such as private equities, even after taking account of the higher expenses incurred to invest therein.
- With increased diversification comes the opportunity for higher expected returns through periodic rebalancing. That is, when one asset class increases in value, a rebalancing policy reallocates some of the increased assets to other classes that have not (yet) achieved the same growth. This imposes a "sell high, buy low" discipline that can materially add to overall returns, even beyond the 45 bps that the OCA currently projects from this process.

- For developed market equities, the OCA assumes an equity risk premium of 2.1% per year (for 2025 and beyond) on top of the expected real rate of return on long-term Government of Canada bonds of 2.6% per year. This is an area where both past experience and expert opinion vary widely. For example, the *CIA Report on Canadian Economic Statistics, 1924-2015* shows that over the last 75 years, Canadian equity returns have averaged 3.8% per year above long Canada bond returns. Yet the same report shows that over the last 25 years the equity risk premium has averaged minus 0.7% per year; that is, long Canada bonds have outperformed Canadian equities over this relatively lengthy period. Statistics like these illustrate the difficulty of projecting future rates of return based on past experience. There is also considerable debate about the sustainability of the equity risk premium, particularly given the changes in the investment environment that have occurred during the last century (changes in laws and regulations, technological innovations, demographic shifts, globalization, climate change risks, recent success in subduing inflation in developed markets, shifts in the relative returns to labour and capital, and so on). This challenging backdrop allows the OCA to reasonably assume an equity risk premium for developed markets of 2.1% per year. However, this assumed equity risk premium is lower than the 75-year average for both Canadian and international markets, and lower than the equity risk premium postulated by many (but not all) experts.
- The CPPIB undertakes leveraged investing. That is, funds are borrowed at short-term interest rates and invested for the long term. Such use of leverage is expected to add value on average but it can certainly also detract. The OCA approach to modelling expected investment returns effectively ignores the use of leverage until such time as the leverage has either added or subtracted value. That is, the expected added value from the use of leverage is taken into account only retrospectively, not prospectively. This is a prudent approach but it does reduce the prospective returns that one might otherwise assume.

We believe that the modelling approach used by the Chief Actuary will need to increase in sophistication, particularly as the CPPIB continues to increase the sophistication of its approach to investing the CPP assets. We also expect that the Chief Actuary will continue his 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 is heavily invested in non-Canadian assets. Also, the analysis should not be confined to a review of the past, since the future may differ substantially.

We also note that the Chief Actuary's assumptions do not include an additional allowance for the CPPIB outperforming the normally expected returns for the various asset classes. We understand that CPPIB strives for such outperformance, and CPPIB staff compensation includes a significant reward if it is achieved, which may lead to higher real rates of return. However, Canadian actuarial practice is to anticipate such higher returns only if "the actuary has reason to believe, based on relevant supporting data, that such additional returns will be consistently and reliably earned over the long term." We agree with the Chief Actuary that the track record of the CPPIB does not yet allow one to reasonably anticipate such future outperformance.

Review of the 27th Actuarial Report on the Canada Pension Plan

Finally, it is important to understand that the 4.0% ultimate real rate of return assumed in AR27 is not a performance target for the CPPIB to strive to attain. Rather, this assumption is the Chief Actuary's estimate of what the returns will ultimately be, given the supporting assumptions as to future asset mix and future real rates of return for the various classes of assets. The mandate of the CPPIB is to earn a maximum rate of return without undue risk of loss, regardless of what the Chief Actuary assumes for the ultimate real rate of return.

Opinion on Real Rate of Return on Investments

In our opinion, the Chief Actuary's real rate of return assumption is reasonable, but somewhat low within the reasonable range.

6.4 Assumptions in the Aggregate and Opinion Thereon

The Chief Actuary's actuarial assumptions are his best estimates, based on his review of past experience and his judgement about the likely course of future experience. For most assumptions, there is considerable room for actuarial judgement and the range of values that would be considered reasonable can be quite wide. In our review of the major actuarial assumptions, we concluded that each of them is within the reasonable range.

Notwithstanding all this, we caution the reader that since the range of reasonable assumptions is wide, so too is the range of reasonable valuation results. The sensitivity tests in AR27 present plausible ranges of results but actual results could be even wider.

Opinion on Assumptions in the Aggregate

In our opinion, the assumptions in completing AR27 were, in the aggregate, reasonable.

6.5 Recommendations

Recommendation 6: We recommend that the Chief Actuary strive to more closely model the actual CPPIB investment portfolio to form a better assumption as to the real rates of return that should be anticipated.

SECTION 7 – COMMUNICATION OF RESULTS

In this Section, we address the following question:

“Does the 27th Report fairly communicate the results of the work performed by the Chief Actuary and his staff?”

7.1 Background

AR27, as tabled in the House of Commons on 27 September 2016, is a bound soft-cover book, separately published in English (139 pages) and French (146 pages).

The English version of AR27 is available from the OSFI website at:

<http://www.osfi-bsif.gc.ca/Eng/Docs/cpp27.pdf>

and the French version at:

<http://www.osfi-bsif.gc.ca/Fra/Docs/cpp27.pdf>

Supporting information for AR27 is also available in great detail. The OSFI website provides links to:

- all current and prior “Actuarial Reports” produced since the inception of the CPP,
- “Actuarial Studies”,
- documents relating to the “CPP Actuarial Peer Review”,
- “Speeches and Presentations” by the OCA staff,
- material presented at CPP-related and QPP-related “Inter-Disciplinary Seminars”, and
- various other CPP-related documents.

In addition, the supporting working papers for AR27 are comprehensive. Detailed projection tables are available, in CD-ROM format, to the public upon request and are also provided to all provincial governments. We believe that the information in AR27 together with the supporting CD-ROM is sufficient for any reader to get a full understanding of the analysis.

7.2 Observations

AR27 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.

AR27 has both a broad audience and a technical audience. The broad audience is mainly interested in the high-level results of the actuarial review. The technical audience of actuaries, economists, demographers, policy analysts, and others is interested in more extensive detail regarding the Plan provisions, data, methodology, assumptions, demographic projections and financial projections.

Review of the 27th Actuarial Report on the Canada Pension Plan

The Chief Actuary recognizes the dual nature of the audience and has changed the layout of the report to include the high-level results in the main body of the report, 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.

For example, one area of AR27 where this compromise approach is not wholly successful for technical readers is with respect to the treatment of what actuaries call “subsequent events”. These are events arising after the valuation date (31 December 2015) and before the report date (22 September 2016) that had an influence on the valuation. The Chief Actuary took key subsequent events into account (e.g. worse-than-expected year-to-date investment experience) and disclosed this in AR27. However, the report could be clearer about:

- the cut-off date up to which subsequent events are considered (for practical reasons, the cut-off date is usually several weeks sooner than the report date)
- the particular subsequent events that are considered and how they are taken into account, and
- the fact that both better-than-expected and worse-than-expected experience is considered.

We anticipate that the Chief Actuary will continue to improve the actuarial valuation report in the future, as he has consistently done in the past.

In the presentation of the actuarial balance sheet, a non-specialized reader could think that this confirmation of long-term financial sustainability results directly from the fact that the ratio of assets to liabilities is above 100% in 2015 and close to 100% in 2025. Considering that this ratio was below 100% in the previous Actuarial Report (AR26) and that the conclusion was the same, we think that the report should mention that the assets-to-liabilities ratio is not an absolute measure of the Plan's financial sustainability, that the CPP can tolerate fluctuations of this ratio below and above 100% and still be on solid financial ground, and that that the actuarial balance sheet is complementary to the minimum contribution rate as a measurement of the long-term financial sustainability of the Plan.

In addition, the actuarial report could mention that, since 2011, the CPP actuarial balance sheets appear in the notes to the Public Accounts of Canada, which reinforces the necessity to present this information in CPP actuarial reports.

7.3 Opinion on Communication of Results

In our opinion, AR27 fairly communicated the results of the work performed by the Chief Actuary and his staff.

7.4 Recommendations

Recommendation 7: We recommend that the section of the report dealing with the actuarial balance sheet mention:

- the assets-to-liabilities ratio is not an absolute measure of the Plan's financial sustainability, the CPP can tolerate fluctuations of this ratio below and above 100% and still be on solid financial ground, and the actuarial balance sheet is complementary to the minimum contribution rate as a measurement of the long-term financial sustainability of the Plan;
- since 2011, the CPP actuarial balance sheets appear in the notes to the Public Accounts of Canada, which reinforces the necessity to present this information in CPP actuarial reports.

SECTION 8 – OTHER MATTERS RELATED TO AR27 AND RECOMMENDATIONS THEREON

In this Section, we address two other issues that we considered in our review, namely:

- CPP expenses, and
- external guidance in selecting assumptions.

8.1 Expenses

8.1.1 CPP Operating Expenses

CPP operating expenses include those incurred by ESDC, CRA, Service Canada, OSFI, and the Department of Finance. AR27 includes Table 7, which shows the projection of CPP operating expenses, as well as Tables 9 and 86, which relate those expenses as percentages of contributory earnings and total earnings, respectively. In calendar year 2015, operating expenses excluding CPPIB amounted to \$543 million. CPP operating expenses, when expressed as a percentage of total annual earnings, have averaged 0.092% over the last 15 years. CPP operating expenses have been, and are projected to be, mostly stable with the exception of a one-time expense that arose in 2012. Accordingly, the ratio of 0.092% is assumed to hold going forward.

8.1.2 CPPIB Expenses

CPPIB expenses are not included in Plan operating expenses in AR27, but are reported as allocated to the CPPIB assets and accounted for separately in the investment expenses assumption. We support this method of reporting.

From the AR27 working papers and the CPPIB Fiscal 2016 Annual Report, we have the following information regarding total CPPIB expenses, measured as a fraction (in basis points, or bps) of average assets under CPPIB management:

Fiscal Year Ending March 31	External Management Fees and Transaction Costs \$Millions (bps)	Internal Operating Expenses \$Millions (bps)	Total CPPIB Expenses \$Million (bps)
2007	201 (20)	114 (11)	314 (31)
2008	346 (29)	154 (13)	500 (42)
2009	476 (41)	189 (17)	665 (58)
2010	614 (53)	236 (20)	850 (73)
2011	673 (49)	328 (24)	1,001 (73)
2012	878 (57)	440 (28)	1,318 (85)
2013	959 (56)	490 (28)	1,449 (84)
2014	1,163 (57)	576 (29)	1,739 (86)
2015	1,527 (63)	803 (33)	2,330 (96)
2016	1,767 (65)	876 (32)	2,643 (97)

The upward trend in total CPPIB expenses reflects a progressively more active investment management strategy, as well as a performance-based fee structure that has resulted in increasing cost when performance has been beyond target (as has been the case in recent years). Over the last three calendar years, total expenses, as a percentage of assets, averaged 93 bps. Intuitively, one would expect that, over time, as operations become more established and as assets under management grow, expenses as a percentage of assets under management will stabilize, if not decrease (unless the growth in performance-based fees outpaces the growth in assets). We have been advised by the CPPIB that they are still building their active management capabilities and that recent performance has been very strong.

Fiscal year 2007 was the first year of implementation of the CPPIB active management strategy. At that time, the CPPIB also created the CPP Reference Portfolio, which is a hypothetical portfolio against which the value-added returns from active management are measured. In general, the objective of active management is to generate returns in excess of those from this Reference Portfolio, after reduction for the additional expenses incurred from active management. Thus, the additional returns from a successful active management program should at least equal the cost incurred to pursue active management.

The following table compares the CPPIB added value (from which external management fees and transaction costs have already been deducted) with the internal operating expenses of the CPPIB. The net added value, after all CPPIB expenses, is then shown.

**Review of the 27th Actuarial Report
on the Canada Pension Plan**

Fiscal Year Ending March 31	CPPIB Added Value Calculated By OCA (bps)	Internal Operating Expenses (bps)	Net Added Value After All CPPIB Expenses (bps)
2007	235	11	224
2008	243	13	230
2009	0	17	-17
2010	-540	21	-561
2011	196	24	172
2012	200	28	172
2013	12	29	-17
2014	26	29	-3
2015	149	33	116
2016	444	31	413

Over the period 2007-2016 the net value added was extremely variable, with both large positive and large negative amounts.

Consistent with Canadian actuarial practice, AR27 reflects an assumption that the added value from active management will exactly equal the incremental expenses incurred to pursue that active management strategy. That is, no net added value is assumed to be either gained or lost. We agree with this approach for now and believe that it is important to closely monitor the relationship between incremental returns and incremental expenses with a view to refining this assumption in the future.

8.2 External Guidance in Selecting Assumptions

AR27 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 forecasts of future events.

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, 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 the 5th CPP Seminar on Demographic, Economic and Investment Perspectives for Canada, Years 2015 to 2050 on 25 September 2015. Representatives of the OCA also attended a seminar hosted by the RRQ on 29 October 2015. Participation at these events helped the OCA to formulate best-estimate assumptions and methodologies for AR27.

After the tabling of each of the last six triennial actuarial reports on the CPP (AR17, AR18, AR21, AR23, AR25 and AR26), 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. All of these actuarial review panel reports 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.

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, maintains effective two-way communication with the CPPIB, and devotes a considerable amount of time to keeping abreast of experts' views on demographic and economic matters. He also considers the comments and advice contained in the reports of the actuarial review panels that reviewed the previous actuarial reports.

8.3 Recommendations

Recommendation 8: We recommend that the Chief Actuary continue to analyze the incremental investment expenses incurred over time to implement the CPPIB's active management strategy in order to assess whether added value is being consistently and reliably earned over the long term.

Recommendation 9: We recommend that the Chief Actuary:

- continue the CPP-related seminars with presentations from an array of appropriate experts covering a range of viewpoints, and
- maintain effective two-way communication with the CPPIB, with the goal of achieving continual improvements in the process of setting best-estimate assumptions.

SECTION 9 - ACTUARIAL ADJUSTMENT FACTORS

Upon retirement under the CPP, actuarial adjustment factors are applied for early (pre-65) and late (post-65) pension take-up. The current legislated actuarial adjustment factor for early pension take-up is 0.60% for each month between the start date of the pension and the pensioner's age 65, while the factor for late pension take-up is 0.7% for each month between the pensioner's age 65 and the start date of the pension.

Subsection 115(1.11) of the *Canada Pension Plan* requires that the Chief Actuary calculate the actuarial adjustment factors and specify them in the 31 December 2015 actuarial report and in every third actuarial report that follows (or sooner if the Chief Actuary considers this necessary).

9.1 Forthcoming Actuarial Study

Appendix F to AR27 reports that the Chief Actuary has calculated the actuarial adjustment factors and they are the same as the current legislated factors. The Chief Actuary further reports that details of his analysis, including the methodology used, will be published later in 2017 in the form of an actuarial study.

OCA has provided us with a summary of the forthcoming details but we do not believe that a formal finding about the Chief Actuary's work can be made in the absence of a published actuarial study. We understand that the intended actuarial study could not be published on a timely basis due to the unexpected volume of work arising from the CPP enhancement discussed in Section 10. We sympathize with and accept this but also believe that any supporting actuarial study on the actuarial adjustment factors should be published roughly coincident with the actuarial report.

We believe that the delay in publishing the actuarial study is not compliant with *ISAP 2*. Section 3.1.3 of *ISAP 2* requires that the "methodology, data and assumptions" for a financial analysis of a social security program be published in a report along with the "results and findings". AR27 provides the results and findings of the OCA's review of the actuarial adjustment factors but does not provide the supporting methodology, data and assumptions.

9.2 Opinion on Professional Requirements

In order to comply with professional requirements, the forthcoming actuarial study on the derivation of the actuarial adjustment factors should have been published at the same time as AR27.

9.3 Recommendations

Recommendation 10: Any future actuarial report that includes a review of the actuarial adjustment factors should be accompanied by an actuarial study that provides the details of such review.

SECTION 10 - 28th ACTUARIAL REPORT

The 28th Actuarial Report on the CPP is the supplementary actuarial report, dated 26 October 2016, prepared in the context of the CPP enhancement introduced by Bill C-26. Some provisions of the additional CPP created by Bill C-26 are still under discussion and the full set of rules for adjusting the additional CPP in case of financial disequilibrium is not yet established.

AR28 is not part of the terms of reference of this peer review. However, the review panel considers it important to comment on AR28 given that:

1. the CPP enhancement could affect the future evolution of certain demographic and economic variables on which the results of AR27 depend;
2. the OCA could benefit from comments made by the review panel in the preparation of the next regular actuarial report which will cover the additional CPP; and
3. regulations are still expected for defining certain provisions of the law and the regulators could benefit from comments made by the review panel.

10.1 Actuarial Assumptions

AR28 uses the best-estimate assumptions of AR27, except for the assumptions regarding investments and operating expenses. The change in investment assumption is due solely to a change in the assumed portfolio mix. However, we believe that other assumptions could be affected by the CPP enhancement. For example:

- participation rates at older ages and the timing of CPP pension claims (retirement rates) could be affected in the long term by enhanced CPP pensions;
- the ratio of earnings to total compensation could be affected by increased employers' contributions to the CPP and by a possible reduction of the size of enterprise-based pension plans;
- the general economic environment might be affected by higher future CPP contributions and benefits; and
- even mortality rates could be affected by CPP beneficiaries having larger benefits.

10.2 Assumed Investment Policy

The draft legislation provides for the establishment of an Additional Canada Pension Plan Account separated from the Account of the base CPP. There are no precise indications, however, about the investment policy that will be applied by the CPPIB to the part of CPP assets related to the additional CPP. The strong reliance of the additional CPP on investment income as a source of revenue will result in a financial situation for the additional CPP that is much more sensitive to financial market volatility than the base CPP. AR28 illustrates the high sensitivity of the minimum additional contribution rates to the rate of return assumption, but this illustration is based (1) on a best-estimate assumption that is not yet supported by a clearly defined investment policy for the additional CPP and (2) on higher-cost and lower-cost scenarios that are based on arbitrary rate of return and volatility parameters. The valuation

results and sensitivity tests shown in AR28 will remain conjectural until the investment policy for the additional CPP becomes more readily foreseeable.

10.3 Target Benefit Plan Implications

The additional CPP has characteristics of a target benefit plan in that the required contributions and/or promised benefits can be adjusted upwards or downwards to respond to the adequacy of its funding. As a result, the rules for assessing the financial equilibrium of the additional CPP and the determination of funding levels that will trigger modifications to its provisions are crucial. The funding outcomes can lead to changes to contributions and/or benefits that will have direct impacts on workers, employers and beneficiaries. In that context, the criteria for assessing the sufficiency of the first and second additional contribution rates need to be robust and tested under different demographic and economic environments. Our view is that one of the financing objectives currently used in AR28 for defining the financial equilibrium of the CPP, namely requiring the asset-expenditure ratio to stabilize at 25 in the long-term, is not a uniquely correct criterion.

10.4 Large Investment Risks

The stakeholders need to consider additional information about the substantial investment risks that the additional CPP will entail. For example, depending on the investment policy adopted and the approach taken to respond to emerging experience, the financial position of the additional CPP could become extremely volatile. This will be particularly true once the additional CPP assets are large relative to the annual contribution requirements of the additional CPP. For example, additional CPP assets are projected by 2065 to exceed annual additional CPP contributions by a ratio of over 40 to 1. Small deviations in future investment experience, particularly during this period of plan maturity, could have outsized effects on the contribution requirements of the additional CPP or, alternatively, on its benefits promises.

10.5 Need for Peer Review

AR28 is a foundation for momentous decisions required by the CPP stakeholders regarding the additional CPP. These decisions include the initial design of the additional CPP benefits, the initial contribution rates established to fund those benefits, the financing approach used to adjust benefits and/or contributions over time in response to emerging experience, and the initial investment policy for the additional CPP account. It is precisely at times of such decision-making that Canadians and their stakeholder representatives stand in greatest need of assurance that the actuarial information they are receiving is of the highest quality. The peer reviewers of the 23rd Actuarial Report on the CPP, almost a decade before the establishment of the additional CPP, made the following statement with which we agree: *“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*

Review of the 27th Actuarial Report on the Canada Pension Plan

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."

10.6 Recommendations

Recommendation 11: AR28 should be subjected to a peer review process similar to that applied for AR27.

SIGNATURES

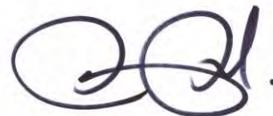
This report has been prepared in accordance with accepted actuarial practice in Canada, and is respectfully submitted on 7 March 2017 by



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