Review of the Seventeenth Actuarial Report on the Canada Pension Plan

Conducted by the CPP Actuarial Review Panel
March 31, 1999

M. David R. Brown, FCIA
Robert C. Dowsett, FCIA
James G. Paterson, FCIA

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This report was prepared by a review panel of three independent actuaries, M. David R. Brown of Eckler Partners Limited, Robert C. Dowsett of Robert Dowsett Consulting, and James G. Paterson of Paterson Pension Management Inc., all Fellows of the Canadian Institute of Actuaries and of the Society of Actuaries.

EXECUTIVE SUMMARY

1. Introduction

Terms of Reference:

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

"The panel will review the work of the Acting Chief Actuary in completing the Seventeenth Actuarial Report on the Canada Pension Plan and provide a report to the Superintendent of Financial Institutions expressing its opinion on the following questions:

1. Is the professional experience of the Acting Chief Actuary and the 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?

3. Has the Acting Chief Actuary had access to the information he required and completed such tests and analysis on the data as might be expected?

4. Were the methods and assumptions used in completing this report reasonable?

5. Does the Seventeenth Actuarial Report fairly communicate the results of the work performed by the Acting Chief Actuary and his staff?

and make such recommendations as the panel feels appropriate in relation to these questions."

Actuarial Report 17

AR17 was prepared as at December 31, 1997. It presents a best-estimate projection of pay-as-you-go contribution rates for the Plan as amended, rising from 8.21% in 1998 to 11.21% in 2035 and then generally staying in the 11% - 11.25% range through to 2100.

It also presents a steady-state contribution rate to be paid in 2003 and later of 9.8% of contributory earnings. Using this steady-state contribution rate, it projects ratios of assets-to-expenditures peaking at 4.95 in 2021, then dropping to 4.50 by 2042, and then dropping gradually to 3.54 in 2100. Under a continuation of the current 9.9% contribution rate from 2003 on, it projects ratios peaking at 5.18 in 2022, then dropping to 5.01 in 2035 and then rising to 6.61 in 2100.

AR17 also presents the results of several sensitivity tests which show how different the results would be if eight main assumptions were varied up or down.

All of the results are estimates. All but the sensitivity tests represent the Chief Actuary's (or, in the case of AR17, the Acting Chief Actuary's) "best" estimates, with no deliberate margins of conservatism or other deliberate bias.

It is essential to recognize that these results are not predictions. They are not necessarily accurate to one decimal place or even to one percent of contributory earnings. The parameters involved (e.g., fertility rates, net migration rates, mortality rates, real rates of wage increase, real rates of return on investments from 1998 through to 2100) are not open to accurate prediction.

2. Professional Experience

Question: "Is the professional experience of the acting Chief Actuary and the staff who worked on the l7th Actuarial Report adequate for carrying out the work required?"

Opinion: In our opinion, the professional experience of the Acting Chief Actuary and the staff who worked on AR17 was adequate for carrying out the work required.

Recommendation 1: We recommend that the Department of Finance and OSFI seriously consider establishing the Chief Actuary's Department, separate from OSFI and reporting directly to the Minister of Finance or to the Minister of State for Finance. The work of the Social Insurance Programs Section-Valuation Unit and the valuation responsibilities

for pension plans for the public service, the military , RCMP, MPs and federal judges could also be transferred to the new Chief Actuary's Department.

Recommendation 2: We recommend that adequate staff and financial resources be made available to the Chief Actuary's Department to allow for more extensive "inter-valuation" studies of emerging experience and continuing development of improved forecasting and modelling techniques for projecting future contributions and expenditures.

Recommendation 3: We recommend that consideration be given to establishing an Advisory Panel, to advise the Chief Actuary with regard to the assumptions to be used in actuarial reviews of the CPP; the Advisory Panel would be made up of senior and experienced professionals, such as actuaries, economists and demographers.

3. Professional Standards of Practice

Question: "Has the work [on AR17] been completed in compliance with the relevant professional standards of practice?"

Opinion: In our opinion, the work on AR17 was completed in compliance with the relevant professional standards.

4. Data

Question: "Has the Acting Chief Actuary had access to the information he required and completed such tests and analysis on the data as might be expected?"

Opinion: In our opinion, except for the narrow scope of the data used for certain assumptions and for deficiencies in data on emigrants,

- the current status data are adequate and appropriate for the purpose of the actuarial review;

- the validation data are acceptable for this purpose, but not as fully appropriate as they could be, due to the absence of actual earnings data for validation purposes, for the year before the review date;

- the data used to develop assumptions are appropriate for the purpose of the actuarial review, apart from the data on net immigration;

- the data testing, when taken in combination with the validation processes described in Section 5 (Methodology) of this report, is adequate and appropriate;

- the Acting Chief Actuary had access to the information he required.

Recommendation 4: We recommend that Revenue Canada be requested to provide the Chief Actuary with details of CPP contributions and the earnings of CPP contributors promptly (i.e., within, say, three months) after the end of each calendar year.

Recommendation 5: We recommend that Statistics Canada be asked to investigate what steps can be taken to improve the data on emigrants and returning emigrants.

Recommendation 6: We recommend that, in future, additional sources of data, inside and outside of Canada and inside and outside of government, be reviewed to broaden, where appropriate, the data and considerations used to develop actuarial assumptions.

5. Methodology

Question: "Were the methods used in completing AR17 reasonable?"

Opinion: In our opinion, under the current CPP legislation and presuming provincial approval of the federal regulation on the calculation of default contribution rates, all of the methodology elements employed in AR17 are appropriate and reasonable for the purposes of the Plan and have been properly applied.

Recommendation 7: We recommend that the Chief Actuary continue in future to improve the methodology. Examples of possible improvements are:

- application of stochastic processes to aspects of the actuarial review;
- development of objective criteria for selection of sensitivity tests;
- improvements in methodology for "validation adjustments".

Recommendation 8: We recommend that HRDC be asked to investigate further the causes of apparent under-utilization of widower's benefits, death benefits and children's benefits

and develop a long term policy as to what actions it may take in this regard. The Chief Actuary could then take this policy into consideration, in addition to past experience, in future actuarial reviews.

6. Assumptions

Question: "Were the assumptions used in completing AR17 reasonable?"

Reasonableness of the Assumptions in the Aggregate:
In our review of the major actuarial assumptions, we found that each of them, with one exception, was reasonable.

The one exception was the ultimate assumption of net annual immigration to Canada of 0.60% of population, which is discussed in section 6.2.2. We would consider an ultimate net annual immigration assumption of 0.50% of population to be reasonable. Judging from the sensitivity test results, we believe that such a change in the assumption would increase the steady-state contribution rate by about 0.20%.

On the other hand, we believe that the economic assumptions used in AR17 are, in the aggregate, a little conservative. Changing the real rate of investment return from 4.00% to 4.25% (which we think would still be in the "reasonable" range) would reduce the unrounded steady-state contribution rate by about 0.10% and increasing the ultimate real wage assumption from 1.0% to 1.2% per year (also still in the "reasonable" range) would reduce it by approximately 0.20%. Thus, these reductions in the contribution rate resulting from small changes in assumptions that are now reasonable and that would continue to be reasonable if changed, would more than offset the increase in the contribution rate that would result from changing the immigration assumption to one that we consider reasonable.

Opinion on Assumptions in the Aggregate:
In our opinion, seven of the eight key assumptions used in AR 17 are reasonable and one (net rates of immigration) is not reasonable. Moreover, we believe there is a margin of conservatism in two of the reasonable assumptions. Those margins are sufficient to offset what we believe is a negative margin in the net immigration assumption. We therefore conclude that the assumptions in the aggregate result in a steady-state contribution rate that is equal to a rate that would be produced using a set of assumptions each of which is reasonable.

7. Other Actuarial Issues

High- and Low-cost Projections

Recommendation 9: We recommend that the Chief Actuary continue to produce high-cost and low-cost "combined" sensitivity tests in addition to the one-parameter-at-a-time sensitivity tests. These high-cost and low-cost estimates should each represent a plausible combination of assumptions and lead to a meaningful estimate.

Recommendation 10: We recommend that the calculation of the steady-state contribution rate should continue to be based on the Chief Actuary's best-estimate derived independently from the high-cost and low-cost estimates.

Peer Review

Recommendation 11: We recommend that, for future actuarial reviews of the CPP, a rigorous and complete peer review process be adopted, with appropriate time allowed for expert and objective analysis of data, assumptions and methodologies as well as report preparation.

8. Communication of Results

Question :"Does the 17th Actuarial Report fairly communicate the results of the work performed by the Acting Chief Actuary and his staff?"

Opinion : In our opinion, AR17 fairly communicates the results of the work performed by the Acting Chief Actuary and his staff.

Recommendation 12: We recommend the inclusion of an Executive Summary in future Actuarial Reports, showing the main results and including information on sensitivity testing.

Recommendation 13: We recommend that the full report be published separately in French and English, each in three volumes. One volume would contain the Executive Summary, a second would contain the major findings (i.e. Sections I to VI and Appendix D in AR17) and the third would contain the technical material (found in Appendices A, B and C).

9. Summary Opinion

Following an in-depth review of the Seventeenth Actuarial Report on the Canada Pension Plan, we have set out our opinions in the various sections of this report in response to the questions asked in our terms of reference. These opinions are summarized below.

In our opinion, the professional experience of the Acting Chief Actuary and the staff who worked on the Seventeenth Actuarial Report is adequate for carrying out the work required, the work was completed in compliance with the relevant standards of practice, and the Acting Chief Actuary had access to the required information. Apart from the work on the development of the net immigration assumption, he and his staff conducted such tests and analyses on the data as might be expected.

Also, in our opinion, the Seventeenth Actuarial Report fairly communicates the results of the work performed by the Acting Chief Actuary and his staff.

In our opinion, the methods and assumptions used were reasonable with the exception of the assumption used for future net immigration, which we believe was too high. However, in our opinion, in two of the economic assumptions used, there are sufficient margins of conservatism to offset the negative margin in the net immigration assumption.

We concluded that the best-estimate steady-state contribution rate developed in the Seventeenth Actuarial Report on the CPP (9.8 % for the years 2003 and later) is equal to a rate that would be calculated using a set of economic and demographic assumptions each of which, in our opinion, is reasonable.

In spite of our concern about the net immigration assumption, we believe that the Seventeenth Actuarial Report on the CPP was competently prepared and presents a reasonable set of results.

As in all other human endeavors, there are some improvements that could be made in the process of preparing and presenting future actuarial reports on the CPP. In this spirit, we have included in our report a number of recommendations regarding the data and methodology to be used, the preparation of the actuarial reports and the organization and staffing involved in future actuarial reviews of the CPP.

SECTION 1 - INTRODUCTION

This report presents the results of an in-depth review we conducted into the Seventeenth Actuarial Report on the Canada Pension Plan (AR17) and the detailed actuarial examination on which it was based.

1.1 TERMS OF REFERENCE

In accordance with our terms of reference, our review focussed on the actuarial work done on the Plan. We were not asked to, and did not review, the design, administration or investment arrangements of the Plan.

The terms of reference for our review were as follows:

> "The panel will review the work of the Acting Chief Actuary in completing the Seventeenth Actuarial Report on the Canada Pension Plan and provide a report to the Superintendent of Financial Institutions expressing its opinion on the following questions:
>
> 1. Is the professional experience of the Acting Chief Actuary and the 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?
>
> 3. Has the Acting Chief Actuary had access to the information he required and completed such tests and analysis on the data as might be expected?
>
> 4. Were the methods and assumptions used in completing this report reasonable?
>
> 5. Does the Seventeenth Actuarial Report fairly communicate the results of the work performed by the Acting Chief Actuary and his staff?
>
> and make such recommendations as the panel feels appropriate in relation to these questions."

1.2 PROCEDURES FOLLOWED

Our review was conducted as a close collaboration of the three panel members. Over the months of February and March 1999, we held two two-day meetings in person and had twelve teleconference meetings. We exchanged dozens of fax and e-mail messages and drafts of report sections.

We interviewed the Acting Chief Actuary and the Head of the Social Insurance Valuation Unit of the Office of the Superintendent of Financial Institutions (OSFI) on two occasions. We spoke to the former Chief Actuary, the Chief Actuary of the U.S. Social Security Administration, officials of the Department of Finance (Canada) and the Director of the Population Projections Section of Statistics Canada, an official of the Population Division of the Department of Economic and Social Affairs of the United Nations and to actuaries outside of government who have particular experience with social insurance programs. We obtained technical materials from the Office of the Chief Actuary, from Statistics Canada, from the U.S. Social Security Administration and from the United Nations.

The Office of the Chief Actuary responded promptly and fully to each request we made for information.

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

1.3 THE CANADA PENSION PLAN

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

Before 1997, contribution rates were set at a level which 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 by Bill C-2 to require an increased measure of advanced funding, to require that the funds not used for immediate benefit payments and expenses be invested in a diversified portfolio of investments and to establish an Investment Board to control the investments.

1.4 STATUTORY ACTUARIAL REQUIREMENTS

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

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

Section 113.1 also refers to "the financing objective of having a contribution rate that is no lower than the rate that, beginning with the year 2003, is the lowest constant rate that can be maintained over the foreseeable future." Section 115 states that projections must extend for at least 75 years into the future.

The federal government adopted the Calculation of Default Contribution Rates Regulation by order-in-council on December 10, 1998. This Regulation has not yet been confirmed by the required two-thirds of the provinces containing two-thirds of the population of Canada. This Regulation, as adopted by the federal government, calls for a default contribution rate calculated as that rate for which the projected ratio of Plan assets-to-expenditures in 2010 matches the corresponding projected ratio in 2060. This differs from the calculation of the "steady-state" contribution rate reported in AR16. In that calculation, the projected ratio of Plan assets-to-expenditures in 2030 matches the corresponding projected ratio in 2100 – i.e., same method as AR17, but different pairing of years.

1.5 ACTUARIAL REPORTS 15 AND 16 (AR15 AND AR16)

The last full actuarial review of the CPP was conducted as at December 31, 1993 and is reported in AR15. After the publication of AR15, to assist with the planning and development of Bill C-2, AR16 was prepared. It too was prepared as at December 31, 1993 but was adjusted to include the Bill C-2 amendments to the CPP.

AR16 presented a best-estimate projection of paygo contribution rates for the Plan as amended rising from 7.83% in 1997 to 11.45% in 2035 and then staying in the 11% - 11.5% range through to 2100.

It also presented a best-estimate steady-state contribution rate to be paid in 2003 and later (based on the 2030/2100 pairing) of 9.9% of contributory earnings. Using this steady-state contribution rate, it projected ratios of assets-to-expenditures peaking at 4.87 in 2020, then dropping to 4.40 in 2035, remaining at that level until 2075, and then gradually reducing to 3.91 in 2100.

Several sensitivity tests were presented in AR15 which show how different the results would be under alternative actuarial assumptions.

1.6 ACTUARIAL REPORT 17

AR17 was prepared as at December 31, 1997. It presents a best-estimate projection of paygo contribution rates for the Plan as amended rising from 8.21% in 1998 to 11.21% in 2035 and then generally staying in the 11% - 11.25% range through to 2100.

It also presents a best-estimate steady-state contribution rate to be paid in 2003 and later (based on the 2010/2060 pairing) of 9.8% of contributory earnings. Using this steady-state contribution rate, it projects ratios of assets-to-expenditures peaking at 4.95 in 2021, then dropping to 4.50 by 2042, and then dropping gradually to 3.54 in 2100. Under a continuation of the current 9.9% contribution rate from 2003 on, it projects ratios peaking at 5.18 in 2022, then dropping to 5.01 in 2035 and then rising to 6.61 in 2100.

The decline in the steady-state contribution rate from 9.9% in AR16 to 9.8% in AR17 is attributed to:

➢ experience losses	+ .2%
➢ changes in actuarial assumptions	- .3%
➢ change in steady-state pairing of years	- .1%
➢ effects of rounding	+ .1%
	- .1%

AR17 presents an expanded array of sensitivity tests.

1.7 COMPLEXITY

The CPP is a complex plan which 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. It will be obvious from a reading of the body of our report that the actuarial computer model used to produce the results in AR17 is an extremely complex model. It projects the intertwining of the plan provisions and current population statistics with projections of future demographic and economic experience.

In our work, we have tended to concentrate on what we consider to be the most important issues, in particular, the data used, the major methodology issues, and the eight key actuarial assumptions.

1.8 INTERPRETATION OF RESULTS

AR17 presents:

- the projected paygo contribution rates year by year through to 2100;
- the steady-state contribution rate;
- a number of sensitivity tests (which illustrate the results which would be obtained under various changes in actuarial assumptions);
- the results which would be obtained using the accrued benefit actuarial cost method (which is commonly used with occupational pension plans);
- a calculation of the internal rate of return of each cohort of participants (the projected rate of return each cohort can expect to achieve on its combined employee and employer contributions).

Only one of these results may translate into actual contributions to the CPP. If the provinces approve the federal Regulation, the steady-state contribution rate will become the default contribution rate. The other results are also useful because they provide information as to the

long-term pattern of costs under the Plan, the unpredictability and variability of the costs, how these costs compare with the costs of occupational pension plans and the value-for-money each cohort of participants may receive.

All of the results are estimates. All but the sensitivity tests represent the Chief Actuary's (or, in the case of AR17, the Acting Chief Actuary's) "best" estimates, with no deliberate margins of conservatism or other deliberate bias.

It is essential to recognize that these results are not predictions. They are not necessarily accurate to one decimal place or even to one percent of contributory earnings. The parameters involved (e.g., fertility rates, net migration rates, mortality rates, real rates of wage increase, real rates of return on investments, each from 1998 through to 2100) are not open to accurate prediction.

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

1.9 OUTLINE OF THIS REPORT

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

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

Section 7 (Other Actuarial Issues) deals with three other actuarial matters on which we have observations and recommendations.

Section 8 (Communication of Results) addresses the last question in our terms of reference.

The Executive Summary provides an overview of our findings.

SECTION 2 - PROFESSIONAL EXPERIENCE

In this section we address the following question :

> "Is the professional experience of the acting Chief Actuary and the staff who worked on the l7th Actuarial Report adequate for carrying out the work required?"

2.1 BACKGROUND

AR17 was submitted to the Minister of Finance on December 15, 1998 by the Acting Chief Actuary (ACA), Michael Hafeman. Mr. Hafeman is a Fellow of the Society of Actuaries (1977) and of the Canadian Institute of Actuaries (1990) and a Member of the American Academy of Actuaries (1979). He is an experienced pension consultant working with Morneau Sobeco, a well-known Canadian actuarial, pension and benefits consulting firm. He undertook the ACA role as a temporary assignment, primarily to complete AR17. Mr. Hafeman was recruited as ACA less than four months prior to the required completion of AR17.

Mr. Hafeman has had more professional experience with the CPP than most actuaries working in Canada; a major element of this experience was the completion of the Review of the l5th Actuarial Report on the CPP carried out by Mr. Hafeman and Mr. B. Gagnon of Sobeco Ernst & Young at the request of the Auditor General (April 17, 1996). This was a substantial assignment involving a detailed review of the assumptions and methodology utilized in the CPP actuarial review process.

The professional who worked most closely with Mr. Hafeman on AR17 is Michel Montambeault, Principal and Head of the Valuation Unit in the Social Insurance Programs Section of OSFI. Mr. Montambeault is a Fellow of the Society of Actuaries (1992) and of the Canadian Institute of Actuaries (1992). He has worked on actuarial reviews of the CPP and other programs in the Social Insurance Programs Section of OSFI for the last 10 years, including the last six years as team leader for the Valuation Unit.

In addition, there are 3 other professionals with actuarial training who worked on AR17. Michel Germain is an Associate of the Society of Actuaries (A.S.A.) with 10 years' experience working in the Unit. Alain Guimond, A.S.A., has 2 years' experience in the Unit and Patrick Dontigny is an actuarial student with 2½ years experience in the Unit.

Extensive work for AR17 was carried out in the period January through July of 1998 under the direction of the previous Chief Actuary, Bernard Dussault, who left OSFI in August, 1998 after seven years as Chief Actuary. An important continuity link in the transition from Mr Dussault to Mr. Hafeman, in the role of Chief Actuary, was provided by Mr. Montambeault.

2.2 OBSERVATIONS

There are very few actuaries working in Canada with experience in valuing and costing social programs like the CPP and Old Age Security. There are many actuaries with extensive experience in valuing and pricing employer-sponsored pension and insurance programs, but the data sources, macro-economic modelling and range of assumptions involved in evaluating social programs are more complex than for employer-sponsored plans and thus employer plan experience is useful but not as useful as previous experience with social programs like the CPP.

We are satisfied that Mr. Hafeman and the staff who assisted him in preparing AR17 have relevant experience and are qualified to carry out the assignment.

2.2.1 Continuity of Staff

Clearly, for each actuarial review of the CPP, it is desirable to have the adjustments to assumptions and changes to data sources and methodologies made by a group of professionals who have had previous experience with the process. The more professionals with previous experience the better, all other things being equal. In the transition from Mr. Dussault to Mr. Hafeman, the responsibility for continuity fell primarily on Mr. Montambeault. This was a strength of the current staffing, but exposes a vulnerability in that there is no clear successor to Michel Montambeault. There needs to be a solid recruiting and succession planning process in place, to build up a mix of more experienced and newer personnel. Competitive compensation is necessary.

Between the triennial reviews of the CPP it is usual for the staff of the Social Programs Section to conduct studies of emerging demographic and other statistics to allow for well-based adjustments of assumptions in the next actuarial review, and to develop improvements in the forecasting techniques used in preparing the Actuarial Reports. The Acting Chief Actuary has recommended that, in addition to the hiring of a permanent Chief Actuary, another professional be added to the staff to address these needs. This is helpful but does not address the succession planning concern raised above.

2.2.2 Structure of the Office of the Chief Actuary

Concern has been expressed regarding the seniority of the position of the Chief Actuary in Canada. In the United Kingdom the Government Actuary completes valuations of social security programs using work processes similar to those employed by the Canadian Chief Actuary. However, the Government Actuary in the UK reports directly to a Minister of the government and there is a Government Actuary's Department which has its own budget process and hiring program.

If the Chief Actuary in Canada reported directly to the Minister of Finance, then we believe the higher status of the office would make it easier to achieve the appropriate build-up of experienced staff than under the present structure in which the Chief Actuary and his staff form one Section within OSFI.

The benefit payments under the CPP and OAS programs are projected to be 5.66% of Gross Domestic Product in 2030. These benefits constitute such a large proportion of the income distribution flows in Canada that the role of the Chief Actuary - so instrumental to the sound operation of those programs - should be highly valued, and the incumbent should be a competent and experienced professional who is competitively remunerated. The Office of the Chief Actuary should be assured of adequate resources.

2.2.3 Advisory Panel

Because of the wide range and complexity of the assumptions and methods involved in actuarial reviews of the CPP, we think it would be desirable to implement a regular process that would provide to the Chief Actuary advice and guidance from a group of experts, including actuaries, demographers and economists. This would help to ensure that a wide range of analysis is considered and to improve the credibility of the actuarial reviews.

In the United States, the Chief Actuary for the Social Security Administration obtains advice regarding the assumptions and methods for use in the Social Security valuations from a Panel of Technical Experts, appointed by the Social Security Advisory Board. The Panel is made up of about 15 actuaries, economists and demographers.

2.3 OPINION ON PROFESSIONAL EXPERIENCE

In our opinion, the professional experience of the Acting Chief Actuary and the staff who worked on AR17 was adequate for carrying out the work required.

2.4 RECOMMENDATIONS

Recommendation 1: We recommend that the Department of Finance and OSFI seriously consider establishing the Chief Actuary's Department, separate from OSFI and reporting directly to the Minister of Finance or to the Minister of State for Finance. The work of the Social Insurance Programs Section-Valuation Unit and the valuation responsibilities for pension plans for the public service, the military, RCMP, MPs and federal judges could be transferred to the new Chief Actuary's Department.

Recommendation 2: We recommend that adequate staff and financial resources be made available to the Chief Actuary's Department to allow for more extensive "inter-valuation" studies of emerging experience and continuing development of improved forecasting and modelling techniques for projecting future contributions and expenditures.

Recommendation 3: We recommend that consideration be given to establishing an Advisory Panel, to advise the Chief Actuary with regard to the assumptions to be used in actuarial reviews of the CPP; the Advisory Panel would be made up of senior and experienced professionals, such as actuaries, economists and demographers.

SECTION 3 - PROFESSIONAL STANDARDS OF PRACTICE

In this section, we address the following question:

> "Has the work [on AR17] been completed in compliance with the relevant professional standards of practice?"

3.1 BACKGROUND

The relevant standards of practice for actuarial work in Canada are those which have been adopted by the Canadian Institute of Actuaries (CIA). The Institute has adopted "Rules of Professional Conduct" that "identify the professional rules and ethical standards with which a member must comply and thereby serve the public interest."

We recognized the following Rules as being relevant to AR17:

Rule 2: A member shall perform professional services with integrity, skill and care.

Rule 3: A member shall perform professional services only when the member is qualified to do so and meets applicable qualification standards.

Rule 4: A member shall ensure that professional services performed by or under the direction of the member meet applicable standards of practice.

Rule 15: A member shall include, where appropriate, in any report or certificate, a statement or reference describing or identifying the data and the actuarial methods and assumptions employed.

Rule 17: A member shall ensure that any calculations or recommendations made by the member or under the member's direction are, wherever possible, based on sufficient and reliable data and that any assumptions made are adequate and appropriate, and subject to Rule 18, that the methods are consistent with the principles established by precedent or common usage within the actuarial profession. [Rule 18 requires the member to qualify his findings

> whenever he is directed to make a report that does not comply with Rule 17 or when the data is not sufficient and reliable.]

We are satisfied that the Acting Chief Actuary and his staff met the requirements of Rule 2 and Rule 15 in the preparation of AR17.

As indicated in Section 2 (Professional Experience) of this report, we are also satisfied that they met the requirements of Rule 3.

Compliance with Rules 4 and 17 is based on the relevant CIA Standards of Practice, which are discussed below.

The CIA has adopted standards of practice in the major areas of professional work by Canadian actuaries, in particular, life insurance, property and casualty insurance, occupational pensions, workers' compensation, self-insured employee benefit plans and the presentation of expert evidence in the courts. However, there is, so far, no standard of practice governing actuarial work for social insurance programs such as the CPP. In the USA, the Actuarial Standards Board has adopted Standard of Practice No. 32 on Social Insurance, on which we will comment below.

The CIA has undertaken a project to restructure and consolidate its standards of practice in the form of "general" standards that apply in all areas of practice and "practice-specific" standards like those already in place. An exposure draft of these "Consolidated Standards of Practice" (CSOP) was released in June, 1995 and has been the subject of extensive discussion since then.

While there are no practice-specific standards that are binding on actuaries working on social insurance programs, there are three sources of prescribed standards of practice that have some degree of relevance to the work done for AR17 : the CIA Standard of Practice for the Valuation of Pension Plans, the draft of the CIA Consolidated Standards of Practice and the U.S. Actuarial Standards Board's Standard of Practice No. 32.

3.2 CIA STANDARD OF PRACTICE FOR THE VALUATION OF PENSION PLANS

This Standard ("the Pension Standard") was adopted in 1994. The wording will be revised after the adoption of CSOP but that should not affect its substance. Section 1.01 explicitly excludes from the scope of the Pension Standard "social security programs, such as the Canada Pension Plan, the Québec Pension Plan or the Old Age Security Act." We believe this exclusion arises

from the character of these plans, which differs from occupational plans where major concerns include benefit security in the event of the plan sponsor's financial incapacity and the year-by-year allocation of plan costs in the employer's financial accounting. However, some portions of the Pension Standard, particularly "Part 2 – Data" and "Part 4 – Actuarial Assumptions" are relevant to the actuarial work on the CPP. The Pension Standard also prescribes various statements and opinions that the actuary's report should contain.

In our view, the work on AR17 complied with the relevant portions of the Pension Standard.

3.3 DRAFT CIA CONSOLIDATED STANDARDS OF PRACTICE (CSOP)

The draft CSOP document runs to 156 pages but these pages include extensive examples and footnote commentary. Even so, it has not been practical for us, in the time available, to pick out all the guidance which is provided in the draft that may be relevant to the AR17, especially since the guidance is still in draft form and not yet authoritative. Both the CSOP pension-specific standard and the current Pension Standard require that the assumptions be appropriate in the aggregate, for the purpose of the report.

As will be seen from our conclusions in Section 5 (Methodology) and Section 6 (Assumptions), even though we may take issue with specific methods or assumptions, we have concluded that the methods and assumptions adopted for the AR17 are, in the aggregate, "reasonable". This is a question we are required by our terms of reference to answer. We have also concluded that the methods and assumptions are "appropriate", as required by the Pension Standard and the draft CSOP.

3.4 ACTUARIAL STANDARD OF PRACTICE NO. 32

This Standard was adopted by the U.S. Actuarial Standards Board in January, 1998. Normally, we would pay no attention in this report to a U.S. Standard but, since it is specifically addressed to a practice area for which there is no Canadian counterpart standard, we thought it would be useful to review it and comment on it in this report.

Many sections of Standard No. 32 deal with areas that are important but where it is obvious that the work on AR17 clearly complies, (e.g. required assumptions and disclosures and the

requirement that the actuary take account of all relevant program features). Less obvious are Section 3.4 of Standard No. 32 on Actuarial Assumptions and Section 3.5 on Sensitivity Testing.

> 3.4 Actuarial Assumptions – The actuarial assumptions, both individually and in combination, should reflect the actuary's best judgement, taking into account anticipated future events affecting the related social insurance program. The actuary should consider the actual past experience of the social insurance program, over both short- and long-range periods, also taking into account relevant factors that may create material differences in future experience.
>
> 3.5 Sensitivity Testing – In addition to using actuarial judgment in selecting assumptions, the actuary should state in an actuarial report that the results depend on the assumptions used and that actual experience is likely to differ from expected. The actuary should perform an analysis of the sensitivity of the program's cost or financing method under reasonable, alternative scenarios that are different from expected experience.

Although 3.4 has a different flavor from the Canadian standards and 3.5 deals with a matter that is not addressed at all in the Canadian standards, we believe that AR17 complies with these two sections.

3.5 OPINION ON PROFESSIONAL STANDARDS

In our opinion, the work on AR17 was completed in compliance with the relevant professional standards.

SECTION 4 - DATA

In this section we address the following question:

> "Has the Acting Chief Actuary had access to the information he required and completed such tests and analysis on the data as might be expected?"

4.1 BACKGROUND

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

Purpose	Examples of Data	Source
current status data	• current population by age and sex	• 1996 census
	• past average earnings	• past censuses
	• current earnings of contributors	• Dep't of Finance estimates
	• current benefits paid	• Human Resources Development Canada (HRDC)
	• current assets	• HRDC, Finance
validation data	• CPP financial transactions	• HRDC, Finance
	• benefit statistics	• HRDC
	• earnings statistics	• HRDC, Revenue Canada
data for assumptions	• economic indices	• Statistics Canada, • Canadian Institute of Actuaries
	• current mortality rates	• Statistics Canada Life Tables
	• future mortality improvement rates	• Social Security Administration (U.S.)
	• fertility rates	• Statistics Canada
	• migration rates	• Statistics Canada
	• disability statistics	• HRDC

The current status and validation data are factual and up to date, except for contributions in the year before the actuarial review date, which are based on estimates prepared by the Department of Finance. Estimates are required because Revenue Canada accounts for the apportionment of pay deductions between EI and CPP only annually, after the end of the year, and not in time for the actual results to be included in the actuarial report.

The data used to develop assumptions include both historical data and various projections of possible future experience. The principal data sources are government departments and agencies, mostly of the Government of Canada.

The data on benefits and earnings received from HRDC are tested in detail for internal consistency and reasonableness. The data from other sources are reviewed for internal consistency and consistency with past data. Any irregularities are checked out with the data source and any data errors are corrected.

The Acting Chief Actuary has advised us that he had access to all data he felt he required to complete his work.

4.2 OBSERVATIONS

- Our investigation confirmed that while there were no problems with access to data, the information obtained from Statistics Canada about emigrants is incomplete and the information about returning emigrants is based on assumptions and not on actual data. Both may be overstated. To the best of our knowledge, there is no alternative source for this information;

- We think it would be useful to expand the sources of data for use in the development of some assumptions, particularly fertility, migration and long-term economic parameters.

4.3 OPINION ON DATA

In our opinion, except for the narrow scope of the data used for certain assumptions and for deficiencies in data on emigrants,

- the current status data are adequate and appropriate for the purpose of the actuarial review;
- the validation data are acceptable for this purpose, but not as fully appropriate as they could be, due to the absence of actual earnings data for validation purposes, for the year before the review date;
- the data used to develop assumptions, apart from the data on net immigration, are appropriate for the purpose of the actuarial review;
- the data testing, when taken in combination with the validation processes described in Section 5 (Methodology) of this report, is adequate and appropriate; and
- the Acting Chief Actuary had access to the information he required.

4.4 RECOMMENDATIONS

Recommendation 4: We recommend that Revenue Canada be requested to provide the Chief Actuary with details of CPP contributions and the earnings of CPP contributors promptly (i.e., within, say, 3 months) after the end of each calendar year.

Recommendation 5: We recommend that Statistics Canada be asked to investigate what steps can be taken to improve the data on emigrants and returning emigrants.

Recommendation 6: We recommend that, in future, additional sources of data, inside and outside of Canada and inside and outside of government, be reviewed to broaden, where appropriate, the data and considerations used to develop actuarial assumptions.

SECTION 5 - METHODOLOGY

In this section, we address the following question:

"Were the methods used in completing AR17 reasonable?"

5.1 BACKGROUND

The results presented in AR17 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 2100.

5.1.1 Macro-simulation Model

The macro-simulation model starts with current and past statistics on 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. It projects anticipated experience in future years based on economic and demographic assumptions relating to the plan as a whole. These assumptions include population parameters such as future fertility and migration rates, and the proportion of the population contributing to the CPP.

This differs from the micro-simulation model used to conduct actuarial valuations of most defined benefit occupational pension plans in Canada. The micro-simulation model starts with current and past data on each plan member and beneficiary of the plan. It then projects anticipated experience in future years based on a shorter list of economic and demographic assumptions some of which relate to the individual members and beneficiaries and some of which relate to the plan as a whole. The typical micro-simulation model does not use such parameters as future fertility and migration rates, and the proportion of the population contributing to the CPP.

Both types of model include assumptions as to future rates of mortality, inflation, real wage gains and rates of return on investments.

5.1.2 Deterministic Approach

The model uses a deterministic, rather than stochastic, mathematical approach. That is, each run of the model produces a single set of projected results for each year up to 2100 rather than a probability distribution of possible results derived from projections of the underlying volatility of one or more of the parameters of the model.

5.1.3 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 some information on the possible range of future actual results.

Two sets of sensitivity tests were conducted. The first set examines separately the effect of a change, both upward and downward, in each of eight parameters (i.e., one-parameter-at-a-time tests). The report states that “the alternative assumptions selected are intended to represent a reasonable range of potential long-term experience”.

The second set of sensitivity tests consists of two tests, one in which all of the low-cost test changes are combined and one in which all of the high-cost test changes are combined. In this set, the impact of the high-cost test changes taken together is an increase in the steady-state contribution rate of 2.9% of contributory earnings. This is considerably greater than the decrease in that rate of 1.7% that results from the combined low-cost test changes.

5.1.4 Actuarial Cost Methods

Results are presented on three actuarial cost methods. The main results of the actuarial review are presented on both the traditional "pay-as-you-go", or " paygo", method and a relatively new, so-called "steady-state" method. In addition, results are presented on the accrued benefit actuarial cost method.

The paygo method projects CPP income and expenditures year by year into the future. In AR17, the projection extends to the year 2100.

The steady-state method used in AR17 is based on a comparison of assets-to-expenditures ratios 10 and 60 years following the review period (i.e., starting three years after the review date, therefore comparing ratios in the years 2010 and 2060 for AR17).

The accrued benefit actuarial cost method is the method used by typical funded defined benefit pension plans. It produces a comparison of current Plan assets to accrued liabilities for the members and beneficiaries currently covered by the CPP and a calculation of normal actuarial cost (the cost of benefits currently accruing).

5.1.5 Back-testing of Results

The methodology is "validated" by a back-testing procedure. The model produces results starting from 1966, the first year of the Plan. In the validation process, the assumptions for years before the actuarial review date are replaced by actual experience values. The results produced by the model are then compared against the actual benefits paid, actual contributions made, actual numbers of beneficiaries and contributors, and the like.

Where there are significant differences, adjustments are made to the model. For example, the actual amounts of widowers' pensions, death benefits and children's benefits have been less than were projected by the model. Accordingly changes have been made to bring these parameters in the model into line with past experience. In AR17, the adjustments were made for both past and future years. These adjustments reflected the benefits paid in 1997 and the pattern of experience of the decade or so preceding the review date.

5.1.6 Reconciliations

Detailed reconciliations are conducted of the current results on the paygo, steady-state and accrued benefit methods against the corresponding results in AR16. These identify the principal causes of the changes from AR16 to AR17, and measure their impacts on the results. The detailed reconciliations serve as a further check on the results of the current review.

5.1.7 Form of Output

The model produces four principal forms of output. These are:

- projected financial results, showing the paygo contribution rate, the assets/expenditures ratio based on the current statutory contribution rates, and other details for each year;
- the steady-state contribution rate;
- a comparison of current Plan assets to accrued liabilities and a calculation of normal actuarial cost, based on the accrued benefit actuarial cost method; and
- the internal rates of return, each of which is the rate of return for a particular year-of-birth cohort that the report estimates will be realized by that cohort when comparing its projected benefits to its total (employee and employer) contributions to the Plan.

5.2 OBSERVATIONS

5.2.1 Deterministic vs. Stochastic Projections

The use of a macro-simulation model and deterministic projections is the normal practice for valuation of public and social security programs. There is some movement in the direction of introducing stochastic processes for some aspects of the projections. This appears to be a useful development, but one which requires considerably more development and testing.

5.2.2 Sensitivity Testing

The approach of producing a single best-estimate set of results (together with sensitivity tests) conforms to the CPP statute, which refers to only one set of results. This differs from the U.S Social Security Administration practice of producing official high, low and intermediate projections.

In all but two of the sensitivity tests of individual assumptions, the upward and downward test changes are of equal magnitude. The two exceptions are net migration rates and disability incidence rates. In both of these cases, the high-cost test change is larger than the low-cost test change. Not surprisingly, the impact of the upward test change is greater than the impact of the downward test change in these two cases. In the other cases, the impacts of the upward and downward test changes are not much different from each other. The test changes selected fall within a range that can be characterized as "currently plausible outcomes" but they do not attempt to encompass "all possible outcomes".

The sensitivity tests in AR17 cover most of the key parameters and provide much useful information on the possible range of future outcomes. We are concerned about misuse by readers of AR17 of the "combined" test results and discuss this further in Section 7 (Other Actuarial Issues) of this report.

We think it would be helpful to develop objective criteria for how far from the best-estimate assumption each sensitivity test assumption should fall. In probability terms, should each be set so as to represent an approximation to, for example, one standard deviation away from the best-estimate assumption or two standard deviations away? We think a consistent approach along these lines would be helpful.

5.2.3 Back-testing of Results

The back-testing procedure is a very powerful and useful procedure which is rarely used in actuarial work for occupational pension plans. The actuaries for such plans monitor the validity of their assumptions through experience studies and the analysis of actuarial gains and losses over the period since the last actuarial review. The CPP back-testing procedure compares actual benefit payments and contributions since the inception of the CPP in 1966 with the amounts that would have been forecast by the current actuarial model. The uses of this comparison are:

- to "validate" that the model reasonably reproduces actual experience;
- to adjust future projections produced by the model ("validation adjustments") on the basis of any "error" indicated by the back-testing comparisons; and
- to detect anomalies such as the apparent under- utilization of certain benefits (e.g. widower's pensions and other benefits payable on the death of a female spouse).

The validation adjustments are based on the experience of the most recent 10 years. The choice of this time period appears to us to be somewhat arbitrary and might be refined by testing and analysis of alternative averaging approaches and time periods.

5.2.4 Under-utilization

It appears to us that more diligent investigation of the causes of such anomalies as the under-utilization of widower's benefits could lead to improvements in the administration of the CPP or the actuarial model, or both.

5.3 OPINION ON METHODOLOGY

In our opinion, under the current CPP legislation and presuming provincial approval of the federal regulation on the calculation of default contribution rates, all of the methodology elements employed in AR17 are appropriate and reasonable for the purposes of the Plan and have been properly applied.

5.4 RECOMMENDATIONS

Recommendation 7: We recommend that the Chief Actuary continue in future to improve the methodology. Examples of possible improvements are:

- application of stochastic processes to aspects of the actuarial review;
- development of objective criteria for selection of sensitivity tests;
- improvements in methodology for "validation adjustments".

Recommendation 8: We recommend that HRDC be asked to investigate further the causes of apparent under-utilization of widower's benefits, death benefits and children's benefits and develop a long term policy as to what actions it may take in this regard. The Chief Actuary could then take this policy into consideration, in addition to past experience, in future actuarial reviews.

SECTION 6 - ASSUMPTIONS

In this section, we address the following question:

"Were the assumptions used in completing AR17 reasonable?

6.1 BACKGROUND

The actuarial review that is required to be made every three years under section 115 of the CPP Act 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 itself complex. The assumptions incorporated into the model for a particular actuarial review reflect the Chief Actuary's judgment, 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 estimates (not predictions) about the future based on the evidence available and then to revisit and review them every one or two or three years and where appropriate, to make "mid-course corrections" in the assumptions as the emerging experience of the Plan deviates from the previous assumptions and the available information on likely future experience changes. In assessing whether to change an assumption and if so, by how much, the actuary must weigh

- long-term historical data;
- shorter-term historical data;
- very recent experience data;
- 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 but where the actuary judges that more recent data for a particular assumption indicate a trend that is likely to continue for the long-term future, the actuary will recognize that trend in adjusting the assumption.

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". From the inception of the CPP, successive Chief Actuaries have maintained a policy of using "best-estimate" assumptions, i.e. assumptions that are about equally likely to understate or overstate the actual experience.

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

The major actuarial assumptions in AR17 can be conveniently divided into two groups:

- "demographic" assumptions that deal with changes in the covered population (fertility, migration and mortality rates) and events (death, disability, retirement) that trigger the starting or stopping of CPP benefit payments or contributions;

- "economic" assumptions that deal with employment, wages, prices and returns on investment.

6.2 DEMOGRAPHIC ASSUMPTIONS

6.2.1 Fertility

The total fertility rate summarizes a set of age-specific fertility rates and indicates the average number of children that would be born to a woman in her lifetime based on those age-specific rates. Like some other assumptions, the approach used in AR17 (and in past Actuarial Reports on the CPP) is to develop one assumption for Canada and a separate one for Québec. The assumptions are used to develop separate population projections for Canada and for Québec. From these the projected population of Canada-less- Québec is derived.

The fertility assumptions in AR17 are lower than those used in AR15 and AR16 and the select period is much longer. For Canada, AR17 assumes an ultimate rate of 1.7 in 2016 and later, compared to the previous assumption of 1.85 in 2000 and later.

The effect of this change on the steady-state contribution rate is an increase of 0.279% of contributory earnings. The effect on the paygo rates, as compared to the paygo rates that would have resulted from using the same assumption as in AR15, is to increase the paygo rates by a steadily increasing amount: .165% of contributory earnings in 2025, .597% in 2050 and .663% in 2100.

The rationale stated in AR17 for this assumption is that it reflects the experience of the last 20 years (fertility rates were much higher before that) and the ultimate assumption is the same as the one adopted by Statistics Canada for its most recent "medium" population projections.

The sensitivity tests for the fertility assumption were a low-cost ultimate rate of 1.9 for Canada and a high-cost ultimate rate of 1.5. These alternative assumptions were used by Statistics Canada for their "high" and "low" projections, respectively. The tests showed a significant variation in the long-term paygo rates (a decrease of 1.02% or an increase of 1.22% of contributory payroll in 2100) but relatively little variation in the steady-state contribution rate (a rounded low-cost decrease of 0.2% and a rounded high-cost increase of 0.1% of contributory earnings).

We note that the Statistics Canada population projections go only as far as 2016 whereas the AR17 projections run to 2100.

The long-term fertility assumption is one of the most difficult for the actuary, since it depends on social, medical and economic factors that are difficult to predict. Following a sharp decline in the 1960's and early 1970's resulting from the development of birth control pills and other social and economic changes, fertility rates in Canada have been relatively stable for the last 20 years. They could decline to the lower levels experienced in Québec and some European countries or could increase in the direction of a "full replacement" rate.

An agency of the United Nations has done some recent population projections for Canada using a somewhat higher ultimate fertility assumption than the one used in AR17. On the other hand, current fertility rates are a little lower than the AR17 assumption.

Opinion on Fertility

On balance, we believe that the AR17 best-estimate fertility assumptions can properly be described as "reasonable".

6.2.2 Immigration

The AR17 assumption is net annual immigration to Canada of 0.61% of population in 1996 grading to 0.60% in 2005 and later, with net migration from Québec to other provinces of 10,000 per year, indefinitely. This assumption is considerably higher than the assumption in AR15 and AR16, which was 0.4% of population in all years with Québec migration to the rest of Canada of 10,000 in 1991 grading to 0 in 2010.

The effect of the change in this assumption was significant. It reduced the steady-state rate by 0.492% of contributory earnings and the long-term (2100) paygo rate by 0.913% of such earnings. The downward changes in the paygo rates for 2025 and later were larger than for any other single change in the assumptions.

AR17 gives the following reasons for the change in the migration assumption:

- that the assumption in all previous reports did not take account of emigrants who later return to Canada (the AR17 assumption does take account of them);
- that the new assumption is consistent with the experience of the last 10 to 15 years;
- that the new assumption reflects the target adopted by the federal government in its 1994 immigration plan; and
- that the new assumption is the same as that adopted by Statistics Canada for its "medium" projections.

The sensitivity tests for the migration assumption were a low-cost emigration rate of 0.75% and a high-cost rate of 0.40%. As with the fertility assumption, these were the alternatives used by Statistics Canada in their "high" and "low" projections. The tests showed a relatively high variation in the medium term (the difference between the high cost and low-cost paygo rates in 2025 was 1.01%, which is larger than the comparable difference for any other single assumption)

but less variation in the long term (2100) paygo rate than the tests for the fertility, mortality, or real wage assumptions. The effect on the (rounded) steady-state rate was a low-cost decrease of 0.3% and a high-cost increase of 0.4%.

Considering both the historical data and the significant effect a change in the immigration assumption has on the results, the reasons given for the magnitude of the change made to this assumption seem to us to be less convincing than the reasons given for the changes to the other demographic assumptions.

The Acting Chief Actuary based his conclusions on data prepared by Statistics Canada contained on the CANSIM database. After adjusting these data for the estimated number of returning Canadians before 1972 using the same assumed rate (50% of emigrants) used by Statistics Canada for years from 1972 through 1996, we estimate the average annual net migration rates as 0.56% of population over the last 45 years, 0.51% over the last 25 years and 0.64% over the last 10 years (all these periods ending with 1996).

Unfortunately, the estimates of both emigrants and returning Canadians are not derived from reliable data. The emigration data are estimates and the returning Canadians data are derived using a simple assumption (used also by Statistics Canada in its population projections 1993-2016), that the number of returning emigrants in any year is approximately equal to 50% of the number of emigrants in that year. Apparently, Statistics Canada now feel that the number of emigrants over the last five years has been materially understated (by more than 50%) and the number of returners for all past years may be a much lower percentage of emigrants than previously thought. These newer findings are based on new survey data. We expect that future Statistics Canada data on migration will show downward revisions to the net immigration.

The assumed rate of 0.60% was based in part on the Statistics Canada projections to 2016 which, in turn, were based to a significant degree, on the government's 1994 immigration plan. We do not think undue weight should be attached to current government policy and immigration targets – these have been subject to frequent changes in the past and the targets are not always met. We note that the targets have dropped since adoption of the 1994 immigration plan. We also question whether an assumption used by Statistics Canada for a 20 year projection into the future is entirely appropriate for a CPP projection of 100 years into the future.

Some increase in the assumption above the previous one of 0.40% seems justified. The inclusion of returning Canadians alone requires an increase in the net immigration rate of between 0.05% and 0.10%. An increase from 0.40% to 0.60%, however, places too much weight on recent

history and not enough on previous history. We note that the assumed immigration rate was 0.40% in AR11 (December 31, 1988), AR14 (December 31, 1991) and AR15 (December 31, 1993) and was below 0.40% before that. The lack of change in the two previous reviews is not surprising since the evidence supporting a higher assumption has emerged only more recently.

Opinion on Immigration

In our opinion, an assumed annual net immigration rate of 0.60% is too high. Even before considering any revisions to the Statistics Canada data, we think a rate in the range of 0.50% to 0.55% would be more appropriate. We also feel that more investigation could have been done before settling on this assumption and this would likely have uncovered the existence of at least some of the data problems relating to emigrants and returning Canadians. For this reason, it is our opinion that 0.50% is a more appropriate best-estimate assumption for the annual rate of net immigration.

6.2.3 Mortality

The mortality assumption for AR17 is based on the 1990-92 mortality rates in the Canada Life Tables, taken as representative of mortality in 1991, with annual decreases in mortality rates in all future years. After 2011, the decreases are based on a study of mortality rate decreases by age and sex which was conducted by the actuaries for the U.S. Social Security system. The results of that study were adjusted for historical differences between Canada and the U.S.A. in mortality rate reductions and the reduction rates were graded from those experienced recently into the ultimate rates in 2011. The mortality assumption for AR15 and AR16 was based on the 1985-87 Canada Life Tables and an earlier U.S. Social Security study of rates of reduction in mortality. The AR17 assumption gives lower mortality rates than those previously assumed.

The effect of the change in the mortality assumption was an increase in the paygo rate for 2100 of 0.460% of contributory earnings and in the steady-state rate of 0.318% of earnings.

The sensitivity tests were a high-cost scenario of ultimate mortality reductions of 150% of the best-estimate rates of reduction and a low-cost scenario of 50% of those rates. The high-cost paygo rates in 2100 are higher than on the best-estimate basis by 0.73% of contributory earnings and the corresponding low-cost rate is lower than the best-estimate basis by 0.76% of contributory earnings. The effect on the steady-state rate is an increase of 0.2% for the high-cost scenario and a decrease of 0.3% for the low-cost.

We note that there is a fairly extensive academic literature on the subject of future mortality reductions. Some innovative approaches to better estimation of these reductions have been published in the last few years and might well be considered by the Chief Actuary who has responsibility for the next triennial actuarial review of the CPP.

The AR17 assumed future rates of reduction in mortality rates are based largely on projected U.S. Social Security rates of reduction in mortality. These U.S. rates of reduction are a little lower than the consensus of a broad group of experts at a seminar on this subject in 1997 that was sponsored by the Society of Actuaries but the difference, in our opinion, is not material.

Opinion on Mortality

In our opinion, the AR17 mortality assumptions are reasonable.

6.2.4 Disability Incidence

The assumption about the incidence of disability takes the form of rates that vary by age and sex. These can be summarized as an aggregate rate based on the current population distribution. The AR17 assumptions for years 2005 and later can be expressed as aggregate rates of 4.0 new disabilities per 1000 eligible male workers with a corresponding female rate of 3.0 per thousand, or a combined rate of 3.5 per thousand. These rates are considerably lower than the aggregate rates of 5.0 used in AR16 and 5.5 in AR15. This is intended to reflect the more stringent administrative rules that were adopted in 1995 and the significant change in the qualification requirements that were introduced as a result of the passage in 1997 of Bill C-2. The rates for AR17 are at about the same level as the disability incidence rates experienced by the CPP before 1990 when the rates started to climb sharply, and are a little higher than the rates experienced in 1996 and 1997.

The effect of the change in the disability incidence assumption from the assumption used in AR16 is identified in AR17 as a reduction in the paygo rates - short term (.266% in 2000), medium term (.683% in 2025) and long term (.579% in 2100), compared to the paygo rates in AR16. The reduction in the steady-state contribution rate is .613% of contributory earnings.

The sensitivity tests of the disability incidence assumption are high-cost aggregate ultimate assumed rates of 5.5 per thousand for males and 4.5 for females and a low-cost rate of 3.5 per thousand for males and 2.5 for females. These rates do not differ by the same amount from the

best-estimate rates of 4.0 for males and 3.0 for females. The high-cost rates differ from the best-estimate rates by three times the difference between the best-estimate rates and the low-cost rates. Not surprisingly, the reduction in costs for the low-cost scenario are much smaller than the increase in costs for the high-cost scenario. The paygo rate goes down by about 0.15% under the low-cost scenario versus an increase of about 0.50% under the high-cost scenario : For the steady-state rate, the low-cost decrease is 0.2% of contributory earnings but the high-cost increase is 0.4%.

We believe that a significant downward change in this assumption was required because of changes in administrative practice, the plan provisions and the observed experience since these changes took place. We think the choice of best-estimate rates of 4.0 for males and 3.0 for females are appropriate.

Opinion on Disability Incidence

In our opinion, the AR17 disability incidence assumptions are reasonable.

6.3 ECONOMIC ASSUMPTIONS

6.3.1 Employment

AR17 identifies "employment" as one of the major actuarial assumptions, and notes that employment levels are reflected in the actuarial model through the proportions (ProEar) for each age/sex grouping of the population, who have earnings in a given year. ProEar rates are affected by the rate of unemployment and also by other factors such as the secular trend of female workforce participation, longer periods of formal education of the young and retirement trends among older workers.

The development of the assumption about future rates of ProEar for AR15 was based on an examination of the actual historical rates back to 1966 and adoption of assumed ultimate rates for 2000 and later years based on extrapolation of some of the observed trends in the historical data. These ultimate rates incorporated an implicit unemployment rate of 7.5%.

The procedure for AR17 was different. The ultimate rates of ProEar for 2010 and later were based on a combination of the approach used in AR15 and the results of projections prepared by Department of Finance economists using a cohort-based model that recognizes different lifetime

employment patterns for different year-of-birth groups. These ultimate ProEar rates are described in AR17 as "consistent with an ultimate unemployment rate of approximately 7.0%".

The ProEar rates assumed in AR17 are generally lower than those in AR15 and result in increases in the estimated cost of the CPP. The increase in paygo rates in 2000 is .475% of contributory earnings but this decreases gradually to an increase in the rate for 2100 of .110%. The increase in the steady-state contribution rate is .239% of contributory earnings.

The sensitivity tests for this assumption were a high-cost scenario with ProEar rates equal to 99% of the best-estimate ProEar rates (this was considered to be equivalent to assuming an unemployment rate of 8% and no changes in the other factors that affect ProEar) and the low-cost scenario with ProEar rates equal to 101% of the best-estimate ProEar rates (said to be equivalent to assuming 6% unemployment). The changes in cost under these test scenarios were very small. The high-cost scenario increased the pay-go rates by no more than .09% of contributory earnings in any year and there is no increase in the rounded steady-state contribution rate. The low-cost rates indicate decreases that mirror the high-cost increases, except for rounding.

We think that the partial use of a cohort-based model when developing this assumption is an improvement.

Some observers have criticized the assumed unemployment rate of 7% as too low. This criticism is largely refuted by the insensitivity of the costs to changes in this assumption. A higher unemployment assumption would result in lower future contributions but it would also result in lower future benefits. The effects of higher unemployment rates in the past 30 years are already built into the benefit calculations of those who were subject to those rates of unemployment. However, the choice of 99% and 101% of the best-estimate ProEar rates as the basis for the sensitivity tests may be too small a deviation from the best-estimates to indicate the effects of larger but conceivable variations, e.g. 10% unemployment.

<u>Opinion on Proportion of Earners</u>

In our opinion, the AR17 assumptions as to the proportions of the population who are earners are reasonable.

6.3.2 Real Wages

Both contributions and benefits under the CPP are affected by wage increases. Since benefits are indexed to remove the adverse effect of inflation, the actuarial model requires an explicit inflation assumption, which is discussed below. The wage increase assumption is separated into two parts: the inflation assumption and the real wage increase assumption.

For AR17, real wages are assumed to increase by 0.6% in 1998 with yearly increases grading up to 1.0% in 2003 and later years. This is very similar to the AR15 and AR16 assumption which was real increases of 1.0% in all years.

The sensitivity tests in AR17 were a high-cost scenario of 0.6% in all years and a low-cost scenario of 0.6% in 1998 grading up to 1.4% in 2003 and later. The paygo rates for 2100 showed an increase for the high-cost scenario of 0.85% of contributory earnings and a decrease for the low-cost scenario of 0.74%. The rounded steady-state contribution rate increased and decreased by 0.4%.

In the Sobeco review of AR15, it was suggested that this is a critical assumption and that more weight should be given to recent experience when considering it. Given the apparent downward trend in this statistic over the last 50 years, an important question is then how to define "recent". According to the CIA Report on Economic Statistics, the average annual rate of real wage increase over the last 74 years (1924-1997) is 1.54%, the last 50 years (1948-1997) 1.57% and the last 25 years (1973-1997) 0.29%.

The ultimate assumption used in the 1997 actuarial report on the Quebec Pension Plan was 1.2%. The assumption used in the most recent valuations of the major occupational pension plans in the public sector in the provinces of Ontario and British Columbia ranged from 1.0% to 2.0%. Available survey evidence on private-sector plans indicates that their real wage valuation assumptions are in a similar range. We received an indication that economists in the Department of Finance thought that a 1% assumption was low. We were advised by the Acting Chief Actuary that he did not solicit the opinions of economists outside the government on this question.

Considering the long-term historical evidence and the range of prevailing real wage assumptions adopted by the actuaries of other large plans, the range of reasonable assumed annual rates of real wage increases appears to us to be from 1.0% to about 1.5%.

Opinion on Real Wages

In our opinion, the real wage increase assumption used in AR17 is in the range of reasonable values. We would, however, select a best-estimate that is slightly higher, perhaps 1.2% per year in 2003 and thereafter.

6.3.3 Price Increases

The rate of price inflation is a necessary assumption for an actuarial review of the CPP. Nominal rates of wage and salary increase and of benefit payments are both affected by inflation but, because the impact of inflation on employment earnings occurs earlier in time than the impact on benefits, the effects on paygo rates and on the steady-state contribution rate of a change in the inflation assumption do not cancel out. An increase in the inflation assumption results in a decrease in the paygo and steady-state contribution rates and vice versa.

The inflation assumption in AR17 is 1% in 1998, increasing to 3% in 2003 and later. This is a decrease from the assumption used in AR15 and AR16, which was 1% in 1995 increasing to 3.5% in 2000 and later. The effect of the change in the assumption was to increase the paygo rates (by 0.172% of contributory earnings in 2000 and by 0.095% in 2100) and the steady-state rate (by 0.209%).

The sensitivity tests for this assumption were a high-cost scenario with an ultimate inflation rate of 2% and a low-cost scenario with an ultimate rate of 4%. The high-cost paygo rates were 0.25% to 0.39% higher than the best-estimate rates and the low-cost paygo rates were 0.20% to 0.33% lower than the best-estimate rates. The rounded steady-state contribution rates were higher by 0.2% and lower by 0.3%, respectively, of contributory earnings.

Historic levels of inflation in Canada have averaged 3.13% per year over the last 74 years (1924-1997), 4.29% per year over the last 50 years (1948-1997) and 5.73% over the last 25 years. In the last 50 years, the rate of inflation has been less than 3.0% in 20 of those years. In the last 25 years, it has been less than 3.0% in only six years, the last six years.

A 1998 survey of private-sector occupational pension plan valuations indicates that the average price-inflation assumption was exactly 3.00%. The assumption used in recent valuations of the large occupational pension plans in the provincial public sector varied in a range from 3.50% to

4.50%. For the 1997 report on the QPP, it was 1% in 1998 increasing to 3% in 2015 and thereafter.

Given both the long term (74 year) average and the prolonged recent decline in Canada's inflation rate, we believe it was appropriate for the Acting Chief Actuary to adopt a lower inflation rate in AR17 than the rate used in AR15 and AR16.

Opinion on Price Increases

The price increase assumption used in AR17 was, in our opinion, reasonable.

6.3.4 Real Rate of Return on Investments

If the CPP were totally unfunded (i.e., if the contributions each year were just enough to cover that year's benefit payments and expenses), then the costs would be equal to the paygo rates and no assumption for the rate of investment return would be required.

However, with the adoption of the steady-state contribution rate approach to financing the plan, a sizeable fund will accumulate (equal to five to six years' benefit payments, according to AR17) and the rate of investment return becomes a material factor in the cost of the plan. 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.

The real rate of return assumption in AR17 is 4% per year for new money invested in the CPP Fund (which excludes the Operating Balance) and 1.5% for the Operating Balance with an ultimate weighted average for the total assets of about 3.88%. The Operating Balance is equal to three months of benefit payments and is generally invested in very short-term securities. The AR17 assumptions for the real rates of return are the same as those adopted for AR16, so the steady-state contribution rate in AR17 was not affected by any change in this assumption, unlike each of the other major assumptions previously discussed. The 4.0% AR16 assumption represented a change from 2.5% in AR15, to take account of the change in investment policy from loans to the provinces to market investments managed by the new CPP Investment Board.

The sensitivity tests for this assumption were to replace the 4.0% best-estimate assumption with a high-cost rate of 3.0% and a low-cost rate of 5.0%. These scenarios have no effect on the

paygo rates but they would increase or decrease the rounded steady-state contribution rate by 0.4% of contributory earnings, in either case, i.e. to 10.2% or to 9.4% of contributory earnings.

The reasons given in AR17 for this assumption consists of the following considerations:

- The average real yield on the QPP account, which is invested in a diversified portfolio, has been around 4%;
- The CIA Report on Economic Statistics indicates average real yields in the last 25 years on a sample of large private pension plans was nearly 5%;
- Historical real yields over the last 50 years on a hypothetical portfolio consisting in equal parts of conventional mortgages, long-term federal bonds, 91-day Treasury Bills, Canadian equities and the U.S. equities would be in the range of 4% to 5%;
- Indexed federal bonds have a market yield a little over 4%.

In our view, these considerations taken together support a best-estimate assumption higher than 4%.

- The 25-year average real return on large private pension plans of nearly 5% is substantially more than 4%;
- The hypothetical portfolio is an unusual asset mix, and in our opinion, a conservative one. The average real return on a portfolio consisting of 50% long-term federal bonds and 50% Canadian equities has averaged 4.92% over the last 74 years, 4.62% over the last 50 years and 4.68% over the last 25 years;
- The yield on indexed bonds (consistently above 4%) seems more like a floor for the expected return on a diversified portfolio rather than an indicator for a best-estimate.

However, the eventual investment policy of the new CPP Investment Board is still unknown and unproven at this time. Moreover, the provinces will have a limited right to renew their 20-year loans as they mature and the extent to which they will exercise this option is unknown at present. Accordingly, there is wisdom in taking a cautious approach to this assumption at the present

time. Even allowing for a suitable degree of caution, we believe that a higher assumption than 4% would still be reasonable.

Opinion on Real Rate of Return

In our opinion, the 4.0% assumption for the ultimate annual real rate of investment return on new fund investments is in the reasonable range. We would, however, select a best-estimate assumption that is slightly higher, perhaps 4.25% per year.

6.4 REASONABLENESS OF THE ASSUMPTIONS IN THE AGGREGATE

In our review of the major actuarial assumptions, we found that each of them, with one exception, was reasonable on the basis of:

- relevant historical data including past CPP experience;
- plan amendments in Bill C-2;
- relevant statistical information from Statistics Canada;
- comparison with assumptions used in the actuarial analysis of the Québec Pension Plan;
- where applicable, comparison with the prevailing practice for valuations of large Canadian occupational pension plans in the provincial public sector and the private sector.

The one exception was the ultimate assumption of net annual immigration to Canada of 0.60% of population, which is discussed in section 6.2.2. We would consider an ultimate net annual immigration assumption of 0.50% of population to be reasonable. Judging from the sensitivity test results, we believe that such a change in the assumption would increase the steady-state contribution rate by about 0.20%.

On the other hand, we believe that the economic assumptions used in AR17 are, in the aggregate, a little conservative. Changing the real rate of investment return from 4.00% to 4.25% (which we think would still be in the "reasonable" range) would reduce the unrounded steady-state

contribution rate by about 0.10% and increasing the ultimate real wage assumption from 1.0% to 1.2% per year (also still in the "reasonable" range) would reduce it by approximately 0.20%. Thus, these reductions in the contribution rate resulting from small changes in assumptions that are now reasonable and that would continue to be reasonable if changed, would more than offset the increase in the contribution rate that would result from changing the immigration assumption to one that we consider reasonable.

6.5 OPINION ON ASSUMPTIONS IN THE AGGREGATE

In our opinion, seven of the eight key assumptions used in AR17 are reasonable and one (net rates of immigration) is not reasonable. Moreover, we believe there is a margin of conservatism in two of the reasonable assumptions. Those margins are sufficient to offset what we believe is a negative margin in the net immigration assumption. We therefore conclude that the assumptions in the aggregate result in a steady-state contribution rate that is equal to a rate that would be produced using a set of assumptions each of which is reasonable.

SECTION 7 - OTHER ACTUARIAL ISSUES

In this section we address three additional actuarial issues which arose in our review. These are:

- use and development of high- and low-cost projections;
- peer review;
- further comments on the nature of the results of actuarial reviews.

7.1 USE AND DEVELOPMENT OF HIGH- AND LOW-COST PROJECTIONS

We have read and heard a number of observers remark that the best-estimate results (the main results in the report) project lower costs than the average of the high- and low-cost "combined" sensitivity tests. In AR17, the best-estimate steady-state contribution rate is 9.8% while the average of the high- and low-cost "combined" sensitivity tests is 10.4% (i.e. the average of 12.7% and 8.1%).

The report states that "the alternative assumptions selected are intended to represent a reasonable range of potential long-term experience". The Acting Chief Actuary has advised us that the high and low-cost "combined" sensitivity tests were not selected with a view to providing equal probability extremes or any other qualities which would make them appropriate for use in an averaging process. We note also that two of the sensitivity tests are not symmetric. In these circumstances, we believe that is not appropriate to create a central estimate by averaging the high- and low-cost "combined" sensitivity tests.

Moreover, the high-cost alternatives for some assumptions may be logically incompatible with the high-cost alternatives for some other assumptions. The simultaneous occurrence of all the high-cost assumptions at the same time may, therefore, be highly unlikely. No matter how carefully the high- and low-cost "combined" sensitivity tests are chosen, we think it is preferable to base funding decisions on best-estimate results rather than to take an average of high-cost and low-cost results.

As noted in Section 5 (Methodology), we think it would be helpful to develop objective criteria for how far from the best-estimate assumption each sensitivity test assumption should fall. In probability terms, should each be set so as to represent an approximation to, for example, one

standard deviation away from the best-estimate assumption or two standard deviations away? We think a consistent and disciplined approach along these lines would be helpful.

We also think there is merit in continuing to produce high-cost and low-cost "combined" sensitivity tests in addition to the one-parameter-at-a-time sensitivity tests. We believe, however, that the high-cost and low-cost "combined" estimates should be developed independently of the one-parameter-at-a-time sensitivity tests. Each high-cost and low-cost "combined" estimate should represent a plausible combination of assumptions and lead to a meaningful estimate, and not be just a combination of all of the one-parameter-at-a-time sensitivity tests. The main estimate, however, should continue to be derived from independent best-estimate assumptions and not be simply the average of the high- and low-cost estimates.

The U.S. Social Security Administration develops official high-cost, low-cost and intermediate estimates. At one time their intermediate estimates were the average of high- and low-cost estimates. For many years, however, the U.S. intermediate estimates have been derived independently from their other two estimates.

7.2 RECOMMENDATIONS

Recommendation 9: We recommend that the Chief Actuary continue to produce high-cost and low-cost "combined" sensitivity tests in addition to the one-parameter-at-a-time sensitivity tests. These high-cost and low-cost estimates should each represent a plausible combination of assumptions and lead to a meaningful estimate.

Recommendation 10: We recommend that the calculation of the steady-state contribution rate should continue to be based on the Chief Actuary's best-estimate derived independently from the high-cost and low-cost estimates.

7.3 PEER REVIEW

It is normal practice among actuaries to arrange for the "peer review" of important actuarial reports prior to the release of those reports to the intended users. "Peer review" normally means a careful and objective critical review carried out by actuaries experienced in the particular field of actuarial practice, but who are not directly responsible for completing the report. After the review is completed, the final report is usually modified to incorporate many of the reviewers'

opinions; then there is a shared responsibility, to some degree, that the final report meets the needs of the user, even when the reviewers do not sign the final report (they may or may not do so).

The usual objectives of peer review are to ensure that:

- the report responds to the questions that it should answer;
- the data are adequate, the methodologies and assumptions are appropriate and the relevant professional standards have been followed;
- the report conveys its findings in a manner that is intelligible to its intended audience.

Based on our inquiries, it appears that a partial peer review of AR17 was conducted by an actuary from another Section of OSFI. This review was generally limited to the third of the above objectives. It appears that there was insufficient time to incorporate many of the reviewer's suggestions into the final report.

7.4 RECOMMENDATION

Recommendation 11: We recommend that, for future actuarial reviews of the CPP, a rigorous and complete peer review process be adopted, with appropriate time allowed for expert and objective analysis of data, assumptions and methods as well as report preparation.

7.5 NATURE OF RESULTS

The projected outcomes of an actuarial review reflect a delicate balance of the effects of the actuarial assumptions selected. For example, in AR17, the projected best-estimate paygo costs are relatively stable after 2030 and very stable after 2050. This state of equilibrium might also occur for some other possible sets of assumptions but there is no rule or principle that says it must occur for all possible sets of assumptions.

The sensitivity tests described in this report demonstrate that some quite plausible sets of assumptions can lead to paygo costs that increase (or decrease) indefinitely, rather than stabilize

at some equilibrium level. For example, the projected continuing increases in life expectancy are approximately offset by the projected continuation of population growth due to continuing relatively high assumed rates of net immigration. Under some sensitivity tests (e.g., lower fertility or net immigration rates), the paygo rates continue to increase indefinitely into the future.

SECTION 8 - COMMUNICATION OF RESULTS

In this section we address the following question:

> "Does the 17th Actuarial Report fairly communicate the results of the work performed by the Acting Chief Actuary and his staff?"

8.1 BACKGROUND

AR17, as presented to the Minister of Finance on December 15th, 1998, is a large cerlox-bound document, about 400 pages in length, with both English and French versions bound together. It consists of the following sections:

	Number of Pages
• Complete index, listing all the sections, tables and graphs	5
• I. Introduction	2
• II. Results based on Best-Estimate Assumptions	10
• III. Key Assumptions descriptions	8
• IV. Comparison with Previous Projections	6
• V. Sensitivity Tests descriptions and results	12
• VI. Actuarial Opinion of Michael Hafeman	1
• Appendix A - Description of the Main Provisions of CPP	16
• Appendix B - Descriptions of Data, Assumptions and Methodology, subdivided into	
I. Population	22
II. Earnings and Benefits	64
III. Pay-As-You-Go Rates, Contribution Rates and Assets	8
• Appendix C - Detailed Financial Tables	32
• Appendix D - Supplemental Actuarial Information	6

8.2 OBSERVATIONS

AR17 is a well-organized document which presents the results in a readable and straightforward manner. It includes many helpful graphs and tables. The sensitivity testing shows the results of both high-cost and low-cost variations for each of 8 key assumptions in addition to the results using the best-estimate assumptions. The overall conclusions are clearly set out.

The few relatively minor deficiencies we have identified are:

- Despite its length, the document does not contain an Executive Summary;
- The single volume is so large at 400 pages that many readers are likely dissuaded from attempting to read it. It contains both the English and French versions of the report and both the main results and the lengthy technical appendices;
- Some tables and graphs are shown for Canada as a whole (e.g. Graph II.1 and Table VII.B.10) while most are shown for Canada excluding Québec. We feel the latter are the most relevant since Québec is covered by another plan (the QPP) and not by the CPP.

8.3 OPINION ON COMMUNICATION OF RESULTS

In our opinion, AR17 fairly communicates the results of the work performed by the Acting Chief Actuary and his staff.

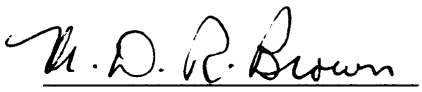
8.4 RECOMMENDATIONS

Recommendation 12: We recommend the inclusion of an Executive Summary in future Actuarial Reports, showing the main results and including information on sensitivity testing.

Recommendation 13: We recommend that the full report be published separately in French and English, each in three volumes. One volume would contain the Executive Summary, a second would contain the major findings (i.e., Sections I to VI and Appendix D in AR17) and the third would contain the technical material found in Appendices A, B and C.

Signatures

This report is respectfully submitted by,



M. David R. Brown,
FSA, FCIA

Robert C. Dowsett,
FSA, FCIA, MAAA

James G. Paterson,
FSA, FCIA

March 31, 1999.