Actuarial Report

(18th)

on the

CANADA PENSION PLAN

As at 31 December 2000

Office of the Superintendent
of Financial Institutions

Office of the Chief Actuary

Bureau du surintendant
des institutions financières

Bureau de l'actuaire en chef

Canada

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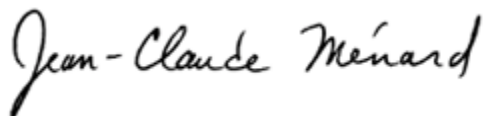Ce rapport est aussi disponible en français.

21 November 2001

The Honourable Paul Martin, P.C., M.P.
Minister of Finance
House of Commons
Ottawa, Canada
K1A 0G5

Dear Minister:

In accordance with section 115 of the *Canada Pension Plan Act*, which provides that an actuarial report shall be prepared every three years for purposes of the contribution rate review by the Minister of Finance and the ministers of the Crown of the provinces, I am pleased to submit the Eighteenth Actuarial Report on the Canada Pension Plan, prepared as at 31 December 2000.

Yours sincerely,

Jean-Claude Ménard

Jean-Claude Ménard, F.S.A., F.C.I.A.
Chief Actuary

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I. Executive Summary

This is the Eighteenth Actuarial Report since the inception of the Canada Pension Plan (CPP) in 1966. It presents the results of an actuarial examination of the status of the Plan as at 31 December 2000, and includes projections of future experience through the year 2075. The previous triennial report is the Seventeenth Actuarial Report as at 31 December 1997, which was tabled in the House of Commons on 16 December 1998.

A. Purpose of the Report

This report has been prepared in compliance with the timing and information requirements of the *Canada Pension Plan Act*.

Section 113.1 of the Act provides that the Minister of Finance and ministers of the Crown of the provinces shall review the state of the CPP once every three years, and may consequently make recommendations to change the benefits or contribution rates, or both. Section 113.1 identifies the factors they consider in their review, including information to be provided by the Chief Actuary.

Another important purpose of the report is to inform contributors and beneficiaries of the current and projected financial status of the Plan. It provides information to evaluate its financial sustainability over a long period, provided the Act remains unchanged. Such information should facilitate a better understanding of the financial status of the Plan and the factors that influence costs, contributing to an informed public discussion of issues related to it.

B. Scope of the Report

Section II presents the general methodology used in preparing the actuarial estimates included in this report, which are based on the key "best-estimate" assumptions described in Section III. Section IV includes information and trends in key demographic and financial indicators, highlights of the projection of the income, expenditures, assets and the steady-state contribution rate determined on the basis of these projections.

A wide variety of factors influence both the current and projected financial position of the Plan. Accordingly, the results shown in this report differ from those shown in previous reports. Likewise, future actuarial examinations will reveal results that differ from the projections included in this report. Section V summarizes the results of tests of sensitivity in key actuarial assumptions under alternative plausible "low-dependency" and "high-dependency" scenarios.

Section VI presents a general conclusion about the short-term and long-term financial status of the Plan based on the results obtained in this report, while Section VII consists of the actuarial opinion regarding this actuarial examination.

The various appendices provide for supplemental information on the provisions of the Plan, the description of the data, assumptions and methods employed, sensitivity analysis,

the long-term financial sustainability of the Plan and the reconciliation of the results shown in this report and those presented in the Seventeenth Report.

C. Main Findings

The results of the actuarial projections of the financial status of the Canada Pension Plan presented in this Eighteenth Report are generally consistent with the trends revealed in the previous actuarial report.

- Demographic changes will have a major impact on the ratio of workers to retirees; the ratio of the number of people aged 20 to 64 to those aged 65 and over is expected to fall from about 4.9 in 2000 to 2.2 in 2075.

- The pay-as-you-go rate is expected to increase steadily from 8.1% in 2001 to 11.0% by 2030, mainly driven by the retirement of the baby boom generation.

- Under the current schedule of contribution rates, the funding level is expected to increase significantly over the next 30 years, with the ratio of assets to the following year's expenditures growing from 2.2 in 2001 to 5.3 by 2030.

- The steady-state contribution rate, which is the lowest rate sufficient to sustain the Plan without further increase, is 9.8% of contributory earnings. This is applicable for 2003 and thereafter and is the same as presented in the previous actuarial report and 0.1% lower than the 9.9% contribution rate currently scheduled.

	Steady-State Contribution Rate
17th Report	9.8%
Changes in Demographic Assumptions	0.2%
Changes in Economic assumptions	
-Employment	(0.1)%
-Inflation	0.1%
-Return on Investments	(0.1)%
Changes in Benefit assumptions	(0.1)%
18th Report	9.8%

- The assets invested by the CPP Investment Board are expected to grow from $6.4 billion at the end of 2000 to $112 billion by the end of 2010. Total assets including the Fund (long-term provincial bonds), the Account (Operating Balance) and the assets of the CPP Investment Board are expected to reach more than $140 billion by 2010.

- The proportion of total assets under the management of the CPP Investment Board is expected to grow from 15% in 2000 to 80% by the end of 2010.

- During the period 2001 to 2020 contributions are more than sufficient to cover the expenditures. Thereafter a portion of the investment earnings is required to make up the difference between contributions and expenditures. In 2075, the portion is 32%.

- Investment earnings, which represent 11% of total revenues (i.e. contributions and investment earnings) in 2001, will represent 26% thereof in 2020, when the asset growth reduces significantly. In 2075, investment earnings represent 33% of total revenues. This clearly illustrates the importance of the investment earnings as a source of revenues to the Plan.

D. General Conclusions

The results contained in this report confirm that the contribution rate, which increased from 7.8% in 2000 to 8.6% in 2001 and will further increase to 9.4% in 2002 and 9.9% in 2003 and thereafter, is sufficient to pay for future expenditures and to accumulate assets worth $141 billion (i.e. 4.2 times the annual expenditures) in 2010. In 2050 the assets are projected to be $1,506 billion or 5.6 times the annual expenditures.

The steady-state contribution rate determined under this report is 9.8%. A more pessimistic demographic outlook, due to the continuing downward trend in fertility rates, and a better economic outlook, especially regarding labour force participation rates, are the main differences relative to the Seventeenth Report. These factors tend to counterbalance each other, leaving the steady-state rate unchanged at 9.8%.

The assets are projected to grow rapidly over the next 20 years as contribution revenues under the 9.9% legislated contribution rate are expected to exceed the expenditures over that period. Assets will continue to grow until the end of the projection period, but at a slower pace, and the asset/expenditure ratio is expected to reach a level of 6.0 by 2075. These are indicators that the Plan is sustainable over the long term, as it is projected that there will be more cash inflows than outflows over the entire projection period. The pool of assets generated over the projection period makes it possible for the Plan to absorb almost any unforeseen economic or demographic fluctuations, which otherwise would have to be reflected in the contribution rate. Thus, despite the projected substantial increase in benefits paid as a result of an aging population, the Plan is expected to be able to meet its obligations throughout the projection period.

II. Methodology

The actuarial examination of the Canada Pension Plan involves projections of its revenues and expenditures over a long period of time, so that the future impact of historical and projected trends in demographic and economic factors can be properly assessed. The actuarial estimates in this report are based on the current provisions of the Plan, data regarding the starting point for the projections, "best-estimate" assumptions regarding future demographic and economic experience, and a methodology for translating this information into estimates of future revenues and expenditures.

The revenue of the Plan includes both contributions and investment earnings. The projection of contributions begins with a projection of the working-age population. This requires assumptions regarding demographic factors such as fertility, migration and mortality. Total contributory earnings are derived by applying labour force participation and job creation rates to the projected population and by projecting future employment earnings; this requires assumptions such as wage increases and proportion of contributors. Contributions to the Plan are obtained by applying the contribution rate to contributory earnings. Investment earnings are projected on the basis of the existing portfolio of assets, projected net cash flows and the assumed rates of return on investments.

Expenditures are made up of the benefits paid out and administrative expenses. Newly emerging benefits are projected by applying demographic assumptions regarding retirement, disability and death to the eligible populations, together with the benefit provisions and the earnings histories of the participants. The projection of total benefits, which include the continuation of benefits already in payment at the valuation date, requires further assumptions, along with an assumption regarding the rate of increase in prices. Administrative expenses are projected based on historical experience. The assets at the end of any year are thus determined by adding the excess of revenues over expenditures for the given year to the assets at the end of the previous year.

The assumptions and results presented in the following sections make it possible to measure the financial status of the Plan in each projection year and to calculate a steady-state contribution rate. The steady-state contribution rate is defined as the lowest level contribution rate, rounded to the nearest 0.1%, that results in the asset/expenditure ratio being the same in the 13th and 63rd year after the valuation date. For this report, the relevant years are 2013 and 2063.

III. Best-Estimate Assumptions

A. Introduction

The information required by statute, which is presented in Section IV, requires making several assumptions regarding future demographic and economic trends. The projections included in this report cover a long period of time (75 years) and the assumptions are determined by putting more emphasis on historical trends than on short-term trends. These assumptions reflect our best judgement and are referred to in this report as the "best-estimate" assumptions. The assumptions were chosen to form a coherent whole, taking into account certain interrelationships among them.

An independent panel of actuaries reviewed the Seventeenth Actuarial Report and released a report in March 1999. The Review Panel supported the actuarial conclusions reached by the then Acting Chief Actuary about the soundness of the Canada Pension Plan. The Review Panel found that the Seventeenth Actuarial Report was prepared in accordance with professional standards, and that the assumptions used by the Chief Actuary were reasonable and within the acceptable range. The Review Panel report made a series of recommendations dealing with data, methodology, assumptions and communication of results. For the Eighteenth Actuarial Report, the Office of the Chief Actuary took action on those recommendations.

In particular, Recommendation #3 of the Review Panel, which dealt with the establishment of an advisory panel of experts to advise the Chief Actuary on the assumptions to be used, was addressed by conducting two seminars on the demographic and economic outlook for Canada. The use of seminars instead of an advisory panel has enabled the Chief Actuary to get opinions from a wide range of individuals with relevant expertise. These seminars were held in March and November of 2000. Eight experts in the fields of demography, economics and social security were invited to present their views. Amongst the participants at these seminars were representatives of the Office of the Chief Actuary, Human Resources and Development Canada and Department of Finance, as well as representatives of provincial and territorial governments.

Table 1 below presents a summary of the most important assumptions used in this report and those used in the previous report. The assumptions are described in more detail in Appendix B of this report.

Table 1 Best-Estimate Demographic and Economic Assumptions

Canada	Report 18 (as at 31 December 2000)	Report 17 (as at 31 December 1997)
Total fertility rate	1.64	1.70
Net migration rate	0.50% of population to 2015 0.52% of population 2020+	0.60% of population
Mortality	1990-92 Life Tables for Canada with future improvements differing by Report	
Canadian life Expectancy at birth:	2000 2025 Males: 76.2 years 78.8 years Females: 81.6 years 83.2 years	2000 2025 Males: 76.2 years 78.0 years Females: 82.2 years 83.8 years
CPP Disability incidence Rates (per 1,000 eligible)	Males: 3.25 Females: 2.75	Males: 4.00 Females: 3.00
Unemployment rate	6.5%	7.0%
Participation rate Proportion of contributors	Aged 15-69: 72.5% (2030) Aged 18-69: 70.4% (2030)	Aged 15-69: N/A* Aged 18-69: 69.8% (2030)
Real-wage differential	1.1% (2015+)	1.0% (2003+)
Rate of increase in prices	3.0% (2015+)	3.0% (2003+)
Real rates of return	Account: 2.0% Fund: 3.5% CPPIB: 4.25%	Account: 1.5% Fund/CPPIB: 4.0%

* The methodology of the Seventeenth Report did not use specifically the labour force participation rates.

B. Demographic Assumptions

The demographic projections start with the Canada and Québec population on 1 July 2000, to which are applied fertility, migration and mortality assumptions. The relevant population for the Canada Pension Plan is Canada less Québec and is obtained by subtracting the projected results for Québec from those for Canada. The population projections are essential to determine the future number of CPP contributors and beneficiaries.

The distribution by age of the population of Canada less Québec has changed considerably since the inception of the Plan in 1966, with the population aging each year since then. The causes of this aging are examined in the following subsections.

1. Fertility

The first cause of the aging of the Canadian population is the large drop in the total fertility rate over the last three decades, relative to the baby boom generation born from the mid-1940s to the mid-1960s. The fertility rate in Canada has dropped rapidly from an average level of about 4.0 per 1,000 women in the 1950s to 1.75 in the late 1970s and to 1.65 over the last two decades. The same observations can be made for Québec except that fertility rates are slightly lower.

The decrease occurred as a result of changes in a variety of social, medical and economic factors. It seems unlikely that fertility rates will return to historical levels in the absence of significant societal changes. It was therefore assumed that the total fertility rate for Canada would increase slightly from its 1997 level of 1.55 (1.46 in 1999 for Québec) to an ultimate level of 1.64 in 2007 (1.60 in 2009 for Québec). As a result, the total fertility rate for Canada less Québec is assumed to be 1.66 in 2010 and thereafter.

2. Mortality

Another element that has contributed to the aging of the population is the significant reduction in age-specific mortality rates. This can be best measured by the increase in life expectancy at age 65, which directly affects how long retirement benefits will be paid to the beneficiaries. Life expectancy at age 65 has increased 20% for men between 1966 and 2000, rising from 13.8 to 16.5 years. For women, life expectancy at age 65 has also increased 20%, from 16.8 to 20.1 years over the same period.

Mortality improvements are expected to continue in the future, but at a slower pace than observed over the last 25 years. The ultimate rates of improvement were established by adjusting the results of a detailed study prepared by the Social Security Administration in the United States for their 2000 trustees report. The adjustments are to reflect, in part, historical differences between Canada and the United States. Rates of improvements are assumed to grade down from their current levels to their ultimate levels by year 2021. Chart 1 shows the changes in life expectancy at age 65 since the Plan inception in 1966 to the end of the projection period.

Chart 1 Trend in Life Expectancy at Age 65
(Canada)
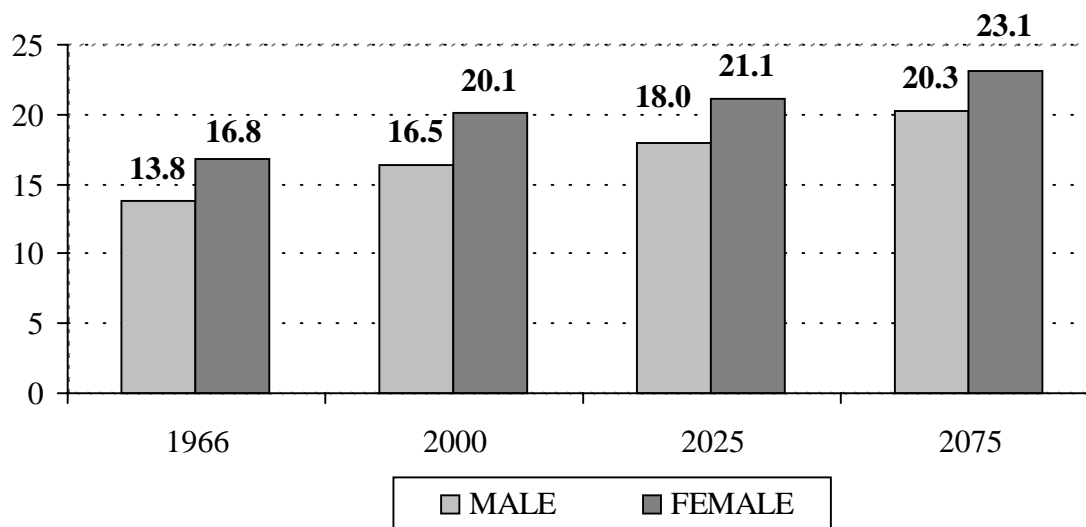
3. Net Migration

Net migration (i.e. the excess of immigration over emigration) is unlikely to materially reduce the continued aging of the population unless (1) the level of immigration rises significantly above what has been observed historically and (2) the average age at immigration falls dramatically.

Net external migration to Canada was 0.47% of the population in 2000 and has averaged about 0.50% of the population over the last 15 to 20 years. Based on a continuation of these net migration levels and the expected pressures on the labour markets due to the impending retirement of the baby boom generation, an ultimate assumption of 0.52% of population has been established for years 2020 and beyond. The initial 0.47% level is gradually increased to 0.50% in 2005, then kept constant until 2015 and finally increased uniformly to 0.52% for 2020 and thereafter to take into account the effects of the anticipated labour shortage. The ultimate 0.52% is comparable to the actual averages observed over the last 10 to 15 years. Assumptions on migration for the projection of the Québec population result in an average net migration rate of about 0.35% for Québec over the projection period.

4. Population Projections

Chart 2 shows the evolution of the Canada less Québec population age distribution since the inception of the Plan. One can easily observe that the triangular shape of the 1970s is becoming more rectangular, thus leading to an older population on average. The effects of the baby boom and baby bust can be seen. The chart also reveals that the number of people aged 85 and over is expected to increase dramatically over the next 50 years.

Finally, Table 2 shows the population for three age groups (i.e. 0-19, 20-64 and 65 and over) over the projection period. The ratio of people aged 20-64 to those aged 65 and over is a measure that approximates the number of working-age people to retirees. Because of the population aging, this ratio drops by more than half during the projection period, from 4.9 in 2001 to 2.2 in 2075.

Chart 2 Population Distribution of Canada less Québec
(thousands)

■ Baby Boomers
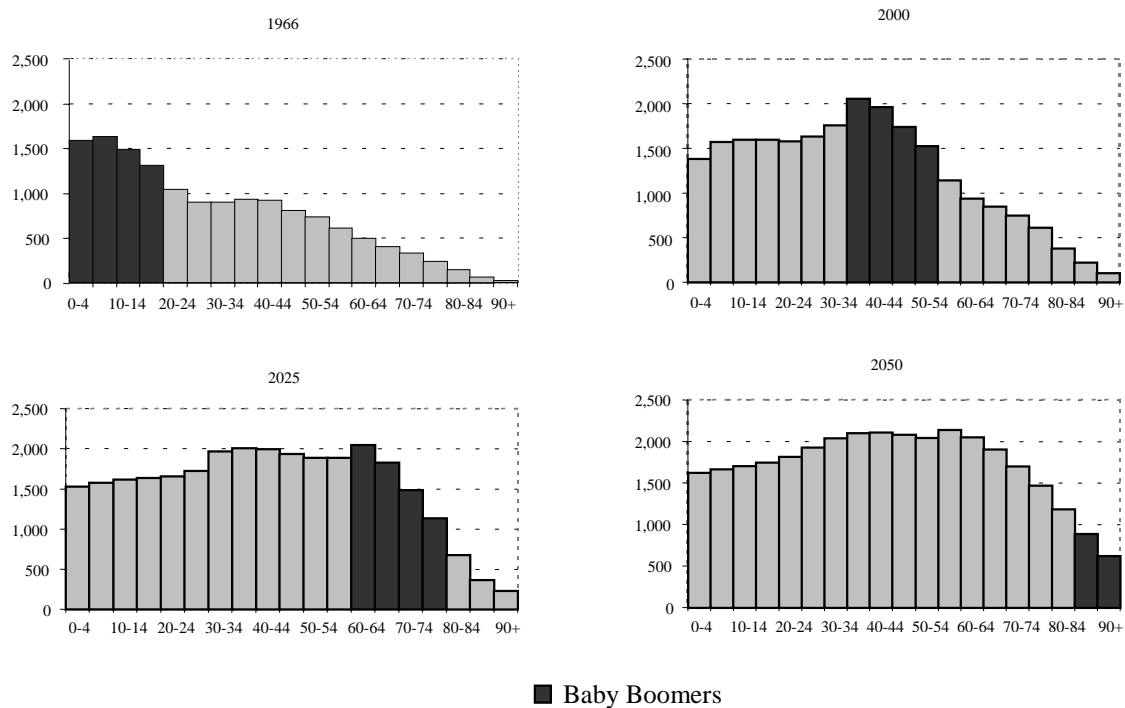
Table 2 Population of Canada less Québec
(thousands)

Year	Total	Age 10-19	Age 20-64	Age 65 and over	Ratio of 20-64 To 65 and over
2001	23,623	6,144	14,526	2,953	4.9
2002	23,868	6,143	14,727	2,998	4.9
2003	24,114	6,139	14,929	3,046	4.9
2004	24,359	6,134	15,129	3,096	4.9
2005	24,605	6,127	15,331	3,147	4.9
2006	24,849	6,121	15,524	3,204	4.8
2007	25,094	6,120	15,708	3,266	4.8
2008	25,338	6,123	15,874	3,341	4.8
2009	25,578	6,116	16,043	3,419	4.7
2010	25,817	6,100	16,220	3,497	4.6
2015	26,985	6,075	16,786	4,124	4.1
2020	28,127	6,224	17,041	4,862	3.5
2025	29,200	6,361	17,119	5,720	3.0
2030	30,153	6,452	17,137	6,564	2.6
2050	32,785	6,738	18,287	7,760	2.4
2075	35,555	7,209	19,557	8,789	2.2

C. Economic Assumptions

The main economic assumptions related to the Canada Pension Plan are the labour force participation rates, employment rates, unemployment rates and average employment earnings increases. For benefit and asset projection purposes, assumptions regarding the rate of increase in prices and rates of return on invested assets are also required.

One of the key elements underlying the best-estimate key economic assumptions relates to the expected labour shortage due to the aging of the population and the retirement of the baby boom generation between 2010 and 2030. Labour force growth will weaken as the population of labour force age expands at a slower pace. The outlook for the participation rates also points to slower labour force growth. Growing labour shortages, especially after 2005, are assumed to force higher real wage growth. The higher real wages will also help to keep people in the labour force that might otherwise retire. The net result is an unemployment rate drop.

1. Labour Force

Employment levels are reflected in the actuarial projection model through the assumption regarding the proportions of the population, by age and sex, who have earnings in a given year. These proportions vary not only with the rate of unemployment, but also reflect trends to increased workforce participation by women, longer periods of formal education among young adults and changing retirement patterns of older workers.

Because of the aging of the population, the labour force participation rates for Canadians aged 15 and over are expected to decline from 66.1% in 2001 to 61.0% by 2030. A more useful measure of the working age population is the participation rates of those aged 15 to 69, which are expected to slightly decline from 73.1% in 2000 to 72.5% in 2030. The participation rate of those aged 55 and over increases gradually after 2001. Moreover, the narrowing of the gap between the age-specific participation rates of men and women continues but at a much slower pace than in the past, except for women aged 55 and over. The participation rate for the latter group increases at a faster rate at the beginning of the period, when the generation of women historically most active in the labour force reaches age 55.

The rate of job growth in Canada was 1.8% on average from 1976 to 2000, based on available employment data; it is assumed that the number of jobs increases by 0.5% in 2001.

An economic slowdown followed by a recovery is assumed at the beginning of the projection period. The job creation rate decreases to 0.3% in 2002. From 2003 to 2007 the rate is about 1.2% on average and 0.5% from 2008 to 2020. For 2020 and thereafter, because of the aging of the population, the job creation rate follows the labour force growth rate of about 0.2%.

The job creation rate is determined on the basis of the short-term economic outlook and the natural unemployment rate, which remains at around 7.0% until 2010. Thereafter, the relative stability of the labour force makes it possible for the natural unemployment rate to drop to 6.5% around 2015.

Chart 3 below shows the impact of the employment and participation assumptions on the distribution of the population aged 15 and over.

Chart 3 Distribution of the Canadian Population Aged 15 and Over
(millions)
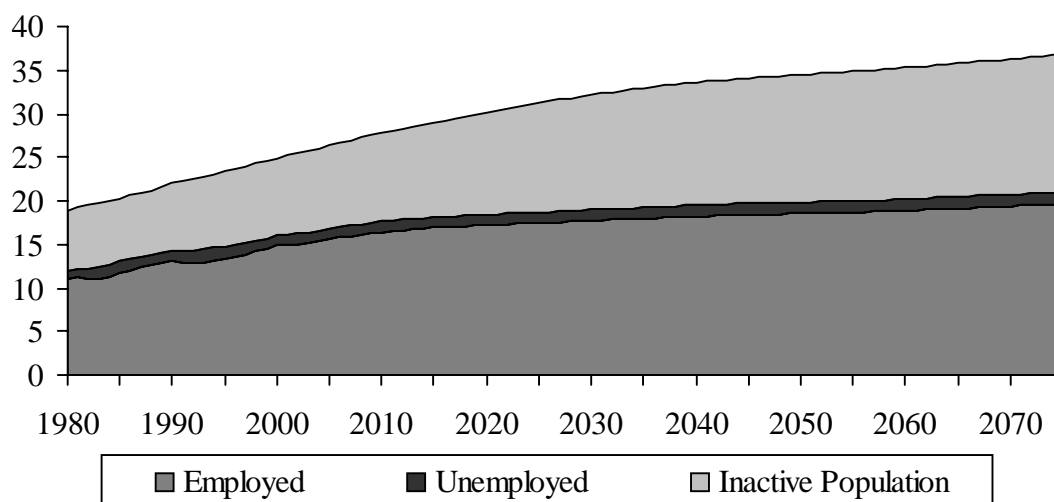
2. **Wage Increases (Average Annual Employment Earnings and Year's Maximum Pensionable Earnings)**

Wage increases impact the financial balance of the Canada Pension Plan in two ways. In the short term, an increase in the average wage translates into higher contribution income, with little immediate impact on benefits. Over the longer term, higher average wages produce higher benefits. The long-term projected financial status of the Plan is more dependent on the differential between the assumed annual rate of wage increases and price increases (the real-wage differential) than on the absolute level of wage increases assumed.

Many factors have influenced the real rate of increase in average annual wages, including general productivity improvements, the move to a service economy, decreases in the average hours worked and fluctuation in the size of the workforce. Considering these factors, together with the historical trends, the expected labour shortage and judgement regarding the long-term course of the economy, an ultimate real wage differential of 1.1% has been assumed for 2015 and thereafter. Combined with the price increase assumption described below, it results in assumed nominal annual increases in average wages of 4.1% in 2015 and thereafter.

Furthermore, the current difference between the real rate of increase in the Average Weekly Earnings (AWE) used in the projection of the Year's Maximum Pensionable Earnings (YMPE) and the real rate of increase in the average annual employment earnings has been recognized. However, consistent with the long-term relationship between the real increases in the AWE and the average annual employment earnings, the current difference

is assumed to reduce to zero over the next eight years. Specifically, taking into account of the latest trends in the AWE, the real increase in AWE is assumed at –1.0% for 2001. For 2002, the real increase in AWE is assumed to be 0.2% and this rate is then gradually increased to reach 1.1% by 2015.

Due to the expected economic slowdown, the real increase in average annual employment earnings is assumed at 0.0% for 2002. For the period 2003 to 2007, the real increase in average annual earnings is then assumed to outpace increases in the AWE. For 2008 and thereafter, the average annual employment earnings are increased at the same rate as for the AWE.

The assumed increase in average annual wages and in the proportions of earners results in projected average annual real increases in total employment earnings of about 1.7% for the period 2001 to 2020. This decreases to about 1.4% ultimately, reflecting the 1.1% real increase in average annual wages and the 0.3% annual growth in the working-age population.

3. Price Increases

Price increases, as measured by changes in the Consumer Price Index, tend to fluctuate from year to year. Based on historical trends, the renewed commitment of the Bank of Canada and the government to keep inflation between 1% and 3% over the next five years and judgement about the long-term outlook for inflation, an ultimate rate of price increase of 3.0% has been assumed for 2015 and thereafter. Recognizing recent experience, the rate of price increase is assumed at 2.8% for 2001 and 2.0% for years 2002 to 2005. From 2006 the rate is then uniformly increased to its ultimate level of 3.0% in 2015.

4. Rates of Return on Investments

The assets of the Canada Pension Plan consist of three components, as follows:

- the Account, which corresponds to three months of benefit payments;
- the Fund, which consists of 20-year loans to the provinces; and,
- the assets invested by the CPP Investment Board.

The real rates of return are the excess of the nominal rates of return over the rates of price increase. For the Account component, which mainly consists of short-term investments, the ultimate real rate of return is assumed at 2.0%, based on historical trends. For the Fund component, again based on historical trends and the market rate of return on provincial long-term bonds, an ultimate real rate of return of 3.5% on new loans has been assumed.

Finally, for the assets invested by the CPP Investment Board, it is assumed that the ultimate real rate of return on investments will be 4.25% net of investment expenses. The initial year reflects recently observed yields for the first ten months of 2001, while the long-term level is in line with historical yields for large pension plans. The assumed long-term real rate of return on CPP Investment Board assets takes into account the distribution

of investments by category. Tables 3 and 4 summarize the main economic assumptions over the projection period.

Table 3 Economic Assumptions

Year	Real Increase in Average Annual Wage	Real Increase in Average Weekly Earnings (AWE/YMPE)	Price Increase	Labour Force			
				Participation Rate	Job Creation Rate	Unemployment Rate	Labour Force Annual Increase
	(%)	(%)	(%)	(%)	(%)	(%)	(%)
2001	(0.50)	(1.00)	2.8	66.1	0.5	7.4	1.2
2002	0.00	0.20	2.0	65.8	0.3	7.8	0.7
2003	0.55	0.30	2.0	65.4	1.0	7.5	0.6
2004	0.60	0.40	2.0	65.4	1.4	7.2	1.2
2005	0.65	0.50	2.0	65.4	1.3	7.1	1.2
2006	0.70	0.60	2.1	65.4	1.2	7.1	1.1
2007	0.75	0.70	2.2	65.3	1.1	7.0	1.0
2008	0.80	0.80	2.3	65.1	1.0	6.9	0.9
2009	0.90	0.90	2.4	65.0	0.9	6.8	0.9
2010	1.00	1.00	2.5	65.0	0.9	6.8	0.9
2015	1.10	1.10	3.0	64.1	0.4	6.5	0.4
2020	1.10	1.10	3.0	62.9	0.3	6.5	0.3
2025	1.10	1.10	3.0	61.7	0.2	6.5	0.2
2050	1.10	1.10	3.0	59.7	0.1	6.5	0.1
2075	1.10	1.10	3.0	59.1	0.2	6.5	0.2

Table 4 Real Rate of Return on New Investments

Year	Account	Fund	CPP Investment Board	TOTAL
	(%)	(%)	(%)	(%)
2001	2.00	3.12	(15.63)	(6.03)
2002	2.00	3.15	4.59	3.91
2003	2.00	3.18	4.59	4.10
2004	2.00	3.21	4.59	4.20
2005	2.00	3.23	4.53	4.23
2006	2.00	3.26	4.47	4.21
2007	2.00	3.29	4.41	4.20
2008	2.00	3.32	4.38	4.19
2009	2.00	3.35	4.35	4.19
2010	2.00	3.38	4.34	4.19
2015	2.00	-	4.29	4.16
2020	2.00	-	4.28	4.16
2025	2.00	-	4.26	4.15
2050	2.00	-	4.25	4.15
2075	2.00	-	4.25	4.16

D. Other Assumptions

This report includes several other assumptions, such as the retirement rates and the disability incidence rates.

1. Retirement Rates

The sex-distinct retirement rates for any given age between 60 and 70 correspond to the number of emerging retirement beneficiaries divided by the product of the population and the retirement benefit eligibility rates for the given age.

The normal retirement age under the Canada Pension Plan is 65. However, since 1987 a person can choose to receive a reduced retirement pension as early as age 60. This provision has lowered the average age at retirement from 65.1 in 1986 to 62.3 in 2000. Over the period 1987-2000 the participation rate of men aged 60 to 64 has dropped from 51.6% to 47.2%; the participation rate for women has not exhibited the same pattern over this period due to their increased presence in the labour force.

There exists a relationship between the retirement rates and the participation rates in the age group 60 to 64. In this report it is assumed that the participation rates for people aged 60 to 64 will increase by 16% from 2001 to 2020. In light of this assumption, the retirement rates were adjusted. The retirement rates in 2000 at age 60 are 34% and 41% for males and females respectively. These rates are assumed to gradually decrease to reach levels of 31% and 38% in 2030 for men and women respectively. The retirement rates are then kept constant for 2030 and thereafter.

2. Disability Incidence Rates

The sex-distinct disability incidence rates at any given age are the number of new disability beneficiaries divided by the total number of people eligible for the disability benefit. Based on the historical Plan experience, the all-age incidence rates for the Plan as a whole have been assumed at 3.25 and 2.75 per thousand eligible for males and females respectively. These rates are 20% and 10% lower than the corresponding rates in the Seventeenth Actuarial Report.

The assumption recognizes in part that incidence rates have significantly declined since 1994. That being said, the rate of decline has slowed down since 1998. The revised assumption also takes into account the narrowing of the gap between male and female incidence rates over the last decade.

IV. Results

A. Overview

The results of the actuarial projections of the financial status of the Canada Pension Plan presented in this report are generally consistent with the trends revealed in the previous actuarial report. The key observations and findings are as follows.

- Demographic changes will have a major impact on the ratio of workers to retirees; the ratio of the number of people aged 20 to 64 to those aged 65 and over is expected to fall from about 4.9 in 2000 to 2.2 in 2075.

- The pay-as-you-go rate is expected to increase steadily from 8.1% in 2001 to 11.0% in 2030, mainly driven by the retirement of the baby boom generation.

- The steady-state contribution rate, which is the lowest rate sufficient to sustain the Plan without further increase, is 9.8% of contributory earnings. This is applicable for 2003 and thereafter and is the same as presented in the previous actuarial report and 0.1% lower than the 9.9% contribution rate currently scheduled.

- Under the current schedule of contribution rates, the funding level is expected to increase significantly over the next 30 years, with the ratio of assets to the following year's expenditures growing from 2.2 in 2001 to 5.3 by 2030.

- The assets invested by the Canada Pension Plan Investment Board are expected to grow from $6.4 billion at the end of 2000 to $112 billion by the end of 2010. Total assets including the Fund (long-term provincial bonds), the Account (Operating Balance) and the assets of the CPP Investment Board are expected to reach more than $140 billion by 2010.

- The proportion of total assets under the management of the Canada Pension Plan Investment Board is expected to grow from 15% in 2000 to 80% by the end of 2010.

- The assets of the Fund, which consists of loans to the provinces, will have been completely rolled over to the CPP Investment Board by year 2033.

B. Contributions

Projected contributions are the product of the contribution rate, the number of contributors and the average contributory earnings.

The contribution rate is set by law and is scheduled to increase from 8.6% in 2001 to 9.9% in 2003 and thereafter.

The number of contributors by age and sex is directly linked to the assumed labour force participation rates and the projected working-age population. Hence, the demographic and economic assumptions described in the preceding sections have a great influence on the

expected level of contributions. In this report the number of CPP contributors increases continually throughout the projection period from 11.0 million in 2001 to 13.3 million over the next 20 years, after which the increases are limited to the projected low growth in the labour force. The growth in contributory earnings, which are derived by subtracting the Year's Basic Exemption (YBE) from pensionable earnings, is linked to the growth in average employment earnings through the assumption regarding annual increases in wages and is affected by the freeze of the YBE since 1998. The average projected contributory earnings in 2001 are $24,814 for men and $20,245 for women.

Total contributions increase by 23% from 2001 to 2003 due to the scheduled increases in the contribution rate, reaching $26.8 billion in 2003. After 2003, contributions increase at the same rate as the total contributory earnings. Table 5 presents the projected components of total contributions.

C. Expenditures

The projected number of total beneficiaries by type of benefit is given in Table 6, while Table 7 presents the same information for males and females separately.

The numbers of retirement, disability and survivor beneficiaries increase throughout the projection period. In particular, due to the aging of the population, one can observe that the number of retirement beneficiaries is expected to more than double over the next 25 years. In 2001 there are 5% fewer female retirement beneficiaries than male ones but by 2005 the numbers are equal and by 2025 the females outnumber the males by 16%. Over the same period, the number of disability and survivor pensioners increases but at a much slower pace than for retirement pensioners.

Tables 8 and 9 show the amounts of projected expenditures by type. Projected expenditures in 2001 are $20.6 billion and reach $31.9 billion in 2010. Table 10 shows the projected expenditures by type expressed as a percentage of the contributory earnings basis. They are referred to as the pay-as-you-go rates. The pay-as-you-go rate is expected to increase significantly from its current level of 8.1% in 2001 to 11.5% by the end of the projection period.

Table 5 Contributions

Year	Contribution Rate	Number of Contributors	Contributory Earnings	Contributions
	(%)	(thousands)	($ million)	($ million)
2001	8.6	10,970	253,577	21,808
2002	9.4	11,039	260,944	24,529
2003	9.9	11,198	271,200	26,849
2004	9.9	11,391	283,066	28,024
2005	9.9	11,573	295,429	29,248
2006	9.9	11,745	308,123	30,504
2007	9.9	11,904	321,464	31,825
2008	9.9	12,050	335,996	33,264
2009	9.9	12,191	351,034	34,752
2010	9.9	12,335	367,821	36,414
2015	9.9	12,942	469,322	46,463
2020	9.9	13,308	596,125	59,016
2025	9.9	13,591	748,125	74,064
2030	9.9	13,925	940,030	93,063
2050	9.9	15,077	2,290,546	226,764
2075	9.9	16,301	6,785,276	671,742

Table 6 Beneficiaries
(thousands)

Year	Retirement*	Disability	Survivor**	Children	Death***
2001	2,846	289	964	234	101
2002	2,925	294	992	238	105
2003	3,010	300	1,021	242	109
2004	3,099	308	1,049	247	114
2005	3,190	318	1,076	253	119
2006	3,291	329	1,103	258	124
2007	3,412	340	1,130	264	129
2008	3,541	352	1,157	268	135
2009	3,673	363	1,184	272	140
2010	3,810	374	1,211	276	146
2015	4,623	416	1,315	290	167
2020	5,549	446	1,423	298	187
2025	6,525	456	1,552	304	210
2030	7,311	451	1,701	309	237
2050	8,660	509	2,160	315	319
2075	9,733	556	2,266	326	340

*   The number given for retirement beneficiaries does not take into account that the retirement pension can be shared between spouses.

**   A beneficiary who receives concurrently a retirement and a survivor pension are counted in each category.

***   This is the number of deceased contributors giving entitlement to a death benefit during the given year.

Table 7 Beneficiaries by sex
(thousands)

Year	Males				Females			
	Retirement*	Disability	Survivor**	Death***	Retirement*	Disability	Survivor**	Death***
2001	1,461	151	140	71	1,385	138	823	29
2002	1,490	152	149	73	1,435	141	844	32
2003	1,522	155	158	75	1,488	145	863	34
2004	1,556	159	166	77	1,543	149	882	37
2005	1,591	164	175	79	1,599	154	901	40
2006	1,630	169	184	82	1,661	160	919	42
2007	1,678	175	193	84	1,734	165	937	45
2008	1,731	181	202	86	1,810	171	955	49
2009	1,785	187	211	88	1,888	176	972	52
2010	1,841	193	221	91	1,969	182	990	55
2015	2,186	214	257	101	2,437	202	1,058	66
2020	2,586	230	292	111	2,963	216	1,131	76
2025	3,017	235	328	124	3,508	221	1,224	86
2030	3,360	232	361	139	3,951	219	1,340	98
2050	3,906	262	422	176	4,754	246	1,738	143
2075	4,442	288	439	186	5,291	269	1,827	154

*   The number given for retirement beneficiaries does not take into account that the retirement pension can be shared between spouses.
**   A beneficiary who receives concurrently a retirement and a survivor pension are counted in each category.
***   This is the number of deceased contributors giving entitlement to a death benefit during the given year.

Table 8 Expenditures
($ million)

Year	Retirement	Disability	Survivor	Children	Death	Administrative Expenses	Total
2001	14,049	2,622	2,908	463	241	353	20,637
2002	14,822	2,716	3,049	483	254	366	21,690
2003	15,530	2,809	3,170	501	267	384	22,661
2004	16,259	2,921	3,291	521	280	400	23,672
2005	17,028	3,051	3,415	543	293	416	24,747
2006	17,858	3,200	3,545	566	307	434	25,909
2007	18,812	3,360	3,680	590	321	452	27,215
2008	19,901	3,527	3,824	613	335	470	28,670
2009	21,087	3,706	3,977	637	349	490	30,247
2010	22,367	3,900	4,140	662	363	513	31,945
2011	23,779	4,090	4,311	688	378	536	33,782
2012	25,380	4,262	4,472	713	387	560	35,774
2013	27,152	4,450	4,642	739	397	586	37,965
2014	29,058	4,657	4,821	765	406	614	40,322
2015	31,114	4,878	5,012	793	416	643	42,856
2016	33,338	5,112	5,215	823	426	673	45,586
2017	35,719	5,351	5,426	853	436	703	48,488
2018	38,278	5,587	5,646	884	446	735	51,574
2019	41,023	5,820	5,876	916	456	767	54,858
2020	43,964	6,052	6,119	948	467	801	58,350
2021	47,092	6,290	6,374	981	478	836	62,050
2022	50,402	6,524	6,643	1,015	489	872	65,946
2023	53,906	6,759	6,929	1,050	501	910	70,055
2024	57,595	6,995	7,232	1,086	513	950	74,371
2025	61,449	7,225	7,553	1,122	525	991	78,865
2026	65,432	7,454	7,894	1,159	538	1,035	83,511
2027	69,506	7,689	8,256	1,197	551	1,081	88,280
2028	73,695	7,919	8,642	1,237	565	1,129	93,185
2029	78,010	8,163	9,051	1,278	579	1,179	98,259
2030	82,418	8,440	9,486	1,320	593	1,231	103,488
2035	105,521	10,325	12,054	1,552	664	1,528	131,645
2040	132,533	12,807	15,291	1,812	727	1,899	165,070
2045	165,857	15,852	19,153	2,100	773	2,355	206,089
2050	208,310	19,397	23,594	2,431	798	2,910	257,440
2055	263,131	23,437	28,685	2,829	807	3,594	322,482
2060	331,399	28,048	34,734	3,311	811	4,446	402,750
2065	413,372	34,508	42,234	3,880	819	5,519	500,333
2070	516,544	42,429	51,672	4,527	834	6,849	622,854
2075	646,877	51,964	63,405	5,265	850	8,485	776,846

Table 9 Expenditures
(millions of 2001 constant dollars)[1]

Year	Retirement	Disability	Survivor	Children	Death	Administrative Expenses	Total
2001	14,049	2,623	2,908	464	241	353	20,637
2002	14,407	2,640	2,963	469	247	356	21,083
2003	14,781	2,673	3,017	478	254	365	21,568
2004	15,171	2,725	3,071	486	261	373	22,088
2005	15,577	2,791	3,125	497	268	381	22,639
2006	16,016	2,871	3,179	509	275	389	23,237
2007	16,527	2,952	3,233	518	282	397	23,910
2008	17,111	3,032	3,288	527	288	404	24,650
2009	17,725	3,116	3,343	535	293	412	25,425
2010	18,364	3,202	3,399	544	298	421	26,227
2011	19,050	3,277	3,454	550	303	429	27,063
2012	19,820	3,328	3,492	557	302	437	27,937
2013	20,650	3,384	3,530	562	302	446	28,874
2014	21,501	3,446	3,568	566	300	454	29,836
2015	22,377	3,508	3,605	571	299	462	30,822
2016	23,282	3,570	3,642	575	298	470	31,835
2017	24,218	3,627	3,679	578	296	477	32,876
2018	25,197	3,678	3,717	582	294	484	33,950
2019	26,218	3,720	3,755	585	291	490	35,060
2020	27,279	3,755	3,797	588	290	497	36,205
2021	28,369	3,789	3,840	591	288	504	37,380
2022	29,478	3,816	3,885	594	286	510	38,569
2023	30,609	3,838	3,934	597	284	517	39,779
2024	31,752	3,857	3,986	599	283	524	41,000
2025	32,890	3,867	4,043	601	281	530	42,211
2026	34,001	3,873	4,102	602	280	538	43,396
2027	35,066	3,879	4,165	604	278	545	44,538
2028	36,097	3,879	4,233	606	277	553	45,643
2029	37,097	3,882	4,305	608	275	561	46,727
2030	38,052	3,896	4,380	609	274	568	47,780
2035	42,025	4,112	4,801	619	264	609	52,429
2040	45,531	4,399	5,254	623	250	652	56,709
2045	49,151	4,698	5,676	623	229	698	61,074
2050	53,250	4,958	6,031	621	204	744	65,809
2055	58,023	5,168	6,325	624	178	793	71,110
2060	63,036	5,335	6,607	630	154	846	76,608
2065	67,826	5,662	6,930	637	134	906	82,094
2070	73,110	6,005	7,313	641	118	969	88,156
2075	78,978	6,344	7,741	643	104	1,036	94,845

(1) For a given year, the value in 2001 constant dollars is equal to the corresponding value in current dollars divided by the cumulative index of the indexation rates for benefits provided for as of 2001 in the projections.

Table 10 Expenditures as Percentage of Contributory Earnings
(pay-as-you-go rates)

Year	Retirement	Disability	Survivor	Children	Death	Administrative Expenses	Total
	(%)	(%)	(%)	(%)	(%)	(%)	(%)
2001	5.54	1.03	1.15	0.18	0.10	0.14	8.14
2002	5.68	1.04	1.17	0.19	0.10	0.14	8.31
2003	5.73	1.04	1.17	0.19	0.10	0.14	8.36
2004	5.74	1.03	1.16	0.18	0.10	0.14	8.36
2005	5.76	1.03	1.16	0.18	0.10	0.14	8.38
2006	5.80	1.04	1.15	0.18	0.10	0.14	8.41
2007	5.85	1.05	1.14	0.18	0.10	0.14	8.47
2008	5.92	1.05	1.14	0.18	0.10	0.14	8.53
2009	6.01	1.06	1.13	0.18	0.10	0.14	8.62
2010	6.08	1.06	1.13	0.18	0.10	0.14	8.68
2011	6.17	1.06	1.12	0.18	0.10	0.14	8.76
2012	6.27	1.05	1.10	0.18	0.10	0.14	8.84
2013	6.39	1.05	1.09	0.17	0.09	0.14	8.93
2014	6.51	1.04	1.08	0.17	0.09	0.14	9.03
2015	6.63	1.04	1.07	0.17	0.09	0.14	9.13
2016	6.76	1.04	1.06	0.17	0.09	0.14	9.25
2017	6.90	1.03	1.05	0.16	0.08	0.14	9.37
2018	7.05	1.03	1.04	0.16	0.08	0.14	9.50
2019	7.21	1.02	1.03	0.16	0.08	0.13	9.64
2020	7.37	1.02	1.03	0.16	0.08	0.13	9.79
2021	7.55	1.01	1.02	0.16	0.08	0.13	9.95
2022	7.72	1.00	1.02	0.16	0.07	0.13	10.10
2023	7.89	0.99	1.01	0.15	0.07	0.13	10.25
2024	8.06	0.98	1.01	0.15	0.07	0.13	10.40
2025	8.21	0.97	1.01	0.15	0.07	0.13	10.54
2026	8.36	0.95	1.01	0.15	0.07	0.13	10.67
2027	8.48	0.94	1.01	0.15	0.07	0.13	10.77
2028	8.59	0.92	1.01	0.14	0.07	0.13	10.86
2029	8.69	0.91	1.01	0.14	0.06	0.13	10.94
2030	8.77	0.90	1.01	0.14	0.06	0.13	11.01
2035	8.95	0.88	1.02	0.13	0.06	0.13	11.17
2040	8.97	0.87	1.04	0.12	0.05	0.13	11.18
2045	9.00	0.86	1.04	0.11	0.04	0.13	11.18
2050	9.09	0.85	1.03	0.11	0.03	0.13	11.24
2055	9.26	0.82	1.01	0.10	0.03	0.13	11.35
2060	9.39	0.79	0.98	0.09	0.02	0.13	11.41
2065	9.40	0.79	0.96	0.09	0.02	0.13	11.38
2070	9.45	0.78	0.95	0.08	0.02	0.13	11.39
2075	9.53	0.77	0.93	0.08	0.01	0.13	11.45

Finally, it is interesting to compare the relative change in the distribution of expenditures by type over the projection period. Chart 4 presents the distribution of expenditures for 2001 and 2050. The increasing proportion of retirement benefits, which rise from 68% in 2001 to 81% in 2050, clearly shows the impact of the aging population on the benefits paid by the Canada Pension Plan.

Chart 4 Distribution of Expenditures by Type
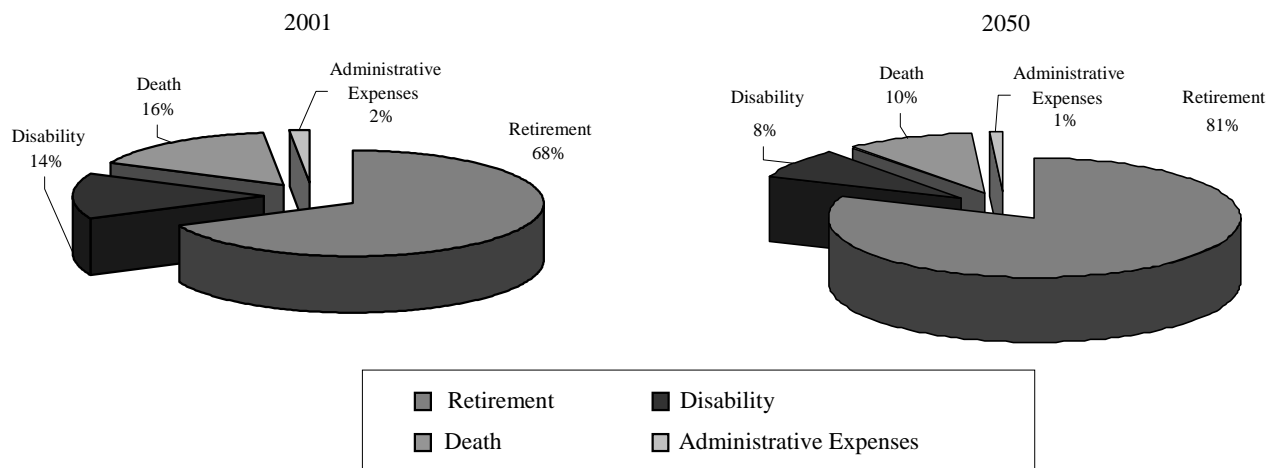
D. Asset Projections

1. Historical Results

The assets as at 31 December 2000 represent the accumulated difference between cash inflows and outflows since the Plan began in 1966. Table 11 presents the historical results from 1966 to 2000 on a cash basis.

2. Projected Financial Status

Tables 12 and 13 show, respectively, in current dollars and in 2001 constant dollars, the projected financial status of the CPP, assuming the current schedule of contribution rates is maintained. The impact of adopting the steady-state contribution rate of 9.8% is discussed in subsection 3 below and the detailed financial projections are presented in Appendix F. The CPP Investment Board assets are valued at market while the Account and Fund components are presented at cost value.

Table 11 Historical Results
($ million)

Year	Paygo Rate* (%)	Contribution Rate (%)	Contributions	Expenditures	Net Cash Flow	Investment Earnings	Assets at 31 Dec.	Yield (%)	Asset/ Expenditure Ratio
1966	0.05	3.60	531	8	523	5	525	2.26	52.47
1967	0.06	3.60	623	10	614	37	1,175	3.71	48.98
1968	0.14	3.60	686	24	662	79	1,916	5.23	35.49
1969	0.29	3.60	737	54	683	128	2,727	5.45	28.12
1970	0.49	3.60	773	97	676	193	3,596	6.29	24.14
1971	0.69	3.60	816	149	666	260	4,523	6.50	21.33
1972	0.90	3.60	869	212	657	333	5,513	6.90	19.83
1973	1.08	3.60	939	278	661	406	6,578	6.73	16.78
1974	1.24	3.60	1,203	392	812	497	7,887	6.91	14.06
1975	1.50	3.60	1,426	561	865	608	9,359	7.36	11.47
1976	1.90	3.60	1,630	816	815	746	10,920	7.62	10.48
1977	2.17	3.60	1,828	1,042	786	889	12,596	7.63	9.72
1978	2.38	3.60	2,022	1,296	727	1,043	14,365	8.01	9.03
1979	2.54	3.60	2,317	1,590	727	1,235	16,328	8.41	8.31
1980	2.79	3.60	2,604	1,965	638	1,467	18,433	8.66	7.64
1981	2.94	3.60	3,008	2,413	595	1,785	20,812	9.50	7.03
1982	3.30	3.60	3,665	2,958	707	2,160	23,679	10.14	6.58
1983	3.70	3.60	3,474	3,598	(124)	2,494	26,049	10.65	6.22
1984	3.87	3.60	4,118	4,185	(67)	2,829	28,811	10.78	5.97
1985	4.02	3.60	4,032	4,826	(795)	3,114	31,130	10.91	5.66
1986	4.16	3.60	4,721	5,503	(782)	3,395	33,743	10.84	4.73
1987	5.08	3.80	5,393	7,130	(1,736)	3,653	35,660	10.77	4.31
1988	5.49	4.00	6,113	8,272	(2,159)	3,885	37,387	10.95	3.98
1989	5.76	4.20	6,694	9,391	(2,698)	4,162	38,852	11.08	3.72
1990	6.08	4.40	7,889	10,438	(2,549)	4,387	40,689	11.33	3.53
1991	6.54	4.60	8,396	11,518	(3,122)	4,476	42,043	10.99	3.22
1992	7.23	4.80	8,883	13,076	(4,193)	4,498	42,347	10.77	2.97
1993	7.72	5.00	9,166	14,273	(5,106)	4,479	41,720	10.59	2.72
1994	8.02	5.20	9,585	15,362	(5,778)	4,404	40,346	10.56	2.52
1995	8.09	5.40	10,911	15,986	(5,075)	4,411	39,683	11.01	2.37
1996	8.28	5.60	10,757	16,723	(5,966)	4,178	37,894	10.58	2.15
1997	8.30	6.00	12,165	17,570	(5,405)	3,971	36,460	10.56	1.97
1998	8.19	6.40	14,473	18,338	(3,865)	3,938	36,535	10.68	1.94
1999	8.05	7.00	16,052	18,877	(2,825)	3,845	37,554	10.73	1.91
2000	8.01	7.80	19,977	19,683	294	3,747	41,595	10.84	2.02

* The pay-as-you-go rates have been calculated using the historical contributory earnings while the contributions are based on an estimate made by the Department of Finance.

Table 12 Financial Status
($ million)

Year	Paygo Rate	Contribution Rate	Contributory Earnings	Contributions	Expenditures	Net Cash Flow	Investment Earnings	Assets at 31 Dec.*	Yield	Asset/ Expenditure Ratio
	(%)	(%)							(%)	
2001	8.14	8.60	253,577	21,808	20,637	1,171	2,823	47,709	6.36	2.20
2002	8.31	9.40	260,944	24,529	21,690	2,839	4,140	54,688	8.38	2.41
2003	8.36	9.90	271,200	26,849	22,661	4,188	4,475	63,351	7.83	2.68
2004	8.36	9.90	283,066	28,024	23,672	4,352	4,824	72,526	7.32	2.93
2005	8.38	9.90	295,429	29,247	24,747	4,500	5,258	82,285	6.99	3.18
2006	8.41	9.90	308,123	30,504	25,909	4,595	5,807	92,687	6.83	3.41
2007	8.47	9.90	321,464	31,825	27,215	4,610	6,413	103,709	6.72	3.62
2008	8.53	9.90	335,996	33,264	28,670	4,594	7,081	115,384	6.65	3.81
2009	8.62	9.90	351,034	34,752	30,247	4,505	7,834	127,724	6.64	4.00
2010	8.68	9.90	367,821	36,414	31,945	4,469	8,638	140,831	6.63	4.17
2011	8.76	9.90	385,591	38,174	33,782	4,392	9,545	154,768	6.65	4.33
2012	8.84	9.90	404,736	40,069	35,774	4,295	10,566	169,629	6.72	4.47
2013	8.93	9.90	425,072	42,082	37,965	4,117	11,730	185,476	6.82	4.60
2014	9.03	9.90	446,685	44,222	40,322	3,900	12,996	202,372	6.92	4.72
2015	9.13	9.90	469,322	46,463	42,856	3,607	14,363	220,342	7.02	4.83
2016	9.25	9.90	492,994	48,806	45,586	3,220	15,635	239,197	7.03	4.93
2017	9.37	9.90	517,715	51,254	48,488	2,766	16,967	258,929	7.05	5.02
2018	9.50	9.90	542,690	53,726	51,574	2,152	18,355	279,436	7.05	5.09
2019	9.64	9.90	568,988	56,330	54,858	1,472	19,788	300,697	7.06	5.15
2020	9.79	9.90	596,125	59,016	58,350	666	21,277	322,640	7.07	5.20
2021	9.95	9.90	623,689	61,745	62,050	(305)	22,820	345,155	7.08	5.23
2022	10.10	9.90	652,912	64,638	65,946	(1,308)	24,417	368,265	7.09	5.26
2023	10.25	9.90	683,593	67,676	70,055	(2,379)	26,056	391,942	7.10	5.27
2024	10.40	9.90	714,969	70,782	74,371	(3,589)	27,727	416,080	7.11	5.28
2025	10.54	9.90	748,125	74,064	78,865	(4,801)	29,429	440,709	7.12	5.28
2026	10.67	9.90	782,780	77,495	83,511	(6,016)	31,158	465,851	7.13	5.28
2027	10.77	9.90	819,702	81,151	88,280	(7,130)	32,922	491,644	7.13	5.28
2028	10.86	9.90	857,916	84,934	93,185	(8,251)	34,732	518,124	7.14	5.27
2029	10.94	9.90	898,032	88,905	98,259	(9,354)	36,592	545,363	7.14	5.27
2030	11.01	9.90	940,030	93,063	103,488	(10,425)	38,507	573,444	7.14	5.27
2035	11.17	9.90	1,178,461	116,668	131,645	(14,977)	49,156	730,778	7.15	5.30
2040	11.18	9.90	1,476,994	146,222	165,070	(18,848)	62,455	928,443	7.15	5.38
2045	11.18	9.90	1,843,364	182,493	206,089	(23,596)	79,547	1,182,436	7.15	5.49
2050	11.24	9.90	2,290,546	226,764	257,440	(30,676)	101,328	1,505,607	7.15	5.59
2055	11.35	9.90	2,841,947	281,353	322,482	(41,129)	128,488	1,908,003	7.15	5.65
2060	11.41	9.90	3,529,612	349,432	402,750	(53,318)	162,014	2,405,003	7.15	5.72
2065	11.38	9.90	4,395,350	435,140	500,333	(65,193)	204,483	3,035,813	7.15	5.81
2070	11.39	9.90	5,466,134	541,147	622,854	(81,707)	258,871	3,842,929	7.16	5.90
2075	11.45	9.90	6,785,276	671,742	776,846	(105,104)	327,576	4,861,435	7.16	5.99

*   The Account and Fund components are valued at cost and the CPP Investment Board component is valued at market.

Table 13 Financial Status
(millions of 2001 constant dollars)

Year	Paygo Rate	Contribution Rate	Contributory Earnings	Contributions	Expenditures	Net Cash Flow	Investment Earnings	Assets at 31 Dec.*
	(%)	(%)						
2001	8.14	8.60	253,577	21,808	20,637	1,171	2,823	47,709
2002	8.31	9.40	253,646	23,843	21,083	2,759	4,024	53,158
2003	8.36	9.90	258,117	25,554	21,568	3,986	4,259	60,294
2004	8.36	9.90	264,128	26,149	22,088	4,060	4,501	67,674
2005	8.38	9.90	270,258	26,756	22,639	4,117	4,810	75,274
2006	8.41	9.90	276,344	27,358	23,237	4,121	5,208	83,127
2007	8.47	9.90	282,424	27,960	23,910	4,050	5,634	91,114
2008	8.53	9.90	288,883	28,599	24,650	3,950	6,088	99,205
2009	8.62	9.90	295,074	29,212	25,425	3,787	6,585	107,363
2010	8.68	9.90	301,987	29,897	26,227	3,669	7,092	115,625
2011	8.76	9.90	308,904	30,582	27,063	3,518	7,647	123,987
2012	8.84	9.90	316,075	31,291	27,937	3,354	8,252	132,470
2013	8.93	9.90	323,281	32,005	28,874	3,131	8,921	141,061
2014	9.03	9.90	330,518	32,721	29,836	2,886	9,616	149,742
2015	9.13	9.90	337,534	33,416	30,822	2,594	10,330	158,469
2016	9.25	9.90	344,286	34,084	31,835	2,249	10,919	167,045
2017	9.37	9.90	351,020	34,751	32,876	1,875	11,504	175,559
2018	9.50	9.90	357,236	35,366	33,950	1,417	12,082	183,944
2019	9.64	9.90	363,638	36,000	35,060	941	12,647	192,174
2020	9.79	9.90	369,885	36,619	36,205	413	13,202	200,192
2021	9.95	9.90	375,716	37,196	37,380	(184)	13,747	207,925
2022	10.10	9.90	381,865	37,805	38,569	(765)	14,281	215,385
2023	10.25	9.90	388,164	38,428	39,779	(1,351)	14,796	222,556
2024	10.40	9.90	394,155	39,021	41,000	(1,979)	15,286	229,381
2025	10.54	9.90	400,421	39,642	42,211	(2,569)	15,752	235,882
2026	10.67	9.90	406,767	40,270	43,396	(3,126)	16,191	242,076
2027	10.77	9.90	413,547	40,941	44,538	(3,597)	16,610	248,038
2028	10.86	9.90	420,219	41,602	45,643	(4,042)	17,012	253,785
2029	10.94	9.90	427,057	42,279	46,727	(4,448)	17,401	259,346
2030	11.01	9.90	434,009	42,967	47,780	(4,813)	17,778	264,757
2035	11.17	9.90	469,338	46,464	52,429	(5,965)	19,577	291,043
2040	11.18	9.90	507,415	50,234	56,709	(6,475)	21,456	318,963
2045	11.18	9.90	546,273	54,081	61,074	(6,993)	23,574	350,410
2050	11.24	9.90	585,533	57,968	65,809	(7,842)	25,902	384,879
2055	11.35	9.90	626,675	62,041	71,110	(9,069)	28,333	420,732
2060	11.41	9.90	671,378	66,466	76,608	(10,142)	30,817	457,463
2065	11.38	9.90	721,186	71,397	82,094	(10,697)	33,551	498,114
2070	11.39	9.90	773,656	76,592	88,156	(11,564)	36,640	543,914
2075	11.45	9.90	828,417	82,013	94,845	(12,832)	39,994	593,535

*   The Account and Fund components are valued at cost and the CPP Investment Board component is valued at market.

Table 14 Assets by Component – Using 9.9% Contribution Rate
($ billion)

Year	Net Cash Flow	Investment Earnings				Assets*			
		Account	Fund	CPPIB	Total	Account	Fund	CPPIB	Total
2001	1.2	0.3	3.3	(0.7)	2.8	5.3	29.9	12.5	47.7
2002	2.8	0.2	3.0	1.0	4.1	5.6	29.0	20.1	54.7
2003	4.2	0.2	2.7	1.5	4.5	5.8	28.2	29.4	63.4
2004	4.4	0.2	2.5	2.1	4.8	6.1	27.3	39.2	72.5
2005	4.5	0.2	2.3	2.7	5.3	6.4	26.4	49.5	82.3
2006	4.6	0.3	2.1	3.4	5.8	6.7	24.6	61.4	92.7
2007	4.6	0.3	1.9	4.2	6.4	7.0	23.1	73.6	103.7
2008	4.6	0.3	1.7	5.1	7.1	7.4	22.0	86.0	115.4
2009	4.5	0.3	1.5	6.0	7.8	7.8	21.3	98.6	127.7
2010	4.5	0.4	1.4	6.9	8.6	8.3	20.3	112.3	140.8
2011	4.4	0.4	1.2	7.9	9.5	8.8	19.6	126.4	154.8
2012	4.3	0.4	1.1	9.0	10.6	9.3	19.1	141.3	169.6
2013	4.1	0.4	1.1	10.2	11.7	9.9	19.0	156.6	185.5
2014	3.9	0.5	1.1	11.4	13.0	10.5	19.0	172.9	202.4
2015	3.6	0.5	1.1	12.8	14.4	11.1	19.0	190.2	220.3
2016	3.2	0.6	1.1	14.0	15.6	11.9	19.0	208.4	239.2
2017	2.8	0.6	1.1	15.3	17.0	12.6	19.0	227.3	258.9
2018	2.2	0.6	1.1	16.6	18.4	13.4	19.0	247.0	279.4
2019	1.5	0.7	1.1	18.0	19.8	14.3	17.8	268.6	300.7
2020	0.7	0.7	1.0	19.6	21.3	15.2	16.4	291.1	322.6
2021	(0.3)	0.8	0.9	21.2	22.8	16.1	14.9	314.2	345.2
2022	(1.3)	0.8	0.8	22.8	24.4	17.1	13.0	338.1	368.3
2023	(2.4)	0.9	0.7	24.5	26.1	18.2	11.4	362.4	391.9
2024	(3.6)	0.9	0.6	26.2	27.7	19.3	9.7	387.1	416.1
2025	(4.8)	1.0	0.6	27.9	29.4	20.4	8.3	411.9	440.7
2026	(6.0)	1.0	0.5	29.6	31.2	21.6	7.3	436.9	465.9
2027	(7.1)	1.1	0.4	31.4	32.9	22.8	6.3	462.5	491.6
2028	(8.3)	1.1	0.4	33.2	34.7	24.1	5.1	488.9	518.1
2029	(9.4)	1.2	0.3	35.1	36.6	25.4	3.8	516.2	545.4
2030	(10.4)	1.3	0.2	37.0	38.5	26.7	2.6	544.2	573.4
2035	(15.0)	1.6	-	47.5	49.2	33.9	-	696.9	730.8
2050	(30.7)	3.2	-	98.2	101.3	66.2	-	1,439.4	1,505.6
2075	(105.1)	9.5	-	318.0	327.6	199.7	-	4,661.7	4,861.4

* The CPP Account and Fund components are valued at cost and the CPP Investment Board component is
 valued at market.

Table 14 presents the projected assets by component, namely the Account, the Fund (federal and provincial bonds) and the assets under the management of the Canada Pension Plan Investment Board.

Assets increase significantly over the next 20 years, from $48 billion in 2001 to $323 billion in 2020. Income is about 40% higher than expenditures over that period. Thereafter, income continues to be higher than expenditures but to a lesser extent. This causes the assets to grow at a much slower pace. The assets reach a level of $4,861 billion by 2075. Table 15 shows in more detail the sources of the cash required to cover the expenditures.

Table 15 Sources of Income and Funding of Expenditures
($ billion)

Year	Expenditures	Contributions	Shortfall	Investment Earnings	Shortfall as % of Investment Earnings	Total Assets
2001	20.6	21.8	0.0	2.8	0.0	47.7
2002	21.7	24.5	0.0	4.1	0.0	54.7
2003	22.7	26.8	0.0	4.5	0.0	63.4
2004	23.7	28.0	0.0	4.8	0.0	72.5
2005	24.7	29.2	0.0	5.3	0.0	82.3
2006	25.9	30.5	0.0	5.8	0.0	92.7
2007	27.2	31.8	0.0	6.4	0.0	103.7
2008	28.7	33.3	0.0	7.1	0.0	115.4
2009	30.2	34.8	0.0	7.8	0.0	127.7
2010	31.9	36.4	0.0	8.6	0.0	140.8
2011	33.8	38.2	0.0	9.5	0.0	154.8
2012	35.8	40.1	0.0	10.6	0.0	169.6
2013	38.0	42.1	0.0	11.7	0.0	185.5
2014	40.3	44.2	0.0	13.0	0.0	202.4
2015	42.9	46.5	0.0	14.4	0.0	220.3
2020	58.4	59.0	0.0	21.3	0.0	322.6
2021	62.1	61.7	0.3	22.8	1.3	345.2
2022	65.9	64.6	1.3	24.4	5.4	368.3
2023	70.1	67.7	2.4	26.1	9.1	391.9
2024	74.4	70.8	3.6	27.7	12.9	416.1
2025	78.9	74.1	4.8	29.4	16.3	440.7
2030	103.5	93.1	10.4	38.5	27.1	573.4
2040	165.1	146.2	18.8	62.5	30.2	928.4
2050	257.4	226.8	30.7	101.3	30.3	1,505.6
2075	776.8	671.7	105.1	327.6	32.1	4,861.4

From Table 15 several conclusions can be drawn.

- The assets grow continuously over the projection period. During the period 2001 to 2020 contributions are more than sufficient to cover the expenditures.

- From 2021 onward, some of the investment earnings are required to fund the net cash outflows. In 2075, 32% of investment earnings are required to pay for benefits.

- Investment earnings, which represent 11% of total revenues (i.e. contributions and investment earnings) in 2001, will represent 26% in 2020, that is, at the time when the asset growth reduces significantly. In 2075, investment earnings represent 33% of total revenues. This clearly illustrates the importance of the investment earnings as a source of revenues to the Plan.

Chart 5 shows the distribution of cash flows by source for the period 1990 to 2025.

Chart 5 Distribution of Cash Flows by Source
(millions of 2001 constant dollars)
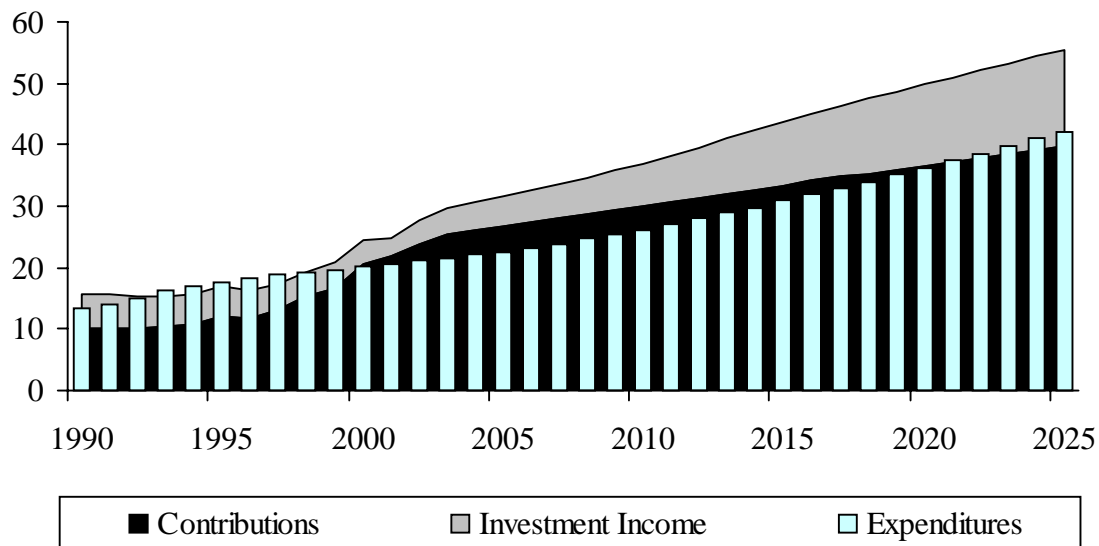
An important measure of the Plan's funding status is defined by the ratio of assets at the end of one year to the expenditures of the next. In 1990 this ratio was 3.5; by 2000 it had declined to 2.0. As can be seen in Chart 6 this ratio is projected to increase over the next two decades, reaching 5.2 by 2020. Thereafter it rises slowly to a value of 6.0 in 2075.

Chart 6 Asset/Expenditure Ratio
(9.9% contribution rate for 2003+)
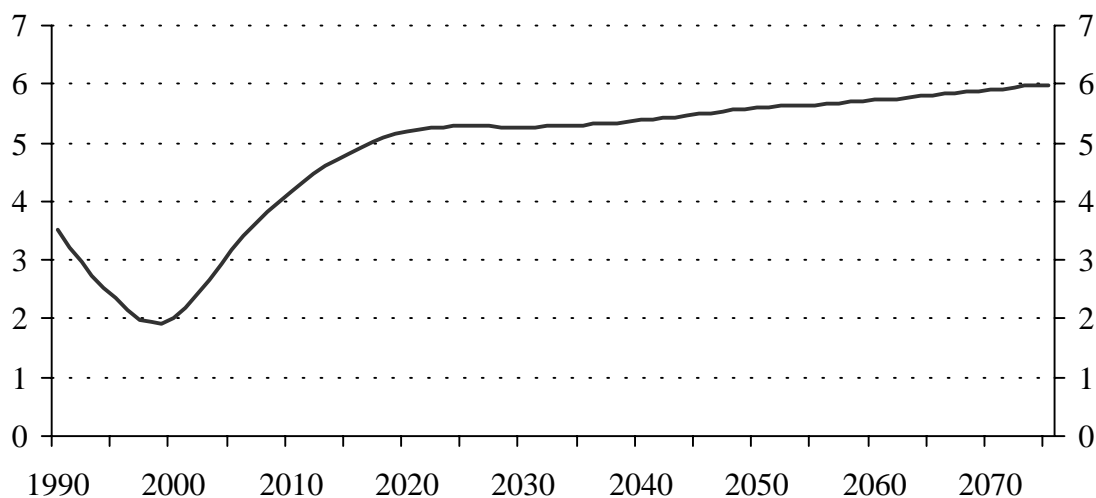
The slowdown in the growth rate of the ratio from 2015 to 2035 results from the retirement of the baby boom generation, which increases the cash outflows of the Plan. The existence of a large pool of assets enables the Plan to absorb the increased outflow and to maintain the contribution rate at 9.9% without impairing the financial soundness of the Plan.

3. Steady-State Contribution Rate

Section 113.1 of the *Canada Pension Plan Act* describes a financing objective of having a contribution rate in 2003 and thereafter that is no lower than the lowest rate that will result in the ratio of the assets to the following year's expenditures remaining generally constant over the foreseeable future. The lowest contribution rate that will meet this objective is referred to as the steady-state contribution rate in this report.

Bill C-2, which came into effect on 1 January 1998, provides that the methodology for calculating the default contribution rates be established by regulation. The regulation was approved on 21 May 2001 and requires a comparison of the asset/expenditure ratio 10 and 60 years following the end of the applicable review period. The methodology has been incorporated in the determination of the steady-state contribution rate for this actuarial report, using the years 2013 and 2063.

The resulting steady-state contribution rate for this report was determined to be 9.8% for years 2003 and thereafter.

The steady-state contribution rate required under subsection 115(1.1) (c) of the *Canada Pension Plan Act* is referred to by the default provisions in subsections 113.1(11.11) to 113.1(11.15). The default provisions may result in adjustments being made to the contribution rate and, perhaps, benefits in payment if the federal and provincial governments reach no agreement in response to the actuarial determination of a steady-state contribution rate. In respect of the current triennial review, the steady-state contribution rate is less than 9.9% and so the default provisions do not apply. Therefore, in the absence of specific action by the federal and provincial governments the contribution rate will remain as currently scheduled, i.e. 9.9% for years 2003 and thereafter.

Table 16 compares the projected funding levels of the Plan if either the scheduled 9.9% contribution rate or the 9.8% steady-state contribution rate is used. A detailed financial projection based on the steady-state contribution rate of 9.8% in 2003 and thereafter is shown in Appendix F of this report.

Table 16 Asset/Expenditure Ratio

Contribution Rate	2001	*2013*	2025	2050	*2063*	2075
9.9% (Statutory)	2.20	4.60	5.28	5.59	5.77	5.99
9.8% (Steady-State)	2.20	4.47	5.00	4.79	4.52	4.17

The steady-state contribution rate will be recalculated in connection with the next triennial actuarial report, to be prepared as at 31 December 2003. It may also be recalculated at any other date to reflect the cost impact of any proposed amendments to the Plan.

4. Asset Projections at Market Value

CPP assets have historically been presented at cost value because they had been traditionally limited to short-term investments for the Account component and 20-year bonds for the Fund component (i.e. loans to provinces). However, since the implementation of Bill C-2 in 1998 the CPP Investment Board has been mandated to invest excess cash flows in the capital markets. Those assets, as is the case for private pension plans, are usually valued at market. All the financial projections presented thus far in this report are at cost value for the Account and Fund components and at market value for the CPP Investment Board.

For consistency with methodology used in large private pension plans and in the Québec Pension Plan actuarial report, we have also made financial projections where all assets, including the Fund, which consists of 20-year loans to the provinces carrying semi-annual interest coupons, have been valued at market. Table 17 presents a summary of the result of such a projection.

Table 17 Financial Status Using Market Value for All Assets
(9.9% contribution rate for 2003+)

Year	Cost/market Value Basis		Market Value Basis	
	Assets at 31 Dec.	Asset/ Expenditure Ratio	Assets at 31 Dec.	Asset/ Expenditure Ratio
	($ million)		($ million)	
2001	47,709	2.2	53,458	2.5
2010	140,831	4.2	139,057	4.1
2020	322,640	5.2	320,514	5.2

The market value of assets as at 31 December 2001 under this approach is $53 billion as compared to a $48 billion cost value. This has the effect of increasing the asset/expenditure ratio in 2001 from 2.2 to 2.5. The market value approach has a reducing impact over the next 20 years as the Fund component diminishes and the last bond comes to maturity and is rolled over to the CPP Investment Board in 2033. The steady-state contribution rate under the market value approach is the same 9.8% obtained under the cost value approach.

Future actuarial reports may present the financial status of the Plan based only on the market value approach. The new investment policies make it more realistic to use a market value approach in projecting assets, especially as the proportion of assets under the CPP Investment Board is expected to grow to over 95% over the projection period. Moreover, this will be more consistent with methods used for large private pension plans and for the Québec Pension Plan actuarial reports.

V. Sensitivity Analysis

A. Introduction

The future income and outgo of the Canada Pension Plan depends on many economic and demographic factors, including labour force, average earnings, productivity, inflation, fertility, mortality, migration, retirement patterns and disability rates.

The income will depend on how these factors affect the size and composition of the working population and the level and distribution of earnings. Similarly, the outgo will depend on how these factors affect the size and composition of the beneficiary population and the general level of benefits.

The projected long-term financial status of the Plan is based on assumptions; the objective of this section is to present plausible alternative scenarios. The alternatives presented illustrate the sensitivity of the long-term projected financial position of the Plan to changes in the future economic and demographic outlook. These scenarios portray a generally more optimistic (low-dependency scenario) and pessimistic (high-dependency scenario) future, in terms of the financial status of the Plan.

The scenarios reflect the possible outlooks on each of the principal assumptions, taking into account the interrelationships among these assumptions. For example, one could assume a much lower fertility rate but might also assume that immigration policies would change to partly compensate for the reduction in population growth that would otherwise occur. As another example, one may suggest longer life expectancy at age 65 combined with an increased average age at retirement. The choice of assumptions will always remain subjective to a certain degree and one could always argue that the range of possible projected outcomes presented herein is not realistic. However, we must keep in mind that these alternative scenarios are only presented to provide a reasonable range of possible future outcomes for the costs of the Plan.

Because the projected financial status of the Plan is very sensitive to the assumed demographic outlook, the alternative scenarios presented in this section are demographically based. First we look at a low-dependency alternative where the ratio of retirees to workers would be lower than under the best-estimate assumption. The second scenario has a ratio of retirees to workers that is higher than the best-estimate and can be referred to as the high-dependency scenario. The economic outlook under both demographic alternatives has been adjusted to reflect the anticipated effects of a modified demographic environment on the main economic variables that affect the Plan.

Sensitivity tests on an individual assumption basis were also performed for the main assumptions and are presented in Appendix C of this report.

B. Low-Dependency Scenario

Under the low-dependency scenario, it is assumed that the total fertility rate would be 1.80 for Canada and 1.75 for Québec. These are 0.15 higher than the best-estimate assumption. These rates could be attained if the current increasing trend in fertility for those aged 30

and over is extrapolated further in time than has been done under the best-estimate scenario. These levels of fertility remain well under the replacement rate of 2.1 and correspond to the 1970s experience.

Net migration to Canada is assumed to reach a level of 0.6% of the population by year 2005. This is a 15% increase from the best-estimate and corresponds to the level of migration observed during the mid-1990s. Mortality is assumed to improve at half the rate assumed in the best-estimate scenario. This reflects to a certain degree the slowdown in mortality improvements observed over the last few years. This results in life expectancy at age 65 being reduced by about one year for both males and females.

The combination of these low-dependency assumptions results in a dependency ratio of those aged 65 and over to the working-age population (20-64) of 0.38 (or 2.65 workers per retiree) in 2050. This ratio is 11% lower than under the best-estimate scenario where this ratio reaches a level of 0.42 (or 2.36 workers per retiree) in 2050.

It was assumed that under a better demographic outlook (low-dependency ratio) the anticipated labour shortage would be less severe. As a result, it was assumed that the ultimate unemployment rate would be slightly higher than under the best-estimate, i.e. 7.0% as opposed to 6.5%, and that the labour force participation rates would be somewhat lower, especially for ages 55 and over. With a larger labour force there would be less pressure to work to a later age and both employers and unions would more easily manage early retirement.

Furthermore, due to the reduced risk of an anticipated labour shortage, there would be fewer pressures on average wages, as the demand for workers would be met more easily. For this reason, the assumed ultimate real wage increase was reduced from 1.1% to 1.0%. Prices are assumed to be lower under such a scenario as the average consumer demand for goods can be met with more ease through a larger labour force. The ultimate price assumption was set at 2.75% as opposed to 3%.

Disability incidence rates were reduced under this scenario as slightly better economic conditions prevail. Disability incidence rates were set at 3.0 and 2.5 per thousand for males and females respectively.

Under this scenario, the ultimate real increase in total employment earnings is 1.6% as opposed to 1.4% under the best-estimate. The lower real-wage increases under the low-dependency scenario are more than offset by the higher population increases, and so there is a larger real increase in total employment earnings.

Finally, capital markets are assumed to perform better under such conditions as individuals are generally better off economically and are willing to take on additional risk. This would on average yield a higher return on their investments. For this purpose, under this alternative, the real rates of return on the Account, the Fund and the CPP Investment Board asset components were increased by 0.25% to 2.25%, 3.75% and 4.50% respectively.

C. High-Dependency Scenario

Under the high-dependency scenario, it is assumed that the total fertility rate would be 1.50 for Canada and 1.45 for Québec. These are 0.15 lower than under the best-estimate assumption. These rates are plausible, as they are only slightly lower than current observed total fertility levels and could be attained if fewer women have multiple births over their lifetime.

Net migration to Canada is assumed to fall to a level of 0.4% of the population by year 2005. This is 0.12% lower than the best-estimate assumption of 0.52% and corresponds to the level of migration observed during the recession of the early 1980s. Mortality is assumed to improve at a rate that is 50% higher than assumed in the best-estimate scenario. This results in life expectancy at age 65 being increased by about one year for both males and females.

The combination of these high-dependency assumptions results in a dependency ratio of the 65 and over to the working-age population (20-64) of 0.48 (or 2.10 workers per retiree) in 2050. This is 12% higher than under the best-estimate scenario where the dependency ratio reaches a level of 0.42 (or 2.36 workers per retiree) in 2050.

It was assumed that with a poorer demographic outlook (high-dependency ratio) the anticipated labour shortage would be more severe. For this purpose, it was assumed that the ultimate unemployment rate would be slightly lower than under the best-estimate, i.e. 6.0% as opposed to 6.5%, and that the labour force participation rates would be somewhat higher, especially for ages 55 and over. With a smaller labour force there would be more pressure to work to a later age and early retirement would be more difficult to manage for both employers and unions.

Furthermore, due to the increased risk of a labour shortage, there would be upward pressure on average wages, as the demand for workers would be met with greater difficulty. For this reason, the assumed ultimate real wage increase was increased from 1.1% to 1.2%. Prices are assumed to be higher under such an environment as the consumer demand for goods could not be met as economically by a reduced labour force. The ultimate price assumption was set at 3.25% as opposed to 3%.

Disability incidence rates were increased under this alternative as slightly worse economic conditions prevail. Disability incidence rates were set at 3.5 and 3.0 per thousand for males and females respectively.

Under this scenario, the ultimate real increase in total employment earnings is 1.1% as opposed to 1.4% under the best-estimate. The higher real-wage increases are more than offset by the lower population increases, and so there is a smaller real increase in total employment earnings.

Finally, capital markets are assumed to perform worse under such conditions as individuals are generally worse off economically and are less willing to take on risk. This would on average yield a lower return on their investments. For this purpose, under this

alternative, the real rates of return on the Account, the Fund and the CPP Investment Board asset components were decreased by 0.25% to 1.75%, 3.25% and 4.00% respectively.

D. Results

Table 18 presents a summary of the assumptions used in the sensitivity analysis. Tables 19 and 20 present the financial development under both the low- and high- dependency scenarios, respectively. Both projections assume the currently scheduled contribution rate of 9.9%. The steady-state contribution rate was 9.4% and 10.3% for the low- and high-dependency scenarios, respectively. Chart 7 shows the evolution of the asset/expenditure ratio under the low-dependency, best-estimate and high-dependency scenarios.

Table 18 Summary of Sensitivity-Test Assumptions

Canada	Low- Dependency	Best-Estimate	High-Dependency
Total fertility rate	1.80	1.64	1.50
Net migration rate	0.60%	0.52%	0.40%
Mortality	50% of best-estimate improvement rate	1990-92 Canada Life Tables with improvements	150% of best-estimate improvement rate
CPP disability incidence rates (per 1,000 eligible)	Males 3.00 Females 2.50	Males 3.25 Females 2.75	Males 3.50 Females 3.00
Unemployment rate	7.00%	6.50%	6.00%
Real-wage differential	1.00%	1.10%	1.20%
Rate of increase in prices	2.75%	3.00%	3.25%
Real rate of return on new investments	Account: 2.25% Fund: 3.75% CPPIB: 4.50%	Account: 2.00% Fund: 3.50% CPPIB: 4.25%	Account: 1.75% Fund: 3.25% CPPIB: 4.00%
Labour force participation (2030)	Males 15-69: 76% Females 15-69: 66%	Males 15-69: 77% Females 15-69: 68%	Males 15-69: 78% Females 15-69: 69%
Steady-State Rate	**9.4%**	**9.8%**	**10.3%**

Chart 7 Asset/ Expenditure Ratio Under Low- and High-Dependency Scenarios
(9.9% contribution rate for 2003+)
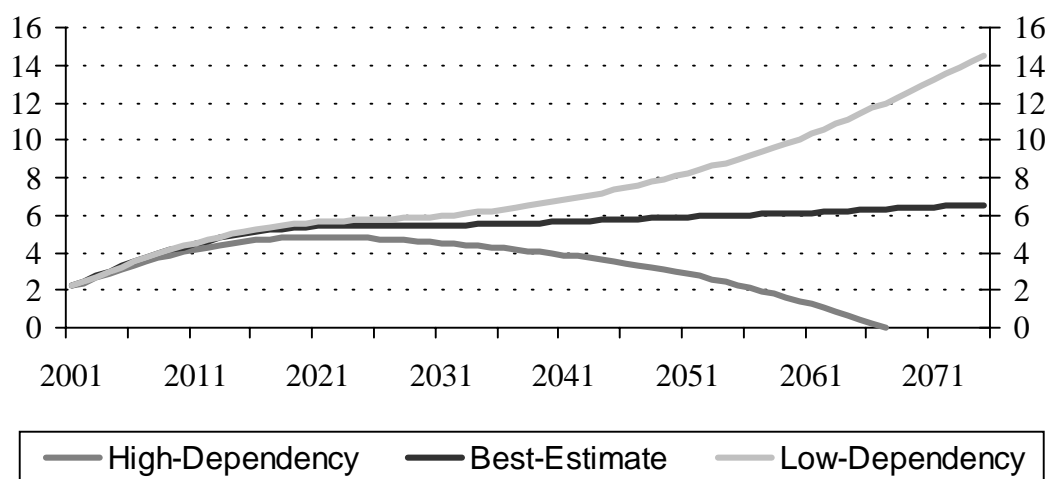
Table 19 Financial Status Under Low-Dependency Scenario
($ billion)

Year	Paygo Rate	Contribution Rate	Contributory Earnings	Contributions	Expenditures	Net Cash Flow	Investment Earnings	Assets at 31 Dec*.	Asset / Expenditure Ratio
	(%)	(%)							
2001	8.11	8.60	254.3	21.9	20.6	1.2	2.9	47.8	2.21
2005	8.32	9.90	296.0	29.3	24.6	4.7	5.5	83.7	3.25
2010	8.61	9.90	368.0	36.4	31.7	4.8	9.1	145.1	4.33
2025	10.49	9.90	723.7	71.6	75.9	(4.3)	30.8	460.8	5.75
2050	10.49	9.90	2,190.4	216.9	229.8	(12.9)	130.0	1,936.9	8.08
2075	10.19	9.90	6,501.6	643.7	662.6	(19.0)	679.9	10,053.2	14.52

Table 20 Financial Status Under High-Dependency Scenario
($ billion)

Year	Paygo Rate	Contribution Rate	Contributory Earnings	Contributions	Expenditures	Net Cash Flow	Investment Earnings	Assets at 31 Dec.*	Asset / Expenditure Ratio
	(%)	(%)							
2001	8.15	8.60	253.2	21.8	20.6	1.1	2.8	47.6	2.20
2005	8.42	9.90	294.6	29.2	24.8	4.4	5.1	81.3	3.13
2010	8.76	9.90	367.4	36.4	32.2	4.2	8.3	137.4	4.03
2025	10.00	9.90	766.2	75.9	82.0	(6.1)	27.7	414.8	4.77
2050	12.20	9.90	2,342.5	231.9	285.9	(53.9)	60.9	898.2	3.00
2075	-	-	-	-	-	-	-	-	-

* The Account and Fund components are valued at cost and the CPP Investment Board component is valued at market.

VI. Conclusion

The results contained in this report confirm that the legislated contribution rates (i.e. 8.6% in 2001, 9.4% in 2002 and 9.9% in 2003 and thereafter) are sufficient to pay for future expenditures and to accumulate assets of $141 billion (4.2 times the annual expenditures) in 2010. In 2050 the assets are projected to be $1,506 billion or 5.6 times the annual expenditures.

The steady-state rate determined under this report is 9.8%. A more pessimistic demographic outlook, based on the continuing downward trend in fertility rates, and a better economic outlook, especially regarding labour force participation rates, are the main forces underlying the results of this report when compared to the Seventeenth Report. These factors tend to counterbalance each other to a certain extent in the long run.

The assets are projected to grow rapidly over the next 20 years as contribution revenues are expected to exceed the expenditures over that period. The asset/expenditure ratio will grow from 2.2 in 2001 to 5.2 in 2020, and remain somewhat stable as the baby boom generation retires between 2015 and 2035. The retirement of the baby boomers will create upward pressures on the Plan outflows and part of the investment income will be required to pay for benefits after all contributions have been used to pay for benefits. However, assets will continue to grow until the end of the projection period, but at a slower pace and the asset/expenditure ratio is expected to reach a level of 6.0 by 2075.

These are indicators that the Plan is sustainable over the long-term, as it is projected that there will be more inflows than outflows to the Plan over the entire projection period. The pool of assets generated over the projection period makes it possible for the Plan to absorb almost any unforeseen economic or demographic fluctuations, which otherwise would have to be reflected in the contribution rate. Thus despite the substantial increase in benefits paid as a result of an aging population, the Plan is expected to be able to meet its obligations throughout the projection period. There exist other measures of the long-term sustainability of the Plan and these are presented in Appendix D of this report.

The projected financial status of the Canada Pension Plan presented in this report is based on the assumed demographic and economic outlook over the long-term. Therefore it remains important to review the Plan's long-term financial status on a regular basis by making periodic actuarial reports. For this purpose, as required by the *Canada Pension Plan Act*, the next such review will be as at 31 December 2003.

VII. Actuarial Opinion
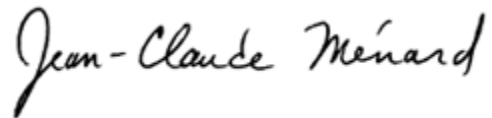
In our opinion, considering that this Eighteenth Actuarial Report was prepared pursuant to the *Canada Pension Plan Act*:

- the methodology employed is appropriate and consistent with sound actuarial principles;

- the data on which this report is based are sufficient and reliable; and

- the assumptions used are, in aggregate, reasonable and appropriate.

this report has been prepared, and our opinions given, in accordance with accepted actuarial practice.

_____
Michel Montambeault, F.S.A., F.C.I.A.
Senior Actuary

_____
Jean-Claude Ménard, F.S.A., F.C.I.A.
Chief Actuary

Appendix A – Summary of Plan Provisions

I. Introduction

The Canada Pension Plan (CPP) came into force on 1 January 1966. Since that time it has been amended several times, the most recent occasion as a result of Bill C-23 (the *Modernization of Benefits and Obligations Act*), which received Royal Assent on 29 June 2000. Effective 1 January 2001 this Act extends benefits and obligations to same-sex couples who have been cohabiting in a conjugal relationship for at least one year, in order to reflect values of tolerance, respect and equality, consistent with the *Canadian Charter of Rights and Freedoms.*

II. Participation

The CPP includes virtually all members of the labour force in Canada (both employees and self-employed persons) between the ages of 18 and 70 with employment earnings, other than persons covered by the Québec Pension Plan (QPP). The main exceptions are persons with annual earnings lower than $3,500 (the Year's Basic Exemption, defined below), persons to whom a CPP retirement or disability pension is payable and members of certain religious groups. It should be noted that the Canada Pension Plan covers all members of the Canadian Forces and the Royal Canadian Mounted Police, including those residing in the province of Québec.

III. Definitions

A. Year's Maximum Pensionable Earnings (YMPE)

The YMPE for a calendar year is the limit to which employment earnings are subject for purposes of the Plan. The YMPE increases each year to the extent warranted by the percentage increase, as at 30 June of the preceding year, in the 12-month average of the Industrial Aggregate (the measure of the Average Weekly Earnings by Statistics Canada). If the amount so calculated is not a multiple of $100, the next lower multiple of $100 is used (although the exact amount forms the basis for the following year's calculation). Under no circumstances is the YMPE allowed to decrease from one year to the next. The YMPE is set at $38,300 in 2001.

B. Year's Basic Exemption (YBE)

The YBE for a calendar year is the minimum employment earnings necessary to participate in the Plan. As well, contributions are waived on earnings up to the YBE. Prior to 1998, the YBE was calculated as 10% of the YMPE and rounded, if necessary, to the next lower multiple of $100. For each year after 1997 the YBE is $3,500.

C. Contributory Period

The contributory period is the number of months from attainment of age 18 or from 1 January 1966, if later, to the earliest of the month in which the contributor dies, the month before the one in which the retirement pension commences and the month before

the one in which the contributor reaches 70 years of age, less the number of months during which the contributor received a CPP or QPP disability benefit (including the three-month waiting period), or during which the contributor had at least one eligible child under seven years of age and had earnings for that year less than the YBE.

D. Pension Index

The Pension Index for a given calendar year is equal to the Consumer Price Index averaged over the 12-month period ending with October of the preceding year; however, the Pension Index of a given year may not be less than the previous year's Pension Index.

IV. Contribution Rates and Contributions

Contributions are required during the contributory period in respect of the contributory earnings of each contributor. From 1966 to 1986, the annual rate of contribution applicable to contributory earnings was 1.8% for employees (and a like amount for their employers) and 3.6% in respect of self-employed earnings. This combined employer-employee contribution rate of 3.6% was subject to an annual increase of 0.2% for 1987 to 1996, attaining 5.6% in the last year of this period.
Combined contribution rates for 1997 to 2003 increase in steps to reach a combined employer-employee contribution rate of 9.9% by 2003, with no subsequent increases scheduled.

Current Schedule of Contribution Rates	
Year	**Contribution Rate**
	(%)
1997	6.00
1998	6.40
1999	7.00
2000	7.80
2001	8.60
2002	9.40
2003+	9.90

The legislation gives the federal and provincial Ministers of Finance the authority to make changes in contribution rates through regulation, in connection with a triennial review. However, year-over-year contribution rate increases cannot exceed 0.2%; beyond that, legislation is required.

If a triennial actuarial report projects a steady-state contribution rate in excess of the scheduled rate and the Ministers cannot agree upon appropriate changes, a regulation on the calculation of default contribution rates approved on 21 May 2001 would apply. The contribution rate would then be increased in stages together with a temporary freeze on inflation adjustments of benefits in payment.

V. Retirement Pension

A. Eligibility requirements

A person aged 60 or over becomes eligible for a retirement pension upon application, provided contributions have been made during at least one calendar year. An applicant for a retirement pension payable before age 65 must have wholly or substantially ceased to be engaged in paid employment or self-employment. A person may not contribute to the CPP after a retirement pension becomes payable or, in any event, after age 70.

B. Amount of Pension

The initial amount of monthly retirement pension payable to a contributor is based on his or her whole history of pensionable earnings during the contributory period. The retirement pension is equal to 25% of the Maximum Pensionable Earnings Average (MPEA) for the year of his or her retirement and the four previous years, adjusted to take into account the contributor's pensionable earnings. For this purpose, the contributor's pensionable earnings for any given month are indexed by the ratio that the MPEA for the year of retirement bears to the YMPE for the year to which the given month belongs.

Some periods with low pensionable earnings may be excluded, from the calculation of benefits, by reason of pensions commencing after age 65 and of the disability, the child-rearing dropout for a child less than seven years of age and the 15% dropout provisions.

The maximum monthly retirement pension in 2001 is $775.00.

C. Adjustment for Early Retirement

The retirement pension is subject to an actuarial adjustment that depends on the contributor's age at commencement of the retirement pension. The retirement pension is permanently adjusted downwards or upwards by 0.5% for each month between age 65 and the age when the pension commences or, if earlier, age 70.

VI. Disability Benefit

A. Eligibility requirements

A person is considered disabled if he or she is determined to be suffering from a severe and prolonged mental or physical disability. A disability is considered severe if by reason of it the person is regularly incapable of pursuing any substantially gainful occupation; a disability is considered prolonged if it is likely to be long-continuing and of indefinite duration or likely to result in death.

A person who becomes disabled while under age 65 and not receiving a CPP retirement pension is eligible for a disability benefit provided that contributions have been made, at time of disablement, for at least four of the last six calendar years, counting only years included wholly or partly in the contributory period. Contributions must be on earnings that are not less than 10% of the YMPE rounded, if necessary, to the next lower multiple of $100.

B. Amount of Pension

The amount of monthly benefit payable is the sum of a flat-rate portion ($353.87 in 2001) depending only on the year in which the benefit is payable and an earnings-related portion equal, when it commences, to 75% of the retirement pension accrued as of the onset of disability, except that no actuarial adjustment applies.

The automatic conversion at age 65 of a disability benefit into a retirement pension is based on the pensionable earnings at the time of disablement and indexed to age 65. In other words, the indexing from disablement to age 65, which determines the initial rate of the retirement pension, will be in line with increases in prices rather than wages. The maximum monthly disability benefit in 2001 is $935.12.

VII. Survivor Benefit

A. Eligibility Requirements

The surviving spouse of a contributor is eligible for a survivor benefit if the following three conditions are met as at the date of the contributor's death.

- If the surviving spouse was not legally married to the deceased contributor, they must have cohabited for not less than one year immediately before the death of the contributor.

- The deceased contributor must have made contributions during the lesser of ten calendar years, or one-third of the number of years included wholly or partly in his or her contributory period, but not less than three years.

- The surviving spouse must have dependent children, be disabled or be at least 35 years of age. A surviving spouse with dependent children means a surviving spouse who wholly or substantially maintains a child of the deceased contributor where the child is under age 18, or aged 18 or over but under age 25 and attending school full-time, or aged 18 or over and disabled, having been disabled without interruption since attaining age 18 or the time of the contributor's death, whichever occurred later.

B. Amount of Pension

The amount of the monthly survivor benefit depends on the age of the survivor at the date of the contributor's death, the survivor's disability status and the presence of dependent children. If a surviving spouse is receiving a retirement pension or a disability benefit, the

monthly amount of the surviving spouse's benefit may be reduced. The following five cases are relevant.

1. **New Survivor Age 45 to 65**

    The amount of monthly benefit payable until the surviving spouse attains age 65 is composed of two portions: a flat-rate benefit depending only on the year in which the survivor benefit is payable ($138.07 in 2001), and an earnings-related benefit depending initially only on the contributor's record of pensionable earnings as at the date of death. The initial earnings-related portion is equal to 37.5% of the retirement pension accrued by the deceased contributor, except that no actuarial adjustment applies.

2. **New Survivor Under Age 45**

    An eligible spouse, without dependent child(ren) and not disabled, who becomes widowed before age 35 is not entitled to a survivor's benefit (but may be entitled at a later date; see 4 and 5 below). If such survivor is between 35 and 45 years of age she or he is entitled to an amount of benefit calculated as described in 1 above but reduced (until the earlier of disablement or attainment of age 65) by 1/120 of such amount for each month that the new survivor's age is less than 45.

3. **New Survivor Under Age 45 with Dependent Child(ren)**

    An eligible spouse who becomes widowed while aged less than 45 and with dependent children is entitled to a survivor benefit calculated as in 1 above. Under certain circumstances the survivor benefit is reduced or even discontinued when the last dependent child loses such status. If the survivor is then under age 45 and not disabled, she or he is considered to be a new survivor entitled only to the benefit in accordance with 2 above.

4. **Disabled Survivor Under Age 65**

    An eligible surviving spouse under age 65 is entitled to a survivor benefit calculated as in 1 above whenever she or he is disabled. If the disabled surviving spouse recovers from disability before age 45, the survivor benefit is discontinued or reduced to what it would be for a new survivor in accordance with 2 above.

5. **Survivor Age 65 or Over**

    At age 65, or upon widowhood at a later age, an eligible surviving spouse is entitled to a monthly benefit equal to 60% of the retirement pension accrued by the deceased contributor, except that no actuarial adjustment applies.

VIII. Death Benefit

A lump sum benefit is payable to the estate of a deceased contributor if the eligibility rules described in VII. A above are met. The amount of the death benefit is equal to six times the monthly amount of retirement pension accrued or payable in the year of death, adjusted to exclude any reduction for retirement before age 65, subject to a maximum of $2,500.

IX. Child Benefits

Each child under age 18 and each full time student age 18 to 25 who is dependent on a contributor eligible for a CPP disability benefit or was dependent on a deceased contributor satisfying the contribution requirement for a survivor benefit is entitled to a flat-rate monthly benefit ($178.42 in 2001). Furthermore, where applicable, a child may receive simultaneously more than one child benefit.

X. Inflation Adjustments

All monthly benefits payable are increased in accordance with inflation each year. Benefits are multiplied on 1 January of each calendar year by the ratio of the Pension Index applicable for that calendar year to the Pension Index for the preceding year.

XI. Credit-splitting

Pensionable earnings may be split between divorced or separated couples (legal or common-law unions) for each year the couple lived together. Pensionable earnings are used to establish eligibility for Canada Pension Plan benefits and to calculate the amount of benefits. Contributors may obtain a credit split even if they have remarried. However, pensionable earnings will not be split for any month in which the earnings allocated to each spouse would be less than 1/12 of the YBE.

XII. Pension-sharing

Couples (legal or common-law partners) in an ongoing relationship may voluntarily (at the request of one of them) share their Canada Pension Plan retirement pensions in proportion to the number of years during which they cohabited. This applies provided both spouses are receiving a retirement pension to which they are entitled under the CPP or the QPP. Pension sharing ceases upon separation, divorce, or a death.

Appendix B – Assumptions and Methods

I. Introduction

This section describes the assumptions and methods that underlie the financial projections in Section IV of the report.

The future cash flows are over a long period of time, i.e. 2001 to 2075, and depend on assumptions such as fertility, mortality, migration, labour force, unemployment rate, inflation, employment earnings and investment returns. These assumptions form the basis for the projections of future income and expenditures of the Plan. Over the years, the cumulative difference between the income from contributions and investment earnings and the expenditures of the Plan generates the accumulated assets. The ratio of the end-of-year assets to the following year's expenditures is then calculated and used to determine the steady-state contribution rate, which is the lowest contribution rate that in the long term would generally stabilize the ratio of assets to expenditures.

Although the economic and demographic assumptions have been developed using the best available information, the resulting estimates should be interpreted with caution. These estimates are not intended to be predictions of the future financial status of the CPP but, rather, to be indicators of the expected trend under certain economic and demographic conditions.

II. Demographic Projections

Both the historical and projected population of Canada less Québec are required for the calculation of future CPP contributions and benefits of the relevant cohorts of contributors and beneficiaries.

The populations of Canada and Québec as at 1 July 2000 are used as a starting point. The populations are then projected by age and sex from one year to the next by adding births and net migrants and subtracting deaths. Applying the fertility, mortality and migration assumptions to the starting population developed the annual numbers of births, deaths and net migrants. The population of Canada less Québec was then obtained by subtracting the projected population of Québec from the projected population of Canada.

The population covered by the CPP pertains to Canada less Québec, but includes all members of the Canadian Forces (CF) and Royal Canadian Mounted Police (RCMP). Consequently, the approach used above to determine the CPP population does not make explicit allowance for the members of the CF or RCMP residing in Québec or outside Canada. However, provision for this group was made implicitly through the development of the proportion of people with earnings and contributors as described in Section III of this Appendix.

A. Initial Population as at 1 July 2000

The starting point for the demographic projections is the most recent Statistics Canada population estimates as at 1 July 2000 for Canada and Québec, by age and sex. The estimates are based on the 1996 census and are adjusted for the census undercount.

B. Fertility Rates

The fertility rate for a given age and year is the average number of live births per female of that age during that year. The total fertility rate for a year is the average number of children that would be born to a woman in her lifetime if she experienced the age-specific fertility rates observed in, or assumed for, that year.

Total fertility rates have declined significantly over the last 50 years, from a high of about 4.0 in the late 1950s for both Canada and Québec to common lows of about 1.55 in the late 1990s. The total fertility rate increased briefly over the early 1990s to reach levels of about 1.70 and 1.65 for Canada and Québec, respectively. For most of the 1990s total fertility rates have been quite stable but a new downward trend has been observed recently. Currently the total fertility rate stands at about 1.55 and 1.45 for Canada and Québec, respectively. These variations in the total fertility rate have resulted from changes in many factors, including social attitudes, economic conditions and changing attitudes to contraception.

In this report, it was assumed that the total fertility rate from 2007 and onward would be 1.64 for Canada and 1.60 from 2009 onward for Québec. These assumed ultimate rates reflect historical trends in fertility by age-group over the last 10 to 15 years. They are slightly higher than the most recently observed rates. A small increase in total fertility rates is expected over the medium-term horizon because of continued trends in women having their first child at a later age due to increased labour force participation, later marriages and longer stays in the education system. There are signs that increases in the divorce rate, in the labour force participation rate of women, and in the percentage of never-married women are slowing or even becoming decreases (all factors that have contributed significantly to the drop of the total fertility rate over the last 25 years). Economic conditions are also assumed to improve over the medium term and could help families plan for additional children.

Consequently, the assumed age-specific fertility rates for the next few years were obtained by interpolating between the current rates and the assumed ultimate rates. Finally, in accordance with the experience over the last 25 years, the assumed ratio of male to female births was maintained at 1.056. Table 21 and Chart 8 below show the historical and projected age-specific and total fertility rates.

Table 21 Total Fertility Rates
(Canada)

	Annual Fertility Rate by Age-Group (per 1,000 women)							Total Fertility Rate Per Woman
Year	15-19	20-24	25-29	30-34	35-39	40-44	45-49	Total
2001	21.3	63.0	100.3	90.6	35.9	6.0	0.2	1.59
2002	21.6	62.7	99.4	92.2	36.7	6.3	0.3	1.60
2003	21.9	62.4	98.5	93.8	37.5	6.5	0.3	1.60
2004	22.2	62.2	97.7	95.3	38.4	6.7	0.3	1.61
2005	22.4	61.9	96.8	96.9	39.2	6.9	0.3	1.62
2006	22.7	61.7	96.0	98.4	40.1	7.1	0.3	1.63
2007	23.0	61.4	95.1	100.0	40.9	7.3	0.3	1.64
2008	23.0	61.4	95.1	100.0	40.9	7.3	0.3	1.64
2009	23.0	61.4	95.1	100.0	40.9	7.3	0.3	1.64
2010+	23.0	61.4	95.1	100.0	40.9	7.3	0.3	1.64

Chart 8 Historical and Assumed Total Fertility Rates
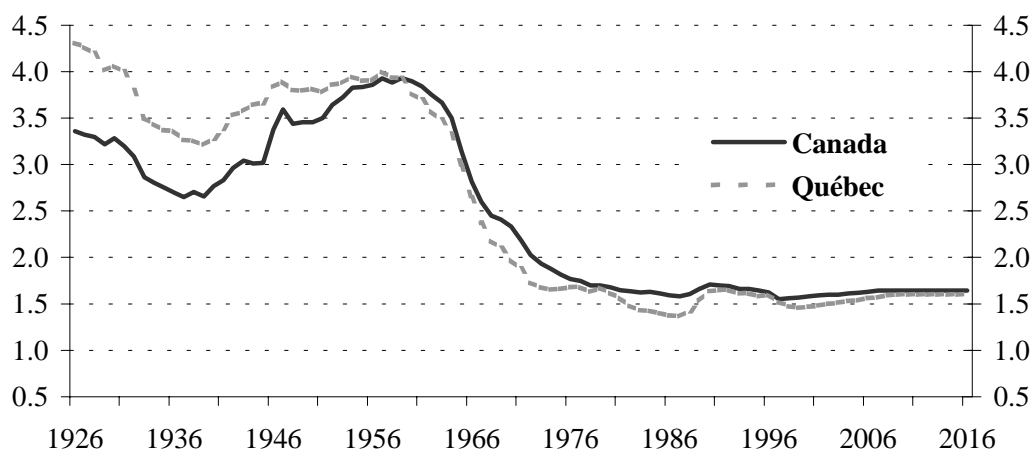
C. Mortality

The starting point for mortality rate projections for this report is the mortality rates from the Statistics Canada publication "Life Tables, Canada and Provinces, 1990-1992". According to these tables, life expectancies at birth for males and females in Canada were 74.6 and 80.9 years, respectively. The 1995-1997 Life Tables were not yet available for this report.

To reflect anticipated sustained improvements in life expectancy, the 1990-1992 Canada and Québec mortality rates were projected to 1996 using the actual improvements in mortality experienced since 1991. This approach produced life expectancies at birth and at age 65 of 75.5 and 16.1 years for males and of 81.2 and 20.0 years for females, respectively, which compared reasonably well with figures published by Statistics Canada for 1996. Mortality rates thus obtained for 1996 were then further projected to the end of the projection period using the following annual rates of mortality improvement.

For 1997 to 2020, the annual rates of mortality improvement, varying by age, sex and calendar year, were obtained by linear interpolation between:

- the average improvement rates experienced in Canada between 1987 and 1996, and

- the fixed improvement rates described below in respect of the period 2021 and thereafter.

For 2021 and subsequent years, the assumed rates of improvement vary by age and sex only and not by calendar year. These ultimate rates were derived from an analysis of the Canadian and U.S. experience over the last century and are generally consistent with the Alternative II assumption used in the 2000 Social Security Administration Old-Age and Survivors Insurance and Disability Insurance Trust Fund trustees report.

Table 22 Mortality Rates for Canada
(annual deaths per 1,000 people)

Age	Males				Females			
	2001	2025	2050	2075	2001	2025	2050	2075
0	5.17	3.14	2.23	1.59	4.23	2.77	2.02	1.48
10	0.10	0.06	0.05	0.04	0.09	0.07	0.06	0.05
20	0.82	0.59	0.50	0.43	0.31	0.25	0.22	0.19
30	1.14	0.97	0.82	0.70	0.45	0.38	0.34	0.30
40	1.85	1.60	1.36	1.16	0.97	0.83	0.73	0.64
50	3.68	2.79	2.40	2.07	2.41	1.97	1.74	1.53
60	9.95	7.40	6.36	5.47	6.03	5.03	4.44	3.92
65	16.71	12.67	10.90	9.38	9.46	7.90	6.97	6.15
70	28.38	22.41	19.28	16.58	15.51	13.22	11.66	10.29
75	44.07	36.22	31.16	26.81	25.97	22.58	19.92	17.57
80	75.58	65.16	56.77	49.46	46.60	41.32	36.45	32.16
85	123.12	110.46	96.23	83.84	81.90	75.56	66.66	58.81

The projected mortality rates in Table 22 indicate a narrowing of the gap between male and female life expectancies over the long term. This trend has been observed over the last 20 to 25 years in Canada. The yearly increase in life expectancies in the early years of the projection reflects the significant increase observed over the last 25 years. Thereafter, there is a projected slowdown in the increase in life expectancies consistent with the low rate of improvement in mortality assumed for years 2021 and thereafter.

For 2001 to 2075, for Canada, life expectancy at birth is projected to grow from 76.4 to 82.0 years for males and from 81.7 to 85.8 years for females. Table 23 shows the resulting Canadian life expectancies at various ages for specified calendar years, assuming that the mortality rates of each such year will remain unchanged thereafter (without improvements). Table 24 is similar to Table 23, the only difference being that it takes into account the assumed mortality improvement after the specified calendar year (with improvements). Given the continuing trend to greater longevity, Table 24 is considered to be more realistic than Table 23.

Table 23 Life Expectancies for Canada, without improvements*

Age	Males				Females			
	2001	2025	2050	2075	2001	2025	2050	2075
0	76.4	78.8	80.4	82.0	81.7	83.2	84.5	85.8
10	66.9	69.1	70.7	72.2	72.1	73.5	74.7	76.0
20	57.1	59.3	60.8	62.3	62.3	63.6	64.8	66.0
30	47.6	49.7	51.1	52.6	52.4	53.8	55.0	56.2
40	38.2	40.2	41.6	43.0	42.7	44.0	45.2	46.4
50	29.0	30.9	32.3	33.6	33.3	34.5	35.7	36.8
60	20.4	22.1	23.3	24.5	24.4	25.4	26.5	27.5
65	16.5	18.0	19.1	20.3	20.2	21.1	22.1	23.1
70	13.0	14.2	15.3	16.3	16.2	17.1	18.0	18.9
75	10.0	10.9	11.8	12.8	12.6	13.3	14.1	15.0
80	7.4	8.1	8.8	9.7	9.4	9.9	10.7	11.4
85	5.4	5.8	6.5	7.2	6.8	7.2	7.8	8.4

* These are calendar year life expectancies based on the mortality rates of the given attained year.

Table 24 Life Expectancies for Canada, with improvements**

Age	Males				Females			
	2001	2025	2050	2075	2001	2025	2050	2075
0	81.4	83.2	84.9	86.5	85.5	86.9	88.3	89.5
10	71.2	72.9	74.5	76.1	75.5	76.7	78.0	79.3
20	60.8	62.4	64.0	65.6	65.1	66.3	67.6	68.9
30	50.6	52.1	53.7	55.3	54.8	56.0	57.2	58.5
40	40.6	42.1	43.6	45.1	44.6	45.8	47.0	48.2
50	30.8	32.3	33.7	35.1	34.6	35.8	37.0	38.2
60	21.5	22.9	24.2	25.5	25.2	26.3	27.4	28.5
65	17.3	18.6	19.8	21.0	20.7	21.8	22.8	23.9
70	13.5	14.7	15.7	16.9	16.6	17.5	18.5	19.5
75	10.3	11.2	12.2	13.2	12.8	13.6	14.5	15.4
80	7.5	8.2	9.1	9.9	9.5	10.1	10.9	11.7
85	5.4	5.9	6.6	7.4	6.8	7.3	7.9	8.6

**   These are cohort life expectancies that take into account future improvements in mortality and therefore
differ from calendar year life expectancies, which are based on the mortality rates of the given attained year.

D. Migration

Immigration and emigration are generally recognized to be volatile parameters of future population growth, since they are subject to a variety of demographic, economic, social and political factors. During the period from 1972 to 2000, annual immigration to Canada has varied from 84,000 to 265,000, annual emigration from Canada is estimated to have fluctuated between 40,000 and 83,000, and the annual numbers of returning Canadians have fluctuated between 19,000 and 39,000. Chart 9 below show the net migration experience of the last half-century.

For purposes of this report, net migration for Canada is assumed to start from its initial level of 143,000 for 2000, which is about 0.47% of total Canadian population. This initial ratio of 0.47% is then gradually increased until 2005 to a level of 0.50%, which is the average experienced over the last 20 years. For 2005 to 2015, the 0.50% assumption is maintained. From 2015 to 2020, the ratio is gradually increased from 0.50% to 0.52% to take into account the expected labour shortage and is then kept at that level thereafter. The ultimate level of 0.52% is the average of the last 15 years.

For purposes of projecting the population of Québec, historical percentages of the Canadian migration components were attributed to Québec. In addition, based on historical data, it was assumed that Québec would experience net interprovincial emigration of 16,200 in 2000, reducing to 10,000 for 2005 to 2010 and further reducing to 7,500 for 2015 and thereafter. These assumptions result in an average ultimate net migration rate of approximately 0.35% for Québec. The distributions of immigrants, emigrants and returning Canadians by age and sex used for the demographic projections were taken from Statistics Canada data averaged over the period 1996 to 2000.

Chart 9 Net Migration as % of Population
(Canada)
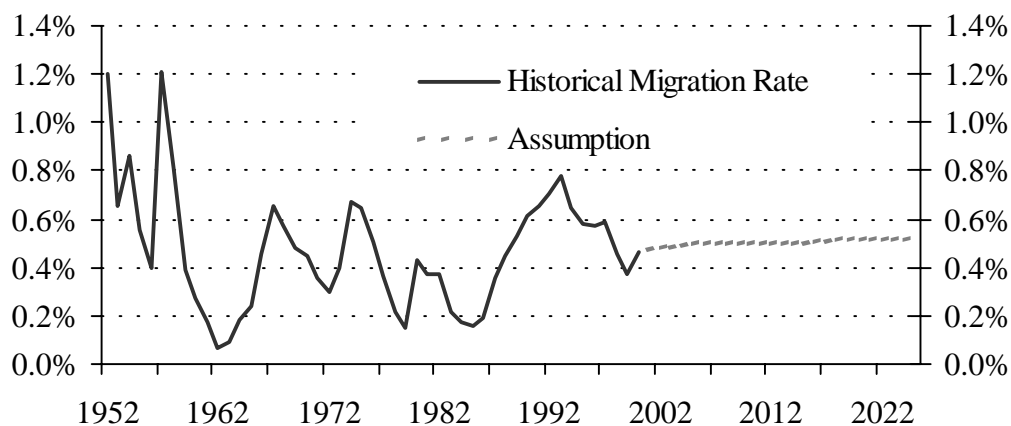
E. Projected Population and its Characteristics

The population of Canada less Québec in 2000 is estimated at 23.4 million. Table 25 presents the projected population at 1 July of selected years. Chart 10 shows the evolution of the total population for Canada less Québec and of those ages 20 to 64 from the inception of the Plan up to 2075. Table 26 shows the variations in the relative size of the various age-groups throughout the projection period. The proportion of people aged 65 and over is expected to almost double over the projection period. The number of people aged 65 and over as a proportion of people aged 20 to 64 more than doubles over the same period. This proportion significantly affects the ratio of benefits to contributions under the CPP.

Over the next 20 years the population of Canada less Québec is projected to grow at about 0.9% per year. The annual growth slows to about 0.6% between 2020 and 2040 and to 0.3% thereafter. The population of Canada less Québec is expected to reach 35.6 million by 2075. Table 27 below shows the components of population growth, namely the projected number of births plus net migrants less the expected deaths for each year to 2075. Chart 11 presents these figures graphically until 2050.

Table 25 Population of Canada less Québec by Age
(thousands)

Year	0-17	18-69	70+	0-19	20-64	65+	Total
2001	5,504	16,012	2,106	6,144	14,526	2,953	23,623
2002	5,496	16,224	2,148	6,143	14,727	2,998	23,868
2003	5,484	16,442	2,187	6,139	14,929	3,046	24,114
2004	5,474	16,665	2,220	6,134	15,129	3,096	24,359
2005	5,469	16,883	2,253	6,127	15,331	3,147	24,605
2006	5,467	17,095	2,288	6,121	15,524	3,204	24,849
2007	5,458	17,316	2,321	6,120	15,708	3,266	25,094
2008	5,439	17,543	2,355	6,123	15,874	3,341	25,338
2009	5,424	17,762	2,393	6,116	16,043	3,419	25,578
2010	5,410	17,976	2,431	6,100	16,220	3,497	25,817
2015	5,423	18,848	2,715	6,075	16,786	4,124	26,985
2020	5,587	19,283	3,258	6,224	17,041	4,862	28,127
2025	5,704	19,608	3,889	6,361	17,119	5,720	29,200
2030	5,777	19,775	4,600	6,452	17,137	6,564	30,153
2050	6,034	20,896	5,854	6,738	18,287	7,760	32,785
2075	6,448	22,360	6,747	7,209	19,557	8,789	35,555

Chart 10 Population of Canada less Québec
(millions)
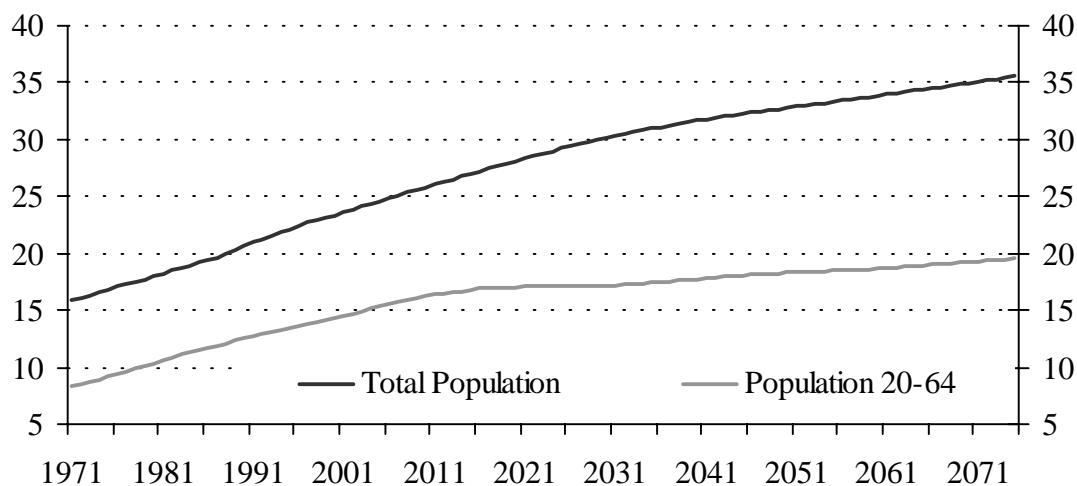
Table 26 Analysis of Population of Canada less Québec

| Year | % of Total Population | | | % of Total Population | | | Age 65 + As % of age 20-64 |
	Ages 0-17	Ages 18-69	Ages 70+	Ages 0-19	Ages 20-64	Ages 65+	
2001	23.3	67.8	8.9	26.0	61.5	12.5	20.3
2002	23.0	68.0	9.0	25.7	61.7	12.6	20.4
2003	22.7	68.2	9.1	25.5	61.9	12.6	20.4
2004	22.5	68.4	9.1	25.2	62.1	12.7	20.5
2005	22.2	68.6	9.2	24.9	62.3	12.8	20.5
2006	22.0	68.8	9.2	24.6	62.5	12.9	20.6
2007	21.7	69.0	9.2	24.4	62.6	13.0	20.8
2008	21.5	69.2	9.3	24.2	62.6	13.2	21.0
2009	21.2	69.4	9.4	23.9	62.7	13.4	21.3
2010	21.0	69.6	9.4	23.6	62.8	13.5	21.6
2015	20.1	69.8	10.1	22.5	62.2	15.3	24.6
2020	19.9	68.6	11.6	22.1	60.6	17.3	28.5
2025	19.5	67.1	13.3	21.8	58.6	19.6	33.4
2030	19.2	65.6	15.3	21.4	56.8	21.8	38.3
2050	18.4	63.7	17.9	20.6	55.8	23.7	42.4
2075	18.1	62.9	19.0	20.3	55.0	24.7	44.9

Chart 11 Components of Population Growth for Canada less Québec
(thousands)
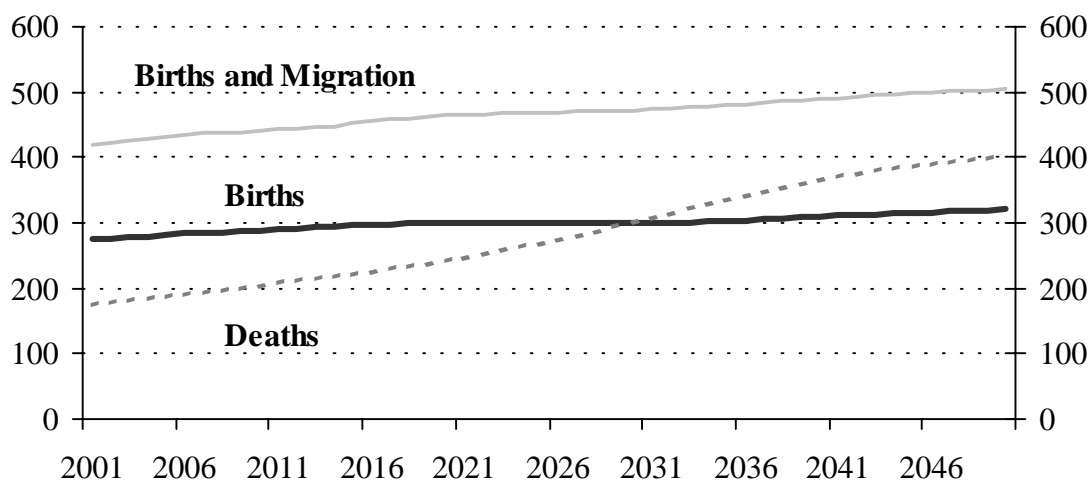
Table 27 Births, Net Migrants and Deaths for Canada less Québec
(thousands)

Year	Population 1st July	Births	Net Migrants	Deaths	Change in Population	Annual Percentage Change		
						20-64	65+	Total
						(%)	(%)	(%)
2001	23,622	275	144	174	245	1.4	1.5	1.0
2002	23,868	277	146	177	245	1.4	1.6	1.0
2003	24,113	278	148	180	246	1.3	1.6	1.0
2004	24,359	280	150	184	246	1.3	1.7	1.0
2005	24,605	281	151	187	245	1.3	1.8	1.0
2006	24,850	284	151	190	244	1.2	1.9	1.0
2007	25,094	285	151	193	243	1.1	2.3	1.0
2008	25,337	286	151	197	241	1.1	2.3	1.0
2009	25,578	288	151	200	239	1.1	2.3	0.9
2010	25,817	289	152	204	237	1.1	2.7	0.9
2015	26,985	296	156	221	231	0.6	3.2	0.9
2020	28,127	299	165	242	222	0.2	3.4	0.8
2025	29,201	299	170	268	201	0.0	3.1	0.7
2030	30,152	299	174	299	173	0.2	1.8	0.6
2050	32,784	320	184	399	105	0.2	0.6	0.3
2075	35,555	340	196	420	116	0.3	0.5	0.3

III. Economic Assumptions

The list of assumptions required to make projections of the various economic indices, benefit expenditures and contributions is quite extensive. The following sections cover the more important of these assumptions.

The economic outlook rests on the assumed evolution of the labour market, i.e. labour force participation, employment, unemployment rate and increase in average employment earnings. The inflation rate and rates of return on CPP assets reflect the financial markets. All these factors must be considered together and form part of an overall economic perspective.

A. Economic Perspective

The future income and expenditures of the CPP depend on many demographic and economic factors. It is important to define the individual economic assumptions in the context of a long-term overall economic perspective. For this report, an initial economic slowdown followed by a recovery period has been assumed. Thereafter, a moderate but sustainable growth in the economy will persist throughout the remaining projection period.

The actuarial examination of the CPP involves the projection of its income and expenditures over a long period of time. Our best judgement regarding future economic trends was used but does not take into account all of the social or technological changes that may occur over the projection period. There will always exist a certain degree of uncertainty. The projected aging of the population combined with the retirement of the baby boom generation over the next decades will certainly create significant social and economic changes. It is possible that the evolution of the working-age population, especially the active population, will be quite different that what has been historically observed.

B. Labour Market

Chart 12 shows the main components of the labour market that are used to determine assumptions on the proportions of earners and contributors by age, sex and calendar year.

Chart 12 Components of Labour Market

```
                        ┌──────────────────────────┐
                        │     Total Population      │
                        └──────────────────────────┘
                 ┌──────────────┴──────────────────┐
      ┌────────────────────────┐        ┌────────────────────────┐
      │ Population aged 15 years│        │ Population aged 0 to 14 │
      │ and over               │        │ years                   │
      └────────────────────────┘        └────────────────────────┘
           ┌────────┴────────────┐
   ┌──────────────────┐  ┌──────────────────────┐
   │ Active Population*│  │ Inactive Population* │
   └──────────────────┘  └──────────────────────┘
       ┌──────┴──────┐
 ┌───────────┐ ┌──────────────┐
 │ Employed  │ │ Unemployed   │
 └───────────┘ └──────────────┘
```

* An active person is one who is employed or is looking for employment (unemployed). A person is said to be inactive in all other cases.
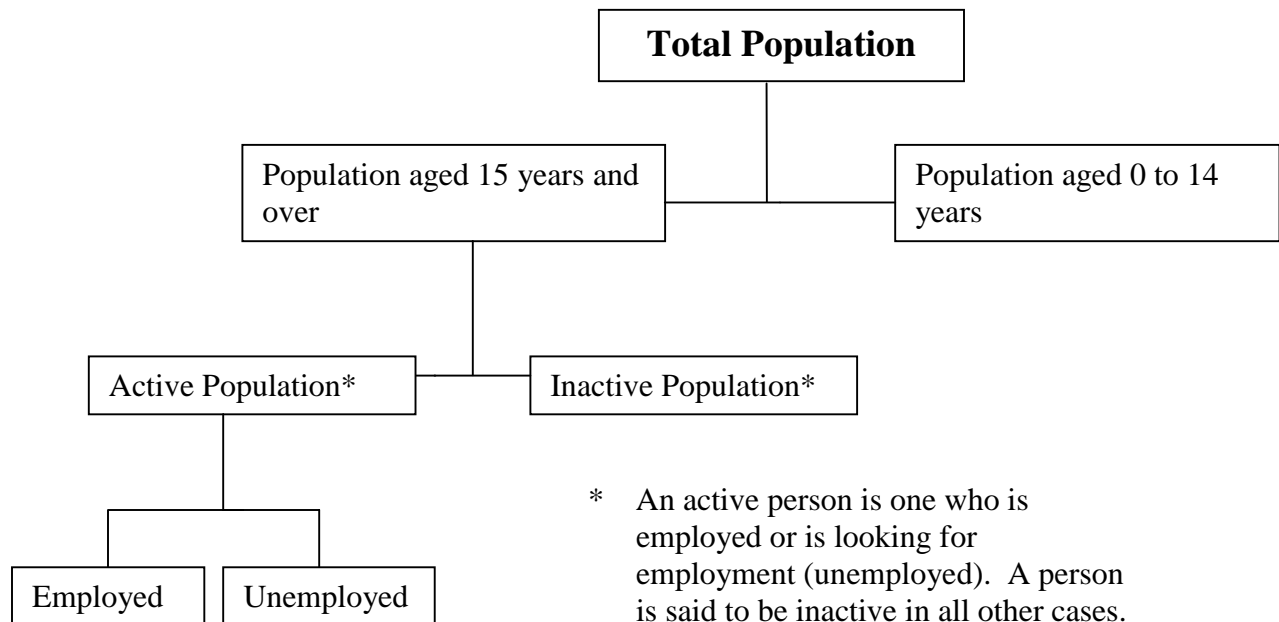
The number of earners is defined as the number of persons who had earnings during a given calendar year. The number of contributors is defined as the number of persons who are aged 18 and over and have earnings during the year at least equal to the Year's Basic Exemption (YBE). The proportion of earners and contributors assumptions (described in section 3 below) rely on the projected active population included in this actuarial report.

1. Active Population

The labour force participation rates in Canada (the active population expressed as a proportion of the population aged 15 and over) from 1976 to 1999 clearly show a narrowing of the gap between male and female rates. The increase in the participation rates of females aged 25 and over has been significant over recent years. In 1976 male participation was at 77.6% versus only 45.7% for females, a gap of 31.9%. This gap had narrowed to 13.6% by 1999 with male and female participation at 72.5% and 58.9%, respectively. It is assumed that females will continue to narrow the gap in participation rates but at a slower pace. It is assumed that the gap will gradually reduce to about 10% by 2030 and remain constant thereafter.

Table 28 shows the projected active population. Over the next few years it is assumed that females aged 50 and over will continue to increase their overall labour force participation. In fact, the currently observed higher labour force participation of women aged less than 50 is assumed to continue as this cohort ages.

Table 28 Active Population
(Canada)

Year	Population Aged 15 and over[1]		Active Population		Labour Force Participation Rates	
	Males	Females	Males	Females	Males	Females
	(thousands)		(thousands)		(%)	(%)
2001	12,045	12,454	8,778	7,405	72.9	59.5
2002	12,187	12,594	8,837	7,456	72.5	59.2
2003	12,327	12,733	8,892	7,504	72.1	58.9
2004	12,474	12,878	8,990	7,595	72.1	59.0
2005	12,629	13,029	9,092	7,690	72.0	59.0
2006	12,782	13,178	9,189	7,780	71.9	59.0
2007	12,933	13,325	9,275	7,860	71.7	59.0
2008	13,077	13,466	9,355	7,935	71.5	58.9
2009	13,217	13,602	9,434	8,009	71.4	58.9
2010	13,355	13,735	9,514	8,082	71.2	58.8
2015	13,932	14,296	9,777	8,320	70.2	58.2
2020	14,460	14,815	9,937	8,491	68.7	57.3
2025	14,951	15,312	10,026	8,637	67.1	56.4
2030	15,379	15,760	10,141	8,838	65.9	56.1
2050	16,404	16,865	10,611	9,234	64.7	54.8
2075	17,577	17,946	11,226	9,754	63.9	54.4

[1] Adjusted to the basis used by Statitistics Canada in their labour force survey.

The aging of the population exerts downward pressures on the overall labour force participation rate in Canada. The overall participation rate would fall from the current 65.6% to 55.1% by 2050 if the 1999 participation rates by age and sex were to apply throughout the projection period. This can be explained by the recent significant decrease in participation among people aged 50 to 64 and the projected increase in the proportion of people in that age group as well as the increase in the proportion of people aged 65 and over. An overall reduction in the participation rates is inevitable under these circumstances.

To recognize this particular demographic trend, the projection period for purposes of projecting the participation rates has been divided in three subperiods, i.e. 2000-2010, 2010-2020 and 2020-2030. Individuals of the baby boom generation who were born between 1945 and 1955, presently active, will be aged 55 to 65 over the next decade and this highly active cohort will put upward pressure on the current low participation rate for

age group 55-64. It is assumed that over the next decade the labour force participation rate of this age-group (55 to 64) will increase slightly to levels somewhat higher than those experienced in the 1990s but lower than those experienced in the 1970s and 1980s. During that period, there will probably result a balance between gains in participation rates and productivity increases through the increase in average employment earnings of workers. Over the same period, female participation for this age-group will increase according to the pattern observed for the under 50 age-group. Nonetheless, these assumed increase in labour force participation rates for those aged 50 and over are not sufficient to counteract the decrease in the overall participation rate due to the demographic shift. For this reason participation rates for people aged less than 55, especially for those aged 20 to 40, were increased somewhat. This results in a labour force participation rate for those aged 15-69 for 2010 of 78.0% and 66.4% for males and females, respectively.

From 2010 to 2020, baby boomers born between 1956 and 1965, which are more numerous than the previous baby boomers, will be reaching the ages of 55 to 65 during that period. The first generation of boomers (1945-1955) has already reached the normal retirement age and this creates downward pressures on the overall participation rate. It was thus assumed that those aged 55-65 during this period would be participating more because of the increased employment opportunities due to the expected labour shortage. This change in work pattern might be expected since this generation of workers is more adaptable, flexible and better educated to prolong their work life. Since the early 1990s, young individuals aged less than 35 have entered the labour force later mainly due to longer schooling and for this reason we might expect a later exit from the labour force. It was thus assumed that participation rates for those aged less than 55 would increase. Again, as for the previous period, we expect a balance between gains in participation and productivity. This results in a labour force participation rate for those aged 15-69 for 2020 of 77.2% and 66.3% for males and females, respectively.

From 2020 to 2030, both baby boom generations have reached the normal retirement age; combined with the projected low growth in the population, this leads to downward pressures on the ratio of active to working age persons. For this reason, the participation rates of those aged 55 and over, especially those aged 60 to 64, are increased to partially offset the decrease in the overall participation rate. Consequently there is a slight increase in the active population over that period. This results in a labour force participation rate for those aged 15-69 for 2030 of 77.2% and 67.7% for males and females, respectively.

Finally for 2031 and thereafter, the participation rates are kept constant. This causes the active population to increase at a low rate of 0.2%.

2. Employment

In Canada the annual average rate of increase in employment has been about 1.8% since 1976. However, this rate has varied greatly, having averaged 2.2% from 1976 to 1989 but only 1.1% from 1990 to 1999. It is assumed that the net job creation rate would be 0.5% in 2001, based on the most recent experience. Thereafter, the annual job creation rate is assumed to decrease to 0.3% in 2002 and to be around 1.2% for 2003 to 2008 and then

decreasing gradually to 0.2% over the long-term as the increase in the active population reduces the pressure on the unemployment rate.Table 29 shows the projected number of employed persons.

If the job creation rate remained constant at the current level throughout the projection period, it would result in the elimination of unemployment in the context of the projected demographic situation. The unemployment rate is not expected to fall below the natural rate of unemployment without creating inflationary pressures. The natural rate of unemployment represents an equilibrium state in the labour market in the long run. In this report, it is assumed that the natural unemployment rate would be about 7.0% up to 2010. Thereafter, the slower growth in the active population would further reduce the natural unemployment rate. For this reason, the natural unemployment rate is assumed to decrease to a level of 6.5% for 2015 and thereafter.

Table 29 Employment of Population Age 18 to 69
(Canada less Québec)

Year	Population		Average Employed		Employment Rate		Proportion With Earnings (Earners)	
	Males	Females	Males	Females	Males	Females	Males	Females
	(thousands)		(thousands)		(%)	(%)	(%)	(%)
2001	8,020	7,993	5,955	5,103	74.3	63.8	79.9	71.1
2002	8,124	8,100	5,978	5,128	73.6	63.3	79.2	70.5
2003	8,233	8,209	6,053	5,192	73.5	63.2	79.1	70.4
2004	8,344	8,320	6,146	5,275	73.7	63.4	79.2	70.6
2005	8,453	8,430	6,232	5,352	73.7	63.5	79.3	70.6
2006	8,558	8,537	6,314	5,425	73.8	63.5	79.3	70.7
2007	8,668	8,648	6,388	5,490	73.7	63.5	79.2	70.6
2008	8,781	8,761	6,455	5,550	73.5	63.4	79.0	70.4
2009	8,891	8,871	6,518	5,607	73.3	63.2	78.7	70.2
2010	8,998	8,978	6,584	5,665	73.2	63.1	78.6	70.0
2015	9,435	9,413	6,857	5,907	72.7	62.8	77.7	69.4
2020	9,653	9,630	6,994	6,048	72.5	62.8	77.3	69.2
2025	9,823	9,785	7,065	6,158	71.9	62.9	76.6	69.3
2030	9,913	9,862	7,143	6,292	72.1	63.8	76.7	70.2
2050	10,489	10,407	7,589	6,661	72.4	64.0	76.9	70.2
2075	11,246	11,114	8,135	7,123	72.3	64.1	76.8	70.0

3. Number of Earners and Contributors

The number of earners for any given year, namely anyone who had any employment earnings during the year, is always more than the employed population, sometimes even more than the labour force because they include all individuals who were earners at any given time during the year. The projected number of earners is obtained by regression based on the historical relationship between the number employed and the number of earners over the period 1976 to 1999. The number of contributors is then obtained by removing from the number of earners those who had earnings less than the YBE during the given year.

C. Annual Increase in Prices (Inflation Rate)

The inflation rate assumption is needed to determine the Pension Index for any given calendar year. It is also used in the determination of the annual nominal increase in average employment earnings, in the Year's Maximum Pensionable Earnings (YMPE) and the nominal rates of return on investments.

Price increases, as measured by changes in the Consumer Price Index (CPI), tend to fluctuate from year to year. Over the last 50 years, the trend was generally upward through the early 1980s and downward since then. For example, the average annual increase in the CPI for the 50-, 25- and 10-year periods ending in 2000 were 4.2%, 4.9% and 2.0%. Going forward, the Bank of Canada has reaffirmed its objective of keeping the inflation rate within a target range of 1% to 3% up to the end of 2005.

For 2001 the inflation rate has been assumed to be 2.8%. Then until 2005 it is assumed that the Bank of Canada will maintain its inflation target policy and so the assumption was set at 2%. This corresponds to the average forecast from various economists and falls in the middle of the Bank of Canada target. On the other hand, the ultimate assumption for price increases for 2015 and thereafter has been set at 3%. This is higher than has been experienced over the last decade but is the maximum of the current Bank of Canada target range. The main reasons for the choice of an ultimate assumption of 3% are as follows:

- The Bank of Canada long-term monetary policy is known only until the end of 2005. Compared to the 75-year projection period of the CPP, the monetary policy of the Bank of Canada could be viewed as short-term.
- The expected upward pressures on real wages due to the labour shortage may create upward pressures on prices.
- There is uncertainty about future energy costs.
- In Canadian history, the longest consecutive periods with an inflation rate of 2% are 1990-2000 and 1955-1965. New economic studies show that the optimum inflation rate that would minimize unemployment is about 3%.

Finally from year 2005 to 2015 the price increase assumption is assumed to increase gradually from 2% to 3% by increments of 0.1% each year.

D. Annual Rate of Increase in Average Employment Earnings

The assumed nominal annual increase in average employment earnings is used to project the average annual earnings of CPP contributors while the assumed nominal annual increase in the industrial aggregate Average Weekly Earnings (AWE) is used to increase the Year's Maximum Pensionable Earnings (YMPE) from one year to the next. The real-wage differential is simply calculated by subtracting the inflation rate from the assumed nominal annual increase in average annual employment earnings or AWE.

Historically, the real-wage differential, as measured by the difference between the nominal increase in the AWE and the CPI, has fluctuated significantly from year to year. The trend was generally downward through the late 1980s, with some improvements since then, e.g. the 10-year average annual real-wage differential was –0.23% for the period ending in 1990 and 0.16% for the period ending in 2000. Over the longer term, the average annual real-wage differential averaged 1.4% for the 50-year period ending in 2000. Many factors have influenced real rates of wage increase, including general productivity, labour demand, the move to a service economy and decreases in the average hours worked. More specifically, labour demand has significant impact on real-wage increases. Real wages are subject to downward pressures as the demand for workers decreases. On the other hand, one could expect upward pressures on wages if the size of the labour force fails to keep up with a growing economy.

In previous actuarial reports, the YMPE and average annual employment earnings were both increased from one year to the next using the assumed increase in the AWE. For this report, it was decided to increase the YMPE and the average annual employment earnings at different rates over the next eight years. The YMPE is increased according to the AWE while the CPP average earnings are increased based on historical data on CPP average annual employment earnings. This choice was made because the increase in the AWE over the last decade has been lower than for average annual employment earnings, i.e. about 0.6% lower in real terms over the last 15 years and about 1.2% lower over the last five years. However, over the long term it is assumed that the AWE will increase at the same rate as annual employment earnings because this relationship has held over the last 25 to 35 years.

Considering these factors together with historical trends and judgement regarding the long-term course of the economy, the real increases in the AWE and average annual employment earnings are assumed to converge over the next eight years. Specifically, taking into account of the latest trends in the AWE, the real increase in AWE is assumed at –1.0% for 2001. For 2002, the real increase in AWE is assumed to be 0.2% and this rate is then gradually increased to reach 1.1% by 2015. Due to the expected economic slowdown, the real increase in average annual employment earnings is assumed at 0.0% for year 2002. For the period 2003 to 2007, the real increase in average annual earnings is

then assumed to outpace increases in the AWE. For 2008 and thereafter, the average annual employment earnings are increased at the same rate as for the AWE.

Then for the period 2011-2015 the real increase in both the AWE and average annual earnings rises gradually from 1.0% to 1.1% to take into account the expected upward pressures on real wages due to the expected labour shortage. The assumption is based on the expected labour shortage starting in 2015, as moderated by higher participation rates at older ages and gains in productivity.

Table 30 below shows the assumptions regarding the annual increases in prices, average annual employment earnings and AWE (YMPE).

Table 30 Inflation, Real Average Earnings and AWE Increases

Year	Prices	Real Average Annual Earnings	Real Average Weekly Earnings (AWE/YMPE)
	(%)	(%)	(%)
2001	2.80	(0.50)	(1.00)
2002	2.00	0.00	0.20
2003	2.00	0.55	0.30
2004	2.00	0.60	0.40
2005	2.00	0.65	0.50
2006	2.10	0.70	0.60
2007	2.20	0.75	0.70
2008	2.30	0.80	0.80
2009	2.40	0.90	0.90
2010	2.50	1.00	1.00
2011	2.60	1.02	1.02
2012	2.70	1.04	1.04
2013	2.80	1.06	1.06
2014	2.90	1.08	1.08
2015+	3.00	1.10	1.10

E. Real Rates of Return

Real rates of return are required for the projection of revenues arising out of investment earnings. They are assumed for each year in the projection period and for each of the main components of CPP assets, namely the CPP Account (the Operating Balance), the CPP Fund (loans to provinces), and the assets under the management of the CPP Investment Board.

1. Real Rate of Return on CPP Account (Operating Balance)

The CPP Account comprises an Operating Balance and short-term investments. The Operating Balance is maintained at a level to meet the anticipated benefit payments and administrative charges from the Account for the next three-month period. These funds are not invested in provincial securities or equities but earn interest on the average daily balance of the reserve. The interest paid on these funds is calculated by averaging the unweighted average yields at tender on three-month Treasury Bills during the month the interest is paid and then subtracting one-eighth of one percent.

Since the CPP Account is generally invested in short-term securities, it is assumed to be totally reinvested yearly and to earn an ultimate real rate of return of 2.0% for years 2001 and thereafter. The assumption recognizes the current downward trend of the short-term real rates as observed over the last 20 years and of the historical long-term averages of the real rate of return on three-month Treasury Bills less one-eighth of one percent. This average was 2.30% and 0.96% respectively for the last 50 and 65 years.

2. Rollover Rate and Real Rate of Return on CPP Fund (Loans to Provinces)

The CPP Fund at the end of 2000 was composed of 20-year bonds consisting of loans made to the provinces. The provinces are allowed to rollover at maturity any bonds that were purchased prior to the CPP amendments (which came into effect on 1 January 1998) for one more 20-year term. As at 31 December 2000, 75% of loans available for rollover have been rolled over. The rollover experience during the period of 1999-2000 for loans was used to determine that the overall pre-1998 loan rollover rate would be about 70%.

The applicable interest rate on rollover bonds is set at the market rate for provincial bonds issued by the given province. On the basis of the average long-, medium- and short-term experience of the spread between the annual yield on federal and provincial long-term investments, the current outlook of the economy and data on rollovers since 1999, an ultimate real rate of return of 3.52% for rollover bonds for years 2015 and thereafter was assumed. For the period from 2001 to 2015, the assumed real rates of returns were derived by interpolation between the assumed 2001 real rate of 3.12% and the ultimate real rate of 3.52% for 2015.

3. **Real Rate of Return on Assets Under the Management of the Canada Pension Plan Investment Board**

The projected real rates of return on variable income assets and fixed income assets have both been derived by taking into consideration the most recent outlook of the Conference Board of Canada. This outlook was based on the fact that over the long term, real interest rates are expected to decrease in the future, as their recent higher level was consequential to growing inflation pressures that would not be sustained in the future. The projected real rate of returns for the different types of investments also reflect that projections are over a 75-year horizon and that they are generally consistent with the longer-term averages of the real rates of return ending with year 2000.

All CPP Investment Board assets are currently invested in equities, specifically in Canadian, U.S. and foreign stock indexed funds. In the derivation of the real rates of returns for these variable return CPP Investment Board investments, consideration was given to the long-term real rates of return and also to the negative real rates of return of the TSE 300, S&P 500 and MSCI World (excluding U.S.) stock indices that were experienced during the first ten months of 2001. Reflecting this first-year adjustment, Canadian equities are projected to achieve a real rate of return of –16.5% for 2001 and of 4.5% thereafter. In comparison, the 35-year historical average of the TSE total annual real return was of 5.48%. As for U.S and foreign (i.e. other than U.S.) equities, they were projected to achieve a real rate of return of –12.6% for 2001 and of 5.0% thereafter.

The CPP Investment Board has currently no investments in fixed income assets because of the dominance of this type of investment in the CPP Fund and because of the existence of the CPP Account (Operating Balance). It is expected that fixed income assets will represent an important portion of the CPP Investment Board investments given the assumed ultimate asset mix of 50% in equities and 50% fixed income (bonds plus Operating Balance) for the CPP as a whole and that the CPP Fund will be gradually transferred as its components come to maturity over the next 30 years. For the real rates of return of fixed income CPP Investment Board investments, which would be composed of federal, provincial and corporate bonds, a real rate of return of 3.8% was assumed throughout the projection period.

Table 31 Real Rates of Return by Type of Asset

| Year | CPP Account | CPP Fund Rollovers | CPP Investment Board | | |
			Canadian Equities	U.S. and Foreign Equities	Bonds
	(%)	(%)	(%)	(%)	(%)
2001	2.00	3.12	(16.50)	(12.60)	-
2002	2.00	3.15	4.50	5.00	-
2003	2.00	3.18	4.50	5.00	-
2004	2.00	3.21	4.50	5.00	3.80
2005	2.00	3.23	4.50	5.00	3.80
2006	2.00	3.26	4.50	5.00	3.80
2007	2.00	3.29	4.50	5.00	3.80
2008	2.00	3.32	4.50	5.00	3.80
2009	2.00	3.35	4.50	5.00	3.80
2010	2.00	3.38	4.50	5.00	3.80
2011	2.00	3.41	4.50	5.00	3.80
2012	2.00	3.43	4.50	5.00	3.80
2015+	2.00	-	4.50	5.00	3.80

IV. Contributions

Contributions are determined by multiplying the number of contributors by the product of the average contributory earnings and the contribution rate.

A. Proportion of Contributors

In respect of a given calendar year, one of the conditions to be a contributor is to have employment earnings exceeding the Year's Basic Exemption (YBE). A proportion of contributors is accordingly determined by multiplying the proportion of earners by the complement of the fraction of earners earning less than the YBE. This fraction was determined for each age, sex and calendar year by expressing the YBE as a percentage of average employment earnings and using the distribution of earners and their earnings. These distributions were obtained from the statistics and are assumed to remain fixed at their adjusted 1999 distribution. Sample values of the projected proportions of contributors and of the resulting number of contributors for ages 18 to 69 are presented in Table 32, while Table 33 presents the proportion of contributors by selected age-groups and years for males and females respectively.

Table 32 Contributors

Year	Proportion of Contributors		Number of Contributors		
	Males	Females	Males	Females	Total
	(%)	(%)	(thousands)	(thousands)	(thousands)
2001	74.0	63.0	5,932	5,038	10,970
2002	73.4	62.7	5,962	5,077	11,039
2003	73.4	62.8	6,043	5,155	11,198
2004	73.6	63.1	6,142	5,250	11,392
2005	73.7	63.3	6,234	5,339	11,573
2006	73.9	63.5	6,321	5,424	11,745
2007	73.9	63.6	6,401	5,502	11,903
2008	73.7	63.6	6,475	5,575	12,050
2009	73.6	63.6	6,545	5,645	12,190
2010	73.6	63.7	6,618	5,717	12,335
2015	73.4	64.0	6,921	6,021	12,942
2020	73.5	64.5	7,093	6,215	13,308
2025	73.3	65.3	7,204	6,387	13,591
2030	74.0	66.8	7,338	6,587	13,925
2050	75.6	68.6	7,934	7,142	15,076
2075	76.3	69.5	8,579	7,723	16,302

Table 33 Proportion of Contributors by Age-Group

Age-Group	Males			Females		
	2001	2025	2050	2001	2025	2050
	(%)	(%)	(%)	(%)	(%)	(%)
20-24	75.6	82.4	85.6	69.2	77.3	80.9
25-29	80.6	84.5	87.3	71.2	78.0	80.0
30-34	81.5	83.2	84.0	69.6	77.0	79.8
35-39	84.7	86.5	87.3	72.3	79.8	82.5
40-44	84.5	86.6	87.3	74.9	80.7	83.2
45-49	84.4	87.3	88.6	75.3	82.8	85.2
50-54	82.1	85.0	86.1	69.3	77.8	81.1
55-59	71.6	77.7	80.3	53.1	62.9	66.2
60-64	41.8	50.3	54.2	26.0	34.1	37.9
65-69	8.0	10.3	11.8	4.1	5.9	7.8
All Ages	74.0	73.3	75.6	63.0	65.3	68.6

B. Average Contributory Earnings

Average contributory earnings were computed in respect of a given age, sex and year cell of contributors by subtracting the YBE from the average pensionable earnings computed for contributory earnings purposes (as opposed to benefit computation purposes).

In respect of a given age and sex cell, contributory earnings for a given year are calculated as the product of:

- the proportion of contributors for contributory earnings purposes,
- the average contributory earnings computed as above, and
- the population.

Total contributory earnings for the given year were obtained by summing contributory earnings computed for each age and sex cell. The average pensionable earnings by age, sex and calendar year used in the calculation of the average contributory earnings correspond to the average portion of individual employment earnings below the Year's Maximum Pensionable Earnings (YMPE) for a cohort of earners earning more than the Year's Basic Exemption (YBE). For 2001, the YMPE and YBE are respectively $38,300 and $3,500. The YMPE is increased annually based on the average industrial aggregate wage in Canada as published by Statistics Canada.

Average pensionable earnings are accordingly computed by removing from average employment earnings (1) the earnings of earners earning less than the YBE and (2) the portion of earnings in excess of the YMPE. Since earnings statistics are aggregate (by age, sex and calendar year) as opposed to individual, such removal is made using the distribution of earners and earnings. Sample values of average contributory earnings are shown in Table 34. For comparison purposes, the YMPE is also shown for the selected years at the end of the table. Table 35 shows the projected average employment earnings by age and sex for selected years.

On the other hand, average employment earnings are projected taking into account the structural demographic changes and the narrowing of the gap between average female and male employment earnings. The ratio of female to male average earnings stood at about 46% in 1966 and was 67% in 1999. This ratio is projected to increase to 90% by 2075.

Table 34 Average Contributory Earnings

Year	Males	Females	Combined	YMPE
	($)	($)	($)	($)
2001	24,814	20,245	22,716	38,300
2002	25,341	20,752	23,231	39,100
2003	25,911	21,330	23,802	39,900
2004	26,534	21,952	24,422	40,800
2005	27,210	22,615	25,090	41,800
2006	27,909	23,308	25,784	42,800
2007	28,680	24,059	26,544	43,900
2008	29,567	24,899	27,408	45,200
2009	30,484	25,778	28,305	46,500
2010	31,520	26,757	29,313	48,000
2015	38,096	32,852	35,656	57,500
2020	46,822	40,892	44,053	70,300
2025	57,277	50,607	54,142	85,900
2030	70,020	62,380	66,406	105,000
2050	156,230	142,017	149,497	234,600
2075	424,530	393,133	409,656	640,800

Table 35 Average Employment Earnings

Age Group	Males			Females		
	2001	2025	2050	2001	2025	2050
	($)	($)	($)	($)	($)	($)
20-24	16,996	37,928	102,075	13,091	31,983	89,665
25-29	29,120	64,309	171,449	22,170	55,105	154,374
30-34	37,130	81,199	216,108	26,016	65,873	186,624
35-39	41,823	91,234	242,321	28,136	71,601	203,809
40-44	44,907	97,565	257,430	30,010	76,520	219,460
45-49	46,892	101,999	268,527	31,501	80,142	230,265
50-54	46,685	101,429	266,685	30,714	79,006	227,771
55-59	41,746	89,774	235,674	26,100	68,727	199,657
60-64	36,163	78,253	205,421	21,907	58,298	171,567
65-69	20,168	44,650	117,460	11,667	32,440	95,260
All Ages	**36,986**	**80,802**	**213,314**	**25,164**	**64,252**	**183,671**

Chart 13 shows the evolution of the ratio of average pensionable earnings for males and females as a percentage of the YMPE. The ratio reduces in time for males mainly due to the freeze in the YBE, which has the effect of increasing the number of earners with low earnings. For females, the YBE effect is more than offset by the greater increase in their average pensionable earnings.

Chart 13 Ratio of Average Pensionable Earnings to Maximum
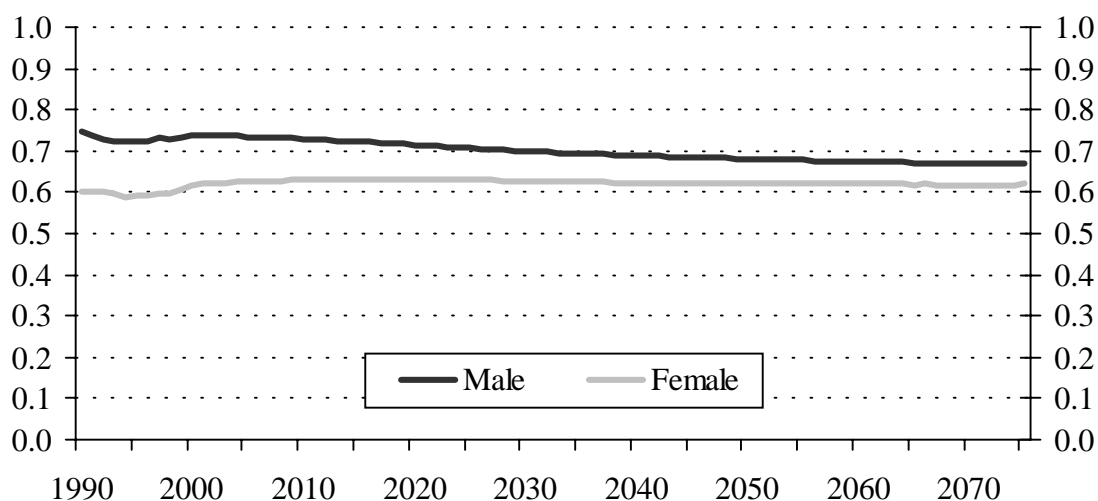
C. Contributions

The annual contributions are obtained as the product of the adjusted contributory earnings and the contribution rate. The contribution rate is set by law at 8.6% in 2001, at 9.4% in 2002 and at 9.9% for years 2003 and thereafter.

Total contributory earnings are adjusted to take into account (1) the non-refundable portion of employer contributions (arising generally in respect of employees with multiple employers during a year) and (2) contributions made in respect of employees earning less than the YBE during a given year.

The annual report on contributors published by HRDC and information from the Canada Customs and Revenue Agency (CCRA) on CPP contribution refunds were used to calculate the adjustment. The adjustment is about 1.8% in 2001 and gradually reduces to 1.6% over the projection period to take into account the freeze on the YBE at $3,500 and the portion of the adjustment related to those earners earning less than the YBE.

V. Benefit Expenditures

The actuarial approach used for projecting the future benefits paid is based on macro-simulation, which means that the projections rely on grouped data. This results in considerably smaller volumes of data to be processed.

The average initial annual retirement pension of all persons born in a given calendar year split by sex is obtained by summing over the contributory period of this cohort the annual products of the proportion of contributors and the average pensionable earnings deemed to apply to the given cohort and dividing this sum by the number of years included in the contributory period.

All benefit projections are made using 1966 as the starting point instead of the beginning (2001) of the statutory valuation period. This is done for the following reasons:

- The valuation methodology can be validated for the pre-valuation years (1966-2000) by comparing the projected values (benefits, contributions, beneficiaries, etc.) for these years with actual results.

- The projection of those benefits already in pay at the valuation date (31 December 2000) is fully integrated with that of benefits emerging after that date, thus ensuring full consistency of the various valuation processes used for those two series of beneficiaries.

- Certain amendments to the Plan, such as Bill C-23, which extends survivor benefits to same sex couples, create beneficiaries retroactively but do not provide for retroactive payments.

A proper valuation can be made by hypothetically adding these beneficiaries at the date when the death of the partner occurred.

A. Adjustments for Credit Splitting and Early Retirement Pensions

The effect of the equal apportionment of unadjusted pensionable earnings between spouses, in the event of marital union breakdown, is accounted for by adjusting projected proportions of contributors and average pensionable earnings of the respective spouses. These adjustments were achieved by assuming the following:

- On the basis of past medium-term average experience, the annual incidence rate of divorce is assumed at 1% for any age/sex/year cell. Divorce rates show a pattern of increases, but this was ignored because of its negligible effect on financial projections and the fact that not all individuals eligible apply for the credit splitting.

- The proportion of contributors is deemed not to vary by marital status for males, and the corresponding proportions for single females are deemed to be the same as those for males having the same age. Assumed proportions for married females for a given

age are then obtained as the weighted differences between overall female proportions of contributors and single-female proportions of contributors assumed as above for the same age.

- The distribution of average pensionable earnings of the cohort of spouses of a cohort of contributors of a given age is assumed to apply uniformly to each of the earnings categories of the given cohort of contributors.

Average pensionable earnings were further adjusted to take into account retirement pensions emerging prior to age 65. These pensions have the effect of reducing the amount of contributions that would otherwise have been made to the CPP. Such effect is already taken into account in the average pensionable earnings described earlier (for contributory earnings purposes, see Table 34). For benefit computation purposes, however, such effect must be removed in respect of contributors not yet retired at a given age before 65. This was done by dividing the above average pensionable earnings by the difference between unity and 40% (assuming retirement occurs mid-year and recognizing that higher paid earners will have made more than 50% of their annual contributions by mid-year) of the appropriate relevant retirement election proportion.

The resulting proportions of contributors and average pensionable earnings adjusted for credit splitting and early retirements (for benefit computation purposes) appear in Tables 36 and 37 respectively.

Table 36 Proportion of Contributors
(for benefit computation purposes)

Age-Group	Males			Females		
	2001	2025	2050	2001	2025	2050
	(%)	(%)	(%)	(%)	(%)	(%)
20-24	76.7	83.3	86.4	73.5	80.7	84.0
25-29	82.8	86.5	88.9	77.2	82.7	84.6
30-34	84.0	85.8	86.6	76.3	82.0	84.1
35-39	86.9	88.7	89.5	78.4	84.2	86.3
40-44	86.7	88.7	89.3	79.7	84.4	86.4
45-49	86.4	89.1	90.3	79.2	85.6	87.6
50-54	83.8	86.6	87.6	73.0	80.5	83.3
55-59	73.0	79.1	81.5	56.8	65.9	69.1
60-64	42.6	51.2	55.2	28.0	36.2	40.1
65-69	8.0	10.3	11.8	4.1	5.9	7.8
All Ages	**75.7**	**74.9**	**77.1**	**67.4**	**68.4**	**71.4**

Table 37 Average Pensionable Earnings
(for benefit computation purposes)

Age-Group	Males			Females		
	2001	2025	2050	2001	2025	2050
	($)	($)	($)	($)	($)	($)
20-24	17,728	37,586	98,214	14,628	32,824	88,261
25-29	24,975	54,551	144,341	21,761	49,815	133,881
30-34	27,632	60,657	161,783	23,674	54,447	147,114
35-39	28,946	63,796	170,834	24,719	56,959	154,484
40-44	29,731	65,502	175,446	25,678	59,245	161,583
45-49	30,284	66,887	179,345	26,423	61,068	166,848
50-54	30,070	66,118	176,744	26,038	60,330	164,491
55-59	28,369	61,342	161,657	23,745	55,416	149,759
60-64	28,684	60,501	154,909	23,655	54,267	143,407
65-69	23,346	46,365	108,540	18,527	39,506	95,108
All Ages	26,964	58,727	155,006	23,089	53,006	142,857

B. Benefit Eligibility Rates

As mentioned in Appendix A (Plan provisions), the eligibility for benefits varies according to the type of benefit involved. Benefit eligibility rates are used in the valuation process for the computation of historical retirement rate proportions, disability incidence rates and benefits of all types.

Benefit eligibility rates are computed using mathematical formulae that were developed to closely reproduce the outcome of a given micro-simulation model. The valuation takes into account the applicable eligibility rules for each type of benefit, the assumed proportions of contributors and the average pensionable earnings for all existing and future cohorts of earners. The eligibility rates are determined taking account of the assumed mobility rate of persons who never contribute and of persons who contribute randomly.

The average earnings-related benefit factors, to which disability and survivor benefit eligibility rates as computed above should normally apply, already implicitly incorporate the retirement benefit eligibility rate. Therefore, the disability and survivor benefit eligibility rates developed above apply to flat-rate benefits but must be divided by the retirement eligibility rate for purposes of computing the earnings-related portion of these two types of benefits.

Moreover, since the eligibility rules for disability and survivor benefits are more stringent than for retirement pensions, contributors eligible for either a disability or survivor benefit

have on average fewer years of nil earnings than contributors solely eligible for a retirement benefit. They consequently have higher aggregate earnings than contributors solely eligible for a retirement pension do and for this purpose, the earnings-related eligibility rates computed as in the previous paragraph were further adjusted to take this into account. Table 38 below shows the resulting eligibility rates for the various benefit types by sex and selected years.

Table 38 Benefit Eligibility Rate by Type of Benefit

Year	Retirement Benefit Eligibility Rate at Age 65		Death Benefit Eligibility Rate at Ages 65+	
	Males	**Females**	**Males**	**Females**
2001	0.99	0.85	0.96	0.68
2002	0.99	0.86	0.96	0.70
2003	0.99	0.87	0.97	0.71
2004	0.99	0.88	0.97	0.72
2005	0.99	0.89	0.97	0.73
2010	0.99	0.94	0.98	0.79
2015	0.99	0.99	0.98	0.84
2020	0.99	0.99	0.98	0.87
2025	0.99	0.99	0.97	0.89
2030	0.99	0.99	0.96	0.89
2050	0.99	0.99	0.94	0.91
2075	0.99	0.99	0.95	0.93
Year	Death Benefit Eligibility Rate at Ages 20-64		Disability Benefit Eligibility Rate at Ages 20-64	
	Males	**Females**	**Males**	**Females**
2001	0.93	0.88	0.87	0.82
2002	0.93	0.87	0.87	0.81
2003	0.93	0.88	0.87	0.81
2004	0.93	0.88	0.87	0.81
2005	0.92	0.88	0.87	0.81
2010	0.92	0.88	0.87	0.82
2015	0.92	0.89	0.87	0.82
2020	0.92	0.89	0.87	0.82
2025	0.92	0.90	0.87	0.83
2030	0.93	0.90	0.87	0.83
2050	0.94	0.92	0.87	0.84
2075	0.94	0.92	0.88	0.84

C. Average Earnings-Related Benefit Factor

The average earnings-related benefit factor is designed to produce, when multiplied by the eligible population and the Pension Index of a given calendar year successively for both sexes and all relevant ages, the total emerging annual earnings-related benefit expenditure for that year.

The gross (i.e. before taking into account the drop-out provisions and earnings index) average earnings-related benefit factor was determined by sex and calendar year for each attained age from 18 to 70 as the product of the retirement benefit proportion (25%) and the ratio of:

- the sum over all the years in the elapsed contributory period (i.e., from age 18 to the attained age) of the ratio in each year of:
  - ➢ the product of the proportion of contributors and the average pensionable earnings (both components adjusted for benefit computation purposes),
  - ➢ to the YMPE

- to the number of years in the elapsed contributory period at the attained age.

The earnings-to-YMPE ratios that have to be dropped from the numerator of the gross benefit factor described above, in respect of an individual, are the lowest ratios for a number of years equal to the sum of the child-rearing period, disability period and 15% of the residual contributory period. However, since the general approach is based on macro-simulation (aggregate), there is no explicit way of determining the lowest ratios for each individual that would have to be dropped from the numerator to take into account the drop-out provisions. Consequently, a formula was developed to help determine the lowest earnings ratios that can be dropped. The formula is based on the length of the contributory period, the basic drop-out percentage, the child-rearing period expressed as a percentage of the elapsed contributory period and the average proportion of contributors over the elapsed contributory period.

The average period that has to be dropped from the contributory period (i.e. the denominator of the gross benefit factor described above) is computed as the sum of the three periods determined in respect of the disability, child-rearing and 15% drop-out provisions.

The average earnings-related benefit factor is finally determined by multiplying the gross factor above, adjusted for the drop-out provisions, by the earnings index, which takes into account the wage indexation provision underlying the calculation of the initial rate of a benefit when it emerges.

Table 39 shows the resulting projected average earnings-related benefit factor by sex for various cohorts of contributors reaching the age of 65 in selected years over the projection period.

Table 39 Average Retirement Benefit Factor as Percentage of Maximum

Year	Retirement Benefit Factor for Cohort Aged 65	
	Males	Females
	(%)	(%)
2001	76	47
2002	77	48
2003	77	49
2004	76	50
2005	77	51
2006	75	51
2007	76	53
2008	76	53
2009	75	54
2010	74	54
2015	72	57
2020	70	57
2025	68	56
2030	66	56
2050	65	58
2075	64	60

D. Retirement Expenditures

For each cohort of contributors reaching a given retirement age from 60 to 70 in each of the calendar years from 1967 to 2075, an average retirement benefit factor was computed, by age, sex and calendar year of emergence of the pension, as the product of:

- the assumed proportion of contributors electing to retire;
- the actuarial adjustment factor in connection with the flexible retirement age provision; and
- the average earnings-related benefit factor.

The assumed proportions, by age, sex and calendar year, of contributors electing to start receiving the retirement pension at a given age last birthday were determined by taking account of the future assumed work patterns of earners aged 60 and over and of the corresponding CPP experience for 1996 to 2000. These proportions correspond to the

ratio of the number of emerging retirement beneficiaries to the product of the population and the retirement benefit eligibility rate.

A small proportion of contributors actually elect to start receiving the retirement pension after age 65 (less than 3%). For each year after 2000, the retirement election rates for ages 60 to 64 and 66 to 69 were determined by using the observed averages over the last five years. For ages 60 and 65 the observed rates for year 2000 are adjusted until 2030 to reflect the anticipated effects of the labour shortage on retirement patterns. For this purpose, the retirement rate at age 60 is reduced by a portion of the difference between the assumed participation rate at age 60 in 2030 and the corresponding participation rate in 2000. The retirement rate at age 65 is then increased by the amount of reduction applied at age 60. With this approach, it is implicitly assumed that all eligible contributors will have applied for the retirement pension by age 70. Table 40 shows the projected retirement election rates by age for males and females respectively.

Table 40 Retirement Rates

Age	Retirement-Age Distribution for Cohort Aged 60 in 2001		Retirement- Age Distribution for Cohort Aged 60 in 2030	
	Males	**Females**	**Males**	**Females**
	(%)	(%)	(%)	(%)
60	34.1	41.3	31.4	38.4
61	6.5	7.0	6.5	7.0
62	6.0	6.0	6.0	6.0
63	5.0	5.0	5.0	5.0
64	6.0	7.5	6.0	7.5
65	40.2	30.2	42.9	33.1
66	0.7	0.7	0.7	0.7
67	0.4	0.6	0.4	0.6
68	0.4	0.6	0.4	0.6
69	0.3	0.5	0.3	0.5
70	0.4	0.6	0.4	0.6
Total	100.0	100.0	100.0	100.0

The retirement pension expenditure for each year following the year of retirement of a given age, sex and year population cohort, until the year during which the cohort attains age 70, was computed as the product of:

- The relevant annualized average rate of retirement pension payable during the year of emergence (described above);

- The population of retirement beneficiaries at emergence;

- The probability of survival from the emergence age to the appropriate attained age; and

- The Pension Index (which recognizes the annual CPI increase to a pension each 1 January after its emergence).

The mortality rates vary by calendar year, sex, age and level of emerging pension. The mortality rates were developed based on the 1966-1997 CPP retirement beneficiaries' mortality experience. The resulting mortality rates and life expectancies appear in Tables 41 and 42 below.

Table 41 Mortality Rates of Retirement Beneficiaries
(Annual deaths per 1,000)

Age	Males				Females			
	2001	2025	2050	2075	2001	2025	2050	2075
60	6.5	4.8	4.2	3.6	4.3	3.6	3.2	2.8
65	15.5	11.9	10.2	8.8	8.5	7.1	6.3	5.5
70	28.6	22.8	19.7	17.0	15.0	12.8	11.3	10.0
75	44.9	37.2	32.1	27.7	25.3	22.2	19.6	17.3
80	76.5	65.6	57.6	50.3	46.1	40.8	36.1	31.9
90	184.2	165.2	143.9	125.7	132.3	121.2	107.1	94.9

Table 42 Life Expectancy of Retirement Beneficiaries

Age	Males				Females			
	2001	2025	2050	2075	2001	2025	2050	2075
60	20.6	22.2	23.4	24.6	24.8	25.8	26.8	27.9
65	16.5	17.9	19.0	20.2	20.4	21.4	22.3	23.3
70	12.9	14.1	15.1	16.2	16.4	17.2	18.1	19.1
75	9.9	10.9	11.7	12.7	12.7	13.5	14.3	15.1
80	7.3	8.0	8.8	9.6	9.5	10.1	10.8	11.6
90	3.9	4.3	4.8	5.4	4.8	5.2	5.7	6.2

The amounts of all retirement pensions payable during any given past or future calendar year were obtained by simply summing the annual expenditure applying for the given calendar year as described above, in respect of all age and sex cohorts having emerged in the given and each of the previous calendar years.

Based on comparisons of actual results and projections for 1966 to 2000, experience adjustment factors by age at emergence were applied to all future emerging retirement pensions calculated using the methodology described above (see Table 43). Table 44 shows the projected number of new retirement beneficiaries along with their projected average retirement benefit by sex and year.

Table 43 Retirement Experience Adjustment Factors

	Age at Emergence	
	60-65	**66 and over**
Males	0.99	0.57
Females	0.98	0.52

Table 44 New Retirement Pensions

Year	Number of Beneficiaries			Average Monthly Pension		
	Males	**Females**	**Total**	**Males**	**Females**	**Total**
				($)	($)	($)
2001	91,142	86,016	177,158	507.38	315.04	413.99
2002	93,697	89,180	182,877	519.70	328.50	426.46
2003	97,358	94,139	191,497	525.02	337.79	432.98
2004	100,859	98,048	198,907	531.27	348.51	441.18
2005	103,256	101,224	204,480	541.54	360.87	452.10
2006	108,749	108,231	216,980	554.22	373.96	464.30
2007	119,759	121,640	241,399	558.38	382.62	469.81
2008	125,244	127,368	252,612	572.63	399.59	485.38
2009	128,016	131,106	259,122	583.49	414.97	498.22
2010	131,437	135,834	267,271	596.44	430.04	511.87
2015	158,388	165,942	324,330	685.99	524.92	603.58
2020	181,223	188,310	369,533	813.64	639.49	724.89
2025	194,564	199,238	393,802	966.93	779.60	872.15
2030	186,676	189,591	376,267	1,157.82	957.80	1,057.04
2050	200,145	204,416	404,561	2,554.03	2,223.94	2,387.24
2075	210,558	213,266	423,824	6,907.65	6,202.31	6,552.73

E. Disability Expenditures

The general approach used to estimate disability pensions was to compute the initial value of benefits emerging by age and sex each year starting in 1970 as the product of:

- The actual or assumed disability incidence rate;
- The probability of being eligible for disability benefits;
- The annual amount of benefit; and
- The corresponding population.

The initial value of the earnings-related benefit by age and sex is equal to 75% of the average retirement earnings-related benefit factor. Finally these emerging benefits are then projected by age and sex to each future year until termination (due to recovery, death, or attainment of age 65) using the disability termination rates for the appropriate duration and the Pension Index.

Historical and projected disability incidence rates are summarized in Chart 14 and Table 45 low.

Chart 14 Disability Incidence Rates
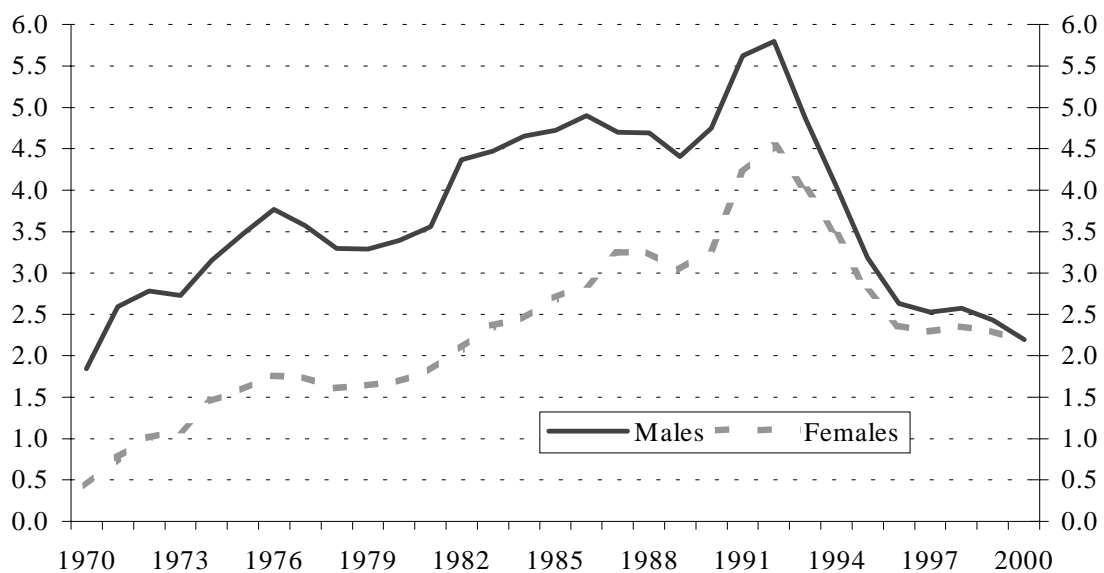(per 1,000 eligible)

Table 45   Ultimate Disability Incidence Rates
(per 1,000 eligible)

Age	Males	Females
20	0.30	0.10
25	0.45	0.33
30	0.97	0.83
35	1.42	1.45
40	2.06	2.13
45	2.92	3.08
50	4.49	4.60
55	8.09	6.45
60	13.25	8.12
61	13.74	8.15
62	13.21	7.69
63	11.34	6.56
64	7.96	4.65

It can be seen from the preceding graph that incidence (i.e. number of new cases as a proportion of the eligible population) gradually increased from 1980 to the mid-1990s. The annual rate of change in incidence rates was particularly acute in 1993 and to a lesser extent in 1994. The disability incidence rate has declined rapidly since 1995 and currently (1999) is at a level even lower than typical historical levels prior to the 1990s.

Factors that have strongly influenced this reversal in the trend are related to administrative changes put in place since 1994. All the following factors have contributed to reduce the disability incidence rates:

- Beginning in 1994, the CPP administration initiated a range of measures designed to effectively manage the growing pressure on the disability program;
- In September 1995, the guidelines for the determination of disabilities were revised to put the emphasis back on the medical basis and to de-emphasize the use of socio-economic factors. The guidelines are used at all levels in the determination process, thus greatly increasing consistency in decision-making;
- Implementation of more stringent eligibility rules since 1998;
- Increased reassessments of the disability status;
- Expansion of vocational rehabilitation services; and
- Implementation of a formal quality assurance program.

After considering the above factors, the aggregate (all ages combined using the 1998 population for weights) ultimate incidence rates for 2005 and subsequent years are taken to be 3.25 and 2.75 per 1,000 for males and females, respectively. These aggregate ultimate incidence rates partially recognize the recent experience and are somewhat higher than the recent 1997-1999 averages of about 2.5 and 2.4 per 1,000 for males and females. They are midway between the rates assumed in the Seventeenth Report and the recent experience. These ultimate aggregate rates were then distributed by age in accordance with the average 1998 actual experience for each sex. For intervening years (2000 to 2004), the male and female rates by age are assumed to increase gradually from their current levels of 2.4 and 2.3 per 1,000 in 1999 towards the assumed aggregate ultimate level for 2005.

The following termination rates are deemed to apply by age, sex and duration on an attained calendar year basis. The graduated average 1997-1999 experience is assumed to apply for 2001. For 2002 and subsequent calendar years, the 1997-1999 rates are projected by age at onset and duration since disablement based on 1989-1999 trends in recovery and death rates.

Table 46 Disability Termination Rates in 2001
(per 1,000 people)

Age	Males						Females					
	1st year	2nd Year	3rd Year	4th Year	5th Year	6+ Year	1st year	2nd Year	3rd Year	4th Year	5th Year	6+ Year
30	81	67	53	43	44	36	59	54	41	34	27	23
40	91	69	49	42	36	25	80	63	33	26	22	17
50	123	76	43	35	35	28	90	66	35	24	16	15
60	114	70	44	38	35	0	84	60	29	26	19	0

Table 47 Disability Termination Rates in 2030
(per 1,000 people)

Age	Males						Females					
	1st year	2nd Year	3rd Year	4th Year	5th Year	6+ Year	1st year	2nd Year	3rd Year	4th Year	5th Year	6+ Year
30	75	60	46	39	41	37	56	51	37	32	26	26
40	85	62	43	37	32	24	76	60	30	23	20	18
50	129	75	40	33	31	23	99	70	34	23	16	14
60	119	69	40	34	29	0	93	63	28	25	17	0

Based on comparisons of actual results and projections for 1966 to 2000 experience adjustment factors were applied to all future emerging disability pensions calculated using the methodology described above. These factors appear in Table 48 below.

Table 48 Disability-Benefit Experience Adjustment Factors

	Flat-Rate	Earnings-Related
Males	1.00	0.95
Females	1.00	0.90

Table 49 shows the projected number of new disability beneficiaries along with their projected average disability benefit by sex and year.

Table 49 New Disability Pensions

Year	Number of Beneficiaries			Average Monthly Pension		
	Males	**Females**	**Total**	**Males**	**Females**	**Total**
				($)	($)	($)
2001	17,080	14,394	31,474	768.04	669.02	722.75
2002	18,408	15,205	33,613	783.80	684.96	739.09
2003	19,845	16,060	35,905	795.87	697.64	751.93
2004	21,309	16,950	38,259	808.65	710.55	765.19
2005	22,842	17,860	40,702	823.31	725.03	780.19
2006	23,486	18,316	41,802	838.37	740.02	795.28
2007	24,063	18,717	42,780	854.43	756.05	811.38
2008	24,606	19,062	43,668	871.91	773.64	829.01
2009	25,131	19,411	44,542	890.73	792.38	847.87
2010	25,565	19,685	45,250	911.56	812.97	868.67
2015	27,411	20,841	48,252	1,044.76	941.75	1,000.26
2020	28,479	21,365	49,844	1,226.74	1,117.06	1,179.73
2025	28,251	21,309	49,560	1,449.36	1,332.47	1,399.10
2030	27,946	21,451	49,397	1,723.87	1,595.27	1,668.03
2050	30,588	23,332	53,920	3,520.53	3,304.41	3,427.01
2075	32,720	25,005	57,725	8,669.58	8,181.38	8,458.10

F. Survivor Expenditures

Starting in 1968, the numbers of male and female contributor deaths, taken from the demographic projections for each individual age 18 and over, were multiplied by the proportions of contributors married at death to produce the numbers of survivor benefits emerging by age, sex and calendar year.

The assumed proportions of contributors married at time of their death were determined from benefit statistics as at 31 December 1997. For each age and sex cell, the resulting actual proportions for 1996 were smoothed with slight adjustments. On the basis of the trends shown over the period 1987 to 1996, the proportions assumed for the projection period were extrapolated each year from 1997 to 2001. They were further adjusted to take into account the Bill C-23 amendment, under which survivor benefits were extended, effective 1 January 2001, to same sex couples. Proportions are assumed to remain constant after 2001. Sample values are shown in Table 50.

Table 50 Proportion of Contributors Married at Death

Age	Males	Females
	(%)	(%)
20	6	5
30	29	41
40	49	65
50	65	68
60	72	64
70	73	49
80	65	21
90	46	4

For purposes of the survivor pensions, the numbers of spousal deaths, by sex and by calendar year, were categorized by age of the surviving spouses using the age distributions of spouses, and each resulting number was multiplied by:

- The initial benefit amount;
- The probability of the deceased spouse being eligible for survivor benefit;
- The appropriate factor taking into account the reductions of survivor pensions in respect of survivors emerging under age 45 without dependent children and not disabled; and
- If applicable, the appropriate factor taking into account the limit applying to combined survivor-disability pensions.

The initial value of the earnings-related benefits is equal to 37.5% or 60% of the average retirement earnings-related benefit factor, depending on whether the surviving spouse is under or over 65.

All survivor pensions emerging by year as well as by age and sex of the surviving spouse are then projected to each subsequent year by incorporating assumed mortality rates adjusted, using results of an actuarial study of the mortality of CPP survivors, to reflect the higher mortality of widows and widowers as compared to that of the general population, and making allowance for the Pension Index.

Based on comparisons of actual results and projections for 1966 to 2000, experience adjustment factors were applied to all future emerging survivor pensions calculated using the methodology described above. To recognize that the current survivor experience adjustment factors reflect both methodology and benefit eligibility adjustments, the initial factors for 2001 are set at the current five-year average while the factors for years 2011 and thereafter correspond to the initial factor plus half of the difference between the initial factors and unity. These factors appear in Table 51. Table 52 below shows the projected number and average amount of survivor pensions by sex and selected years.

Table 51 Survivor-Benefit Experience Adjustment Factors

	Flat-Rate		**Earnings-Related**	
	Initial	**Ultimate**	**Initial**	**Ultimate**
Widows	0.90	0.95	0.90	0.95
Widowers	0.79	0.89	0.54	0.77

Table 52 New Survivor Pensions

Year	Number of Beneficiaries			Average Monthly Pension	
	Under 65	65 and Over	Total	Under 65	65 and Over
				($)	($)
2001	22,181	38,749	60,930	308.91	244.08
2002	22,019	39,624	61,643	316.38	249.77
2003	22,456	40,806	63,262	322.01	254.76
2004	22,921	41,998	64,919	327.65	259.54
2005	23,400	43,208	66,608	334.03	264.36
2006	23,922	44,446	68,368	340.48	269.08
2007	24,446	45,682	70,128	347.58	273.76
2008	24,978	46,949	71,927	355.29	278.48
2009	25,510	48,238	73,748	363.59	283.40
2010	26,048	49,584	75,632	372.49	288.56
2015	27,914	55,839	83,753	427.17	316.86
2020	29,074	63,783	92,857	502.10	354.05
2025	29,527	73,851	103,378	593.82	403.68
2030	29,247	84,928	114,175	704.60	472.42
2050	28,059	103,869	131,928	1,436.15	970.17
2075	26,366	107,923	134,289	3,567.36	2,577.39

G. Death Expenditures

The amount of lump sum death benefits payable each year starting in 1968 was determined by age and sex as the product of:

- The number of deaths, derived by sex for individuals age 18 and over consistent with the population data and projections;

- 50% of the average retirement earnings-related benefit factor (the lump sum death benefit is equivalent to six months of retirement pension) reduced, using the maximum retirement pension and the assumed distribution of average retirement pensions, to allow for the provision limiting the death benefit to 10% of the YMPE for the year of death prior to 1997 and to $2,500 for years after 1997; and

- The proportion of the deceased contributor's earnings eligible for survivor benefits.

Based on the comparison of actual results and projections, experience adjustments were derived. Furthermore, to recognize that the current death-benefit experience adjustment factors reflect both methodology and benefit eligibility adjustments, the initial factors for 2001 are set at their current three-year average while the factors for years 2011 and thereafter correspond to the initial factor plus half of the difference between the initial factors and unity. Tables 53 and 54 below show the projected experience adjustment factors and number of death benefits by sex for selected years.

Table 53 Death-Benefit Experience Adjustment Factors

Males		Females	
Initial	**Ultimate**	**Initial**	**Ultimate**
0.86	0.93	0.60	0.80

Table 54 Death Benefits

	Number of Beneficiaries		
Year	**Males**	**Females**	**Total**
2001	71,274	29,340	100,614
2002	73,275	31,714	104,989
2003	75,233	34,213	109,446
2004	77,333	36,839	114,172
2005	79,427	39,593	119,020
2006	81,679	42,472	124,151
2007	83,869	45,452	129,321
2008	86,180	48,533	134,713
2008	88,443	51,724	140,167
2010	90,863	55,002	145,865
2015	100,528	66,104	166,632
2020	111,149	75,642	186,791
2025	124,005	86,076	210,081
2030	138,695	98,444	237,139
2050	175,870	143,163	319,033
2075	185,778	154,277	340,055

H. Children's Expenditures

The numbers of disabled contributor's child and orphan benefits emerging each year starting in 1970 and 1968, respectively, were determined using the assumed fertility rates, to correspond to the number of children born, up to the date of emergence, to the previously computed number, emerging during the given year, of beneficiaries of disability and/or survivor pensions.

The resulting emerging numbers of children by age, sex and calendar year were thereafter survived out from one year to the next, incorporating the following reasons for termination of benefits:

- attainment of age 25 by the child;
- ceasing full time attendance at school while over age 18; and
- regarding disabled contributor's child benefits only, termination (recovery, death or attainment of age 65) of the parent's disability benefits.

Total eligible-child benefits were then obtained for any given calendar year as the product of (1) the aggregate number of child beneficiaries who emerged before and during the year and survived to the year and (2) the applicable annualized amount of the child flat-rate benefit obtained by adjusting the 2000 rate in accordance with the Pension Index.

The actual disabled contributor's child and orphan benefits paid each year from 1968 to 2000 were compared by age with the corresponding benefits computed by age for each of these years using the above approach. For this purpose, experience adjustment factors of 0.88 for disabled contributor's children and 0.94 for orphans were applied to all future emerging eligible-child pensions calculated using the methodology described above. Table 55 shows the projected number of new eligible-child benefits by type and selected years.

Table 55 New Children Benefits

Year	Disabled Contributor's Child	Orphans	Total
2001	19,404	12,543	31,947
2002	20,542	12,920	33,462
2003	21,729	13,280	35,009
2004	22,932	13,652	36,584
2005	24,163	14,005	38,168
2006	24,542	14,360	38,902
2007	24,856	14,682	39,538
2008	25,111	14,980	40,091
2009	25,338	15,252	40,590
2010	25,517	15,527	41,044
2015	26,296	15,614	41,910
2020	26,972	15,510	42,482
2025	27,546	15,475	43,021
2030	28,163	15,395	43,558
2050	29,776	14,537	44,313
2075	32,128	13,554	45,682

I. Administrative Expenses

The administrative expenses of the CPP have historically arisen from different sources including HRDC, Canada Customs and Revenue Agency, Public Works and Government Services, OSFI and the Department of Finance. Since the inception of the Canada Pension Plan Investment Board in 1998, there is a need to consider the administrative expenses therefore (its investment expenses are treated separately – see Section VI). In calendar year 2000, administrative expenses (including the CPP Investment Board) amounted to about $338 million.

Based on recent experience, the annual administrative expenses were on average about 0.09% of total annual employment earnings during the period from 1998 to 2000. It is also expected that the CPP Investment Board administrative expense ratio will continue to rise over the next few years as the CPP Investment Board matures. The projected CPP administrative expenses in terms of total annual employment earnings are projected to be 0.093% for 2001, 0.094% for 2002 and 0.095% for 2003 and thereafter.

VI. Assets

The total assets of the CPP at the end of any given year throughout the projection period are simply determined by adding together the total assets at the end of the previous year, the projected investment earnings and the contribution revenues and then subtracting the projected benefits and the administrative expenses of the given year. The actual value of assets (on a cost accrual basis) as at 31 December 2000 (the beginning of the projection period) was $43.7 billion. This is the sum of the assets in the three funding vehicles of the CPP: the CPP Account (Operating Balance), the CPP Fund and the assets under CPP Investment Board management. The CPP Account consists of short-term investments deemed to be approximately three months' worth of benefit expenditures. The CPP Fund consists of provincial bonds pursuant to loans made to provinces. It was assumed that the assets of the CPP Investment Board consisted of fixed-income securities such as bonds and of variable-income securities such as Canadian, U.S. and foreign equities. Table 56 reconciles the assets as at 31 December 2000 on the cash and cost accrual bases.

Table 56 Assets as at 31 December 2000
($ million)

Assets on a cash basis as at 31 December 2000	41,594
Plus: Receivables	
Contributions	959
Accrued interest on the Fund	803
Accumulated net income from CPP Investment Board	397
Benefits	48
Amount due from QPP	5
Minus: Liabilities	
Accounts payable	92
Assets on a cost accrual basis as at 31 December 2000	43,714

A. Investment Earnings

This subsection outlines the methods and assumptions used to derive the investment earnings for the CPP.

Investment earnings are produced by each of the three main components of the CPP assets, i.e. the CPP Account, the CPP Fund and the CPP Investment Board assets. In general, investment earnings are the product of the accrual value of a specific component and the projected nominal rate of return (which is obtained by adding the applicable projected real rate of return as described in subsection C below to the projected inflation rate) of that component.

The investment earnings of the CPP Account were based on a real rate of return of 2.0%, which was described in Section III of this appendix. It corresponds to the projected estimate of the real rate of return on 90-day Treasury Bills less one-eighth of one percent.

The investment earnings of the CPP Fund consist of semi-annual coupons at the rate specified at issue of the bonds. The real rate of return assumed on the post-1997 bond rollovers is described in Section III and corresponds to the expected real rate of return on long-term provincial bonds. Based on actual experience since 1998, rollovers have been assumed at 3.52% for years 2015 and thereafter. Since the last issue of the pre-1997 bonds was made in 1993, this means that the last possible renewal may occur in 2013 for another 20 years. This means that the CPP Fund component will be completely depleted by 2033.

The investment earnings of the Canada Pension Plan Investment Board are based on the assumed real rate of return applicable to each type of asset and on the long-term investment policy and strategy. The investment earnings are also adjusted downward to recognize the investment expenses. Based on the experience of the CPP Investment Board and of other large public pension plans, the investment expenses are assumed to reduce the rate of return by 0.04% for 2001 and thereafter.

B. Investments by Type of Asset

The CPP assets are invested in three major components as described above. Short-term assets are invested through the Account, loans to the provinces correspond to 20-year bonds and are invested in the CPP Fund while a mix of other assets are invested through the CPP Investment Board.

The CPP Investment Board invests monies according to its own investment policies, which take into account the needs of the contributors as well as financial market constraints. The investments have been grouped in four categories. Fixed-income securities are bonds. Variable-income securities consist of Canadian, U.S. and foreign equities. Since the CPP Investment Board has not yet established a long-term investment policy, the derivation of the CPP assumed asset mix was done by considering the asset mix policy of other major Canadian pension plans such as the QPP, Teachers and OMERS. It was also elected to use a 25% foreign content (reflected as an equal split between U.S. and foreign equities) which is less than the 30% statutory limit. Table 57 shows the assumed split of assets to apply for years 2015 and thereafter.

Table 57 Ultimate Asset Mix (%)

Fixed Income*	Canadian Equities	U.S. Equities	Foreign Equities
50.0	25.0	12.5	12.5

* Includes the Account, CPP Fund and CPP Investment Board bonds.

C. Rate of Return Calculation

The rate of return on the CPP Investment Board fixed-income securities takes into account the coupons and the market value fluctuations due to changes in interest rates. For the CPP Investment Board variable-income securities, the rate of return includes the dividends of the equities, market value fluctuations, and variations in currency exchange for non-Canadian equities. No distinction is made between realized and unrealized capital gains. These rates of return were described earlier in Section III.

D. Overall Rate of Return on Assets

The rate of return on the total assets was derived as the weighted average rate of return on all types of assets, using the value of the assets as weights. The resulting rates are shown in Table 58.

Table 58 Rate of Return on CPP Assets

Year	Nominal (%)	Real (%)
2001	6.4	3.6
2002	8.4	6.4
2003	7.8	5.8
2004	7.3	5.3
2005	7.0	5.0
2006	6.8	4.7
2007	6.7	4.5
2008	6.7	4.4
2009	6.6	4.2
2010	6.6	4.1
2015	7.0	4.0
2020	7.1	4.1
2025	7.1	4.1
2030+	7.1	4.1

Appendix C – Sensitivity Tests

This actuarial report on the Canada Pension Plan is based on the projection of its income and expenditures over a long period of time. The information required by statute, which is presented in Section IV of this report, has been derived using best-estimate assumptions regarding future demographic and economic trends. The key best-estimate assumptions, i.e. those for which changes within a reasonable range have the most significant impact on the long-term financial results, are described in Section III of this report.

Both the length of the projection period and the number of assumptions required ensure that actual future experience will not develop precisely in accordance with the best-estimate assumptions. Sensitivity tests have been performed, consisting of projections of CPP financial results using alternative assumptions.

The sensitivity tests were performed by varying each of the ten key assumptions individually with the remaining assumptions being maintained at their best-estimate levels. Two tests were performed with respect to each of the assumptions. The alternative assumptions selected are intended to represent a wide range of potential long-term experience. However, the results cannot properly be combined because a change in any particular assumption may impact on another to various degrees. The low- and high-dependency scenarios shown in Section V of this report present a more realistic picture of the possible range for the future financial status of the Plan than does combining the individual tests presented in this Appendix.

Each of these sensitivity tests was categorized as either a low-cost scenario or a high-cost scenario. In the low-cost scenarios, the alternative assumptions have the effect of reducing the steady-state contribution rate. Conversely, in the high-cost scenarios, the assumptions would increase the steady-state contribution rate.

Over the long term, economic cycles have little impact on pay-as-you-go rates as long as, on average, the ultimate assumptions are realized. Their impact on the steady-state contribution rate depends primarily on the assumed pattern of rates of return on investment and real wages. Nevertheless, a separate test dealing with economic cycles is presented in addition to all individual tests. For this purpose, a short-term economic slowdown cycle (more severe than under the best estimate scenario) has been prepared to show the impacts it would have on the long-term pay-as-you-go-rates and on the steady-state contribution rate. This test is described in more detail in section XI of this appendix.

Table 59 below summarises the alternative assumptions used in the sensitivity tests. It is followed by a brief discussion of each assumption and the impact its variation has on the results.

Table 59 Sensitivity-Test Assumptions

	Canada	Low-Cost	Best-Estimate	High-Cost
I.	Fertility rate	1.90	1.64	1.40
II.	Net migration rate	0.65%	0.52%	0.35%
III.	Mortality rates	No improvements after 2020	1990-92 Life Tables for Canada, with improvements	200% of best-estimate improvement rates
IV.	CPP disability rates (per 1,000 eligible)	Males 2.25 Females 1.75	Males 3.25 Females 2.75	Males 4.25 Females 3.75
V.	Retirement rates	All retirements at age 65 from 2006 onward	Retirements between Ages 60 to 70	All retirements at age 60 from 2006 onward
VI.	Unemployment rate	4.5%	6.5%	8.5%
VII.	Participation rates (2030)	Ages 15-69: 81%	Ages 15-69: 72%	Ages 15-69: 68%
VIII.	Real-wage differential	1.6%	1.1%	0.6%
IX.	Rate of increase in prices	4.0%	3.0%	2.0%
X.	Real rate of return on new investments	Account: 3.00% Fund: 4.50% CPPIB: 5.25%	Account: 2.00% Fund: 3.50% CPPIB: 4.25%	Account: 1.00% Fund: 2.50% CPPIB: 3.25%

I. Fertility Rate

The best-estimate assumption is that the total fertility rate for Canada will increase slightly from its 1997 level of 1.55 to an ultimate level of 1.64 in 2007 (1.60 in 2009 for Québec). This lies between the medium and high assumptions adopted by Statistics Canada for its most recent population projections.

The low-cost assumption has the fertility rate increasing to an ultimate level of 1.90 in 2007 (1.85 in 2009 for Québec). This is consistent with Statistics Canada's high assumption and represents a return to the levels typical of the early 1970s. Under this scenario, the population grows to a level in 2050 that is 11% higher than under the best-estimate assumption.

The high-cost assumption has the fertility rate decreasing to an ultimate level of 1.40 in 2007 (1.35 in 2009 for Québec). This is consistent with Statistics Canada's low assumption and represents a continuation of the historical trend of decreases. Under this scenario, the

population grows much more slowly, to a level in 2050 that is 9% lower than under the best-estimate assumption.

Changes in the fertility rate have a small short-term impact on the CPP's financial position. However, the long-term impact of changes may be significant.

II. Net Migration Rate

Net migration to Canada was 0.47% of population in 2000. Based on a continuation of these migration levels, an ultimate best-estimate assumption of 0.52% has been established for 2020 and thereafter. This level is reached in two steps; first a level of 0.50% is reached in 2005 and kept constant until 2015, and then the ultimate level of 0.52% is reached in 2020. This is consistent with experience over the last 15 to 25 years and with the ultimate migration level between the medium and high Statistics Canada population projections.

The low-cost assumption has net migration increasing to an ultimate level of 0.65% of population in 2005. This is consistent with Statistics Canada's high assumption. Under this scenario, the population grows to a level in 2050 that is 9% higher than under the best-estimate assumption.

The high-cost assumption has net migration decreasing to an ultimate level of 0.35% of population in 2005. This is consistent with Statistics Canada's low assumption. Under this scenario, the population grows much more slowly, to a level in 2050 that is 10% lower than under the best-estimate assumption.

III. Mortality Rates

Mortality improvements are expected to continue in the future. The best-estimate ultimate rates of improvement were established by adjusting the results of a detailed study prepared by the United States Social Security Administration actuaries regarding trends in mortality by age, sex and cause of death to reflect, in part, historical differences in mortality improvements between Canada and the United States. Rates of improvement were assumed to grade down from their recent levels to the ultimate by 2021.

For the low-cost scenario, mortality is assumed to improve less rapidly. Rates of improvement were assumed to grade down from recent levels to zero by 2021. Under this scenario, the population grows to a level in 2050 that is 3% lower than under the best-estimate assumption.

For the high-cost scenario, mortality is assumed to improve more rapidly. Rates of improvement were assumed to grade down from recent levels to 200% of the best-estimate ultimate levels by 2021. Under this scenario, the population grows to a level in 2050 that is 3% higher than under the best-estimate assumption.

The different rates of improvement would result in the following life expectancies:

Table 60 Life Expectancy in 2050 Under Alternative Assumptions
(Canada)

		Low-Cost	Best-Estimate	High-Cost
At Birth	Males	77.7	80.4	83.1
	Females	82.3	84.5	86.7
At Age 65	Males	17.3	19.1	21.1
	Females	20.5	22.1	23.8

The life expectancies shown in Table 60 were calculated as if the mortality rates assumed for year 2050 were applicable in all subsequent years.

IV. Disability Rates

The best-estimate projections assume that disability incidence rates will remain at approximately their current levels. The assumed rates vary by age and sex; based on the current distribution of population, the resulting aggregate ultimate rate of incidence for years 2005 and later is 3.00 new disabilities per year among each 1,000 eligible workers (3.25 for males and 2.75 for females, on average).

For the low-cost scenario, disability incidence rates are assumed to continue their recent trend of improvement, reaching ultimate levels in 2005 of 2.25 for males and 1.75 for females. Such incidence rates would be similar to those experienced under the CPP in the 1970s.

For the high-cost scenario, disability incidence rates are assumed to return to levels similar to those of the early 1990s. Ultimate incidence rates, reached in 2005, would be 4.25 for males and 3.75 for females.

Disability continuance rates assumed for future years, under all scenarios, have been based on the average experience during the period 1996 to 2000.

V. Retirement Rates

Retirement rates are used to determine the distribution of retirement ages of new retirement beneficiaries. The best-estimate scenario uses the 1996-2000 average as the starting point in 2001; that average is modified over the next 30 years to take into account the labour shortage and increases in participation rates at ages 60 to 64.

For the low-cost scenario, retirement rates were modified over the next five years so that all retirements were assumed to occur at age 65 beginning in 2006. The proportion of persons with earnings at ages 60 to 64 was therefore increased.

For the high-cost scenario, retirement rates were modified over the next five years so that all retirements were assumed to occur at age 60 except for 10% of disabled beneficiaries converting to retirement at age 65. The proportions of persons with earnings were accordingly set to zero at ages 60 and over.

VI. Unemployment Rate

Employment levels are reflected in the actuarial projection model through the assumption made regarding the level of the labour force and job creation rates, by year, age and sex. These rates vary not only with the rate of unemployment, but also reflect trends in increased workforce participation by women, longer periods of formal education among young adults and the trends in retirement patterns of older workers. The ultimate level of unemployment assumed to apply in 2015 and thereafter is 6.5%.

For the low-cost scenario, the net job creation rates are assumed to increase more rapidly, which results in an ultimate level of unemployment rate of 4.5% in 2015. For the high-cost scenario, the net job creation rates are assumed to increase more slowly, which results in an ultimate level of unemployment rate of 8.5% in 2015.

VII. Participation Rates

Participation rates are used to estimate the active population. The best-estimate scenario divides the projection period in three subperiods, i.e. 2000-2010, 2010-2020 and 2020-2030. During the first decade it is assumed that the labour force participation rate for ages 15 to 69 decreases slightly from about 73% in 2000 to 72% in 2010. For 2010-2020, it is assumed that participation rates will continue to increase to compensate for the labour shortage, particularly at ages below 55. From 2020 to 2030, the baby boomers have reached normal retirement age; combined with the projected low growth in the population, this leads to downward pressures on the ratio of active to working-age persons. For this reason, the participation rates of those aged 55 and over, especially those aged 60 to 64, are increased to partially offset the decrease in the overall participation rate. This results in a slight increase in the active population over that period.

For the low-cost scenario, male participation rates are assumed to reach their highest historical level by 2030 and females are assumed over the same period to reach the level of males. This result in an overall participation rate of 81% for those aged 15 to 69 in 2030.

For the high-cost scenario, male and female participation rates are assumed constant after 1999. This result in an overall participation rate of 68% for those aged 15 to 69 in 2030.

VIII. Real-Wage Differential

Wage increases impact the financial balance of the CPP in two ways. In the short-term, an increase in the average wage translates into higher contribution income, with little immediate impact on benefits. Over the longer term, higher average wages produce higher benefits. The long-term projected financial position of the CPP is more dependent on the differential between the assumed annual rates of wage increase and price increase (the real-wage differential) than on the absolute level of wage increases assumed.

An ultimate real-wage differential of 1.1% has been assumed in years 2015 and thereafter for the best-estimate projections. Combined with the best-estimate price increase assumption of 3.0%, it results in assumed nominal annual increases in wages of 4.1% in 2015 and thereafter. During the initial years of the projection period, the real-wage differential is assumed to increase uniformly from 2001 to its ultimate level.

For the low-cost scenario, the assumed real-wage differential increases to an ultimate level of 1.6% in 2015. This corresponds to the highest outlook from a series of economic forecasts we have studied and is much higher than recent experience.

For the high-cost scenario, the assumed real-wage differential increases to an ultimate level of 0.6% in 2004. While much lower than the long-term historical averages, it nevertheless represents an improvement from shorter-term historical averages.

IX. Price Increases

An ultimate annual rate of price increase of 3% has been assumed for the best-estimate projections. The rate of price increase is assumed at 2.8% in 2001, 2% for 2002 to 2005 and is assumed to increase uniformly from 2% in 2005 to its ultimate level of 3% in 2015.

For the low-cost scenario, the annual rate of price increase is assumed to rise to an ultimate level of 4% in 2015. This level of inflation is comparable to long-term historical averages. Although a higher rate of increase in prices results in higher CPP expenditures, it also results in higher contributory earnings (this is because the same real-wage differential is added to a higher base of inflation, producing a higher nominal rate of wage increase).

For the high-cost scenario, the annual rate of price increase is assumed to be 2% for years 2002 and thereafter. This level of inflation is comparable to that of the 1960s and 1990s.

X. Rate of Return on Investments

Assets of the CPP include the Operating Balance, which amounts to three months of benefit payments, the Fund, which consists of 20-year loans to the provinces, and the diversified portfolio of assets managed by the Canada Pension Plan Investment Board. In accordance with the new policy of investing the assets in a diversified portfolio, the ultimate real rate of return on the investment of future net cash flows is projected to be 2.0% for the Operating Balance, 3.5% for the Fund and 4.25% for the CPP Investment Board assets under the best-estimate assumptions.

For the low-cost scenario, real rates of return on new investments were assumed to be 3.0% on the Operating Balance, 4.5% on the Fund and 5.25% on the CPP Investment Board assets. For the high-cost scenario, real rates of return on new investments were assumed to be 1.0% on the Operating Balance, 2.5% on the Fund and 3.25% on the CPP Investment Board assets.

The real rates of return have no effect on the pay-as-you-go rates, since they affect neither benefits nor contributory earnings.

XI. Economic Cycles

Under the best-estimate scenario a short-term economic slowdown followed by a recovery is assumed at the beginning of the projection period. The sensitivity test presented in this section assumes that the economic slowdown will be more severe and followed by a longer period of economic recovery.

Under that scenario, the total contributory earnings are reduced by 6% in 2003 and followed by an economic recovery over the following 10 years. The job creation rate, the real increases in average weekly earnings and the real increase in average annual earnings are reduced over next few years. The real rates of return of the CPPIB are reduced for 2002 and 2003. Disability incidence rates and early retirement rates are also increased over the short-term to account for the fact that in times of economic slowdowns disability incidence rates and early retirement rates have historically increased.

XII. Results

Under each scenario, contribution rates were projected to follow the current schedule through 2002 and a new steady-state contribution rate was determined for years 2003 and thereafter. Table 61 summarizes the pay-as-you-go contribution rates and the steady-state contribution rates under each of the scenarios.

Under some of the sensitivity tests, the ultimate pay-as-you-go rates do not stabilize. In such cases, while the steady-state contribution rates shown in Table 61 would be adequate through 2071, they could result in significant increases or decreases in the ratio of assets to expenditures in the later years of the projection period.

Table 62 summarizes the projected impact on the ratio of the assets to the following year's expenditures under each of the alternative sets of assumptions, if the currently scheduled contribution rate of 9.9% continues to apply in years 2003 and thereafter.

Table 61 Sensitivity of Steady-State Contribution Rate
(percentages)

	Assumption	Scenario	Steady State Contribution Rate	Pay-as-You-Go Rates		
				2025	2050	2075
		Best-Estimate	9.8	10.54	11.24	11.45
I.	Fertility Rate	Low	9.5	10.45	10.40	10.19
		High	10.0	10.63	12.12	12.86
II.	Migration Rate	Low	9.6	10.21	10.79	10.97
		High	10.1	10.94	11.89	12.13
III.	Mortality Rates	Low	9.6	10.45	10.74	10.58
		High	10.0	10.64	11.73	12.31
IV.	Disability Rates	Low	9.5	10.20	10.91	11.14
		High	10.1	10.88	11.57	11.76
V.	Retirement Rates	Low	9.4	10.04	11.12	11.43
		High	10.1	11.06	11.54	11.69
VI.	Unemployment Rate	Low	9.7	10.36	11.15	11.43
		High	9.9	10.73	11.35	11.48
VII.	Participation Rates	Low	9.4	9.98	10.59	11.21
		High	10.1	11.02	11.54	11.58
VIII.	Real-Wage Differential	Low	9.5	10.04	10.37	10.54
		High	10.2	11.18	12.24	12.50
IX.	Price Increases	Low	9.6	10.30	10.95	11.21
		High	10.0	10.81	11.59	11.74
X.	Return on Investments	Low	9.4	10.54	11.24	11.45
		High	10.2	10.54	11.24	11.45
XI.	Economic Cycle		9.9	10.46	11.21	11.45

Table 62 Sensitivity of Funding Levels
(9.9% ultimate contribution rate)

	Assumption	Scenario	Asset/Expenditure Ratio		
			2025	2050	2075
		Best-Estimate	5.28	5.59	5.99
I.	Fertility Rate	Low	5.28	6.76	10.93
		High	5.27	4.49	1.05
II.	Migration Rate	Low	5.67	7.15	9.70
		High	4.87	3.67	0.91
III.	Mortality Rates	Low	5.42	6.94	10.97
		High	5.14	4.39	1.87
IV.	Disability Rates	Low	6.13	8.00	11.39
		High	4.48	3.31	0.86
V.	Retirement Rates	Low	7.66	9.83	14.05
		High	4.21	3.08	0.64
VI.	Unemployment Rate	Low	5.62	6.54	7.86
		High	4.98	4.67	4.12
VII.	Participation Rates	Low	5.51	8.10	11.42
		High	4.63	3.43	1.43
VIII.	Real-Wage Differential	Low	5.57	7.50	10.73
		High	4.79	3.03	*
IX.	Price Increases	Low	5.53	6.84	9.00
		High	5.02	4.23	2.59
X.	Return on Investments	Low	6.32	9.88	18.41
		High	4.43	2.88	0.30
XI.	Economic Cycle		4.72	4.71	4.33

*Assets depleted in 2071.

Appendix D – Financing the Canada Pension Plan

I. Long-Term Financial Status and Funding of the Canada Pension Plan

Historically, the retirement system in Canada has been designed as a three-tier system. Firstly, the Old Age Security (OAS) provides for a minimum floor based on residence in Canada. Secondly, the CPP covers most employment earnings. Finally, individuals can be covered by registered private pension plans (RPP) and can purchase individual registered retirement savings plans (RRSP) to complete their retirement needs.

Each tier is financed using a different approach; OAS is financed through general tax revenues on a pay-as-you-go basis, the CPP is partially funded (projected 25%-30%) based on contributions on employment earnings and RPPs and RRSPs are fully funded. To properly assess the long-term financial status of the CPP, one must consider the whole retirement pension system in Canada rather than the CPP in isolation. This variety in funding methods enables the system to be steered towards more or less funding by putting emphasis on the different tiers depending on the demographic and economic conditions.

Historically, the objective of CPP funding has been to accumulate and maintain a small reserve worth about two years of benefits. However, because of changes in the demographic and economic conditions (low fertility rates, real interest rates greater than real earnings growth), more funding for the CPP became desirable. In reaction to this, amendments were made in 1998 to gradually increase the level of CPP funding by increasing contribution rates over the short term, reducing benefits over the long term and investing cash flows in the private markets through the CPP Investment Board to achieve higher rates of return. It is projected that the level of funding for the CPP will grow from its current level of about 9% to a level of about 25% to 30% over the next few decades. The objective of the changes was to improve the financial long-term sustainability of the Plan. This will be accomplished if the degree of funding and the contribution rate remain relatively stable, which implies a long-term growth rate of assets at least equal to the long-term growth rate of liabilities.

There exist various ways to fully assess the long-term financial status of the CPP. The first measure of long-term sustainability uses the accrued benefit actuarial valuation method and the second is a new measure called the "actuarial balance". These two measures address both the adequacy of financing the projected costs over the long-range period as a whole, and the likely stability of its projected adequacy for future CPP reports. These are discussed in more detail in the following sections.

II. Actuarial Valuation – Accrued Benefit Method

The Canada Pension Plan is a defined benefit pension plan, i.e. in exchange for contributions, a worker and his or her dependants become eligible for a range of benefits, the amounts of which are based on his or her participation and earnings history. In this sense the CPP is similar to a defined benefit pension plan that might be established by an employer for its employees.

However, the CPP differs from a typical employer sponsored pension plan in that it is only partially funded. CPP assets are expected to reach a level of about five to six years of expenditures, which represents about a 25% to 30% funding level under the assumptions of this report. From its inception, the CPP was never intended to be a fully funded plan, as it is only one of the three components of the retirement pension scheme in Canada. As mentioned earlier, the three pillars of the retirement system are complementary as their funding approaches differ and provide better flexibility and shorten the time required adjusting to changing demographic and economic circumstances. These changing conditions might make it more or less costly to prefund retirement liabilities.

The accrued benefit method is used to determine the actuarial liability of the CPP. It is the method most widely used for the actuarial valuation of registered pension plans. Under this method, the benefits that will be paid in respect of CPP participation on or before the valuation date must first be projected. This projection is based on the best-estimate assumptions described in Appendix B, with the following exceptions:

- no new entrants to the workforce are included; and

- current Plan participants who are not yet retired at the valuation date are assumed to have no contributory earnings beyond that date.

Next, the projected expenditures were discounted at interest to determine their present value, which is the actuarial liability. The actuarial position as at 31 December 2000 is presented in Table 63. To obtain the unfunded liability, CPP assets are deducted from the actuarial liability at the valuation date.

Table 63 Balance Sheet as at 31 December 2000

	Amount	% of Liability
	($ million)	
Actuarial liability	486,682	100.0
Actuarial value of assets	43,715	9.0
Unfunded liability	442,967	91.0

If the CPP were fully funded, the ratio of its assets to anticipated 2001 expenditures would be about 24. This ratio will vary in future years, in accordance with demographic and economic experience and any changes in assumptions. With the changes introduced in 1998, the CPP is moving away from pay-as-you-go financing (with a small contingency reserve) towards fuller funding. Therefore the funding of the Plan is expected to increase from its current level of about 9% to a somewhat stable level of about 25% to 30%, thus reducing the relative size of the unfunded liability. The unfunded liability is put in a better perspective by looking at the future funding level of the CPP. Chart 15 summarizes this information.

Chart 15 Funding Ratio
(9.9% contribution rate for 2003+)
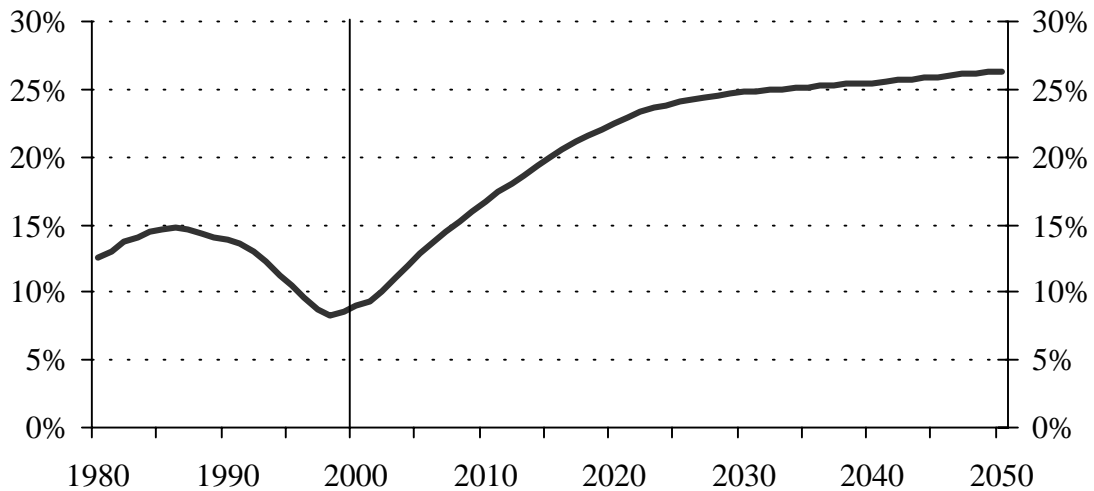
Again these results confirm that the current financial status of the Plan is projected to improve significantly over the next 50 years.

One way to understand the effect of the 1998 amendments on the CPP financial status is to look at the past and projected evolution of assets and liabilities using the best-estimate assumptions presented in this report. The historical and projected annual growth rates of assets and liabilities are presented in Chart 16.

Chart 16   Annual Growth Rates of Assets and Liabilities
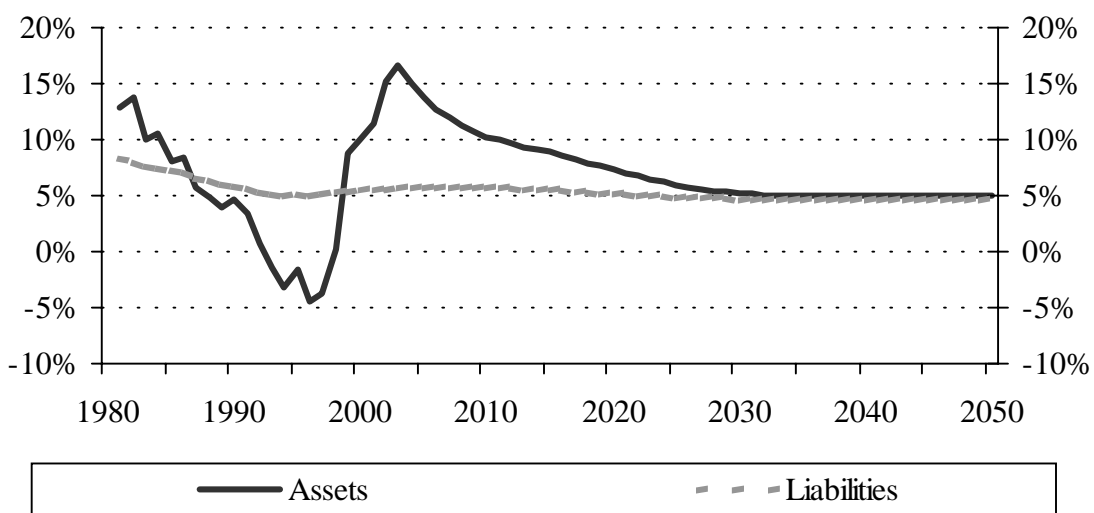
As can be seen, up to 1985 the CPP was accumulating assets more rapidly than its liabilities were growing, resulting in a fund worth about six times annual benefits by the end of 1985. However, from 1985 until the last part of the 1990s assets started to grow less rapidly then liabilities in reaction to changing demographic and economic conditions. Because of this, the fund multiple fell from about six in 1985 to about two by the end of 2000. More importantly, during the 1993 to 1998 period, the asset growth rate was negative because some assets in addition to all contributions were being used to pay benefits.

The latest CPP amendments, which became effective on 1 January 1998, reversed this trend. Chart 16 clearly shows that assets will again start growing much more quickly than liabilities in the short- to medium-term and will thereafter always grow at a rate somewhat higher. This will result in the fund growing to a stable level of between five to six years of benefits from its current level of two over the next few decades. This clearly indicates that the latest amendments will rapidly put the CPP on a better financial footing over the foreseeable future as the asset growth outpaces the growth in liabilities over the next 30 years. During that period the baby boom generation will have retired and as a result of the baby bust fewer young Canadians will replace them in the workforce.

Once the CPP has reached the higher funding level of about 25-30%, the long-term asset growth rate thereafter must be at least equal to the liability growth rate to ensure long-term financial sustainability. As shown in Chart 16, the asset and liability growth rate will stabilize at about 5% over the long term, making the Plan financially sustainable.

The notion of unfunded liability, especially if shown at only one particular point in time, is not a good indicator of the future financial health of the CPP. The evolution of the funding level and the projected growth rates of assets and liabilities are one example of better measures, as was demonstrated above.

III. Actuarial Balances

Is the Plan generating enough income to meet its obligations over the long run? This is the question that needs to be addressed to better quantify the Plan's viability in the long run. To answer this question we need to look at the streams of future income and outgo of the Plan over various periods of time. These streams combined with initial assets can reveal whether the Plan has sufficient income to cover expenditures over these various time periods.

In this section we are introducing a new measure of financial sustainability called the "actuarial balance". This new measure will help answer such questions and will be presented in future actuarial reports on the CPP.

For any given period, the actuarial balance can be defined as the difference between (1) the sum of the beginning assets and the present value of contributions for the period and (2) the present value of the expenditures for the same period, each divided by the present value of the contributory earnings for all years in the period. The following general formula can be used for any valuation period.

Actuarial Balance = *Asset Rate + Income Rate – Expenditure Rate*

where:

Asset Rate (AR) = *CPP assets as at beginning of year expressed as a percentage of the present value of CPP contributory earnings over the valuation period.*

Income Rate (IR) = *Present value of CPP contributions over the period expressed as a percentage of the present value of CPP contributory earnings over the valuation period.*

Expenditure Rate (ER) = *Present value of CPP expenditures over the period expressed as a percentage of the present value of CPP contributory earnings over the valuation period.*

Note: The present value calculations take account of the effect of interest on future income and expenditures. The interest rate assumed for discounting the stream of income and expenditures to the beginning of the period is the same as that used to calculate the interest earnings of the assets during the period.

A positive actuarial balance indicates that estimated income (assets and contributions) is more than sufficient to meet estimated CPP expenditures for the period as a whole; a negative actuarial balance indicates the opposite.

This calculation can be done for various subperiods of the projection period. In our analysis we look at 10-, 15-, 25-, 50- and 75-year period to get an overall picture of the actuarial status of the CPP over the short-, medium- and long-term horizon. A 75-year period actuarial balance is a convenient financial measure that can be used to assess the CPP overall long-term projected financial status. Table 64 below shows the actuarial balance over periods ranging from 10 to 75 years, based on the best-estimate assumptions.

Table 64 Actuarial Balances over Various Periods
(as % of present value of contributing earnings in period)

Period	Assets (AR)*	Income (IR)	Expenditures (ER)	Actuarial Balance (AR)+(IR)-(ER)
	(%)	(%)	(%)	(%)
2001-2010	2.10	9.70	8.41	3.39
2001-2015	1.48	9.76	8.57	2.67
2001-2025	0.99	9.80	9.00	1.79
2001-2050	0.63	9.84	9.75	0.72
2001-2075	0.53	9.85	10.01	0.37
2026-2050	3.30	9.90	11.09	2.11
2051-2075	3.83	9.90	11.38	2.35

Note: * based on assets of $43.7 billion at the end of 2000.

The size of the actuarial balance for any valuation period represents a measure of the CPP financial adequacy for that period. The actuarial balance can be interpreted as the amount of change, which, if made to the contribution rate schedule under the present law for each year in the period, would bring the program into exact actuarial balance. For example, the 75-year actuarial balance of 0.37% under the best-estimate assumption of this report means that the scheduled contribution rate could be reduced by 0.37% and still be sufficient when combined with the CPP assets at the beginning of 2001 to meet all expenditures for the 75-year period. Under this scenario, the assets will equal zero at the end of the period.

In Table 64 we observe that the actuarial balance is positive for the various periods. This shows that the projected CPP financial situation is expected to significantly improve over the foreseeable future due to the successive accumulation of small actuarial surpluses averaging 0.37% over the next 75 years. These surpluses will gradually increase the asset/expenditure ratio from the current level of two to a level over six by the end of 2075, using the legislated 9.9% contribution rate. The Plan is not projected to accumulate any more deficits and will increase its funding level from about 9% to about 25-30% over the next 75 years. This is another clear indicator of the long-term financial sustainability of the CPP.

IV. Reconciliation of Changes in Unfunded Liability

The major factors that account for the changes in the unfunded liability from the amount shown in the Seventeenth Actuarial Report are identified in Table 65.

Table 65 Reconciliation of Unfunded Liability with Previous Report
($ million)

Seventeenth Report unfunded liability as at 31 December 1997	**428,100**
Update to 31 December 2000	83,827
Seventeenth Report unfunded liability as at 31 December 2000	**511,927**
Methodology and experience update	(10,754)
Changes in key assumptions	
Fertility	124
Migration	(1,494)
Mortality	(2,959)
Disability	(709)
Employment	13,904
Real-wage differential	(9,976)
Price increases	(25,399)
Return on Investments	(25,830)
Others	(6,136)
Sub-Total: Assumption Changes	**(58,475)**
Plan Amendments	
Bill C-23	269
Eighteenth Report unfunded liability as at 31 December 2000	**442,967**

V. Internal Rates of Return

The internal rate of return is, with respect to a group of CPP participants born in a given year (i.e. a cohort), the unique interest rate resulting in the equality of:

- the present value of past and future contributions paid or expected to be paid by and in respect of that cohort, and

- the present value of past and future benefits earned or expected to be earned by that cohort.

Accordingly, actual internal rates of return cannot be determined until the last member of the cohort has died. However, they can be estimated based on the historical and projected experience of the cohort. Internal rates of return have been calculated on the basis of the best-

estimate assumptions and using the currently scheduled contribution rate of 9.9% for 2003 and thereafter.

The results presented in Table 66, are net rates in the sense that the administrative expenses associated with the cohort are not included in the value of the benefits. They are shown on two bases, as both nominal and real internal rates of return. To determine the real internal rates of return, both contributions and benefits were first adjusted to remove the impact of price increases.

Table 66 Internal Rates of Return by Cohort
(annual percentages)

Birth Year	Nominal	Real
1930	15.4	9.4
1940	10.4	6.1
1950	7.3	4.0
1960	5.9	3.0
1970	5.3	2.3
1980	5.1	2.1
1990	5.0	2.0
2000	5.0	2.0

The higher internal rates of return of the earlier cohorts mean that they are expected to receive better value from the CPP than those who follow do. The differences provide an indication of the degree of intergenerational transfer inherent in the Plan. However, the fact that all of the rates in the table are greater than zero shows that each cohort is expected to realize a positive return from its investment in the CPP.

Appendix E – Reconciliation with Previous Report

I. Introduction

The results presented in this report differ from those previously projected for a variety of reasons. Differences between the actual experience during 1998 through 2000 and that projected in the Seventeenth Actuarial Report are addressed in Section II below. Since historical results provide the starting point for the projections shown in this report, these historical differences also have an effect on the projected experience. The impacts of the experience update and other factors that have significantly changed the projected results are addressed in Section III.

II. Financial Status – 1998 to 2000

The major components of change in the CPP assets from 31 December 1997 to 31 December 2000 are summarized in Table 67. Because the accrual accounting basis has been put in place in recently, the assets for 1997 on an accrual basis are not available. For this analysis assets have been shown on the cash basis.

Contributions during the period 1997 to 2000 were about $1.2 billion more than projected. Over that period contributory earnings were greater due to higher-than-expected levels of employment.

Expenditures during the period were $91 million less than projected, slightly adding to the positive impact of the higher contributions. This represents a deviation from expected of less than 0.2% and is mainly due to a slight overprojection of death-related benefits. The details by type of expenditures appear in Table 68.

Investment earnings were about $122 million more than projected. This excess resulted largely from the higher net amount of assets available for investment. Overall, assets increased by $5.1 billion during this period, 37% higher than the projected increase of $3.8 billion. This resulted in overall assets being 3% higher than originally projected over the same period.

Table 67 Financial Status - 1998 to 2000
($ million)

	Actual	Expected	Difference	Ratio
Assets* at 31 December 1997	**36,460**	**36,460**		
+ Contributions	50,503	49,341	1,162	1.02
- Expenditures	56,898	56,989	(91)	1.00
+ Investment Earnings	11,530	11,408	122	1.01
Change in Assets	5,135	3,760	1,375	1.37
Assets* at 31 December 2000	**41,595**	**40,220**	**1,375**	**1.03**

*Assets presented on a cash basis.

Table 68 Summary of Expenditures - 1998 to 2000
($ million)

	Actual	Expected	Difference	Ratio
Retirement	38,369	38,339	30	1.00
Disability	7,674	7,700	(26)	1.00
Survivors	7,935	8,026	(91)	0.99
Children	1,343	1,375	(32)	0.98
Death	692	737	(45)	0.94
Administrative Expenses	885	812	73	1.09
Total Expenditures	**56,898**	**56,989**	**(91)**	**1.00**

III. Changes in Pay-as-You-Go Rates – 2001 to 2075

The pay-as-you-go rate, which is the ratio of expenditures to contributory earnings in a given year, is an important measure of the cost of the CPP. One way of understanding the differences between the best-estimate projections in this report and those presented in the Seventeenth Actuarial Report is by looking at the effects of various factors on the pay-as-you-go rates. The most significant effects are identified in the reconciliation presented in Table 69 and the discussion below.

The methodology described in Appendix B reflects a number of relatively minor improvements from that used in previous reports. These refinements had the effect of increasing the projected pay-as-you-go rates slightly in most years. The primary variations in experience during 1998 to 2000 were discussed in Section II above. The long-term effect of the experience update was to increase the projected pay-as-you-go rates slightly.

Changes made in the key assumptions from the previous report are outlined in Appendix B. The effects of these changes may be summarized as follows.

- The decrease in the ultimate fertility rate significantly increases the long-term pay-as-you-go rates, because its effect in slowing the growth in total contributory earnings outweighs the ultimate reductions in expenditures.

- The decrease in the assumed level of net migration significantly increases the pay-as-you-go rates, because its effect in decreasing the growth in total contributory earnings outweighs the ultimate decrease in expenditures.

- The slightly more rapid mortality improvements assumed for this report increase the pay-as-you-go rates, because beneficiaries are expected to receive their monthly benefits over longer periods of time.

- The lower levels of disability incidence assumed in the future, reflecting the significant recent improvements in experience and the changes in eligibility rules in 1998, reduce the pay-as-you-go rates.

- The increase in the assumed proportions of people with earnings, especially at older ages and for females, decreases the pay-as-you-go rates, although the effect declines with time as the higher participation translates into higher benefit entitlements.

- The increase in the real-wage differential decreases the pay-as-you-go rates in the short term with a smaller long-term impact because of the higher benefits paid eventually.

Some of the less significant assumptions, which are described in Appendix B, were also changed. For example, the proportions of people ages 18 to 24 attending school full-time, used in the projection of orphan benefits, and the experience adjustment factors applied in the projection of retirement, disability and survivor benefits were revised to reflect more recent experience. Overall, the changes in these other assumptions had the effect of increasing the projected pay-as-you-go rates.

Table 69   Reconciliation of Changes in Pay-As-You-Go Rates
(% of contributory earnings)

	2001	2025	2050	2075
Seventeenth Report Rate	**8.13**	**10.59**	**11.00**	**10.96**
I. Improvements in Methodology	**(0.01)**	**0.01**	**0.01**	**0.02**
II. Experience Update (1998-2000)				
Demographic	0.02	0.09	0.16	(0.03)
Economic	0.15	(0.06)	0.02	0.01
Benefits	(0.07)	(0.03)	(0.01)	0.00
Subtotal:	**0.10**	**0.00**	**0.17**	**(0.02)**
III.Changes in Assumptions				
Fertility	0.00	0.00	0.12	0.37
Net migration	0.04	0.23	0.39	0.41
Mortality	(0.02)	0.00	0.02	0.07
Disability	(0.01)	(0.14)	(0.10)	(0.07)
Employment	(0.12)	(0.11)	(0.23)	(0.14)
Real-wage differential	(0.03)	(0.05)	(0.19)	(0.18)
Price increases	(0.03)	0.08	0.01	0.00
Other assumptions	0.08	(0.07)	0.01	0.02
Subtotal:	**(0.09)**	**(0.06)**	**0.03**	**0.48**
IV. Plan Amendments				
Bill C-23	0.00	0.01	0.01	0.01
Total of I to IV	**0.01**	**(0.05)**	**0.24**	**0.49**
Eighteenth Report Rate	**8.14**	**10.54**	**11.24**	**11.45**

Factors that lead to changes in the pay-as-you-go rates generally have comparable effects on the steady-state contribution rate. Furthermore, while the actual and assumed rates of return on investments have no effect on pay-as-you-go rates, they may have a significant impact on the steady-state contribution rate. A reconciliation of the change in the exact steady-state contribution rate from the 9.764% shown in the Seventeenth Report to the new level of 9.795% is provided in Table 70.

The change in the funding target years from 2010 and 2060 to 2013 to 2063 has an impact on the steady-state rate as the asset/expenditure ratio in 2013 is somewhat higher than in 2010; this results in a higher funding target, which requires an increase of 0.05% in the steady-state contribution rate.

Table 70 Reconciliation of Change in Steady-State Contribution Rate
(% of contributory earnings)

Seventeenth Report Rates- After Rounding	**9.800**
Seventeenth Report Rates- Before Rounding	**9.764**
I. Improvements in Methodology	**(0.049)**
II. Experience Update (1998-2000)	
Demographic	0.058
Economic	(0.025)
Benefits	(0.037)
Subtotal:	**(0.004)**
III. Changes in Assumptions	
Fertility	0.027
Migration	0.190
Mortality	0.002
Disability	(0.120)
Employment	(0.061)
Real-wage differential	0.000
Price increases	0.108
Return on investments	(0.087)
Other assumptions	(0.027)
Subtotal:	**0.032**
IV. Plan Amendments	
Bill C-23	0.005
Total of I to IV	**(0.016)**
Change in funding target	0.047
Eighteenth Report Rates – Before Rounding	**9.795**
Eighteenth Report Rates – After Rounding	**9.800**

Appendix F – Financial Projections with 9.8% Steady-State Contribution Rate

The results presented in Table 71 are based on the best-estimate assumptions but using the rounded steady-state contribution rate of 9.8% as opposed to the currently scheduled contribution rate of 9.9% for years 2003 and thereafter.

Table 71 Financial Results - 9.8% Steady-State Contribution Rate
($ million)

Year	Paygo Rate	Contribution Rate	Contributory Earnings	Contributions	Expenditures	Net Cash Flow	Investment Earnings	Assets at 31 Dec.*	Asset / Expenditure Ratio
	(%)	(%)							
2001	8.14	8.6	253,577	21,808	20,637	1,171	2,823	47,709	2.20
2002	8.31	9.4	260,944	24,529	21,690	2,839	4,140	54,688	2.41
2003	8.36	9.8	271,200	26,578	22,661	3,917	4,462	63,067	2.66
2004	8.36	9.8	283,066	27,740	23,672	4,068	4,793	71,928	2.91
2005	8.38	9.8	295,429	28,952	24,747	4,205	5,209	81,342	3.14
2006	8.41	9.8	308,123	30,196	25,909	4,287	5,735	91,364	3.36
2007	8.47	9.8	321,464	31,503	27,215	4,288	6,315	101,967	3.56
2008	8.53	9.8	335,996	32,928	28,670	4,258	6,954	113,179	3.74
2009	8.62	9.8	351,034	34,401	30,247	4,154	7,674	125,008	3.91
2010	8.69	9.8	367,821	36,046	31,945	4,101	8,441	137,550	4.07
2011	8.76	9.8	385,591	37,788	33,782	4,006	9,306	150,861	4.22
2012	8.84	9.8	404,736	39,664	35,774	3,890	10,279	165,031	4.35
2013	8.93	9.8	425,072	41,657	37,965	3,692	11,390	180,112	4.47
2014	9.03	9.8	446,685	43,775	40,322	3,453	12,594	196,160	4.58
2015	9.13	9.8	469,322	45,994	42,856	3,138	13,894	213,191	4.68
2016	9.25	9.8	492,994	48,313	45,586	2,727	15,097	231,016	4.76
2017	9.37	9.8	517,715	50,736	48,488	2,248	16,353	249,617	4.84
2018	9.50	9.8	542,690	53,184	51,574	1,610	17,658	268,885	4.90
2019	9.64	9.8	568,988	55,761	54,858	903	19,001	288,789	4.95
2020	9.79	9.8	596,125	58,420	58,350	70	20,391	309,250	4.98
2021	9.95	9.8	623,689	61,122	62,050	(928)	21,825	330,146	5.01
2022	10.10	9.8	652,912	63,985	65,946	(1,961)	23,304	351,489	5.02
2023	10.25	9.8	683,593	66,992	70,055	(3,063)	24,814	373,240	5.02
2024	10.40	9.8	714,969	70,067	74,371	(4,304)	26,344	395,281	5.01
2025	10.54	9.8	748,125	73,316	78,865	(5,549)	27,893	417,625	5.00
2026	10.67	9.8	782,780	76,712	83,511	(6,799)	29,455	440,282	4.99
2027	10.77	9.8	819,702	80,331	88,280	(7,949)	31,038	463,370	4.97
2028	10.86	9.8	857,916	84,076	93,185	(9,109)	32,650	486,912	4.96
2029	10.94	9.8	898,032	88,007	98,259	(10,252)	34,296	510,956	4.94
2030	11.01	9.8	940,030	92,123	103,488	(11,365)	35,978	535,569	4.92
2035	11.17	9.8	1,178,461	115,489	131,645	(16,156)	45,131	670,618	4.86
2040	11.18	9.8	1,476,994	144,745	165,070	(20,325)	56,197	835,047	4.84
2045	11.18	9.8	1,843,364	180,650	206,089	(25,439)	69,983	1,039,885	4.83
2050	11.24	9.8	2,290,546	224,474	257,440	(32,966)	86,907	1,290,880	4.79
2055	11.35	9.8	2,841,947	278,511	322,482	(43,971)	106,975	1,587,899	4.71
2060	11.41	9.8	3,529,612	345,902	402,750	(56,848)	130,186	1,931,717	4.59
2065	11.38	9.8	4,395,350	430,744	500,333	(69,589)	157,709	2,340,591	4.48
2070	11.40	9.8	5,466,134	535,681	622,854	(87,173)	190,501	2,827,113	4.34
2075	11.45	9.8	6,785,276	664,957	776,846	(111,889)	228,089	3,383,762	4.17

* The Account and Fund components are valued at cost and the CPP Investment Board component is valued at market.

Appendix G – Acknowledgements

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