ACTUARIAL REPORT 26th

on the

Canada Pension Plan

as at 31 December 2012

Canada

21 November 2013

The Honourable James M. Flaherty, P.C., M.P.
Minister of Finance
House of Commons
Ottawa, Canada
K1A 0A6

Dear Minister:

In accordance with section 115 of the *Canada Pension Plan*, which provides that an actuarial report shall be prepared every three years for purposes of the financial state review by the Minister of Finance and the ministers of the Crown from the provinces, I am pleased to submit the Twenty-Sixth Actuarial Report on the Canada Pension Plan, prepared as at 31 December 2012.

Yours sincerely,

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

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I. Executive Summary

This is the 26th Actuarial Report since the inception of the Canada Pension Plan (CPP or the "Plan") in 1966. It presents the financial status of the Plan as at 31 December 2012. The previous triennial report was the 25th Actuarial Report on the Canada Pension Plan as at 31 December 2009, which was tabled in the House of Commons on 15 November 2010. An independent panel of actuaries reviewed the 25th CPP Actuarial Report and released a report in March 2011. The Office of the Chief Actuary gave due consideration to the review panel's recommendations and action was taken accordingly.

Since the 25th CPP Actuarial Report, the *Canada Pension Plan* has been amended, most recently as a result of technical amendments under Bill C-45 – *Jobs and Growth Act, 2012*, which received Royal Assent on 14 December 2012. As required by the *Canada Pension Plan*, the amendments under Bill C-45 will come into force once formal approval of the provinces is received. This is in process and should be completed in due course. In addition, all amendments to the *Canada Pension Plan*, as set forth under the *Economic Recovery Act (stimulus)* have come into force as of 1 January 2012. This 26th CPP Actuarial Report includes all the amendments made to the *Canada Pension Plan* under the *Economic Recovery Act (stimulus)* and the *Jobs and Growth Act, 2012*.

A. Purpose of the Report

This report has been prepared in compliance with the timing and information requirements of the *Canada Pension Plan*. Section 113.1 of the *Canada Pension Plan* provides that the Minister of Finance and ministers of the Crown from the provinces shall review the financial 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 the ministers consider in their review, including information to be provided by the Chief Actuary.

An important purpose of the report is to inform contributors and beneficiaries of the current and projected financial status of the Plan. The report provides information to evaluate the Plan's financial sustainability over a long period, assuming the legislation remains unchanged. Such information should facilitate a better understanding of the financial status of the Plan and the factors that influence costs, and thus contribute to an informed public discussion of issues related to the finances of the Plan.

B. Scope of the Report

Section II presents a general overview of the methodology used in preparing the actuarial estimates included in this report, which are based on the best-estimate assumptions described in section III. The results are presented in section IV and include the projections of the revenues, expenditures, and assets of the Plan over the next 75 years. Section V presents the reconciliation of the results with those presented in the 25th CPP Actuarial Report. Section VI concludes with the financial status of the Plan, while section VII provides the actuarial opinion.

The various appendices provide supplemental information on the long-term financial sustainability of the Plan, the uncertainty of the results, including the impact that asset allocation and financial market volatility have on the financial status of the Plan as well as a sensitivity analysis of the key best-estimate assumptions based on deterministic and stochastic approaches, the Plan provisions, a detailed reconciliation of the results with the previous triennial report and a description of the data, assumptions, and methodology employed.
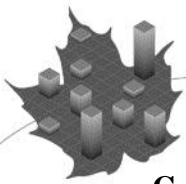
C. Main Findings

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 triennial actuarial report.

- With the legislated contribution rate of 9.9%, contributions are projected to be more than sufficient to cover the expenditures over the period 2013 to 2022. Thereafter, a proportion of investment income is required to make up the difference between contributions and expenditures. In 2050, 27% of investment income is required to pay for expenditures.

- With the legislated contribution rate of 9.9%, total assets are expected to increase significantly over the next decade and then will continue increasing at a slower pace. Total assets are expected to grow from $175 billion at the end of 2012 to $300 billion by the end of 2020. The ratio of assets to the following year's expenditures is projected to grow from 4.7 in 2013 to 5.4 by 2025 and 5.9 by 2075.

- The minimum contribution rate to sustain the Plan is 9.84% of contributory earnings for the year 2016 and thereafter. The legislated rate of 9.9% applies to the first three years after the valuation year, that is, to the current review period of 2013-2015.

- With the minimum contribution rate of 9.84% applicable for 2016 and thereafter, the assets are expected to increase significantly but to a lower level than under the legislated contribution rate. The ratio of assets to the following year's expenditures is projected to grow from 4.7 in 2013 to 5.3 by 2025 and to be the same fifty years later in 2075.

- The number of contributors is expected to grow from 13.5 million in 2013 to 14.5 million by 2020. Under the legislated contribution rate of 9.9%, contributions are expected to increase from $42 billion in 2013 to $56 billion in 2020.

- The number of retirement beneficiaries is expected to increase from 4.6 million in 2013 to 10.2 million in 2050.

D. Uncertainty of Results

To measure the sensitivity of the long-term projected financial position of the Plan to future changes in the demographic and economic environments, a variety of sensitivity tests were performed. The tests and results are presented in detail in Appendix B of this report.

One of the tests performed focuses on the impact of the Plan's assets being invested in portfolios with different asset mixes than the best-estimate portfolio. The tests show that the minimum contribution rate varies between 9.5% and 10.7% depending on the proportions of fixed income securities versus equity and real asset securities of the portfolios. Those portfolios more heavily weighted toward fixed income securities place upward pressure on the minimum contribution rate, whereas portfolios more heavily invested in equities and real assets tend to lower the minimum contribution rate.

Sensitivity tests were also performed to measure the impact that market shocks could have on the financial sustainability of the Plan under the best-estimate portfolio and alternative investment portfolios. Investment portfolio shocks, whether positive or negative, can have an immediate and significant impact on the financial status of the Plan. The impact varies depending on the amount of risk present in the portfolio. A portfolio more heavily weighted toward equity will tend to experience larger changes in the minimum contribution rate (either positive or negative) and is
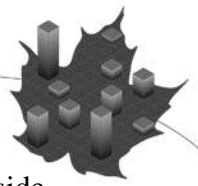
more likely to experience severe portfolio shocks in market upswings and downturns. The upside of investing in a risky portfolio must be weighed against the downside risk and the probability of poor investment returns occurring. These tests show that the minimum contribution rate could vary between 9.4% and 10.1% depending on the magnitude of the investment shock and the degree of risk present in a portfolio.

Following the economic slowdown experienced in 2008-09, sensitivity tests were created to analyze the capacity of the CPP to withstand another similar slowdown in the near future. These sensitivity tests assume that an economic slowdown would occur in 2014 and 2015, followed by a period of recovery. The impact on the minimum contribution rate would be relatively small, if it is assumed that only the unemployment rate and real wage increase are affected. In this case, the minimum contribution rate would increase to 9.9%. However, if a large investment loss occurs over the same period, then this could result in the minimum contribution rate reaching 10.1%.

Key best-estimate assumptions were varied individually in order to measure the potential impact that long-term changes in those assumptions could have on the financial status of the Plan. The individual sensitivity tests show that the minimum contribution rate could deviate significantly, from 9.0% to 10.7%, compared to its best-estimate of 9.84%, if other than best-estimate assumptions were to be realized.

Mortality is the most sensitive demographic assumption as it produces the widest range of the minimum contribution rate. If life expectancies continue to increase at the current rate, especially for ages 75 to 89, the long-term mortality assumptions will need to be adjusted accordingly. This will put additional pressure on the minimum contribution rate that could cause the rate to increase above 9.9%.

The last tests performed concern the aging of the population and how it may differ from the best-estimate projection. Two demographically based scenarios were developed that portray generally younger and older populations. These scenarios produced minimum contribution rates of 9.3% and 10.4%, respectively.

E. Conclusion

The results contained in this report confirm that the legislated contribution rate of 9.9% is sufficient to financially sustain the Plan over the long term. The results also show that assets accumulate to $300 billion (i.e. 5.2 times the annual expenditures) by 2020.

The minimum contribution rate required to financially sustain the Plan under this report is 9.84% for the year 2016 and thereafter, compared to 9.86% for years 2013 to 2022 and 9.85% from 2023 onward, as determined for the 25th CPP Actuarial Report. Experience over the period 2010 to 2012 was better than anticipated overall, especially regarding migration, benefits, and investment returns. However, this is offset by higher projected life expectancies at age 65 and lower assumed real wage increases. The net result of all changes since the 25th CPP Actuarial Report is an overall small decrease in the minimum contribution rate.

Under the 9.9% legislated contribution rate, the assets are projected to grow rapidly over the next decade as contribution revenue is expected to exceed expenditures over that period. Assets will continue to grow thereafter until the end of the projection period, but at a slower pace, with the ratio of assets to the following year's expenditures expected to reach a level of 6.0 by 2050. 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 and to remain financially sustainable over the long term.
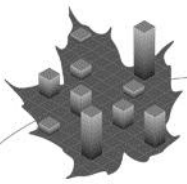
II.   Methodology

The actuarial examination of the Canada Pension Plan (CPP or the "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 provisions of the *Canada Pension Plan* as at 31 December 2012, data regarding the starting point for the projections, and "best-estimate" assumptions regarding future demographic and economic experience.

The revenues of the Plan include both contributions and investment income. 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 about various factors such as wage increases, an earnings distribution, and unemployment rates. Contributions to the Plan are obtained by applying the contribution rate to contributory earnings. Investment income is projected on the basis of the existing portfolio of assets, projected net cash flows (contributions less expenditures), and the assumptions regarding the future asset mix and rates of return on investments net of investment expenses.

Expenditures consist of the benefits paid out and operating expenses. Newly emerging benefits are projected by applying assumptions regarding retirement, disability, and death to the populations eligible to benefits, together with the benefit provisions and the earnings histories of the participants. The projection of total benefits, which includes the continuation of benefits already in pay at the valuation date, requires further assumptions. Operating expenses, excluding CPPIB operating expenses, are projected by considering the historical relationship between expenses and total employment earnings, while CPPIB operating expenses are considered in the determination of the rate of return.

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 the minimum contribution rate, which consists of two components. The first component is applicable to the Plan excluding the full funding provision for increased or new benefits, and is referred to as the "steady-state" contribution rate. The second component of the minimum contribution rate consists of the full funding rate for increased or new benefits.

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.

III. Best-Estimate Assumptions

A. Introduction

The information required by statute, which is presented in section IV of this report, 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 long-term trends than on more recent short-term trends. These assumptions reflect the Chief Actuary's best judgment and are referred to in this report as the "best-estimate" assumptions. The assumptions were chosen to be, independently and in aggregate, reasonable and appropriate, taking into account certain interrelationships between them.

An independent panel of actuaries reviewed the 25th Actuarial Report on the CPP (the previous triennial report on the Plan) and released a report in March 2011. The findings of the review panel reflected the professionalism and expertise of the staff of the Office of the Chief Actuary (OCA) in their work of projecting the financial status of the Plan. The review panel confirmed that the 25th CPP Actuarial Report was prepared in accordance with professional standards of practice and statutory requirements. The review panel found that the 25th CPP Actuarial Report was prepared using reasonable actuarial methods, and that the assumptions were, individually and in the aggregate, within the reasonable range. The review panel made a series of recommendations dealing with data, methodology, assumptions, communication of results, and other actuarial issues. As well, the reviewers provided an opinion and recommendations on the 24th Actuarial Report on the CPP that provided cost estimates of recent amendments to the *Canada Pension Plan* pursuant to the *Economic Recovery Act (stimulus)*.

The Government Actuary's Department of the United Kingdom selected the reviewers who were suitably qualified to carry out the review and provided the opinion that the work carried out for the review and the review report adequately addressed the issues set out in the terms of reference. For this 26th Actuarial Report on the CPP, the OCA gave due consideration to the review panel's recommendations and acted on them accordingly.

Since the 25th CPP Actuarial Report, the *Canada Pension Plan* has been amended, most recently as a result of technical amendments under Bill C-45 – *Jobs and Growth Act, 2012*, which received Royal Assent on 14 December 2012. As required by the *Canada Pension Plan*, the amendments under Bill C-45 will come into force once formal approval of the provinces is received. This is in process and should be completed in due course. In addition, all amendments to the *Canada Pension Plan*, as set forth under the *Economic Recovery Act (stimulus)* have come into force as of 1 January 2012. This 26th CPP Actuarial Report includes all the amendments made to the *Canada Pension Plan* under the *Economic Recovery Act (stimulus)* and the *Jobs and Growth Act, 2012*.

The Chief Actuary held a seminar in September 2012 on the long-term demographic, economic, and investment outlook for Canada to obtain opinions from a wide range of individuals with relevant expertise. Four experts in the fields of demography, economics, and investments were invited to present their views. Among the participants at the seminar were representatives from the OCA, federal departments including Employment and Social Development Canada and the Department of Finance, as well as representatives from provincial and territorial governments and other organizations. Representatives of the OCA also attended a seminar on the demographic, economic and financial outlook for 2012-2060 held by the Québec Pension Plan (QPP) on
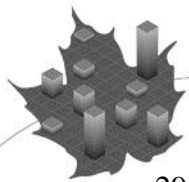
29 November 2012. The various presentation materials from both seminars are available on OSFI's Web site.

Table 1 presents a summary of the most important assumptions used in this report compared with those used in the previous triennial report. The assumptions are described in more detail in Appendix E of this report.

Table 1   Best-Estimate Demographic and Economic Assumptions

Canada	26th Report (as at 31 December 2012)		25th Report (as at 31 December 2009)	
Total fertility rate	1.65 (2015+)		1.65 (2015+)	
Mortality	Canadian Human Mortality Database (CHMD 2009) with assumed future improvements		Canadian Human Mortality Database (CHMD 2006) with assumed future improvements	
Canadian life expectancy at birth in 2013 at age 65 in 2013	Males 86.1 years 20.9 years	Females 89.1 years 23.3 years	Males 85.7 years 20.5 years	Females 88.5 years 22.8 years
Net migration rate	0.60% of population for 2017+		0.58% of population for 2023+	
Participation rate (age group 15-69)	76.8%	(2030)	75.2%	(2030)
Employment rate (age group 15-69)	72.1%	(2030)	70.6%	(2030)
Unemployment rate	6.0%	(2023+)	6.1%	(2022+)
Rate of increase in prices	2.2%	(2021+)	2.3%	(2019+)
Real wage increase	1.2%	(2020+)	1.3%	(2019+)
Real rate of return	4.0%	(2019+)	4.0%	(2017+)[1]
Retirement rates for cohort at age 60	Males Females	34% (2016+) 38% (2016+)	Males Females	38% (2016+) 41% (2016+)
CPP disability incidence rates (per 1,000 eligible)	Males Females	3.30 (2017+) 3.75 (2017+)	Males Females	3.40 (2015+)[2] 3.79 (2015+)[2]

(1)   For the 26th CPP Actuarial Report, the real rate of return assumption is net of all investment expenses, including CPPIB operating expenses. On a comparable basis, the ultimate real rate of return assumption of the 25th CPP Actuarial Report would be restated as 3.9% to reflect this improvement in the methodology.

(2)   The ultimate disability incidence rates assumption of the 25th CPP Actuarial Report has been adjusted based on the 2012 eligible population in order to compare with the assumption for this 26th CPP Actuarial Report on the same basis.

B. Demographic Assumptions

The population projections start with the Canada and Québec populations on 1 July 2012, to which are applied fertility, migration and mortality assumptions. The relevant population for the Canada Pension Plan is the population of Canada less that of Québec and is obtained by subtracting the projected results for Québec from those for Canada. The population projections are essential in determining the future number of CPP contributors and beneficiaries.

1. Fertility

The first cause of the aging of the Canadian population is the large drop in the total fertility rate that occurred between the end of the baby boom period (mid-1940s to mid-1960s) and latter half of the 1980s. The total fertility rate in Canada has dropped rapidly from a level of about 4.0 children per woman in the late 1950s to 1.6 by the mid-1980s. The total fertility rate rose slightly in the early 1990s, but then generally declined to a level of 1.5 by the late 1990s. Canada is one
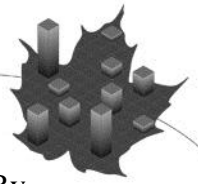
of many industrialized countries that have seen an increase in their fertility rates since 2000. By 2008, the total fertility rate for Canada had reached 1.68. However, in some industrialized countries, including Canada, the total fertility rate has decreased since 2008, which could be attributed to the economic downturn experienced in recent years. As of 2010, the total fertility rate for Canada stood at 1.63.

Similar to Canada, the total fertility rate in Québec fell from a high of about 4.0 per woman in the 1950s; however, the Québec rate fell to a greater degree, reaching 1.4 by the mid-1980s. The Québec rate then recovered somewhat in the early 1990s to over 1.6 and subsequently declined to below 1.5 by the late 1990s. There was a significant increase in the Québec rate since the year 2000, with the rate reaching 1.74 by 2008. However, similar to Canada's fertility rate, the fertility rate for Québec has been decreasing in recent years and was 1.69 in 2011.

The overall decrease in the total fertility rate since the 1950s occurred as a result of changes in a variety of social, medical, and economic factors. Although there have been periods of growth in the total fertility rates in recent decades, it is unlikely that the rates will return to historical levels in the absence of significant societal changes.

It is assumed that the total fertility rate for Canada will increase slightly from its 2010 level of 1.63 children per woman to an ultimate level of 1.65 in 2015. The total fertility rate for Québec is assumed to decrease from its 2011 level of 1.69 to the same ultimate level of 1.65 in 2015.

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 beneficiaries. Male life expectancy (without future mortality improvements) at age 65 increased 37% between 1966 and 2009, rising from 13.6 to 18.6 years. For women, life expectancy at age 65 (without future improvements) increased 28%, from 16.9 to 21.7 years over the same period. Although the overall gains in life expectancy at age 65 since 1966 are similar for males and females (about 5 years), about 60% of the increase occurred after 1991 for males, while for females, about 60% of the increase occurred by 1991.

Mortality improvements are expected to continue in the future, but at a slower pace than most recently observed over the 15-year period ending in 2009. Further, it is assumed that ultimately, mortality improvement rates for males will decrease to the same level as females. The ultimate rates of improvement in the year 2030 correspond to half the value of the average experience for females over the 15 to 20-year periods ending in 2009. Rates of improvement in the year 2010 are assumed to vary by age and sex, and correspond to the average rates experienced over the 15-year period ending in 2009. After 2010, the rates are assumed to gradually reduce to their ultimate levels in 2030 for Canada. As a result, life expectancy at age 65 in 2013 is 20.9 years for males, and 23.3 years for females, assuming future mortality improvements. This represents increases in life expectancies at age 65 in 2013 for males and females of 0.4 and 0.5 of a year, respectively, compared to the 25th CPP Actuarial Report.

To project CPP benefits, the mortality rates for CPP retirement, survivor, and disability beneficiaries reflect actual experience for those segments of the population. Specific mortality experience for CPP beneficiaries is discussed further in Appendix E of this report.
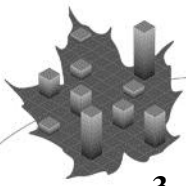
3. Net Migration

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.

The net migration rate is assumed to gradually decline from its current (2012) level of 0.77% of the population to an ultimate level of 0.60% of the population for the year 2017 and thereafter. This assumption reflects the fact that the annual net increase in the number of non-permanent residents has recently grown significantly, and that it is expected to remain at a positive but lower level in the future. The ultimate rate of 0.60% corresponds to the average observed experience over the last 30 to 40 years. For the Québec population, the net migration rate averages 0.50% over the projection period.

4. Population Projections

Table 2 shows the population for three age groups (0-19, 20-64 and 65 and over) throughout the projection period. The ratio of the number of people aged 20-64 to those aged 65 and over is a measure that approximates the ratio of the number of working-age people to retirees. Because of the aging population, this ratio drops from 4.2 in 2013 to less than half its value or 2.0 in 2075.

Table 2   Population of Canada less Québec
(thousands)

Year	Total	Age 0-19	Age 20-64	Age 65 and Over	Ratio of 20-64 to 65 and Over
2013	27,151	6,111	16,998	4,041	4.2
2014	27,475	6,133	17,151	4,192	4.1
2015	27,795	6,156	17,293	4,346	4.0
2016	28,110	6,186	17,420	4,504	3.9
2017	28,418	6,230	17,523	4,665	3.8
2018	28,727	6,286	17,603	4,837	3.6
2019	29,036	6,350	17,665	5,021	3.5
2020	29,345	6,417	17,714	5,214	3.4
2025	30,860	6,776	17,864	6,220	2.9
2030	32,256	7,009	18,001	7,246	2.5
2040	34,615	7,157	19,116	8,342	2.3
2050	36,679	7,415	20,136	9,127	2.2
2075	41,892	8,413	22,498	10,981	2.0

C. Economic Assumptions

The main economic assumptions relating to the Canada Pension Plan are for the following indicators: labour force participation rates, job creation rates, unemployment rates, and real increases in average employment earnings. 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 economic assumptions relates to the continued trend toward delayed retirement. Older workers are expected to exit the workforce at a later age, which could alleviate the impact of the aging of the population on future labour force growth. However, despite the expected later exit ages, labour force growth is projected to weaken as the working-age population expands at a slower pace and as the baby boomers retire and exit the labour force. As a result, a labour shortage is anticipated. Labour shortages together with projected improvements in productivity growth are assumed to create upward pressure on real wages. These higher real wages may in turn help keep people in the labour force who might otherwise retire.

1. Labour Force

Employment levels are reflected in the projections through the assumption regarding the proportion of the population, by age and sex, with earnings in a given year. These proportions 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 changing retirement patterns of older workers.

As the population ages, it becomes more heavily weighted in age groups where labour force participation is lower and, as a result, the labour force participation rate for Canadians aged 15 and over is expected to decline from 66.6% in 2013 to 64.0% by 2030. A more useful measure of the working-age population is the participation rate of those aged 15 to 69, which is expected to increase from 74.6% in 2013 to 76.8% in 2030.

The increase in the participation rate for those aged 15 to 69 is mainly due to an assumed increase in participation rates for those aged 55 and over as a result of an expected continued trend toward delayed retirement. Furthermore, anticipated labour shortages are expected to create attractive employment opportunities that will exert upward pressure on the participation rates for all age groups. It is also expected that future participation rates will increase with the aging of cohorts that have a stronger labour force attachment compared to older cohorts due to higher education attainment. The cohort effect of stronger labour force attachment of women is expected to continue but at a much slower pace than in the past, resulting in a gradual narrowing of the gap between the age-specific participation rates of men and women.

As a result, the participation rates for females are projected to increase slightly more than for males, primarily for those aged 25 to 44. Overall, the male participation rate of those aged 15 to 69 is expected to be 78.5% in 2013 and 80.2% in 2030, while the female participation rate for the same age group is expected to increase from 70.7% in 2013 to 73.4% in 2030. Therefore, the current gap of 7.8% between males and females in this age group is expected to decrease to 6.8%.

The job creation rate (i.e. the change in the number of persons employed) in Canada was on average 1.6% from 1976 to 2012 based on available employment data, and it is assumed that the
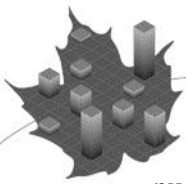
number of jobs will increase by 1.4% in 2013. The job creation rate assumption is determined on the basis of expected moderate economic growth and an unemployment rate that is expected to gradually decrease from its 2012 level of 7.2% to an ultimate rate of 6.0% by 2023. The job creation rate is on average about 1.0% from 2013 to 2017 and 0.7% from 2018 to 2023, which is slightly higher than the labour force growth rate. For the year 2024 and thereafter, the job creation rate follows the labour force growth rate, which is equal to 0.6% per year on average between 2024 and 2030, and 0.5% per year on average thereafter. The aging of the population is the main reason behind the slower long-term growth in the labour force and job creation rate.

2. Price Increases

Price increases, as measured by changes in the Consumer Price Index (CPI), tend to fluctuate from year to year. In 2011, the Bank of Canada and the Government renewed their commitment to keep inflation between 1% and 3% until the end of 2016. It is expected that this policy will be maintained until the end of 2019. In Canada, inflation was moderate at 1.5% in 2012. To reflect recent experience and the short-term expectation that inflation will remain subdued in coming quarters, the price increase assumption was set at 1.5% in 2013. Thereafter, the price increase assumption is set at 2.0% for years 2014 to 2019, 2.1% in 2020, and 2.2% for 2021 and thereafter.

3. Real Wage Increases

Wage increases affect 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.

Increases in the nominal wage comprise increases in the real wage and increases in the level of prices ("inflation"). Put another way, the difference between nominal wage increases and inflation represents increases in the real wage, which is referred to also in this report as the "real wage increase". This increase affects the long-term projected financial status of the Plan.

There are five main factors which influence increases in the real wage, namely general productivity, the extent to which changes in productivity are shared between labour and capital, changes in the compensation structure offered to employees, changes in the average number of hours worked, and changes in labour's terms of trade. Labour's terms of trade measure how shifts in the prices of goods produced by workers (measured by the Gross Domestic Product (GDP) deflator) compare to shifts in the prices of goods consumed by workers (CPI).

Based on the average increase in the real average weekly earnings over the last 15 years, the real wage increase is assumed to be 0.5% in 2013. It is then projected to gradually rise to an ultimate value of 1.2% by 2020. The ultimate real wage increase assumption is developed taking into account the relationships described above, historical trends, and an assumed labour shortage. The ultimate real wage increase assumption combined with the ultimate price increase assumption results in an assumed annual increase in average nominal wages of 3.4% in 2021 and thereafter.

The assumptions regarding the increase in average real annual employment earnings and job creation rates result in projected average annual real increases in total Canadian employment earnings of about 1.8% for the period 2013 to 2030. After 2030, this decreases to about 1.7% on average over the remainder of the projection period, reflecting the assumed 1.2% real increase in annual wages and projected average 0.5% annual growth in the working-age population.
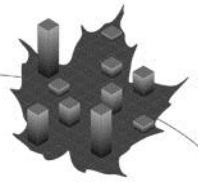
Given historical trends and the long-term relationship between increases in the average real annual employment earnings and the Year's Maximum Pensionable Earnings (YMPE), it is assumed that the real wage increase assumption is also applicable to the increases in the YMPE from one year to the next.

4.   Rates of Return on Investments

Real rates of return are the excess of the nominal rates of return over price increases and are required for the projection of revenue arising from investment income. A real rate of return is assumed for each year in the projection period and for each of the main asset categories in which CPP assets are invested. The assumed long-term real rate of return on CPP assets takes into account the assumed asset mix of investments as well as the assumed real rates of return for all categories of CPP assets. The real rates of return on investments are net of all investment expenses, including CPPIB operating expenses. The ultimate real rate of return is assumed to be 4.0% for the year 2019 and thereafter.

For the period 2013 to 2018, the annual real rates of return are lower than the assumed ultimate real rate of return of 4.0% in 2019 due to lower expected bond returns during the period. Equity returns are assumed to be stable throughout the projection period, and an ultimate equity risk premium of 2.2% is assumed to be reached in 2019. The 4.0% long-term real rate of return on CPP assets is comparable to the average over the last 50 years of historical real rates of return for large pension plans.

Table 3 summarizes the main economic assumptions over the projection period.

Table 3   Economic Assumptions

Year	Real Increase Average Annual Earnings	Real Increase Average Weekly Earnings (YMPE)	Price Increase	Labour Force (Canada)				Real Rate of Return on Investments
				Participation Rate (Ages 15+)	Job Creation Rate	Unemployment Rate	Labour Force Annual Increase	
	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
2013	0.5	0.5	1.5	66.6	1.4	7.1	1.2	2.7
2014	0.6	0.6	2.0	66.6	1.1	7.0	1.0	2.8
2015	0.7	0.7	2.0	66.5	1.0	6.9	0.9	3.0
2016	0.8	0.8	2.0	66.4	0.9	6.8	0.8	3.2
2017	0.9	0.9	2.0	66.2	0.8	6.7	0.7	3.4
2018	1.0	1.0	2.0	66.1	0.8	6.6	0.6	3.4
2019	1.1	1.1	2.0	65.9	0.7	6.5	0.6	4.0
2020	1.2	1.2	2.1	65.7	0.7	6.3	0.6	4.0
2021	1.2	1.2	2.2	65.5	0.7	6.2	0.6	4.0
2025	1.2	1.2	2.2	64.6	0.6	6.0	0.6	4.0
2030	1.2	1.2	2.2	64.0	0.7	6.0	0.7	4.0
2040	1.2	1.2	2.2	62.7	0.5	6.0	0.5	4.0
2050	1.2	1.2	2.2	62.1	0.3	6.0	0.3	4.0
2060	1.2	1.2	2.2	61.3	0.4	6.0	0.4	4.0
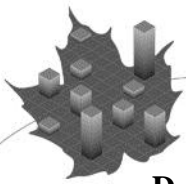
D. Other Assumptions

This report is based on several other key assumptions, such as retirement rates and disability incidence rates.

1.   Retirement Rates

The retirement rates are determined on a cohort basis. The sex-distinct retirement rate for any given age and year from age 60 and above corresponds to the number of emerging (new) retirement beneficiaries divided by the product of the population and the retirement benefit eligibility rate for the given sex, age, and year. The unreduced pension 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 had the effect of lowering the average age at pension take-up. In 1986, the average age at pension take-up was 65.2, compared to about 62.6 over the decade ending in 2012.

In 2012, there was a significant increase observed in the retirement rates at age 60 for the cohort reaching age 60 that year. The retirement rates at age 60 in 2012 were 41% and 44% for males and females, respectively, compared to the corresponding rates of 32% and 35% in 2011. The observed increase in the retirement rates at age 60 in 2012 may have resulted from two provisions of the *Economic Recovery Act (stimulus)*. First, the work cessation test to receive the pension early (prior to age 65) was removed in 2012. As such, starting in 2012, individuals may receive a CPP retirement pension without having to stop working or materially reduce their earnings. The removal of the work cessation test may have thus led at least in part to the observed increase in retirement rates at age 60 in 2012. Second, greater reductions in early retirement pensions are being phased in over a five-year period, starting in 2012. The anticipation of greater adjustments may have also contributed toward the observed increase in retirement rates at age 60 in 2012.

Starting from 2013, the age 60 retirement rates are assumed to gradually decrease to their pre-2012 levels as the higher actuarial adjustments are phased in and the effect of the removal of the work cessation test diminishes. For cohorts reaching age 60 in 2016 and thereafter, the retirement rates are assumed to decrease to 34% and 38% and to increase to 41% and 39%, at age 65 in 2021 and thereafter, for males and females respectively. These rates result in a projected average age at take-up of 62.9 in 2030.

2.   Disability Incidence Rates

The sex-distinct disability incidence rate at any given age is the number of new disability beneficiaries divided by the total number of people eligible for the disability benefit. Based on the average experience over the period 1998 to 2012, the ultimate overall incidence rates for the year 2017 and thereafter are assumed to be 3.30 per thousand eligible for males and 3.75 per thousand eligible for females. Between 2012 and 2017, the rates are assumed to gradually increase from their 2012 levels (3.10 for males, 3.59 for females) to the ultimate assumptions.

The assumptions recognize that although current disability incidence rates are significantly below the levels experienced from the mid-1970s (for males) and early-1980s (for females) to the early-1990s for both sexes, incidence rates for both sexes have been relatively stable since 1997 as a result of administrative changes made to the disability program.

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 triennial actuarial report. The key observations and findings are described below.

- With the legislated contribution rate of 9.9%, contributions are projected to be more than sufficient to cover the expenditures over the period 2013 to 2022. Thereafter, a proportion of investment income is required to make up the difference between contributions and expenditures. In 2050, 27% of investment income is required to pay for expenditures.

- With the legislated contribution rate of 9.9%, total assets are expected to increase significantly over the next decade and then will continue increasing at a slower pace. Total assets are expected to grow from $175 billion at the end of 2012 to $300 billion by the end of 2020. The ratio of assets to the following year's expenditures is projected to grow from 4.7 in 2013 to 5.4 by 2025 and 5.9 by 2075.

- With the legislated contribution rate of 9.9%, investment income, which represents 15% of revenues (i.e. contributions and investment income) in 2013, will represent 24% of revenues in 2020. In 2050, investment income represents 29% of revenues. This clearly illustrates the importance of investment income as a source of revenues for the Plan.

- The minimum contribution rate to sustain the Plan is 9.84% of contributory earnings for the year 2016 and thereafter. The legislated rate of 9.9% applies to the first three years after the valuation year, that is, to the current review period of 2013-2015.

- With the minimum contribution rate of 9.84% applicable for 2016 and thereafter, the assets are expected to increase significantly but at a lower level than under the legislated contribution rate. The ratio of assets to the following year's expenditures is projected to grow from 4.7 in 2013 to 5.3 by 2025 and to be the same fifty years later in 2075.

- Although the pay-as-you-go rate is expected to increase steadily from 8.8% in 2013 to 11.8% by the end of the projection period due to the retirement of the baby boom generation and the continued aging of the population, the legislated contribution rate of 9.9% remains sufficient to sustain the Plan in the long term. The pay-as-you-go rate is the rate that would need to be paid if there were no assets.

- Demographic changes will have a major impact on the ratio of workers to retirees; the ratio of the number of individuals in Canada less Québec aged 20 to 64 to those aged 65 and over is expected to fall from about 4.2 in 2013 to 2.2 in 2050.

- The number of contributors is expected to grow from 13.5 million in 2013 to 14.5 million by 2020. Under the legislated contribution rate of 9.9%, contributions are expected to increase from $42 billion in 2013 to $56 billion in 2020.

- The number of retirement beneficiaries is expected to increase from 4.6 million in 2013 to 10.2 million in 2050.

- There continues to be more female than male retirement beneficiaries and by 2020, there is expected to be approximately 214,000 (or 7.4%) more female than male retirement beneficiaries.

- The proportion of retirement benefits relative to total expenditures is expected to increase from 74% in 2013 to 83% in 2050.

- Total expenditures are expected to grow rapidly from approximately $38 billion in 2013 to $54 billion in 2020.

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 9.9%.

The number of contributors by age and sex is directly linked to the assumed labour force participation rates applied to the projected working-age population and the job creation rates. Hence, the demographic and economic assumptions have a great influence on the expected level of contributions. In this report, the number of CPP contributors is expected to increase continuously throughout the projection period, but at a decreasing pace, from 13.5 million in 2013 to 14.5 million by 2020. The future increase in the number of contributors is limited due to the projected lower growth in the working-age population and 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 on the YBE since 1998.

Contributions are expected to be $42.3 billion in 2013 as shown in Table 4, which presents the projected components of contributions. Since the legislated contribution rate is constant at 9.9% for the year 2013 and thereafter, contributions increase at the same rate as total contributory earnings over the projection period. Table 4 presents the projected number of CPP contributors, including CPP retirement beneficiaries who are working (i.e. "working beneficiaries"), their contributory earnings and contributions.
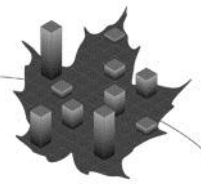
Table 4   Contributions
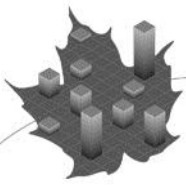
Year	Contribution Rate	Number of Contributors	Contributory Earnings	Contributions
	(%)	(thousands)	($ million)	($ million)
2013	9.9	13,453	427,762	42,348
2014	9.9	13,630	444,048	43,961
2015	9.9	13,806	461,583	45,697
2016	9.9	13,978	481,371	47,656
2017	9.9	14,123	501,091	49,608
2018	9.9	14,261	521,723	51,651
2019	9.9	14,393	543,322	53,789
2020	9.9	14,512	566,009	56,035
2025	9.9	15,021	695,678	68,872
2030	9.9	15,549	854,642	84,610
2040	9.9	16,660	1,285,576	127,272
2050	9.9	17,604	1,904,295	188,525
2060	9.9	18,285	2,772,797	274,507

C. Expenditures

The projected number of beneficiaries by type of benefit is given in Table 5, while Table 6 presents information for male and female beneficiaries separately.

The number of retirement, disability, and survivor beneficiaries increases throughout the projection period. In particular, the number of retirement beneficiaries is expected to double by the year 2040 due to the aging of the population. Female retirement beneficiaries continue to outnumber their male counterparts, and by 2050 there is projected to be 720,000 or 15% more female than male beneficiaries. Over the same period, the number of disability and survivor beneficiaries is projected to increase but at a much slower pace than for retirement beneficiaries.

Table 7 shows the amount of projected expenditures by type. Projected expenditures in 2013 are $37.6 billion and reach $54.4 billion in 2020. Table 8 shows the same information but in millions of 2013 constant dollars. Table 9 shows the projected expenditures by type expressed as a percentage of contributory earnings. These are referred to as the pay-as-you-go (or "paygo") rates. A pay-as-you-go rate corresponds to the contribution rate that would need to be paid if there were no assets. Although the total pay-as-you-go rate is expected to increase significantly from its current level of 8.8% in 2013 to 11.8% by the end of the projection period, the legislated contribution rate of 9.9% is sufficient to financially sustain the Plan over the projection period.

Table 5 Beneficiaries[1]
(thousands)

Year	Retirement[2]	Disability	Survivor[3]	Children	Death[4]
2013	4,594	390	1,203	234	137
2014	4,805	396	1,224	237	140
2015	5,010	402	1,244	240	144
2016	5,205	410	1,265	244	147
2017	5,383	417	1,286	249	151
2018	5,577	424	1,307	252	155
2019	5,784	430	1,329	255	159
2020	6,007	435	1,351	259	163
2025	7,154	449	1,472	282	188
2030	8,105	451	1,613	309	219
2040	9,199	509	1,919	343	287
2050	10,152	562	2,129	343	337
2060	11,149	561	2,202	349	353

(1) Numbers of beneficiaries by sex in Table 6 may not sum to total numbers of beneficiaries shown in Table 5 due to rounding.
(2) The number given for retirement beneficiaries does not take into account that the retirement pension can be shared between spouses.
(3) A beneficiary who receives concurrently a retirement and a survivor's pension is counted in each category.
(4) This is the number of deceased contributors entitled to a death benefit during the given year.

Table 6 Beneficiaries by Sex[1]
(thousands)

Year	Males				Females			
	Retirement[2]	Disability	Survivor[3]	Death[4]	Retirement[2]	Disability	Survivor[3]	Death[4]
2013	2,250	183	210	84	2,344	207	993	53
2014	2,347	185	217	85	2,458	210	1,006	55
2015	2,441	188	225	87	2,568	214	1,020	57
2016	2,531	192	232	88	2,674	218	1,033	59
2017	2,610	195	240	90	2,773	222	1,046	61
2018	2,698	198	248	92	2,879	226	1,060	63
2019	2,793	201	255	94	2,991	229	1,074	65
2020	2,896	203	263	96	3,110	232	1,088	67
2025	3,432	210	303	108	3,723	239	1,169	80
2030	3,865	209	342	124	4,239	242	1,271	95
2040	4,310	235	404	156	4,889	274	1,515	132
2050	4,716	260	431	175	5,436	302	1,698	161
2060	5,197	258	440	181	5,953	304	1,763	173
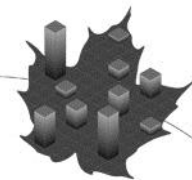
(1) Numbers of beneficiaries by sex in Table 6 may not sum to total numbers of beneficiaries shown in Table 5 due to rounding.
(2) The number given for retirement beneficiaries does not take into account that the retirement pension can be shared between spouses.
(3) A beneficiary who receives concurrently a retirement and a survivor's pension is counted in each category.
(4) This is the number of deceased contributors entitled to a death benefit during the given year.
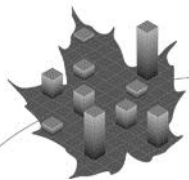
Table 7   Expenditures
($ million)

Year	Retirement[1]	Disability	Survivor	Children	Death	Operating Expenses[2]	Total
2013	27,946	3,852	4,307	510	312	648	37,575
2014	29,803	3,959	4,384	523	321	610	39,601
2015	31,796	4,100	4,486	541	331	634	41,888
2016	33,827	4,254	4,594	561	342	659	44,237
2017	35,828	4,412	4,705	583	353	683	46,564
2018	37,904	4,578	4,817	603	364	709	48,975
2019	40,184	4,737	4,933	624	376	736	51,590
2020	42,672	4,894	5,055	648	389	765	54,422
2021	45,385	5,054	5,187	672	401	796	57,495
2022	48,292	5,213	5,333	699	414	827	60,778
2023	51,347	5,375	5,490	728	428	860	64,229
2024	54,530	5,545	5,658	759	443	894	67,829
2025	57,818	5,712	5,841	790	458	928	71,547
2026	61,182	5,876	6,038	822	474	965	75,357
2027	64,591	6,040	6,251	856	491	1,003	79,232
2028	68,071	6,199	6,482	891	509	1,044	83,195
2029	71,624	6,374	6,733	928	527	1,086	87,273
2030	75,212	6,578	7,006	966	546	1,130	91,439
2031	78,806	6,822	7,298	1,004	563	1,173	95,667
2032	82,390	7,097	7,613	1,041	580	1,219	99,940
2033	85,997	7,390	7,949	1,077	597	1,268	104,277
2034	89,671	7,699	8,306	1,114	615	1,319	108,724
2035	93,440	8,022	8,687	1,151	632	1,371	113,304
2036	97,326	8,357	9,089	1,188	650	1,427	118,036
2037	101,304	8,721	9,510	1,224	667	1,485	122,910
2038	105,374	9,111	9,951	1,259	684	1,546	127,925
2039	109,570	9,530	10,411	1,294	701	1,608	133,116
2040	113,952	9,960	10,890	1,328	717	1,673	138,521
2041	118,556	10,406	11,384	1,361	733	1,740	144,180
2042	123,383	10,869	11,893	1,393	748	1,809	150,095
2043	128,459	11,346	12,416	1,424	762	1,881	156,288
2044	133,822	11,834	12,952	1,456	776	1,954	162,793
2045	139,516	12,324	13,500	1,487	789	2,030	169,646
2050	173,561	14,725	16,376	1,644	841	2,441	209,587
2055	217,506	17,066	19,442	1,835	870	2,924	259,643
2060	269,874	19,677	22,809	2,090	882	3,520	318,852
2065	329,756	23,494	26,856	2,403	897	4,271	387,678
2070	401,344	28,626	32,095	2,748	927	5,198	470,939
2075	489,886	34,652	38,797	3,107	971	6,312	573,725
2080	600,302	41,559	46,830	3,491	1,009	7,634	700,825
2085	737,636	49,134	55,925	3,928	1,029	9,211	856,862
2090	905,580	57,935	66,089	4,450	1,033	11,119	1,046,206

(1)   Retirement expenditures include expenditures related to post-retirement benefits for working beneficiaries.
(2)   Plan operating expenses exclude CPPIB operating expenses, which are accounted for separately in the investment expenses assumption. This is a change from the 25th CPP Actuarial Report.

Table 8 Expenditures (millions of 2013 constant dollars)[1]

Year	Retirement[2]	Disability	Survivor	Children	Death	Operating Expenses[3]	Total
2013	27,946	3,852	4,307	510	312	648	37,575
2014	29,387	3,904	4,322	516	317	601	39,048
2015	30,762	3,967	4,340	524	320	613	40,526
2016	32,085	4,035	4,357	532	324	625	41,959
2017	33,317	4,103	4,375	542	328	635	43,300
2018	34,556	4,175	4,392	550	332	646	44,649
2019	35,916	4,233	4,409	559	336	658	46,111
2020	37,392	4,288	4,429	568	341	670	47,689
2021	38,958	4,338	4,453	577	344	683	49,353
2022	40,567	4,379	4,480	587	348	695	51,056
2023	42,205	4,418	4,513	598	352	707	52,794
2024	43,857	4,460	4,551	610	356	719	54,553
2025	45,500	4,495	4,597	622	360	730	56,304
2026	47,111	4,524	4,649	634	365	743	58,026
2027	48,665	4,550	4,710	645	370	756	59,697
2028	50,183	4,570	4,779	658	375	770	61,333
2029	51,666	4,598	4,857	669	380	783	62,954
2030	53,086	4,643	4,944	682	385	798	64,540
2031	54,426	4,711	5,041	693	389	810	66,070
2032	55,676	4,796	5,145	703	392	824	67,536
2033	56,863	4,886	5,256	712	395	838	68,950
2034	58,016	4,981	5,374	720	398	853	70,342
2035	59,153	5,078	5,500	729	400	868	71,728
2036	60,286	5,177	5,630	736	403	884	73,115
2037	61,400	5,286	5,764	742	404	900	74,495
2038	62,492	5,403	5,901	747	406	917	75,865
2039	63,581	5,530	6,041	751	407	933	77,245
2040	64,701	5,655	6,183	754	407	950	78,651
2041	65,866	5,781	6,325	757	407	967	80,102
2042	67,072	5,908	6,465	757	407	983	81,593
2043	68,328	6,035	6,604	758	405	1,001	83,130
2044	69,648	6,159	6,741	757	404	1,017	84,726
2045	71,049	6,276	6,874	757	402	1,034	86,392
2050	79,274	6,726	7,480	750	384	1,115	95,729
2055	89,103	6,991	7,965	752	356	1,198	106,365
2060	99,158	7,230	8,381	768	324	1,293	117,154
2065	108,669	7,742	8,851	792	296	1,407	127,757
2070	118,625	8,461	9,486	812	274	1,536	139,195
2075	129,867	9,186	10,285	824	257	1,673	152,093
2080	142,732	9,881	11,135	830	240	1,815	166,633
2085	157,304	10,478	11,926	838	219	1,964	182,729
2090	173,208	11,081	12,641	851	198	2,127	200,106

(1) For a given year, the value in 2013 constant dollars is equal to the corresponding value in current dollars divided by the cumulative index of the indexation rates for benefits provided as of 2013 in the projections.
(2) Retirement expenditures include expenditures related to post-retirement benefits for working beneficiaries.
(3) Plan operating expenses exclude CPPIB operating expenses, which are accounted for separately in the investment expenses assumption. This is a change from the 25th CPP Actuarial Report.
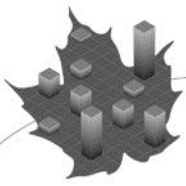
Table 9   Expenditures as Percentage of Contributory Earnings
(pay-as-you-go rates)

Year	Retirement[1]	Disability	Survivor	Children	Death	Operating Expenses[2]	Total
	(%)	(%)	(%)	(%)	(%)	(%)	(%)
2013	6.53	0.90	1.01	0.12	0.07	0.15	8.78
2014	6.71	0.89	0.99	0.12	0.07	0.14	8.92
2015	6.89	0.89	0.97	0.12	0.07	0.14	9.07
2016	7.03	0.88	0.95	0.12	0.07	0.14	9.19
2017	7.15	0.88	0.94	0.12	0.07	0.14	9.29
2018	7.27	0.88	0.92	0.12	0.07	0.14	9.39
2019	7.40	0.87	0.91	0.12	0.07	0.14	9.50
2020	7.54	0.86	0.89	0.11	0.07	0.14	9.62
2021	7.69	0.86	0.88	0.11	0.07	0.13	9.74
2022	7.85	0.85	0.87	0.11	0.07	0.13	9.88
2023	8.01	0.84	0.86	0.11	0.07	0.13	10.01
2024	8.16	0.83	0.85	0.11	0.07	0.13	10.16
2025	8.31	0.82	0.84	0.11	0.07	0.13	10.28
2026	8.44	0.81	0.83	0.11	0.07	0.13	10.40
2027	8.55	0.80	0.83	0.11	0.07	0.13	10.49
2028	8.65	0.79	0.82	0.11	0.06	0.13	10.57
2029	8.73	0.78	0.82	0.11	0.06	0.13	10.64
2030	8.80	0.77	0.82	0.11	0.06	0.13	10.70
2031	8.86	0.77	0.82	0.11	0.06	0.13	10.76
2032	8.90	0.77	0.82	0.11	0.06	0.13	10.80
2033	8.92	0.77	0.82	0.11	0.06	0.13	10.82
2034	8.93	0.77	0.83	0.11	0.06	0.13	10.83
2035	8.94	0.77	0.83	0.11	0.06	0.13	10.84
2036	8.93	0.77	0.83	0.11	0.06	0.13	10.83
2037	8.92	0.77	0.84	0.11	0.06	0.13	10.82
2038	8.90	0.77	0.84	0.11	0.06	0.13	10.81
2039	8.88	0.77	0.84	0.10	0.06	0.13	10.79
2040	8.86	0.77	0.85	0.10	0.06	0.13	10.78
2041	8.85	0.78	0.85	0.10	0.05	0.13	10.77
2042	8.85	0.78	0.85	0.10	0.05	0.13	10.76
2043	8.85	0.78	0.86	0.10	0.05	0.13	10.77
2044	8.86	0.78	0.86	0.10	0.05	0.13	10.78
2045	8.88	0.78	0.86	0.09	0.05	0.13	10.79
2050	9.11	0.77	0.86	0.09	0.04	0.13	11.01
2055	9.48	0.74	0.85	0.08	0.04	0.13	11.32
2060	9.73	0.71	0.82	0.08	0.03	0.13	11.50
2065	9.78	0.70	0.80	0.07	0.03	0.13	11.49
2070	9.75	0.70	0.78	0.07	0.02	0.13	11.44
2075	9.77	0.69	0.77	0.06	0.02	0.13	11.45
2080	9.88	0.68	0.77	0.06	0.02	0.13	11.53
2085	10.04	0.67	0.76	0.05	0.01	0.13	11.66
2090	10.19	0.65	0.74	0.05	0.01	0.13	11.77

(1)   Retirement expenditures include expenditures related to post-retirement benefits for working beneficiaries.
(2)   Plan operating expenses exclude CPPIB operating expenses, which are accounted for separately in the investment expenses assumption. This is a change from the 25th CPP Actuarial Report.

D. Financial Projections with Legislated Contribution Rate

1. Asset Projections at Market Value

Prior to 2001, CPP assets were presented at cost value because they were traditionally limited to short-term investments and 20-year non-marketable bonds in the form of loans to provinces. Since the creation of the CPPIB in 1997, excess cash flows are invested in the capital markets. Those assets, as is usually the case for private pension plans, are valued at market. The market value of assets is $175,095 million as at 31 December 2012.

2. Projected Financial Status

Table 10 presents historical results while Tables 11 and 12 present the projected financial status of the CPP using the legislated contribution rate of 9.9% in current dollars and in 2013 constant dollars, respectively. The projected financial status of the CPP using the minimum contribution rate of 9.84% for the year 2016 and thereafter is discussed in section E.
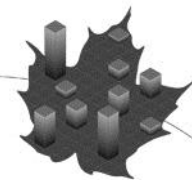
Table 10   Historical Results

Year	PayGo Rate[1] (%)	Contribution Rate (%)	Contributions ($ million)	Expenditures ($ million)	Net Cash Flow ($ million)	Investment Income[2] ($ million)	Assets at 31 Dec.[3] ($ million)	Yield/ Return[3] (%)	Asset/ Expenditure Ratio
1966	0.05	3.60	531	8	523	2	525	0.7	52.50
1970	0.45	3.60	773	97	676	193	3,596	6.2	24.13
1975	1.42	3.60	1,426	561	865	607	9,359	7.2	11.47
1980	2.72	3.60	2,604	1,965	639	1,466	18,433	8.7	7.64
1981	2.89	3.60	3,008	2,413	595	1,784	20,812	9.4	7.04
1982	2.91	3.60	3,665	2,958	707	2,160	23,679	10.0	6.58
1983	3.73	3.60	3,474	3,598	(124)	2,494	26,049	10.4	6.22
1984	3.66	3.60	4,118	4,185	(67)	2,829	28,811	10.7	5.97
1985	4.31	3.60	4,032	4,826	(794)	3,113	31,130	10.8	5.66
1986	4.20	3.60	4,721	5,503	(782)	3,395	33,743	10.9	4.73
1987	5.02	3.80	5,393	7,130	(1,737)	3,654	35,660	10.9	4.31
1988	5.41	4.00	6,113	8,272	(2,159)	3,886	37,387	11.0	3.98
1989	5.89	4.20	6,694	9,391	(2,697)	4,162	38,852	11.3	3.72
1990	5.82	4.40	7,889	10,438	(2,549)	4,386	40,689	11.4	3.53
1991	6.31	4.60	8,396	11,518	(3,122)	4,476	42,043	11.2	3.22
1992	7.07	4.80	8,883	13,076	(4,193)	4,497	42,347	11.0	2.97
1993	7.79	5.00	9,166	14,273	(5,107)	4,480	41,720	10.9	2.72
1994	8.33	5.20	9,585	15,362	(5,777)	4,403	40,346	11.0	2.52
1995	7.91	5.40	10,911	15,986	(5,075)	4,412	39,683	11.3	2.37
1996	8.71	5.60	10,757	16,723	(5,966)	4,177	37,894	11.0	2.16
1997	8.67	6.00	12,165	17,570	(5,405)	3,971	36,460	10.8	1.99
1998	8.11	6.40	14,473	18,338	(3,865)	3,938	36,535	10.9	1.94
1999	8.23	7.00	16,052	18,877	(2,825)	764	42,783	1.7	2.17
2000	7.69	7.80	19,977	19,683	294	4,446	47,523	9.9	2.32
2001	7.85	8.60	22,469	20,515	1,954	3,154	52,631	6.2	2.43
2002	8.16	9.40	24,955	21,666	3,289	187	56,107	0.3	2.47
2003	8.19	9.90	27,454	22,716	4,738	6,769	67,614	11.1	2.84
2004	8.29	9.90	28,459	23,833	4,626	6,475	78,715	8.9	3.15
2005	8.37	9.90	29,539	24,976	4,563	11,083	94,361	13.2	3.59
2006[4]	8.22	9.90	31,000	26,080	4,920	14,300	113,581	14.4	4.10
2007[4]	8.15	9.90	33,621	27,691	5,930	3,269	122,780	2.7	4.20
2008[4]	8.03	9.90	36,053	29,259	6,794	(18,350)	111,224	(14.2)	3.60
2009[4]	8.16	9.90	37,492	30,901	6,591	9,021	126,836	7.6	3.96
2010	8.83	9.90	35,885	32,023	3,862	11,804	142,502	8.9	4.23
2011	8.73	9.90	38,202	33,691	4,511	8,057	155,070	5.4	4.27
2012	8.84	9.90	40,682	36,321	4,361	15,664	175,095	9.7	4.66

(1)   The pay-as-you-go rates have been calculated using the historical contributory earnings, while the contributions are based on estimates made by the Department of Finance.

(2)   Investment income includes both realized and unrealized gains and losses.

(3)   Results for years 1966 to 1998 are on a cost basis, while results for years 1999 to 2012 are presented on a market value basis. If assets were shown at market value at the end of 1998, total assets would be $44,864 million instead of $36,535 million.

(4)   For this 26th CPP Actuarial Report, historical numbers for years 2006 to 2009 were revised to reflect a change in the methodology used to allocate fiscal year-end accounting adjustments. Since 2010, fiscal year-end adjustments are no longer allocated between two calendar years and are now included in the calendar year in which they are reported.
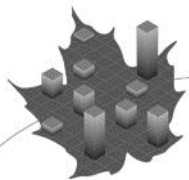
Table 11   Financial Status

Year	PayGo Rate (%)	Contribution Rate (%)	Contributory Earnings ($ million)	Contributions ($ million)	Expenditures ($ million)	Net Cash Flow ($ million)	Investment Income[1] ($ million)	Assets at 31 Dec. ($ million)	Return[2] (%)	Asset/ Expenditure Ratio
2013	8.78	9.90	427,762	42,348	37,575	4,773	7,547	187,415	4.16	4.73
2014	8.92	9.90	444,048	43,961	39,601	4,360	9,233	201,008	4.76	4.80
2015	9.07	9.90	461,583	45,697	41,888	3,809	10,432	215,249	5.03	4.87
2016	9.19	9.90	481,371	47,656	44,237	3,419	11,535	230,203	5.21	4.94
2017	9.29	9.90	501,091	49,608	46,564	3,044	12,656	245,903	5.35	5.02
2018	9.39	9.90	521,723	51,651	48,975	2,676	13,506	262,084	5.35	5.08
2019	9.50	9.90	543,322	53,789	51,590	2,199	16,190	280,472	6.03	5.15
2020	9.62	9.90	566,009	56,035	54,422	1,613	17,431	299,517	6.08	5.21
2021	9.74	9.90	590,261	58,436	57,495	941	18,911	319,368	6.18	5.25
2022	9.88	9.90	615,338	60,918	60,778	140	20,271	339,779	6.23	5.29
2023	10.01	9.90	641,395	63,498	64,229	(731)	21,534	360,582	6.23	5.32
2024	10.16	9.90	667,933	66,125	67,829	(1,704)	22,812	381,691	6.23	5.33
2025	10.28	9.90	695,678	68,872	71,547	(2,675)	24,123	403,138	6.23	5.35
2026	10.40	9.90	724,880	71,763	75,357	(3,594)	25,459	425,003	6.23	5.36
2027	10.49	9.90	755,125	74,757	79,232	(4,475)	26,815	447,344	6.23	5.38
2028	10.57	9.90	787,293	77,942	83,195	(5,253)	28,198	470,289	6.23	5.39
2029	10.64	9.90	820,237	81,203	87,273	(6,070)	29,617	493,836	6.23	5.40
2030	10.70	9.90	854,642	84,610	91,439	(6,829)	31,077	518,084	6.23	5.42
2031	10.76	9.90	889,359	88,047	95,667	(7,620)	32,577	543,041	6.22	5.43
2032	10.80	9.90	925,627	91,637	99,940	(8,303)	34,126	568,864	6.22	5.46
2033	10.82	9.90	963,885	95,425	104,277	(8,852)	35,730	595,742	6.22	5.48
2034	10.83	9.90	1,004,011	99,397	108,724	(9,327)	37,387	623,802	6.22	5.51
2035	10.84	9.90	1,045,706	103,525	113,304	(9,779)	39,120	653,143	6.21	5.53
2036	10.83	9.90	1,089,840	107,894	118,036	(10,142)	40,945	683,946	6.21	5.56
2037	10.82	9.90	1,136,148	112,479	122,910	(10,431)	42,864	716,379	6.21	5.60
2038	10.81	9.90	1,183,732	117,189	127,925	(10,736)	44,887	750,530	6.21	5.64
2039	10.79	9.90	1,234,266	122,192	133,116	(10,924)	47,037	786,643	6.21	5.68
2040	10.78	9.90	1,285,576	127,272	138,521	(11,249)	49,298	824,692	6.21	5.72
2041	10.77	9.90	1,339,172	132,578	144,180	(11,602)	51,686	864,776	6.21	5.76
2042	10.76	9.90	1,394,574	138,063	150,095	(12,032)	54,215	906,959	6.21	5.80
2043	10.77	9.90	1,451,536	143,702	156,288	(12,586)	56,876	951,249	6.21	5.84
2044	10.78	9.90	1,510,635	149,553	162,793	(13,240)	59,649	997,657	6.21	5.88
2045	10.79	9.90	1,571,695	155,598	169,646	(14,048)	62,547	1,046,156	6.21	5.92
2050	11.01	9.90	1,904,295	188,525	209,587	(21,062)	78,832	1,317,472	6.21	6.02
2055	11.32	9.90	2,294,408	227,146	259,643	(32,497)	97,630	1,628,749	6.21	6.01
2060	11.50	9.90	2,772,797	274,507	318,852	(44,345)	118,864	1,980,577	6.21	5.97
2065	11.49	9.90	3,372,805	333,908	387,678	(53,770)	143,875	2,397,107	6.21	5.95
2070	11.44	9.90	4,115,733	407,458	470,939	(63,481)	174,565	2,909,175	6.21	5.94
2075	11.45	9.90	5,011,843	496,172	573,725	(77,553)	212,142	3,535,073	6.21	5.92
2080	11.53	9.90	6,078,663	601,788	700,825	(99,037)	256,924	4,278,419	6.21	5.86
2085	11.66	9.90	7,349,817	727,632	856,862	(129,230)	308,597	5,132,799	6.21	5.75
2090	11.77	9.90	8,887,446	879,857	1,046,206	(166,349)	366,815	6,092,658	6.21	5.60

(1)   Investment income includes both realized and unrealized gains and losses.
(2)   Returns are net of all investment expenses.
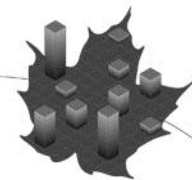
Table 12   Financial Status (millions of 2013 constant dollars)[1]

Year	PayGo Rate	Contribution Rate	Contributory Earnings	Contributions	Expenditures	Net Cash Flow	Investment Income[2]	Assets at 31 Dec.
	(%)	(%)						
2013	8.78	9.90	427,762	42,348	37,575	4,773	7,547	187,415
2014	8.92	9.90	437,845	43,347	39,048	4,299	9,104	198,200
2015	9.07	9.90	446,571	44,211	40,526	3,685	10,093	208,249
2016	9.19	9.90	456,584	45,202	41,959	3,243	10,941	218,349
2017	9.29	9.90	465,969	46,131	43,300	2,831	11,769	228,667
2018	9.39	9.90	475,642	47,089	44,649	2,439	12,313	238,936
2019	9.50	9.90	485,621	48,077	46,111	1,965	14,470	250,686
2020	9.62	9.90	495,979	49,102	47,689	1,413	15,275	262,459
2021	9.74	9.90	506,674	50,161	49,353	808	16,233	274,142
2022	9.88	9.90	516,912	51,174	51,056	118	17,028	285,430
2023	10.01	9.90	527,203	52,193	52,794	(601)	17,700	296,385
2024	10.16	9.90	537,198	53,183	54,553	(1,370)	18,347	306,982
2025	10.28	9.90	547,468	54,199	56,304	(2,105)	18,983	317,252
2026	10.40	9.90	558,169	55,259	58,026	(2,767)	19,604	327,259
2027	10.49	9.90	568,941	56,325	59,697	(3,371)	20,204	337,047
2028	10.57	9.90	580,409	57,460	61,333	(3,873)	20,788	346,707
2029	10.64	9.90	591,679	58,576	62,954	(4,378)	21,364	356,229
2030	10.70	9.90	603,226	59,719	64,540	(4,820)	21,935	365,676
2031	10.76	9.90	614,217	60,808	66,070	(5,263)	22,499	375,040
2032	10.80	9.90	625,504	61,925	67,536	(5,611)	23,061	384,417
2033	10.82	9.90	637,336	63,096	68,950	(5,853)	23,625	393,914
2034	10.83	9.90	649,577	64,308	70,342	(6,034)	24,188	403,588
2035	10.84	9.90	661,989	65,537	71,728	(6,191)	24,765	413,475
2036	10.83	9.90	675,077	66,833	73,115	(6,282)	25,363	423,655
2037	10.82	9.90	688,612	68,173	74,495	(6,322)	25,980	434,193
2038	10.81	9.90	702,008	69,499	75,865	(6,367)	26,620	445,099
2039	10.79	9.90	716,220	70,906	77,245	(6,339)	27,294	456,473
2040	10.78	9.90	729,936	72,264	78,651	(6,387)	27,991	468,251
2041	10.77	9.90	743,999	73,656	80,102	(6,446)	28,715	480,441
2042	10.76	9.90	758,100	75,052	81,593	(6,541)	29,472	493,029
2043	10.77	9.90	772,079	76,436	83,130	(6,695)	30,252	505,974
2044	10.78	9.90	786,218	77,836	84,726	(6,891)	31,045	519,236
2045	10.79	9.90	800,388	79,238	86,392	(7,154)	31,852	532,756
2050	11.01	9.90	869,785	86,109	95,729	(9,620)	36,007	601,754
2055	11.32	9.90	939,927	93,053	106,365	(13,313)	39,995	667,233
2060	11.50	9.90	1,018,795	100,861	117,154	(16,294)	43,674	727,714
2065	11.49	9.90	1,111,490	110,038	127,757	(17,720)	47,413	789,954
2070	11.44	9.90	1,216,486	120,432	139,195	(18,763)	51,596	859,864
2075	11.45	9.90	1,328,626	131,534	152,093	(20,559)	56,238	937,139
2080	11.53	9.90	1,445,303	143,085	166,633	(23,548)	61,088	1,017,265
2085	11.66	9.90	1,567,375	155,170	182,729	(27,559)	65,809	1,094,588
2090	11.77	9.90	1,699,883	168,288	200,106	(31,817)	70,160	1,165,330

(1) For a given year, the value in 2013 constant dollars is equal to the corresponding value in current dollars divided by the cumulative index of the indexation rates for benefits provided as of 2013 in the projections.

(2) Investment income includes both realized and unrealized gains and losses.
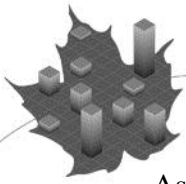
Assets are projected to increase significantly over the next decade, from $175 billion at the end of 2012 to $300 billion by the end of 2020. Contributions and investment income are projected to be higher than expenditures over that period. Thereafter, revenues (i.e. contributions and investment income) continue to be higher than expenditures but to a lesser extent generally over the long term. This causes the assets to grow at a slower pace. The assets reach a level of $1,317 billion by 2050. Table 13 shows in more detail the sources of the revenues required to cover the expenditures.

From Table 13, several conclusions can be drawn.

- The assets grow continuously over the projection period. During the period 2013 to 2022, contributions are more than sufficient to cover expenditures.

- From 2023 onward, a proportion of investment income is required to fund net cash outflows. In 2050, 27% of investment income is required to pay for expenditures.

- Investment income, which represents 15% of revenues in 2013, will represent 24% in 2020. In 2050, investment income represents 29% of revenues. This clearly illustrates the importance of investment income as a source of revenues for the Plan.

Table 13   Sources of Revenues and Funding of Expenditures
($ billion)

Year	Contributions	Expenditures	Shortfall	Investment Income[1]	Total Revenues	Shortfall as % of Investment Income	Investment Income as % of Revenues
						(%)	(%)
2013	42.3	37.6	0.0	7.5	49.9	0.0	15.1
2014	44.0	39.6	0.0	9.2	53.2	0.0	17.4
2015	45.7	41.9	0.0	10.4	56.1	0.0	18.6
2016	47.7	44.2	0.0	11.5	59.2	0.0	19.5
2017	49.6	46.6	0.0	12.7	62.3	0.0	20.3
2018	51.7	49.0	0.0	13.5	65.2	0.0	20.7
2019	53.8	51.6	0.0	16.2	70.0	0.0	23.1
2020	56.0	54.4	0.0	17.4	73.5	0.0	23.7
2021	58.4	57.5	0.0	18.9	77.3	0.0	24.4
2022	60.9	60.8	0.0	20.3	81.2	0.0	25.0
2023	63.5	64.2	0.7	21.5	85.0	3.4	25.3
2024	66.1	67.8	1.7	22.8	88.9	7.5	25.7
2025	68.9	71.5	2.7	24.1	93.0	11.1	25.9
2026	71.8	75.4	3.6	25.5	97.2	14.1	26.2
2027	74.8	79.2	4.5	26.8	101.6	16.7	26.4
2028	77.9	83.2	5.3	28.2	106.1	18.6	26.6
2029	81.2	87.3	6.1	29.6	110.8	20.5	26.7
2030	84.6	91.4	6.8	31.1	115.7	22.0	26.9
2031	88.0	95.7	7.6	32.6	120.6	23.4	27.0
2032	91.6	99.9	8.3	34.1	125.8	24.3	27.1
2033	95.4	104.3	8.9	35.7	131.2	24.8	27.2
2034	99.4	108.7	9.3	37.4	136.8	24.9	27.3
2035	103.5	113.3	9.8	39.1	142.6	25.0	27.4
2036	107.9	118.0	10.1	40.9	148.8	24.8	27.5
2037	112.5	122.9	10.4	42.9	155.3	24.3	27.6
2038	117.2	127.9	10.7	44.9	162.1	23.9	27.7
2039	122.2	133.1	10.9	47.0	169.2	23.2	27.8
2040	127.3	138.5	11.2	49.3	176.6	22.8	27.9
2041	132.6	144.2	11.6	51.7	184.3	22.4	28.1
2042	138.1	150.1	12.0	54.2	192.3	22.2	28.2
2043	143.7	156.3	12.6	56.9	200.6	22.1	28.4
2044	149.6	162.8	13.2	59.6	209.2	22.2	28.5
2045	155.6	169.6	14.0	62.5	218.1	22.5	28.7
2050	188.5	209.6	21.1	78.8	267.4	26.7	29.5
2055	227.1	259.6	32.5	97.6	324.8	33.3	30.1
2060	274.5	318.9	44.3	118.9	393.4	37.3	30.2
2065	333.9	387.7	53.8	143.9	477.8	37.4	30.1
2070	407.5	470.9	63.5	174.6	582.0	36.4	30.0
2075	496.2	573.7	77.6	212.1	708.3	36.6	30.0
2080	601.8	700.8	99.0	256.9	858.7	38.5	29.9
2085	727.6	856.9	129.2	308.6	1,036.2	41.9	29.8
2090	879.9	1,046.2	166.3	366.8	1,246.7	45.4	29.4

(1)   Investment income includes both realized and unrealized gains and losses.

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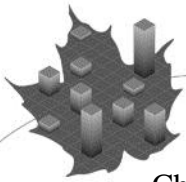
Chart 1 shows historical and projected revenues and expenditures for the period 1995 to 2025.

Chart 1   Revenues and Expenditures
(billions of 2013 constant dollars)
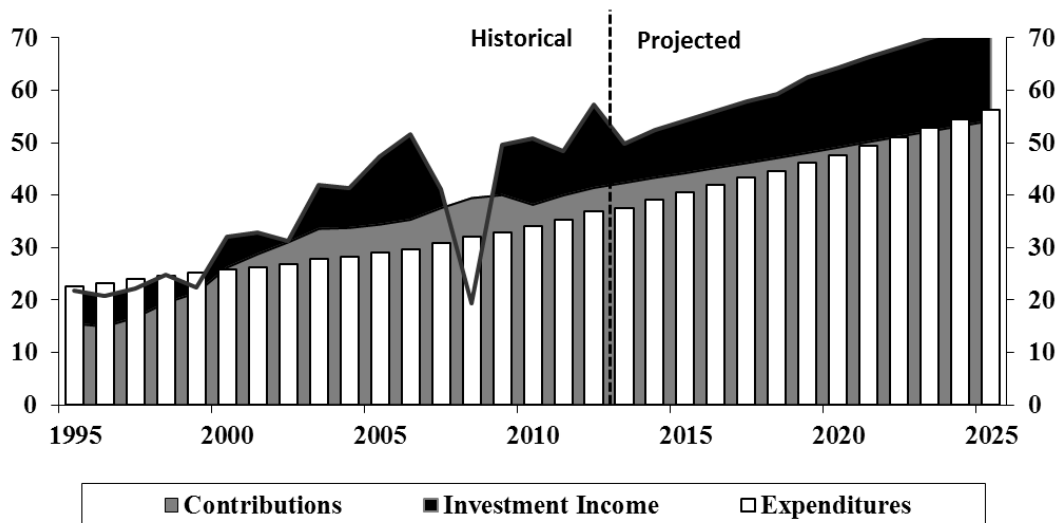
An important measure of the Plan's financial status is the ratio of assets at the end of one year to the expenditures of the next year. As can be seen in Chart 2, under the legislated contribution rate of 9.9%, this ratio is projected to increase over the next decade, reaching 5.4 by 2025. After 2025, it rises slowly to a value of 6.0 by 2050.

The slowdown in the growth of the ratio from 2020 to the early 2030s is caused by 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 maintain the contribution rate at 9.9% without impairing the financial sustainability of the Plan.

Chart 2   Asset/Expenditure Ratio
(9.9% contribution rate)
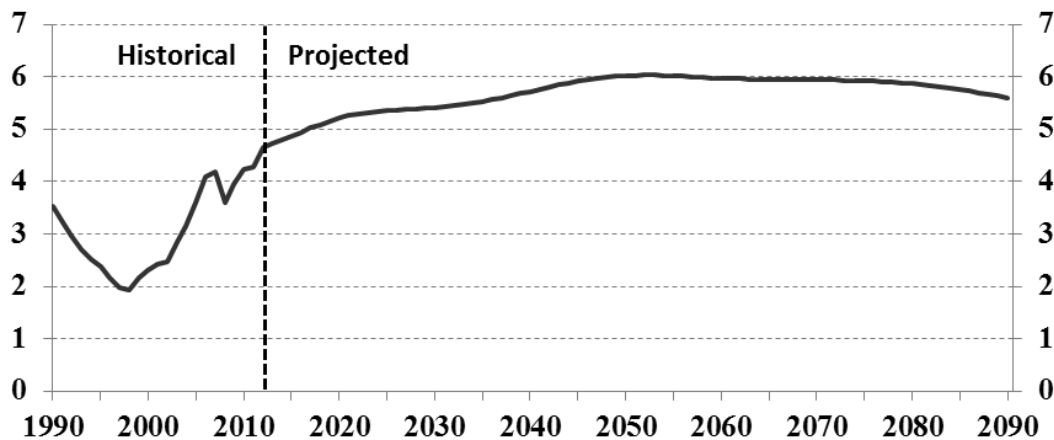
E. Financial Projections with Minimum Contribution Rate

The major reform package of the CPP agreed to by the federal, provincial, and territorial governments in 1997 included significant changes to the Plan's financing provisions.

- The introduction of _steady-state funding_ to replace pay-as-you-go financing in order to build a reserve of assets and stabilize the ratio of assets to expenditures over time. Under steady-state funding, the ratio of assets to expenditures is currently projected to stabilize at a level of about 5.3. Investment income on the pool of assets would help pay benefits as the large cohort of baby boomers retires. This refers to paragraph 113.1(4)(c) of the _Canada Pension Plan_.

- The introduction of _full funding_ which requires that changes to the CPP that increase or add new benefits be fully funded, i.e. that their costs be paid as the benefit is earned and that any costs associated with benefits that have been earned but not paid be amortized and paid for over a defined period of time consistent with common actuarial practice. This refers to paragraph 113.1(4)(d) of the _Canada Pension Plan_.

    113.1(4) _In conducting any review required by this section and in making any recommendations, ministers shall consider…_

    (**d**) _that changes to the Act that increase benefits or add new benefits must be accompanied by a permanent increase in the contribution rates to cover the extra costs of the increased or new benefits and by a temporary increase in the contribution rates for a number of years that is consistent with common actuarial practice to fully pay any unfunded liability resulting from the increased or new benefits._

Both of these funding principles were introduced to improve fairness across generations. The move to steady-state funding eases some of the contribution burden on future generations, while under full funding each generation that receives benefit enrichments is more likely to pay for such enrichments in full so that the associated costs are not passed on to future generations.

Paragraphs 113.1(4)(c) and (d) have been part of the Plan since 1997, but prior to 2008 there were only regulations describing how to calculate the rate under the financing objective of paragraph 113.1(4)(c) (i.e. the steady-state contribution rate). However, as a result of the 2008 amendments to the Plan, the regulations regarding the calculation of contribution rates were also amended to set out the calculation of the contribution rate that the Ministers must consider under paragraph 113.1(4)(d) (i.e. the full funding rate).

1. Steady-State Contribution Rate

Subparagraph 115(1.1)(c)(i), as amended in 2008, requires the Chief Actuary to specify in the report a contribution rate for the first year after the review period 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 of the Plan remaining generally constant over the foreseeable future. The lowest contribution rate that will meet this requirement is referred to as the steady-state contribution rate.

The steady-state contribution rate calculation is specifically defined in the regulations as the lowest level contribution rate applicable after the end of the review period, to the nearest 0.001%, that results in the projected asset/expenditure ratio of the Plan being the same in the 10th and 60th
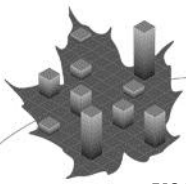
years following the end of the review period. For this report, the end of the review period is 2015. Therefore, the steady-state contribution rate is applicable for 2016 and thereafter and the relevant years for the determination of the steady-state contribution rate are 2025 and 2075. The resulting steady-state contribution rate is rounded to the nearest 0.01% and is 9.84% for the year 2016 and thereafter for this report.

The steady-state contribution rate is calculated separately from the full funding rate, which provides for the funding of increased or new benefits in accordance with the full funding requirements of paragraph 113.1(4)(d) of the *Canada Pension Plan*. However, where the full funding rate is deemed to be nil in accordance with the *Calculation of Contribution Rates Regulations, 2007* for the Plan, as it is determined for this report, the improvement in benefits is financed entirely by the steady-state approach.
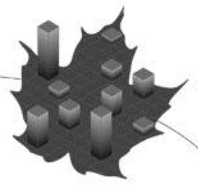
2. Full Funding Rate of New or Increased Benefits

Subparagraph 115(1.1)(c)(ii), as added through Plan amendments in 2008, requires the Chief Actuary to specify in the report a contribution rate in respect of any increased or new benefits in accordance with the requirements of paragraph 113.1(4)(d). The 2008 amendments include the first amendment to the Plan since 1 January 1998 that required the application of paragraph 113.1(4)(d) of the *Canada Pension Plan*. The temporary and permanent full funding contribution rate calculations are also defined in the regulations.

Temporary Full Funding Rate

Since disability benefits that came into pay on or after the effective date of the 2008 amendments to the Plan are based on disabled contributors' Plan participation both before and after the effective date of the amendment, there is a portion of the projected increase in liabilities that relates to Plan participation prior to the effective date. For this report, the increase in past liabilities is calculated as the present value as at 1 January 2013 of the projected increase in expenditures relating to Plan participation prior to the effective date and is estimated at $54 million.

The increase in past liabilities was originally amortized over fifteen years (2008-2022) with the fifteen-year amortization period beginning at the effective date of the amendment in 2008. Thus, ten years remain in the original amortization period. The increase in past liabilities is therefore to be amortized over the remaining ten years (2013-2022). The temporary full funding contribution rate in respect of this period was determined to be 0.001%. This amortization period is consistent with common actuarial practice, as provided in the legislation, and is appropriate in this circumstance since the change does not put the financial sustainability of the Plan at risk. The temporary full funding rate is equal to the ratio of the increase in past liabilities to the present value as at 1 January 2013 of contributory earnings over the remaining period 2013 through 2022.

Permanent Full Funding Rate or "Current Service Cost"

The increased liability due to the 2008 amendments to the Plan regarding the disabled contributors' Plan participation on or after 1 January 2013 is estimated to be $2.3 billion and is fully funded with a permanent contribution rate of 0.011%. This rate is referred to as the "current service cost" of the amendment. The current service cost is equal to the ratio of the increase in liabilities due to future participation to the present value of future contributory earnings as at 1 January 2013.

The sum of the temporary and permanent full funding rates for the first ten years (2013-2022) is 0.012% (0.001% plus 0.011%) and 0.011% for 2023 and thereafter. The rounded full funding rate is 0.01% for the year 2013 and thereafter.

Application of the Regulations – Deeming the Full Funding Rate to be 0%

According to *Calculation of Contribution Rates Regulations, 2007* for the CPP, if the initial full funding rate (sum of temporary and permanent components) after rounding is less than 0.02%, then the full funding rate is deemed to be zero. In previous CPP Actuarial Reports (22nd to 25th), the initial full funding rate in respect of the 2008 amendments was determined to be 0.02%. For these past reports, assumptions were required regarding the number of contributors who would qualify for the improvement, as actual experience data were not yet available. For this 26th CPP Actuarial Report, preliminary experience data regarding long-term contributors eligible for the disability benefit were assessed. Based on analysis of the experience data and resulting projections, the initial full funding rate has been determined to be 0.01%. As a result, the full funding rate in respect of the 2008 amendments for this 26th CPP Actuarial Report is deemed to be zero, and the financing of the improvement in benefits is financed entirely by the steady-state approach.

The total actuarial liability as at 1 January 2013 resulting from the 2008 amendments to the Plan is estimated to be $2,320 million. Table 14 summarizes the results.

Table 14   Full Funding Rates in Respect of the 2008 Amendments to the Plan

Present Value of Contributory Earnings (2013-2022)	Increase in Liability due to Participation Prior to Effective Date	Temporary Full Funding Rate (2013-2022)	Present Value of Contributory Earnings (2013+)	Increase in Liability due to Participation on or After the Effective Date	Permanent Full Funding Rate or "Current Service Cost" (2013+)	Permanent and Temporary Rate (2013-2022)	Permanent and Temporary Rate, after Application of Regulations (2013-2022)
(A)[(1)]	(B)[(2)]	(C) = (B)/(A)	(D)[(1)]	(E)[(2)]	(F) = (E)/(D)	(G) = (C) + (F)	(G) after Regulations applied
($ billion)	($ million)		($ billion)	($ million)			
3,999	54	0.0013%	20,842	2,266	0.0109%	0.0122%	0.0%

(1)   As at 1/1/2013 based on the contributory earnings as projected under this report and using a discount rate equal to the assumed overall rate of return on CPP assets.

(2)   Present values are taken as at 1/1/2013 for the increase in benefits due to participation prior to the effective date (B) and on or after the effective date (E) using a discount rate equal to the assumed overall rate of return on CPP assets.
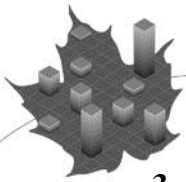
3. Minimum Contribution Rate

The minimum contribution rate is the sum of the Plan's rounded steady-state contribution rate and the rounded full funding rate. For this report, the minimum contribution rate has been determined to be 9.84% for the year 2016 and thereafter. The minimum contribution rate equals the Plan's steady-state contribution rate of 9.84%, since the rate to fully fund the 2008 amendments to the Plan, equal to 0.01%, is less than 0.02% and thus deemed to be zero. As a result, the corresponding funding for the 2008 amendments of 0.01% is included within the steady-state rate of 9.84%. The minimum contribution rate will be recalculated in the next triennial actuarial report to be prepared as at 31 December 2015. It may also be recalculated at any other date to reflect the cost impact of any other proposed amendments to the Plan.

The insufficient rates provisions in subsections 113.1(11.05) to 113.1(11.15) may result in adjustments to the legislated contribution rate and, perhaps, benefits in pay if the federal and provincial governments make no recommendation to either increase the legislated rate or maintain it in the case that the minimum contribution rate exceeds the legislated rate. In respect of the current triennial review, the minimum contribution rate is less than the legislated rate of 9.9%, and thus the insufficient rates provisions do not apply. Therefore, in the absence of specific action by the federal and provincial governments, the legislated contribution rate will remain at 9.9% for the year 2016 and thereafter.

The results presented in Table 15 are based on the best-estimate assumptions but use the minimum contribution rate of 9.84% for 2016 and thereafter as opposed to the currently scheduled contribution rate of 9.9% for those years. The financial projections under the legislated rate of 9.9% were previously presented in Table 11.
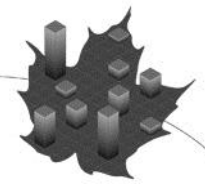
Table 15   Financial Results - Minimum Contribution Rate

Year	PayGo Rate	Contribution Rate	Contributory Earnings	Contributions	Expenditures	Net Cash Flow	Investment Income[1]	Assets at 31 Dec.	Asset/ Expenditure Ratio
	(%)	(%)	($ million)	($ million)	($ million)	($ million)	($ million)	($ million)	
2013	8.78	9.90	427,762	42,348	37,575	4,773	7,547	187,415	4.73
2014	8.92	9.90	444,048	43,961	39,601	4,360	9,233	201,008	4.80
2015	9.07	9.90	461,583	45,697	41,888	3,809	10,432	215,249	4.87
2016	9.19	9.84	481,371	47,367	44,237	3,130	11,527	229,906	4.94
2017	9.29	9.84	501,091	49,307	46,564	2,743	12,631	245,280	5.01
2018	9.39	9.84	521,723	51,338	48,975	2,363	13,463	261,105	5.06
2019	9.50	9.84	543,322	53,463	51,590	1,873	16,120	279,098	5.13
2020	9.62	9.84	566,009	55,695	54,422	1,273	17,336	297,707	5.18
2021	9.74	9.84	590,261	58,082	57,495	587	18,786	317,080	5.22
2022	9.88	9.84	615,338	60,549	60,778	(229)	20,116	336,967	5.25
2023	10.01	9.84	641,395	63,113	64,229	(1,116)	21,346	357,197	5.27
2024	10.16	9.84	667,933	65,725	67,829	(2,104)	22,588	377,681	5.28
2025	10.28	9.84	695,678	68,455	71,547	(3,092)	23,859	398,448	5.29
2026	10.40	9.84	724,880	71,328	75,357	(4,029)	25,153	419,572	5.30
2027	10.49	9.84	755,125	74,304	79,232	(4,928)	26,462	441,106	5.30
2028	10.57	9.84	787,293	77,470	83,195	(5,725)	27,794	463,175	5.31
2029	10.64	9.84	820,237	80,711	87,273	(6,562)	29,158	485,771	5.31
2030	10.70	9.84	854,642	84,097	91,439	(7,342)	30,558	508,988	5.32
2031	10.76	9.84	889,359	87,513	95,667	(8,154)	31,994	532,827	5.33
2032	10.80	9.84	925,627	91,082	99,940	(8,858)	33,473	557,442	5.35
2033	10.82	9.84	963,885	94,846	104,277	(9,431)	35,001	583,012	5.36
2034	10.83	9.84	1,004,011	98,795	108,724	(9,929)	36,575	609,658	5.38
2035	10.84	9.84	1,045,706	102,897	113,304	(10,407)	38,220	637,472	5.40
2036	10.83	9.84	1,089,840	107,240	118,036	(10,796)	39,949	666,625	5.42
2037	10.82	9.84	1,136,148	111,797	122,910	(11,113)	41,765	697,277	5.45
2038	10.81	9.84	1,183,732	116,479	127,925	(11,446)	43,676	729,507	5.48
2039	10.79	9.84	1,234,266	121,452	133,116	(11,664)	45,705	763,547	5.51
2040	10.78	9.84	1,285,576	126,501	138,521	(12,020)	47,837	799,364	5.54
2041	10.77	9.84	1,339,172	131,775	144,180	(12,405)	50,085	837,044	5.58
2042	10.76	9.84	1,394,574	137,226	150,095	(12,869)	52,463	876,638	5.61
2043	10.77	9.84	1,451,536	142,831	156,288	(13,457)	54,962	918,143	5.64
2044	10.78	9.84	1,510,635	148,646	162,793	(14,147)	57,561	961,558	5.67
2045	10.79	9.84	1,571,695	154,655	169,646	(14,991)	60,272	1,006,839	5.69
2050	11.01	9.84	1,904,295	187,383	209,587	(22,204)	75,392	1,258,147	5.75
2055	11.32	9.84	2,294,408	225,770	259,643	(33,873)	92,540	1,541,102	5.69
2060	11.50	9.84	2,772,797	272,843	318,852	(46,009)	111,452	1,853,110	5.59
2065	11.49	9.84	3,372,805	331,884	387,678	(55,794)	133,212	2,213,899	5.49
2070	11.44	9.84	4,115,733	404,988	470,939	(65,951)	159,368	2,648,230	5.41
2075	11.45	9.84	5,011,843	493,165	573,725	(80,560)	190,642	3,166,135	5.30
2080	11.53	9.84	6,078,663	598,140	700,825	(102,685)	226,700	3,760,028	5.15
2085	11.66	9.84	7,349,817	723,222	856,862	(133,640)	266,335	4,408,249	4.94
2090	11.77	9.84	8,887,446	874,525	1,046,206	(171,681)	307,989	5,084,467	4.67

(1)   Investment income includes both realized and unrealized gains and losses.

Table 16 shows the progression of the minimum contribution rate over time under the best-estimate assumptions of this report.
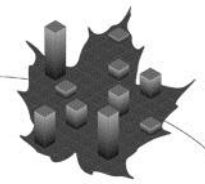
Table 16   Progression of Minimum Contribution Rate over Time

Valuation Year[1]	Target Years[2]	Steady State Target A/E ratio[3]	Minimum Contribution Rate	Years Minimum Contribution Rate Applicable[4]	Average PayGo Rate Over Target Years Period
2012	2025 & 2075	5.29	9.84%	2016+	11.07%
2015	2028 & 2078	5.33	9.85%	2019+	11.14%
2018	2031 & 2081	5.39	9.86%	2022+	11.19%
2021	2034 & 2084	5.48	9.87%	2025+	11.24%
2024	2037 & 2087	5.59	9.89%	2028+	11.29%

(1)   Reports are prepared as at 31 December of the valuation year. Any changes to the steady-state rate as a result of a valuation are effective following the triennial review period. That is, for the current valuation as at 31 December 2012, any changes to the steady-state rate will become effective 1 January 2016.

(2)   Target years refers to the beginning and end of the 50-year interval over which the steady-state contribution rate is determined. This rate is the lowest level rate that results in the asset/expenditure (A/E) ratio being the same in the two target years. For a given triennial review period of the Plan, the target years are 13 and 63 years after the valuation year. For this report, the valuation year is 2012 and thus the target years are 2025 to 2075.

(3)   The steady-state target A/E ratio is the ratio obtained in the target years relating to the determination of the corresponding steady-state contribution rate. Where the ratios in the target years do not match exactly, the ratio presented pertains to the first target year.

(4)   The legislated contribution rate of 9.9 is assumed to apply for all years prior to the period the minimum contribution rate is applicable for a given valuation.

As shown in Table 16, the minimum contribution rate is relatively stable over the periods considered. If the best-estimate assumptions of this report are realized, the minimum contribution rate will increase between 0.01% and 0.02% for each of the next four reports and will remain below the legislated contribution rate of 9.9%. Thus, the current legislated contribution rate is projected to be sustainable over subsequent reports as long as the best-estimate assumptions remain the same and Plan experience does not deviate materially from the assumptions.

V. Reconciliation with Previous Report

A. Introduction

The results presented in this report differ from those previously projected for a variety of reasons. Differences between the actual experience for 2010 through 2012 and that projected in the 25th CPP Actuarial Report are addressed in section B below. Since historical results provide the starting point for the projections shown in this report, these historical differences between actual and projected experience have an effect on the projections. The impact of experience since the last triennial valuation of the Plan (that is, the experience update from the period 2010-2012) and changes in the assumptions and methodology on the minimum contribution rate are addressed in section C. Detailed reconciliations of the projected pay-as-you-go rates and the minimum contribution rate are presented in Appendix D.

B. Experience Update – 2010 to 2012

The major components of the change in the CPP assets from 31 December 2009 to 31 December 2012 are summarized in Table 17.

Contributions during the period 2010 to 2012 were about $553 million less than projected, mainly as a result of lower than anticipated growth in total employment earnings. This represents a deviation from the expected results of about -0.5%.

Expenditures during the period were $167 million less than projected slightly offsetting the impact of lower contributions. This represents a deviation from the expected results of about -0.2%. The difference between actual and expected expenditures is mainly due to an over-projection of retirement, death, and children's benefits that outweighs an under-projection of other expenditures. The details by type of expenditure are given in Table 18.

Investment income was 96% higher than anticipated due to the strong performance of financial markets over the period. As a result, the change in assets was $17 billion or 55% higher than expected over the period. The resulting assets as at 31 December 2012 are 11% higher than projected.

Table 17   Financial Status - 2010 to 2012[1]
(cost accrual basis, $ million)

	Actual	Expected	Difference Actual – Expected	% Change Difference/ Expected
Assets at 31 December 2009	**126,836**	**126,836**	**0**	**0.0%**
+ Contributions	114,770	115,323	(553)	(0.5%)
- Expenditures	102,035	102,202	(167)	(0.2%)
+ Investment Income	35,523	18,097	17,426	96.3%
Change in Assets	48,259	31,218	17,041	54.6%
Assets at 31 December 2012	**175,095**	**158,054**	**17,041**	**10.8%**

(1)   Components may not sum to totals due to rounding.

Table 18   Summary of Expenditures - 2010 to 2012
($ million)

	Actual	Expected	Difference Actual – Expected	% Change Difference/ Expected
Retirement	72,952	73,897	(945)	(1.3%)
Disability	11,390	11,166	224	2.0%
Survivors	12,204	12,078	126	1.0%
Children	1,567	1,598	(31)	(2.0%)
Death	897	909	(12)	(1.3%)
Operating Expenses	3,025	2,554	471	18.4%
Total Expenditures	102,035	102,202	(167)	(0.2%)

C. Changes in the Minimum Contribution Rate

Table 19 presents the main elements of change in the minimum contribution rate since the 25th CPP Actuarial Report and shows an overall small decrease in the rate. Experience over the period 2010 to 2012 was better than anticipated overall, especially regarding migration, benefits, and investment returns, which lowered the minimum contribution rate. In addition, in response to a recommendation made by the independent peer reviewers of the 25th CPP Actuarial Report, the valuation methodology was improved by including CPPIB operating expenses in the investment expenses assumption, instead of as a component of CPP operating expenses, which lowered the minimum contribution rate. Changes made to the assumptions regarding benefits also act to lower the minimum contribution rate. However, these reductions in the rate are mostly offset by higher projected life expectancies at age 65, lower assumed real wage increases, lower inflation expectations, and changes in investments assumptions. A more detailed reconciliation of changes in the minimum contribution rate is provided in Table 34 in Appendix D of this report.

Table 19   Reconciliation of Changes in Minimum Contribution Rate[1,2]

(% of contributory earnings)

	Steady-State Rate	Full Funding Rate		Minimum Rate	
		2013-2022	2023+	2013-2022	2023+
25th CPP Actuarial Report - After Rounding	**9.84**	**0.02**	**0.01**	**9.86**	**9.85**
25th CPP Actuarial Report - Before Rounding	**9.836**	0.017	0.014	9.853	9.850
Improvements in Methodology	(0.067)	(0.001)	(0.000)	(0.068)	(0.067)
Experience (2010 to 2012)	(0.114)	(0.004)	(0.004)	(0.119)	(0.118)
Changes in Demographic Assumptions	0.044	0.000	0.000	0.044	0.044
Changes in Benefit Assumptions	(0.037)	0.000	0.001	(0.037)	(0.036)
Changes in Economic Assumptions	0.124	(0.000)	(0.000)	0.124	0.124
Changes in Investment Assumptions	0.040	(0.000)	(0.000)	0.041	0.040
Rates before Rounding and Adjustment	9.826	0.012	0.011	9.838	9.837
Rounded Rates, in accordance with CPP Regulations[3]	9.83	0.01	0.01	9.84	9.84
Adjustment to Rates, in accordance with CPP Regulations[3]	0.01	(0.01)	(0.01)	0.00	0.00
26th CPP Actuarial Report	**9.84**	**0.00**	**0.00**	**9.84**	**9.84**

(1)   Components may not sum to totals due to rounding.

(2)   For each triennial CPP actuarial report, the minimum contribution rate is determined for all years following the three-year review period in which the report is prepared, with the legislated contribution rate applied during the review period. For the 25th CPP Actuarial Report, the minimum contribution rate was determined for the year 2013 and thereafter, with the legislated rate of 9.9% applied for the 2010-2012 review period. For the 26th CPP Actuarial Report, the minimum contribution rate is determined from 2016 onward, with 9.9% applied for 2013-2015.

(3)   The rounded full funding rate for the years 2013-2022 in respect of the 2008 amendments to the Plan is determined to be 0.01%, which is lower than the minimum level of 0.02% required by the CPP *Calculation of Contribution Rates Regulations, 2007*. According to the Regulations, the full funding rate is thus deemed to be zero, and as a result, the corresponding funding for the 2008 amendments is provided by the steady-state rate, as shown by the adjustments to the rates in the table.

VI. Conclusion

The results contained in this report confirm that the legislated contribution rate of 9.9% is sufficient to financially sustain the Plan over the long term. The results also show that assets accumulate to $300 billion (i.e. 5.2 times the annual expenditures) by 2020.

The minimum contribution rate required to financially sustain the Plan under this report is 9.84% for the year 2016 and thereafter, compared to 9.86% for years 2013 to 2022 and 9.85% from 2023 onward, as determined for the 25th CPP Actuarial Report. Experience over the period 2010 to 2012 was better than anticipated overall, especially regarding migration, benefits, and investment returns. However, this is offset by higher projected life expectancies at age 65 and lower assumed real wage increases. The net result of all changes since the 25th CPP Actuarial Report is an overall small decrease in the minimum contribution rate.

To measure the sensitivity of the long-term projected financial position of the Plan to changes in the future demographic and economic outlook, a number of sensitivity tests were performed. Sensitivity tests on key assumptions and an analysis of the impact of financial market volatility and choice of asset allocation show that the minimum rate could deviate significantly from its best-estimate value of 9.84% if other than best-estimate assumptions were to be realized. If life expectancies continue to increase at the current rate, especially for ages 75 to 89, the long-term mortality assumptions will need to be adjusted accordingly. This will put additional pressure on the minimum contribution rate that could cause the rate to increase above 9.9%.

Under the 9.9% legislated contribution rate, the assets are projected to grow rapidly over the next decade as contribution revenue is expected to exceed expenditures over that period. Assets will continue to grow thereafter until the end of the projection period, but at a slower pace, with the ratio of assets to the following year's expenditures expected to reach a level of 6.0 by 2050. 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 and to remain financially sustainable over the long term.

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 producing periodic actuarial reports. For this purpose, as required by the *Canada Pension Plan*, the next such review will be as at 31 December 2015.
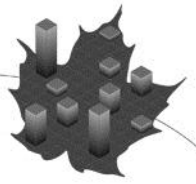
VII. Actuarial Opinion

In our opinion, considering that this 26th Actuarial Report was prepared pursuant to the *Canada Pension Plan*:

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

- the assumptions used are, individually and in aggregate, reasonable and appropriate; and

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

Based on the results of this valuation, we hereby certify that the minimum contribution rate to finance the Canada Pension Plan without further increase is 9.84% for the year 2016 and thereafter.

This report has been prepared, and our opinions given, in accordance with both accepted actuarial practice in Canada, in particular, the General Standards of Practice of the Canadian Institute of Actuaries, and internationally accepted actuarial practice as provided by the International Standard of Actuarial Practice 1 – General Actuarial Practice of the International Actuarial Association.

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Ottawa, Canada
21 November 2013
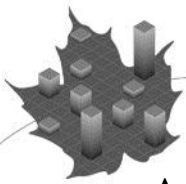
Appendix A – Financing the Canada Pension Plan

I.   Historical Background

The retirement system in Canada has been designed as a three-tier system. First, the Old Age Security (OAS) Program provides for a minimum floor benefit based on residence in Canada. Second, the CPP and QPP cover most individuals with employment earnings. Finally, individuals may be covered by registered pension plans (RPPs) as well as pooled registered pension plans (PRPPs), and can invest in individual registered retirement savings plans (RRSPs) and tax-free saving accounts (TFSAs) to supplement their retirement income.

Each tier is financed using a different approach: the OAS Program is financed through general tax revenues on a pay-as-you-go basis, the CPP/QPP are partially funded based on contributions on employment earnings, and RPPs, PRPPs, RRSPs, and TFSAs are intended to be fully funded. The variety in both the sources and methods of financing enables the Canadian retirement income system to be less vulnerable, and thus more resilient, to changes in economic and demographic conditions compared to systems that are less varied in their provision of retirement income.

The CPP was initially established as a pay-as-you-go plan with a small reserve fund worth about two years of benefits. At the time of the Plan's inception, demographic and economic conditions were characterized by a younger population (higher fertility rates and lower life expectancies), rapid growth in wages and labour force participation, and low rates of return on investments. These conditions made prefunding the scheme unattractive and pay-as-you-go financing more appropriate. Growth in total earnings of the workforce and thus contributions were sufficient to cover growing expenditures without requiring large increases in the contribution rate. Plan assets were invested primarily in long-term non-marketable securities of provincial governments at lower than market rates, thus providing the provinces with a relatively inexpensive source of capital to develop needed infrastructure.

However, changing conditions over time, including lower birth rates, increased life expectancies, and lower real wage growth led to increasing Plan costs. These factors, in combination with higher market returns, made fuller funding more attractive and appropriate. By the mid-1980s, the net cash flow (contributions less expenditures) had turned negative and part of the Plan's investment income was required to meet the shortfall. The shortfall continued to grow, which eventually caused the assets of the reserve fund to start to fall by the mid-1990s.

In the December 1993 (15th) Actuarial Report on the CPP, the Chief Actuary projected that the pay-as-you-go contribution rate (expenditures as a percentage of contributory earnings) would increase to 14.2% by 2030. It was further projected that if changes were not made to the Plan, the reserve fund would be exhausted by 2015. The Chief Actuary identified five factors responsible for the increasing costs of the Plan, namely: lower birth rates, higher life expectancies than expected, lower productivity than expected, benefit enrichments, and increased numbers of Canadians claiming disability benefits for longer periods.

In response to these developments, amendments were made in 1998 to gradually increase the level of CPP funding by increasing contribution rates over the short term, reducing the growth of benefits over the long term, and investing net cash flows in the private markets through the CPPIB to achieve higher rates of return. It was also decided that any future increases to or additions of new benefits under the Plan should be fully funded. The reform package agreed to
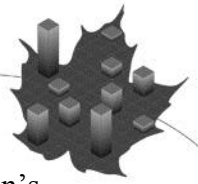
by the federal and provincial governments in 1997 thus included significant changes to the Plan's financing provisions:

- The introduction of *steady-state funding* to replace pay-as-you-go financing in order to build a reserve of assets and stabilize the ratio of assets to expenditures over time. Under steady-state funding, the ratio of assets to expenditures is currently projected to stabilize at a level of about 5.3. Investment income on this pool of assets is projected to help pay benefits when the large cohort of baby boomers retires. This refers to section 113.1(4)(c) of the *Canada Pension Plan*.

- The introduction of *full funding* that requires that changes to the CPP that increase or add new benefits be fully funded, i.e. that their costs be paid as the benefit is earned and that any costs associated with benefits that have already been earned must be amortized and paid for over a defined period of time consistent with common actuarial practice. This refers to section 113.1(4)(d) of the *Canada Pension Plan*.

Both of these funding objectives were introduced to improve fairness across generations. The move to steady-state funding eases some of the contribution burden on future generations, and under full funding each generation that will receive benefit enrichments is more likely to pay for such enrichments in full so that the associated costs are not passed on to future generations.
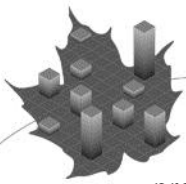
The combination of steady-state funding and full funding supports the objective of the 1997 reform package to improve the financial long-term sustainability of the Plan so that the CPP will be affordable and sustainable for future generations.

II. Balance Sheet

The CPP balance sheet presented in this section is prepared using an open group approach. An open group is defined as one that includes all current and future participants of a plan, where the plan is considered to be ongoing into the future, that is, over an extended time horizon. This means that future contributions of current and new participants and their associated benefits are included in order to determine whether current assets and future contributions will be sufficient to pay for all future expenditures. This is compared to a closed group that includes only current participants of the Plan, with no new entrants permitted and no new benefits accrued.

The choice of the methodology used to produce a social security system's balance sheet is mainly determined by the system's financial approach. Partially funded plans like the CPP represent a social contract where, in any given year, current contributors allow the use of their contributions to pay current beneficiaries' benefits. This social contract creates claims for current and past contributors to contributions of future contributors. As such, the proper assessment of the financial sustainability of partially funded plans by means of their balance sheets should reflect these claims. The open group approach does account explicitly for these claims by considering the benefits and contributions of both the current and future plan participants. In comparison, the closed group methodology does not reflect these claims since only current participants are considered.

To determine the actuarial liability of the Plan under the open group approach, future expenditures with respect to current and future Plan participants are first projected over a 150-year period using the best-estimate assumptions described in Appendix E. Next, these total

projected expenditures are discounted using the projected rate of return on CPP assets to determine their present value. This is the actuarial liability under the open group approach.

To determine the assets of the Plan under the open group approach, future contributions of current and future contributors are first projected over a 150-year period using the best-estimate assumptions described in Appendix E and the legislated rate of 9.9%. These total projected contributions are then discounted using the projected rate of return on current CPP assets to determine their present value. This present value is added to the Plan's current assets to obtain the total assets of the Plan under the open group approach.

The actuarial position of the Plan as at 31 December 2012 and 31 December 2022 under the open group approach is presented in Table 20. To obtain the asset excess (shortfall) of the Plan, the Plan's actuarial liability is deducted from the assets at the valuation date.

Table 20   CPP Balance Sheet (Open Group Approach)

	As at 31 December 2012	As at 31 December 2022
	($ billion)	($ billion)
Assets	2,245.8	3,181.3
Actuarial Liability	2,254.7	3,196.3
Asset Excess (Shortfall)	(8.9)	(15.0)
Assets as Percentage of Liability	99.6%	99.5%

The Plan is intended to be long-term and enduring in nature, a fact that is reinforced by the federal, provincial, and territorial governments' joint stewardship through the established strong governance and accountability framework of the Plan. Therefore, if the Plan's financial sustainability is to be measured based on its asset excess or shortfall, it should be done so on an open group basis that reflects the partially funded nature of the Plan, that is, its reliance on both future contributions and invested assets as means of financing its future expenditures. The inclusion of future contributions and benefits with respect to both current and future participants in the assessment of the Plan's financial status confirms that the Plan is able to meet its financial obligations and is sustainable over the long term[1,2].

III.   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 from the equality of:

- the present value of past and future contributions (both employer and employee portions) 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

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[1]   As at 31 December 2012, under the closed group approach, the actuarial liability of the Plan is equal to $1,004.9 billion, the assets are $175.1 billion, and the assets shortfall is equal to $829.8 billion.

[2]   The 2013 current service cost of the Plan is estimated to be $27.6 billion or 6.4% of contributory earnings.
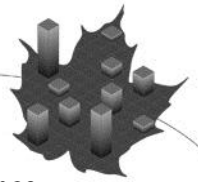
of the cohort. Internal rates of return are dependent on many assumptions as to future experience, such as those regarding the age at pension take-up, life expectancy, the actuarial adjustment factor applied to the pension, and the working beneficiaries provision. The internal rates of return are calculated on the basis of the best-estimate assumptions of this report and using the legislated contribution rate of 9.9%.

The results presented in Table 21 are rates based solely on contributions paid and benefits received; that is, operating expenses associated with each cohort are excluded. Results 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 21   Internal Rates of Return by Cohort
(annual percentages)

Birth Year	Nominal	Real
1950	7.1	4.2
1960	5.3	3.0
1970	4.6	2.4
1980	4.5	2.3
1990	4.5	2.2
2000	4.5	2.3
2010	4.5	2.3

The higher internal rates of return of the cohorts currently reaching age 65 mean that they are expected to receive better value from the CPP than those who will follow. The differences provide an indication of the degree of intergenerational transfer present in the Plan. However, the rates stabilize for cohorts born after 1970. The positive and stable internal rates of return for younger cohorts confirm that the Plan in its current form is a sustainable and fair retirement savings vehicle.
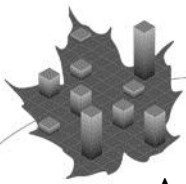
Appendix B – Uncertainty of Results

I.   Introduction

The future income and outgo of the Canada Pension Plan depend on many demographic and economic factors, including fertility, mortality, migration, the labour force, average earnings, inflation, retirement patterns, disability rates, and investment returns. The income will depend on how these factors affect the size and composition of the working-age 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 best-estimate assumptions; the objective of this section is to illustrate the sensitivity of the long-term projected financial position of the Plan to changes in the future demographic and economic outlook.

Section II examines the sensitivity of the Plan to different asset allocations. Six alternative investment portfolios are described, along with the volatility of each portfolio and the resulting impact on the Plan's minimum contribution rate. The impact of financial market volatility on the financial status of the Plan is explored in section III. Severe one-time financial shocks are applied to three investment portfolios with the purpose of quantifying the long-term impact on the minimum contribution rate.

An economic slowdown followed by a partial economic recovery and the resulting impact on the financial status of the Plan is discussed in section IV. The slowdown is assumed to occur in 2014-15 and attempts to replicate the economic slowdown of 2008-09. Section V presents sensitivity tests on individual long-term assumptions based on a combination of judgment and stochastic modeling techniques.

Finally, section VI builds on the individual sensitivity tests performed in section V by combining the demographic and labour force assumptions of the individual sensitivity tests to create younger and older populations. The combination of these assumptions is not meant to necessarily create probable scenarios, but rather to show the possible impact of changing the overall composition of the population.

II.   Sensitivity of Investment Policy

The CPPIB was created in 1997 with the object "to invest its assets with a view to achieving a maximum rate of return, without undue risk of loss, having regard to the factors that may affect the funding of the Canada Pension Plan and the ability of the Canada Pension Plan to meet its financial obligations on any given business day", as stated in the *Canada Pension Plan Investment Board Act*. The purpose of the CPPIB is to meet this mandate while mitigating risk through diversification of investments in equities and other asset classes with the aim of achieving higher returns. Over time, the role of the CPPIB will continue to become increasingly important as assets are expected to grow rapidly over the next decade with contributions to the Plan projected to exceed expenditures over this period. After 2022, it is projected that an increasing proportion of investment income will be required to meet expenditures. Although net cash flows (contributions less expenditures) are projected to be negative after 2022, asset growth is still expected to continue.
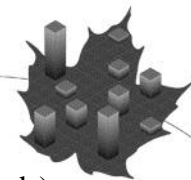
Historically, equities have shown greater volatility than fixed income instruments (such as bonds), volatility being a measure of the magnitude of fluctuation in returns. Similarly, long-term bonds have historically shown greater volatility than shorter fixed income instruments. For instance, in the fifty, twenty-five, and ten years ending in 2012, the volatility (standard deviation) of Canadian equity returns (indicated by the S&P/TSX Total Return Index) was 16.4%, 17.0%, and 19.5%, respectively, as given in the Canadian Institute of Actuaries' Report on Canadian Economic Statistics 1924 – 2012. This compares with the volatility of returns of long-term federal bonds (10+ years) of 10.2%, 9.2%, and 6.8% and with the volatility of returns of medium-term federal bonds (5-10 years) of 7.4%, 6.7%, and 4.8% over the same periods. Higher volatility of a security's returns implies a greater risk since the range of possible outcomes of returns widens. Hence, equities are viewed as being more risky than bonds and long-term bonds are viewed as more risky than medium- or short-term bonds.

Historically, the higher volatility of equities compared to bonds has also been rewarded with higher returns. This describes the key risk-reward relationship, whereby investors seek a higher level of return over the long term, or an equity risk premium, in exchange for assuming a higher level of risk. Nevertheless, over the short term, the potential for lower returns exists along with that for higher returns due to the higher level of volatility.

Investing in a greater proportion of equities requires assuming a higher level of risk and hence the possibility of realizing a wider range of returns. Conversely, investing in lower risk fixed income instruments will tend to produce lower returns. Further, by accepting lower returns with lower risk, investment objectives may not be achieved.

Table 22 shows the impact that various investment portfolios would have on the Plan's real rate of return and minimum contribution rate, as well as the volatility present in each portfolio.

Table 22   Investment Policy Impact on Minimum Contribution Rate

Portfolio	Fixed Income	Equity	Real Assets	Ultimate Real Rate of Return	One-Year Standard Deviation	Average Term to Maturity of Fixed Income Portfolio	Minimum Contribution Rate[1]
	(%)	(%)	(%)	(%)	(%)	(Years)	(%)
1[2]	100	0	0	2.8	8.9	21.5	10.65
2[3]	100	0	0	3.3	7.5	19.7	10.36
3	80	15	5	3.6	7.3	18.5	10.17
4	50	40	10	3.8	8.4	7.7	10.02
BE	*30*	*50*	*20*	*4.0*	*10.6*	*7.7*	*9.84*
5	15	65	20	4.3	12.9	7.7	9.67
6	0	80	20	4.5	15.2	n/a	9.54

(1)   The minimum contribution rate in this table refers to the rate applicable for 2016 and thereafter.
(2)   Assumes the portfolio is invested fully in long-term Government of Canada bonds.
(3)   Assumes the portfolio is invested in a diversified bond portfolio consisting of federal, provincial, corporate and real return bonds.

Portfolio 1 is assumed to consist solely of long-term federal bonds and as such, a low return is expected. This portfolio's volatility (one-year standard deviation) is relatively low for an undiversified portfolio. Under this scenario, the low risk investments would cause the minimum contribution rate to increase to 10.65%. Portfolio 2 is assumed to be a marketable bond portfolio consisting of federal, provincial, corporate, and real return bonds. This portfolio produces a
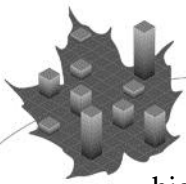
higher real rate of return and lower volatility compared to Portfolio 1 because of the diversification through different bond classes. However, the expected return of Portfolio 2 is still not sufficient to maintain the current 9.9% contribution rate. As for Portfolio 1, Portfolio 2 is a low risk, low return portfolio. These two portfolios demonstrate the necessity of higher investment returns and thus, the incurrence of higher risk, in order to maintain the minimum contribution rate at a level below the legislated rate of 9.9%. This could be achieved by including equities in the investment portfolio.

The remaining portfolios are diversified portfolios that consist of fixed income, equity (Canadian, foreign and emerging markets) and real assets. Portfolio 3 is more diversified than the first two portfolios with 20% in variable income securities (equity and real assets). This diversification increases the expected real rate of return earned on the portfolio while reducing the volatility compared to the first two portfolios, since the three broad asset classes are not perfectly correlated. Portfolio 4 is even more diversified with 50% of the portfolio invested in equities and real assets. However, it is only slightly riskier than portfolios 2 and 3 due to the fact that the higher volatility from increased investment in variable income securities is partially compensated by a reduction in the fixed income's average term to maturity. The lower average term to maturity of bonds of Portfolio 4 more closely reflects actual investments by the CPPIB and is better positioned for an expected increase in bond yields. However, despite increased real returns and similar risks compared to the first two portfolios, portfolios 3 and 4 are still not sufficient to maintain the minimum contribution rate at a level below the legislated rate of 9.9%.

Portfolios 5 and 6 are considered to be more risky than the best-estimate portfolio, because they consist of substantial investments in variable income securities (85% and 100%, respectively) and consequently, have higher volatility. While both portfolios may produce returns that result in the minimum contribution rate being at or below the legislated contribution rate of 9.9%, such portfolios have a greater likelihood of earning poor investment returns when market downturns occur (as demonstrated in the next section). By investing in a less risky portfolio with a lower degree of volatility, the minimum contribution rate can still be maintained at or below 9.9%.

The best-estimate portfolio (BE) is invested 30% in fixed income, 50% in equity and 20% in real assets in the long term. Such a portfolio produces an expected average annual real return of 4.0% with a one-year standard deviation of 10.6%. By observing the volatility of each of the portfolios in Table 22, it can be concluded that a certain degree of risk must be undertaken in order to earn a sufficient return. An asset allocation such as the best-estimate portfolio demonstrates that an average real return of 4.0% can be achieved with a moderate degree of risk. The benefit of an increased return produced by the more risky portfolios (5 and 6) does not seem to outweigh the accompanying increase in risk. This aligns with the investment objective of the CPPIB which is to invest its assets with a view to achieving a maximum rate of return, without undue risk of loss, having regard to the factors that may affect the funding of the CPP and the ability of the Plan to meet its financial obligations on any given business day.

III.   Financial Market Tail Events

This section analyzes the impacts that tail events in portfolio returns could have on the minimum contribution rate. To illustrate this, portfolio returns other than the best estimate are assumed to occur in 2015 for various investment portfolios. Two alternative portfolios were selected from section II to show the potential impacts of a less risky (Portfolio 4: 40% equity, 10% real assets,

50% fixed income) and a more risky (Portfolio 5: 65% equity, 20% real assets, 15% fixed income) portfolio in relation to the best-estimate portfolio.

In this illustration, it is assumed that the returns of the three portfolios follow a normal distribution. The standard deviation for each portfolio is given in Table 22 in section II. The expected nominal returns for the year 2015 are given in Table 23. Two probability levels were selected to analyze: 1/10 and 1/50. These levels can be thought of as the probabilities of earning more or less than a given return once every 10 and 50 years, respectively. Since the normal distribution has two tails, a left tail and a right tail, both were examined. The left tail event is the occurrence of a nominal return such that the probability of earning that return or less is equal to 1/10 (or 1/50). The right tail event is the occurrence of a nominal return such that the probability of earning that return or more is equal to 1/10 (or 1/50).

For each portfolio a nominal return is calculated for 2015 at the two probability levels. Following the various portfolio returns in 2015, it is assumed that the returns revert back to their best-estimate values from 2016 onward. The nominal returns and the resulting impact on the minimum contribution rates are given in Table 23.

Table 23   Impact of Various Portfolio Returns and Portfolios (2015)

		Portfolio 4		Best-Estimate Portfolio		Portfolio 5	
		Expected Nominal Return in 2015	**MCR[1]**	**Expected Nominal Return in 2015**	**MCR[1]**	**Expected Nominal Return in 2015**	**MCR[1]**
		3.8%	10.02%	5.0%	9.84%	5.7%	9.67%
Probability of Return[2]	**Tail**	**(%)**	**Impact on MCR (%)**	**(%)**	**Impact on MCR (%)**	**(%)**	**Impact on MCR (%)**
1/10	Left	(7.0)	0.08	(8.5)	0.11	(10.8)	0.16
	Right	14.6	(0.07)	18.5	(0.11)	22.2	(0.16)
1/50	Left	(13.5)	0.12	(16.7)	0.18	(20.8)	0.25
	Right	21.1	(0.12)	26.7	(0.18)	32.2	(0.25)

(1)   Minimum contribution rate.
(2)   The probability of earning the positive returns in the table corresponds to the probability that the annual return is greater than or equal to the indicated return. Similarly, the probability of earning the negative portfolio return corresponds to the probability of earning the indicated return or less.

Once every ten years, the best-estimate portfolio is expected to experience a nominal return of -8.5% or less as well as a nominal return of +18.5% or more. As a result, the minimum contribution rate could increase or decrease by at least 0.11 percentage points.

If a smaller probability is considered, then one can expect the results to be more extreme and the impact on the minimum contribution rate to be larger. For a once every fifty years event, the left tail event for the best-estimate portfolio is a nominal return of -16.7% or less while the right tail event is a nominal return of +26.7% or more. As a result of these two tail events, the minimum contribution rate could increase or decrease by at least 0.18 percentage points.

Portfolio 4, the lower-risk portfolio, has the lowest proportion of variable income securities and thus, the lowest volatility. As such, the tail events for this portfolio are less extreme than for a
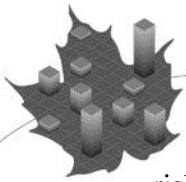
riskier portfolio when considering the same probability levels. It then follows that the impact on the minimum contribution rate is less when compared to a riskier portfolio.

Portfolio 5 has a greater proportion of variable income securities compared to the other two portfolios and thus, the highest volatility. As such, the left and right tail events for Portfolio 5 are more extreme. As a result, the impact on the minimum contribution rate is larger when the portfolio shocks occur. Once every fifty years, a nominal return of -20.8% or less may occur resulting in an absolute increase of at least 0.25 percentage points to the minimum contribution rate. Although such an event is not common, the immediate impact on the financial status of the Plan would be significant.

Investment portfolio shocks, whether positive or negative, can have an immediate and significant impact on the financial status of the Plan. The impact varies depending on the amount of risk present in the portfolio. A portfolio more heavily weighted toward variable income securities will likely experience greater changes in market upswings and downturns, and the minimum contribution rate under such a portfolio will likewise change to a significant degree. The upside of investing in a risky portfolio must be weighed against the downside risk and the associated probability of poor investment returns occurring.

IV. Economic Slowdown

Following the economic slowdown experienced in 2008-09, sensitivity tests were created to analyze the capacity of the CPP to withstand another similar slowdown in the near future. During the 2008-09 economic slowdown, the Canadian unemployment rate increased by over two percentage points. In addition, CPP assets declined from $123 billion to $106 billion. The Canadian economy is still recovering following the recent slowdown. As the short-term economic outlook for major foreign economies and for Canada remains uncertain, there are a number of risk factors which could adversely affect the Canadian economy in the short term.

Under the best-estimate scenario, moderate and sustainable economic growth is assumed. The sensitivity tests assume that another economic slowdown occurs in 2014 and 2015, followed by a period of recovery as economic assumptions return to their best-estimate values. The first scenario focuses on the impact of changes to the economic assumptions, while the second scenario builds on the first one and adds negative shocks to the investment portfolio.

Under the best-estimate scenario, the unemployment rate in Canada is assumed to be 7.0% and 6.9% for 2014 and 2015, respectively, and reaches an ultimate rate of 6.0% by 2023. In addition, average real annual earnings are assumed to increase by 0.6% and 0.7% in 2014 and 2015, respectively, with an ultimate rate of 1.2% reached in 2020.

Under the first scenario, the 2015 unemployment rate is two percentage points higher than under the best-estimate scenario, with the increase occurring over a two-year period. This results in an assumed unemployment rate of 8.0% in 2014 and 8.9% in 2015. It then gradually reverts to its best-estimate value over the following ten years. The real increases in average weekly earnings and average annual earnings are reduced to 0.3% and 0.0% in 2014 and 2015, respectively, and then return to their best-estimate values for 2016 and thereafter. As a result, total contributory earnings are 2.4% lower than under the best-estimate scenario by 2015 and continue to lag the best estimate in all subsequent projection years. Under this scenario, the minimum contribution rate increases slightly to 9.86%.
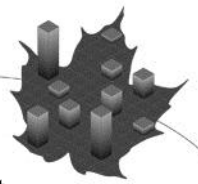
The second scenario builds on the first with the additional assumption that the CPP investment portfolio experiences a nominal rate of return of -10% in both 2014 and 2015, and reverts back to its best-estimate value in the following year. As a result, the minimum contribution rate increases to 10.09%.

The results of these tests are summarized in Table 24.

Table 24   Economic Slowdown (2014-2015)

Canada	Slowdown		Best Estimate	
	(%)	(%)	(%)	(%)
	2014	**2015**	**2014**	**2015**
Scenario #1				
Unemployment Rate	8.0	8.9	7.0	6.9
Real wage Increase	0.3	0.0	0.6	0.7
Minimum Contribution Rate[1]	**9.86**		**9.84**	
Scenario #2				
Unemployment Rate	8.0	8.9	7.0	6.9
Real wage Increase	0.3	0.0	0.6	0.7
Nominal investment return	(10.0)	(10.0)	4.8	5.0
Minimum Contribution Rate[1]	**10.09**		**9.84**	

(1)   The minimum contribution rate in this table refers to the rate applicable for 2016 and thereafter.

V.   Invidividual Sensitivity Tests

This actuarial report on the Canada Pension Plan is based on the projection of its revenues and expenditures over a long period of time. The information required by statute, which is presented in the Results section 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 Appendix E. 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. Individual sensitivity tests have been performed that consist of projecting the financial status of the Plan using alternative assumptions.

With the exception of the labour market test, which uses a purely deterministic model based on judgment, the individual assumption sensitivity tests are developed using a combination of judgment and stochastic modeling techniques. All of the tests are described in the sections below.

Stochastic modeling techniques estimate the probability distribution of an outcome for each selected assumption, and these distributions are used to quantify a range of possible outcomes. The fluctuation in each variable other than the rate of return on investments is projected by using standard time-series modeling, a method designed to make inferences based on historical data. The fluctuation in the rate of return on investments is based on a normal distribution of returns and is projected using historical correlations between asset classes, historical standard deviations, and expected returns for each asset class.

With the time series approach, a variable is modeled by an equation that captures a relationship between current and prior years' values of the variable. A year-by-year random variation consistent with the variation observed in the historical period is then introduced. Parameters for
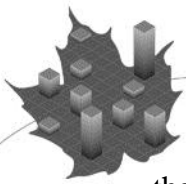
the equations are estimated using historical data for periods that range between 30 years and 84 years. Each time-series equation is designed such that, in the absence of random variation, the value of the variable is equal to the value assumed under the best-estimate assumption.

Future mortality rates are stochastically projected using the time series approach and assuming that, for each year, rates by age and gender are correlated. For each projection year and based on 1,000 outcomes, the life expectancies with future improvements are calculated and an 80% confidence is determined. In addition to the scenario based on the best-estimate mortality rates, two other scenarios based on mortality rates derived using deterministically defined low and high assumed future mortality improvement rates are considered. Alternative assumptions are then derived using the results of these scenarios.

For the remaining stochastically analyzed assumptions, a minimum of 10,000 outcomes are generated for each year in the projection period. Although the yearly outcome of each variable will fluctuate, it is the average outcome over the projection period that will determine the financial sustainability of the Plan. Therefore, an 80% confidence interval is calculated for the cumulative average of each assumption to determine, with 80% probability, the range of possible outcomes over the entire 75-year projection period. If a shorter projection period were to be considered, such as ten or fifteen years, one could expect the average 80% confidence interval to be wider since the outcomes will not have had enough time to stabilize. The upper and lower values of the 80% confidence interval are used as the low-cost and high-cost assumptions, or vice versa depending on the assumption, for these individual sensitivity tests.

The results should be interpreted with caution and a full understanding of the inherent limitations of stochastic modeling. Results are very sensitive to model specifications, degrees of interdependence among variables, and the historical periods used for the parameters estimates. For some variables, using the variations exhibited in relatively recent or, conversely, earlier historical periods may not provide a realistic representation of the potential variation for the future. Furthermore, additional variability could result from incorporating statistical approaches that would more fully model change in the long-range central tendencies of the variables. The historical periods chosen for most variables are relatively homogeneous and do not reflect substantial shifts. The time-series modeling reflects what occurred in these historical periods. As a result, the variation indicated in this section should be viewed as the minimum plausible variation for the future. Structural shifts, as predicted by many experts and as seen in prior centuries, are not reflected in the current models. Rather, the projection models or time series are adjusted to reflect the best judgment over a long period.

The sensitivity tests were performed by varying most of the key assumptions individually in a manner consistent with the results of the stochastic analysis and by keeping the remaining assumptions at their best-estimate levels. Each sensitivity test 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 minimum contribution rate. Conversely, assumptions for the high-cost scenarios increase the minimum contribution rate.

The alternative assumptions selected are intended to represent a wide range of potential long-term experience. However, each individual result cannot simply be combined because a change in any one particular assumption may have an impact on other assumptions to various degrees.

Table 25 summarizes the alternative assumptions used in the individual sensitivity tests. It is followed by a brief discussion of each assumption and the impact that the variation in each assumption has on the results.

Table 25 Individual Sensitivity Test Assumptions

	Canada	Low-Cost		Best-Estimate		High-Cost	
1	Total fertility rate	1.90		1.65		1.40	
2	Mortality: Canadian life expectancy at age 65 in 2050 with future improvements	Males	20.7	Males	23.0	Males	25.6
		Females	22.9	Females	25.3	Females	27.7
3	Net migration rate	0.65%		0.60%		0.55%	
4	Labour Market: Participation rate (aged 15-69)[1]	82% (2030)		77% (2030)		73% (2030)	
	Unemployment rate[1]	4.0%		6.0%		8.0%	
	Average CPP retirement benefit take-up age[1]	63.8		62.9		62.0	
5	Rate of increase in prices	2.7%		2.2%		1.6%	
6	Real wage increase	1.9%		1.2%		0.4%	
7	Real rates of return	5.5%		4.0%		2.5%	
8	CPP disability incidence rates (per 1,000 eligible)	Males	2.50	Males	3.30	Males	4.10
		Females	2.85	Females	3.75	Females	4.65

(1) For these tests, a deterministic instead of a stochastic approach was used to derive the low- and high-cost estimates.

A. Fertility Rate

The best-estimate assumption is that the total fertility rate for Canada will increase slightly from its 2010 level of 1.63 to an ultimate level of 1.65 in 2015. Based on fertility experience of the last 40 years (1971 to 2010), a stochastic approach was used to generate the low- and high-cost scenarios over the 75-year projection period. Factors such as higher labour force participation of women, later entry into marriages or common-law relationships, higher and longer periods of education, as well as others, make it unlikely that high fertility rates such as those experienced during the post-WWII baby boom period will be seen again in the future. Therefore, the experience period selected for the stochastic analysis excludes periods of high fertility rates.

It was projected that the average total fertility rate throughout the 75-year projection period will be in the range 1.4 to 1.9 with 80% probability. Instead, if a 15-year projection period is considered, then the average total fertility rate will be in the range 1.3 to 2.0.

The low-cost assumption has the total fertility rate increasing to an ultimate level of 1.9 in 2015, which is lower than the national population replacement rate. The total Canadian fertility rate has not been above 1.9 since 1973. Under this scenario, the population grows to a level in 2050 that is about 7% higher than under the best-estimate assumption. In addition, a higher ultimate total fertility rate leads to a younger population. Thus, the dependency ratio, defined as the ratio of those aged 65 and over to the working-age population (20-64), is 0.44 (or approximately 2.3 workers per retiree) in 2050 compared to a dependency ratio of 0.46 (or approximately 2.2 workers per retiree) under the best-estimate assumption.
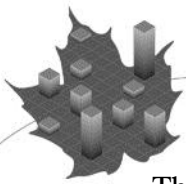
The high-cost assumption has the total fertility rate decreasing to an ultimate level of 1.4 in 2015. This is similar to the recent total fertility rates of Italy and Japan. Under this scenario, the population grows much more slowly, to a level in 2050 that is 6.5% lower than under the best-estimate assumption. A lower ultimate total fertility rate leads to an older population. In this scenario, the dependency ratio increases from the best-estimate value of 0.46 (or 2.2 workers per retiree) in 2050 to 0.48 (or 2.1 workers per retiree).

B. Mortality Rates

In addition to the stochastic projections of the mortality rates, a deterministic element has been introduced to the test to capture the impact of greater uncertainty regarding the long-term mortality improvement rates assumption.

A deterministic model was first used to generate two alternatives for the mortality improvement rate assumption. Under the first alternative, the best-estimate ultimate values of the mortality improvement rates have been reduced by 0.2% whereas for the second alternative, the best-estimate ultimate values of the mortality improvement rates have been increased by 0.2%. Under the alternative of reducing the ultimate improvement rates, the life expectancies of males and females at age 65 in 2050 are 0.5 of a year lower than under the best-estimate assumption. Under the alternative of increasing the ultimate improvement rates, the life expectancies of males and females at age 65 in 2050 are 0.6 of a year higher than under the best estimate.

Based on the mortality experience by age and sex of the last 84 years (1926 to 2009), a stochastic approach was used to generate scenarios over the 75-year projection period under the best-estimate assumption and each of the two alternatives described above. The following table presents the life expectancies at the 10th and 90th percentiles determined by the stochastic analysis as well as the expected life expectancies determined with the deterministic approach. For example, under the best-estimate assumption, it was projected that, on average, the life expectancy of a male aged 65 in 2050 will be in the range of 21.0 to 24.9 years with 80% probability. For a female aged 65 in 2050, life expectancy is projected to be in the range of 23.4 to 27.1 years with 80% probability.

Table 26   Stochastic and Deterministic Projections of Life Expectancy at age 65 in 2050[1]
(Canada)

Mortality Improvement Rates Scenario		Life Expectancy		
		Stochastic 10th Percentile	Deterministic Expected	Stochastic 90th Percentile
Best Estimate	Males	21.0	**23.0**	24.9
	Females	23.4	**25.3**	27.1
Reducing Alternative	Males	**20.7**	22.5	24.4
	Females	**22.9**	24.8	26.7
Increasing Alternative	Males	21.8	23.6	**25.6**
	Females	24.0	25.9	**27.7**

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

The low-cost scenario corresponds to the lower end of the 80% probability range under the alternative of reducing the improvement rate assumption. Under this scenario, mortality is
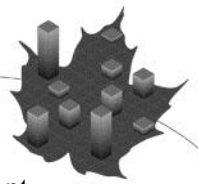
assumed to improve at a slower rate than under the best-estimate scenario, reflecting that current improvements above age 65 might not be sustainable. Under this scenario, the population grows to a level in 2050 that is 1.4% lower than under the best-estimate assumption. In addition, the dependency ratio decreases to 0.43 (or 2.3 workers per retiree) compared to a best-estimate of 0.46 (or 2.2 workers per retiree) since life expectancy is lower and there would be fewer retirees compared to the working-age population.

The high-cost scenario corresponds to the higher end of the 80% probability range under the alternative of increasing the improvement rate assumption. Under this scenario, mortality is assumed to improve at a faster pace than under the best-estimate scenario. Under this scenario, the population grows to a level in 2050 that is 1.5% higher than under the best-estimate assumption. The dependency ratio also increases to 0.48 (or 2.1 workers per retiree) compared to a best-estimate of 0.46 (or 2.2 workers per retiree) since life expectancy is higher and there would be more retirees compared to the working-age population.

Table 27 presents the life expectancies that would result in 2050 from the different rates of improvement.

Table 27   Life Expectancy in 2050 under Alternative Assumptions[1]
(Canada)

		Low Cost	Best Estimate	High Cost
At Birth	Males	85.1	88.6	92.3
	Females	87.5	91.3	94.6
At Age 65	Males	20.7	23.0	25.6
	Females	22.9	25.3	27.7

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

C. Net Migration Rate

Under the best-estimate assumption, the net migration rate is assumed to gradually reduce from its current (2012) level of 0.77% of the population to an ultimate rate of 0.60% of the population for the year 2017 and thereafter.

Based on the net migration experience of the last 54 years (1959 to 2012) and taking into account the recent increase in the number of net-permanent residents, a stochastic approach was used to generate the low- and high-cost scenarios over the 75-year projection period. It is projected that average net migration throughout the entire projection period will be in the range 0.55% to 0.65% of the population with 80% probability. Instead, if a 15-year projection period is considered, then average net migration will be in the range 0.51% to 0.72% of the population.

The low-cost assumption has net migration reaching a level of 0.65% of the population in 2017 and remaining constant thereafter. This is very close to the average net migration rate over the twenty-five-year period ending in 2012. Under this scenario, the population grows to a level in 2050 that is 2.3% higher than under the best-estimate assumption. As well, the dependency ratio of those aged 65 and over to the working-age population (20-64) changes very little from the best estimate of 0.46 (or 2.2 workers per retiree) in 2050.

The high-cost assumption has net migration reaching a level of 0.55% of the population in 2017 and remaining constant thereafter. This is very close to the average net migration rate experienced during the 1990s. Under this scenario, the population grows more slowly, to a level in 2050 that is 2.2% lower than under the best-estimate assumption. As well, the dependency ratio is 0.47 (or approximately 2.1 workers per retiree), which is slightly higher than the best estimate. The dependency ratio only changes slightly under both the low- and high-cost assumptions compared to the best-estimate, since the impact in each case depends on the age distribution of the immigrants and emigrants. If both groups, those aged 65 and above and those aged 20 to 64, are affected similarly by net migration, then one would expect very little change in the dependency ratio.

D. Labour Market

Employment levels are reflected in the actuarial projection model through the assumptions made regarding the level of labour force participation 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 trends in the retirement patterns of older workers.

This sensitivity test analyzes the impact of stronger and weaker labour demand on the cost of the Plan.

Under the best-estimate scenario, the job creation rate assumption is determined on the basis of expected moderate economic growth and an unemployment rate that is expected to gradually decrease from its 2012 level of 7.2% to an ultimate rate of 6.0% by 2023. Furthermore, the participation rates for all age groups are expected to increase due to the attractive employment opportunities resulting from anticipated labour shortages and the aging of cohorts with stronger labour attachments, especially for women and individuals with higher education attainment. The assumed increase in participation rates of those aged 55 and over is even more significant, given that it is also affected by the expected continued trend toward delayed retirement. Under the best-estimate scenario, the participation rate of those aged 15 to 69 is expected to increase from 74.6% in 2013 to 76.8% in 2030.

Retirement rates are used to determine the distribution of retirement ages of new retirement beneficiaries. The ultimate rates for the best-estimate scenario are based on recent experience. For cohorts reaching age 60 in 2016 and thereafter, the retirement rates at age 60 are assumed to decrease from their 2012 levels to 34% and 38% in 2016 and thereafter, and the retirement rates at age 65 are assumed to increase from their 2012 levels to 41% and 39% in 2021 and thereafter for males and females, respectively. These rates result in a projected average age at take-up of 62.9 in 2030.

A deterministic model (instead of a stochastic model) was used to generate the low-cost and high-cost scenarios for these assumptions, since a stochastic model would not accurately reflect the assumed future trends in labour force participation and unemployment. The anticipated future labour shortage and the trend toward delayed retirement are unlike any labour situation experienced in the past, and thus the historical data do not reflect any substantial shifts like the one being projected. Therefore, it was decided to use judgment in determining the low and high cost assumptions for participation rates, unemployment and retirement rates.

Under the strong labour demand scenario, the job creation rate is robust resulting in a lower unemployment level, higher labour force participation rates, and later retirement due to the availability of employment and unwillingness to incur early retirement penalties. Such an environment has the effect of lowering the minimum contribution rate. For this low-cost scenario, the job creation rates are assumed to increase at a faster pace than under the best-estimate scenario, resulting in an unemployment rate of 4.0% in 2023 and thereafter. In addition, ultimate male participation rates in 2030 are assumed to increase more than expected as a result of a higher than anticipated impact of the labour shortage and the delayed retirement trend on future labour market participation. Furthermore, the ultimate gap in 2030 between male and female participation rates is equal to 3.4% as opposed to 6.8% under the best-estimate scenario. This results in an overall participation rate of 81.8% for those aged 15 to 69 in 2030. The lower unemployment rate and higher participation rate are assumed to encourage CPP participants to ask for their CPP retirement benefits at a later age. Therefore, by 2030, retirement rates at age 60 are assumed to gradually decrease to levels that are 20 percentage points lower than the best estimates, i.e. 14% and 18% for males and females, respectively. This results in an increase in a projected average age at take-up from 62.9 to 63.8 in 2030.

Under the weaker labour demand scenario, the job creation rate is lower resulting in a higher unemployment level and lower labour force participation rates. Insufficient employment opportunities are likely to force Plan contributors to ask for their CPP retirement benefit at an earlier age regardless of the early retirement reduction. Such an environment results in a higher minimum contribution rate. For this high-cost scenario, the job creation rates are assumed to increase at a slower pace than under the best-estimate scenario, resulting in an unemployment rate of 8.0% in 2023 and thereafter. In addition, male and female participation rates are assumed to remain constant at their 2012 levels. This results in an overall participation rate of 72.9% for those aged 15 to 69 in 2030. The higher unemployment rate and lower participation rate are assumed to encourage CPP participants to ask for their CPP retirement benefits at an earlier age. Therefore, by 2030, retirement rates at age 60 are assumed to gradually increase to levels that are 20 percentage points higher than the best estimate, i.e. 54% and 58% for males and females, respectively. This results in a decrease in a projected average age at take-up from 62.9 to 62.0 in 2030.

For both low- and high-cost scenarios, the proportions of working beneficiaries were adjusted compared to the best-estimate scenario in order to reflect the change in retirement behavior.

E. Price Increases

Higher price increases result in a lower minimum contribution rate for the CPP. Indeed, although a higher rate of increase in prices produces higher CPP expenditures, this increase in cost is outweighed by higher nominal contributory earnings and thus, higher contributions.

For the best-estimate projections, the annual rate of price increase is assumed to be 1.5% in 2013, 2.0% from 2014 to 2019, 2.1% in 2020 and then to remain at an ultimate level of 2.2% from 2021 onward.

Based on the overall inflation rate experience over the last 30 years (1983 to 2012), a stochastic approach was used to generate the low- and high-cost scenarios over the 75-year projection period. Over the last two decades, the Bank of Canada was successful in its inflation targeting policies resulting in price increases being mostly contained in the 1% to 3% target range with little volatility. Although central banks might not always be able to control inflation, recent
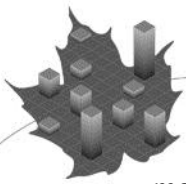
monetary policies in Canada and around the world make it unlikely that very high price increase periods such as the ones after the Second World War and in the 1970s will reoccur. Therefore, the chosen experience period covers periods of both moderately high and low inflation but excludes periods of extremely high inflation seen in earlier years. It was projected that the average annual rate of price increase during the 75-year projection period will be in the range 1.6% to 2.7% with 80% probability. Instead, if a 15-year projection period is considered, then the average annual rate of price increase will be in the range 1.1% to 3.2%.

For the low-cost scenario, the annual rate of price increase is assumed to rise to 2.4% in 2020 and to an ultimate level of 2.7% in 2021. This level of inflation is comparable to the average of the 1960s and over the last three decades.

For the high-cost scenario, the annual rate of price increase is assumed to be 1.8% in 2020 and 1.6% for 2021 and thereafter. This level of inflation is comparable to that of the mid-to-late 1990s.

F. Real Wage Increase

Wage increases affect 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.

An ultimate real wage increase of 1.2% has been assumed in the year 2020 and thereafter for the best-estimate projections. The ultimate real wage increase assumption, combined with the ultimate price increase assumption of 2.2% yields the assumption for ultimate nominal annual increases in wages of 3.4% in 2021 and thereafter. During the initial years of the projection period, the real wage increase is assumed to rise gradually to its ultimate level.

Based on the overall real wage experience of the last 50 years (1962 to 2011), a stochastic approach was used to generate the low- and high-cost scenarios over the 75-year projection period. It was projected that the average real wage increase throughout the 75-year projection period will be in the range 0.4% to 1.9% with 80% probability. Instead, if a 15-year projection period is considered, then the average real wage increase will be in the range -0.2% to 2.6%.

For the low-cost scenario, the assumed real wage increase rises to an ultimate level of 1.9% in 2020. For the high-cost scenario, the assumed real wage increase is held constant at the level of 0.4% for 2014 and thereafter.

G. Rate of Return on Investments

In accordance with the policy of investing CPP assets in a diversified portfolio, the ultimate real rate of return on investments is projected to be 4.0% under the best-estimate assumptions. Using the assumed asset mix of this report and based on historical correlations and standard deviations of returns by asset classes, a stochastic approach was used to generate the low- and high-cost scenarios over the 75-year projection period. It was projected that the average annual real rate of return during the 75-year projection period will be in the range 2.5% to 5.5% with 80% probability. Instead, if a 15-year projection period is considered, then the average annual real rate of return will be in the range 0.6% to 7.4%.

For the low-cost scenario, the real rate of return on investments is assumed to be 5.5% in 2019 and thereafter. For the high-cost scenario, the real rate of return on investments is assumed to be 2.5% in 2019 and thereafter.

The real rates of return do not affect either expenditures or contributory earnings. However, beginning in 2023 when net cash flows of the Plan are projected to turn negative, a proportion of investment income will be required to pay Plan benefits. Thus, sufficient real rates of return are required to produce investment income large enough to cover the necessary portion of Plan expenditures while still increasing the assets of the Plan.

H. Disability Rates

The best-estimate projections assume that disability incidence rates will remain at levels comparable to what has been experienced in recent years. The aggregate ultimate rate of incidence for the year 2017 and later is 3.30 new disability beneficiaries per year among 1,000 eligible workers for males and 3.75 per thousand for females, on average.

Based on the overall disability incidence rate experience of the last 43 years (1970 to 2012), a stochastic approach was used to generate the low- and high-cost scenarios over the 75-year projection period. It was projected that the average annual disability incidence rate for males over the 75-year projection period will be in the range 2.50 to 4.10 per 1,000 eligible workers with 80% probability. For females, the range of disability incidence rates is 2.85 to 4.65 per 1,000 eligible workers.

For the low-cost scenario, disability incidence rates are assumed to reach ultimate levels in 2017 of 2.50 per thousand for males and 2.85 per thousand for females. Neither male nor female incidence rates have been below 3.0 since the early 1970s (on a year 2012 eligible population-adjusted basis for comparison purposes).

For the high-cost scenario, disability incidence rates are assumed to reach ultimate levels in 2017 of 4.10 per thousand for males and 4.65 per thousand for females. These rates are lower than the high levels experienced in the 1980s and early 1990s.
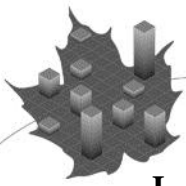
I. Results

Under each scenario, the contribution rate was projected to follow the current schedule through 2015, and a new minimum contribution rate was determined for 2016 and thereafter. Table 28 summarizes the minimum contribution rate and pay-as-you-go rates under each of the scenarios. In addition, the table presents the first year that expenditures exceed contributions.

Table 28 Sensitivity of Minimum Contribution Rate
(percentages)

	Assumption	Scenario	Minimum Contribution Rate[1]	First Year Expenditures Exceed Contributions[2]	Pay-As-You-Go Rates		
					2025	2050	2087
		Best Estimate	9.84	2022	10.28	11.01	11.71
1	Total Fertility Rate	Low Cost	9.53	2020	10.28	10.49	10.50
		High Cost	10.17	2025	10.29	11.58	13.23
2	Mortality Rates	Low Cost	9.46	2020	10.13	10.54	10.97
		High Cost	10.22	2024	10.45	11.49	12.41
3	Net Migration Rate	Low Cost	9.75	2022	10.22	10.83	11.51
		High Cost	9.93	2023	10.35	11.19	11.92
4	Labour Market	Low Cost	9.59	2027	9.50	10.73	12.30
		High Cost	10.12	2020	11.02	11.30	11.43
5	Price Increases	Low Cost	9.74	2022	10.24	10.86	11.59
		High Cost	9.97	2023	10.34	11.20	11.88
6	Real Wage Increases	Low Cost	9.26	2018	9.77	9.87	10.46
		High Cost	10.51	2023	10.94	12.55	13.46
7	Real Rate of Return on Investments	Low Cost	8.97	2016	10.28	11.01	11.71
		High Cost	10.73	2031	10.28	11.01	11.71
8	Disability Rates	Low Cost	9.65	2022	10.12	10.79	11.50
		High Cost	10.03	2023	10.45	11.22	11.91

(1)   The minimum contribution rate in this table refers to the rate applicable for 2016 and thereafter.
(2)   Projections use the minimum contribution rate.

As shown in the Table 28, some assumptions are more sensitive than others to changes in long-term expectations. Mortality is the most sensitive demographic assumption as shown by the wide range of the minimum contribution rate. If male and female life expectancies at age 65 were to increase by approximately 2.5 years by 2050, the minimum contribution rate in 2016 and thereafter would increase to 10.22%, well above the legislated rate of 9.9%. On the other hand, if male and female life expectancies at age 65 were to decrease by about 2.5 years, the minimum contribution rate would decrease significantly to 9.46%.

The most sensitive economic assumptions are the real wage increase and the real rate of return on investments. If an ultimate real wage increase of 1.9% is assumed for 2020 and thereafter, the minimum contribution rate would decrease to 9.26%. However, if an ultimate real wage increase of 0.4% is assumed for 2014 and thereafter, the minimum contribution rate would increase to 10.51%.

Real rates of return can fluctuate greatly from year to year and can have a significant impact on the minimum contribution rate. If a real rate of return of 5.5% is assumed for 2019 and thereafter,

the minimum contribution rate will decrease to 8.97%. However, if the real rate of return is assumed to be 2.5% for 2019 and thereafter, the minimum contribution rate increases to 10.73%.

Under some of the sensitivity tests, the ultimate pay-as-you-go rates do not stabilize. In such cases, while the minimum contribution rates shown in Table 28 would be adequate through 2087, they could still result in significant increases or decreases in the ratio of assets to expenditures in later years.

It should be noted that once the low- and high-cost assumptions reach their ultimate values, they are held constant for the rest of the 75-year projection period and the Plan is assumed to remain in its current form. This may not be realistic. As new demographic and economic trends in society emerge, it may be necessary to update the Plan in order to reflect a new demographic or economic reality with the objective of maintaining affordability and intergenerational equity.

Table 29 summarizes the first year that expenditures exceed contributions and 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 2013 and thereafter.

Table 29   Sensitivity of Funding Levels
(9.9% contribution rate)

	Assumption	Scenario	First Year Expenditures Exceed Contributions	Asset/Expenditure Ratio		
				2025	2050	2087
		Best Estimate	2023	5.35	6.02	5.70
1	Total Fertility Rate	Low Cost	2023	5.35	6.49	10.30
		High Cost	2023	5.35	5.55	0.60
2	Mortality Rates	Low Cost	2024	5.54	7.45	11.64
		High Cost	2022	5.15	4.67	0.50
3	Net Migration Rate	Low Cost	2023	5.38	6.36	6.94
		High Cost	2022	5.32	5.68	4.39
4	Labour Market	Low Cost	2033	6.00	8.37	8.61
		High Cost	2019	4.74	3.88	1.73
5	Price Increases	Low Cost	2023	5.37	6.39	7.06
		High Cost	2022	5.33	5.56	3.96
6	Real Wage Increase	Low Cost	2028	5.56	8.07	12.09
		High Cost	2021	5.09	3.40	—[1]
7	Real Rate of Return on Investments	Low Cost	2023	6.31	11.23	30.49
		High Cost	2023	4.54	2.98	—[2]
8	Disability Rates	Low Cost	2024	5.56	6.92	8.44
		High Cost	2022	5.15	5.16	3.05

(1) Assets depleted by 2069.
(2) Assets depleted by 2076.
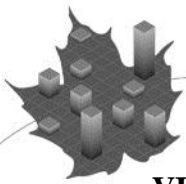
VI.   Younger and Older Populations

Demographic and labour force assumptions are modified in this section with the purpose of projecting younger and older populations compared to the best estimate. However, these alternative populations do not necessarily reflect probable scenarios. Using the demographic assumptions of the individual sensitivity tests, two alternative scenarios were examined. The first scenario is classified as the younger population scenario, since the ratio of retirees to workers is lower than under the best-estimate assumptions. The second scenario has a ratio of retirees to workers that is higher than the best-estimate and is referred to as the older population scenario. Once the two populations were created, the labour force participation rates were modified to align with the new populations.

The demographic assumptions anticipated in these scenarios were determined using the low- and high-cost assumptions regarding fertility, mortality, and migration rates, as well as the labour force participation rates pertaining to the low- and high-cost labour market tests described in section V.

The choice of assumptions will always remain subjective to a certain extent and one could always argue that the range of possible projected outcomes presented herein is not realistic. However, one must keep in mind that these alternative scenarios are only presented to provide a reasonable range of possible future outcomes for the cost of the Plan.

A. Younger Population

Under the younger population scenario, it is assumed that the ultimate total fertility rate is 1.9 per woman for both Canada and Québec. Mortality improvement rates are assumed to increase at a much slower pace than under the best-estimate scenario. The result is that life expectancies at age 65 decrease from their projected best-estimate by approximately 2.5 years for both males and females by 2050. Finally, net migration to Canada is assumed to reach a level of 0.65% of the population by the year 2017.

The combination of these younger population assumptions results in a dependency ratio of those aged 65 and over to the working-age population (20-64) of about 0.40 (or 2.5 workers per retiree) in 2050. This is 13% lower than under the best-estimate scenario where the ratio reaches a level of 0.46 (or 2.2 workers per retiree) in 2050. Under this younger population scenario, the population grows more rapidly, to a level in 2050 that is 7.3% higher compared to the best-estimate scenario.

It is assumed that under a better demographic outlook a possible labour shortage would be less severe. As a result, it is assumed that the labour force participation rates would be lower, especially at the younger and older ages.

B. Older Population

Under the older population scenario, it is assumed that the ultimate total fertility rate is 1.4 per woman for both Canada and Québec. Mortality improvement rates are assumed to increase at a faster pace than under the best-estimate scenario. The result is that life expectancies at age 65 increase from their projected best-estimate levels by approximately 2.5 years for both males and females by 2050. Finally, net migration to Canada is assumed to fall to a level of 0.55% of the population by the year 2017.

The combination of these older population assumptions results in a dependency ratio of those aged 65 and over to the working-age population (20-64) of about 0.53 (or 1.9 workers per retiree) in 2050. This is 15% higher than under the best-estimate scenario where the dependency ratio reaches a level of 0.46 (or 2.2 workers per retiree) in 2050. Under this older population scenario, the population grows more slowly, to a level in 2050 that is 6.6% lower compared to the best-estimate scenario.

It is assumed that with a poorer demographic outlook a possible labour shortage would be more severe. For this purpose, it is assumed that the labour force participation rates would be higher, especially at the older ages.
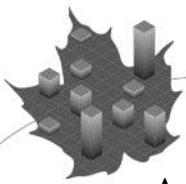
C. Results

Table 30 presents a summary of the assumptions used in this sensitivity analysis and the resulting minimum contribution rates. The minimum contribution rates are 9.29% and 10.43% for the younger and older population scenarios, respectively.

Table 30   Younger and Older Populations Sensitivity Test Assumptions

Canada	Younger Population		Best-Estimate		Older Population	
Total fertility rate	1.90		1.65		1.40	
Mortality: Canadian life expectancy at age 65 in 2050 with future improvements	Males	20.7	Males	23.0	Males	25.6
	Females	22.9	Females	25.3	Females	27.7
Net migration rate	0.65%		0.60%		0.55%	
Participation rate (age group 15-69)	73% (2030)		77% (2030)		82% (2030)	
Minimum Contribution Rate[1]	**9.29%**		**9.84%**		**10.43%**	

(1) The minimum contribution rate in this table refers to the rate applicable for 2016 and thereafter.

Appendix C – Summary of Plan Provisions

I.   Introduction

The *Canada Pension Plan* came into force on 1 January 1966. Since its inception, the CPP has been amended several times, the most recent occasion as a result of technical amendments under Bill C-45 – *Jobs and Growth Act, 2012*, which received Royal Assent on 14 December 2012. As required by the *Canada Pension Plan*, the amendments under Bill C-45 will come into force once formal approval of the provinces is received. This is in process and should be completed in due course. In addition, all amendments to the *Canada Pension Plan,* as set forth under the *Economic Recovery Act (stimulus)* have come into force as of 1 January 2012. This Appendix presents a summary of the provisions of the Plan inclusive of all amendments. The legislation shall prevail if there is a discrepancy between it and this summary.

II.   Participation

The CPP includes virtually all members of the labour force in Canada, including both employees and self-employed persons between the ages of 18 and 70 with employment earnings, other than those 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), members of certain religious groups, and other persons who qualify under excepted employment. It should be noted that the CPP covers all members of the Canadian Forces and the Royal Canadian Mounted Police, including those residing in the province of Québec. The persons to whom a CPP disability pension is payable are not required to contribute.

Effective 1 January 2012, those persons in receipt of a CPP retirement pension who are aged less than 65 and who continue to work will be required to contribute to the Plan and will earn post-retirement benefits. Beneficiaries aged 65 or older who continue to work will not be required to contribute but may choose to do so. In any case, contributions are not permitted upon attaining age 70. This working beneficiaries provision is described further below.

III.   Definitions

A.   Year's Maximum Pensionable Earnings (YMPE)

The YMPE for a calendar year is the limit to which employment earnings are subject to contributions 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 average weekly earnings of the Industrial Aggregate (as published by Statistics Canada). If the amount so calculated is not a multiple of $100, the next lower multiple of $100 is used. The YMPE is set at $51,100 in 2013.

B.   Year's Basic Exemption (YBE)

The YBE for a calendar year is the minimum employment earnings required to participate in the Plan. As well, contributions are waived on earnings up to the YBE inclusive. The YBE is $3,500 in 2013.

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 lower than the YBE. The contributory period excludes periods on or after 1 January
2012 during which beneficiaries contribute while in receipt of a retirement pension.

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

From 1966 to 1986, the annual rate of contribution applicable to contributory earnings was 1.8%
for employees (and the same 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 percentage points from 1987 to 1996, attaining 5.6% in the last year of that period.

Table 31 shows that the combined employer-employee contribution rates from 1997 to 2003
increased in steps to reach a rate of 9.9% by 2003, with no subsequent increases scheduled
thereafter.

Table 31   Contribution Rates

Year	Contribution Rate (%)
1997	6.0
1998	6.4
1999	7.0
2000	7.8
2001	8.6
2002	9.4
2003+	9.9

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

If a triennial actuarial report projects a minimum contribution rate in excess of the scheduled
(legislated) rate and the finance ministers do not make a recommendation to either increase the
legislated rate or maintain it, the insufficient rates provisions of the *Canada Pension Plan* would
apply. The contribution rate would then be increased in stages and a possible temporary freeze on
inflation adjustments to benefits in pay would apply.
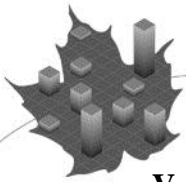
V.   Retirement Pension

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. Prior to 2012, the work cessation test applied in order for a retirement pension to become payable before age 65. This test required individuals who applied to take their CPP retirement benefit early (i.e. before age 65) to either stop working or materially reduce their earnings both in the month immediately preceding and the month of benefit take-up. The month following the start of pension payment, an individual could return to work and/or earn more without affecting the eligibility for or amount of the benefit. However, no further contributions to the CPP were allowed once benefits started being paid. There was no work cessation test for those aged 65 or older.

As of 1 January 2012, the work cessation test has been removed and no longer applies. Also commencing 1 January 2012, individuals aged less than 65 who choose to work in Canada outside of Québec while receiving a CPP or QPP retirement pension are required, along with their employers, to contribute to the CPP. Working beneficiaries aged 65 or older are given the option of continuing to contribute to the Plan; however, employers of those opting to do so are also required to contribute. The contributions from working beneficiaries are applied toward providing a post-retirement benefit only and do not affect eligibility for other CPP benefits. Upon attaining age 70, contributions are no longer permitted under the Plan.

B.   Amount of Pension

The initial amount of the monthly retirement pension payable to a contributor under the Plan is based on his or her entire history of pensionable earnings during the contributory period. The retirement pension is equal to 25% of the average of the YMPE for the year of his or her retirement and the four previous years, referred to as the Maximum Pensionable Earnings Average (MPEA), 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 of the MPEA for the year of retirement 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, disability, child-rearing for a child less than seven years of age, and the general drop-out provision.

The general drop-out provision allows for a number of years with low or zero earnings to be dropped from the calculation of the retirement benefit. For example, for someone who took his/her retirement benefit at age 65 and before 2012, the provision allows for 15% of the number of months with the lowest earnings (up to a maximum of about seven years) to be dropped from the calculation of the benefit. The general drop-out provision has increased to 16% as of 1 January 2012 and will further increase to 17% on 1 January 2014. As a result, by 2014 about eight years of low or nil earnings (one more year than under the previous 15% general drop-out provision) may be dropped from the calculation of the retirement benefit for those contributors who take their benefit at age 65. The actual drop-out percentage that applies is based on the year of benefit take-up. The increase in the general drop-out provision will increase the basic retirement pension, as well as the CPP disability and survivor pensions, since the determination of these benefits depend on the retirement pension.

The maximum monthly retirement pension at age 65 in 2013 is $1,012.50.
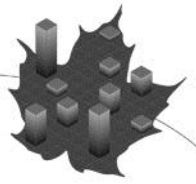
C.   Adjustment for Early or Postponed Retirement Benefit

The retirement pension is subject to an actuarial adjustment that depends on the year and contributor's age at commencement of the retirement pension. The retirement pension is permanently adjusted downwards or upwards by a factor for each month between age 65 and the age when the pension commences or, if earlier, age 70. Prior to 2011, the adjustment factor for both pre-65 and post-65 pension take-up was 0.5% per month. The adjustment factors have since been scheduled to be restored to their actuarially fair values. For contributors who take their retirement benefit early (before age 65), the adjustment factor will gradually increase to 0.6% per month over the five-year period 2012 to 2016. For those who take their benefit after age 65, the factor will gradually increase to 0.7% per month over the three-year period 2011 to 2013. The pension adjustment factors will come into effect according to the following schedule:

Table 32   New Pension Adjustment Factors

Effective date	Pre-65 Downward Monthly Adjustment Factor	Post-65 Upward Monthly Adjustment Factor
1 January 2011	0.50%	0.57%
1 January 2012	0.52%	0.64%
1 January 2013	0.54%	0.70%
1 January 2014	0.56%	0.70%
1 January 2015	0.58%	0.70%
1 January 2016	0.60%	0.70%

The downward pension adjustment factor of 0.6% per month, applicable for the year 2016 and thereafter, will result in a pension that is reduced by 36% for pension take-up at age 60 (compared to a reduction of 30% based on the factor of 0.5%). The upward factor of 0.7% per month, applicable for 2013 and thereafter, will result in a pension increased by 42% for pension take-up at age 70 (compared to an increase of 30% based on the factor of 0.5%).

In accordance with subsection 115(1.11) of the *Canada Pension Plan*, the Chief Actuary shall calculate the pension adjustment factors and specify them in every third triennial CPP Actuarial Report, commencing with the CPP Actuarial Report as at 31 December 2015.

D.   Working Beneficiaries

Prior to 2012, those who received a CPP retirement pension and then returned to work (i.e. working beneficiaries) did not pay contributions and therefore did not continue to build their CPP pension. Commencing 1 January 2012, individuals under the age of 65 who receive either a CPP or QPP retirement pension and continue to work in Canada outside of Québec are required, along with their employers, to contribute to the Plan. Working beneficiaries aged 65 to 69 are not required to contribute, but are given the option to do so. Employers of those working beneficiaries opting to contribute are also required to contribute.

The contributions paid by working beneficiaries provide for a post-retirement benefit that is earned at a rate of 1/40 of the maximum retirement pension under the CPP per year of additional contributions and is adjusted for the earnings level and age of the contributor. Contributions paid by working beneficiaries toward accruing the post-retirement benefit do not affect eligibility for other CPP benefits. In addition, pensionable earnings of working beneficiaries do not qualify for credit splitting.
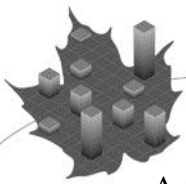
A post-retirement benefit becomes payable the year following the year in which contributions are made, and multiple post-retirement benefits may accumulate over time. The total pension payable resulting from the combination of the retirement pension and post-retirement benefit may be greater than the maximum CPP or QPP pension payable. As for the CPP retirement pension, the post-retirement benefit is payable for a beneficiary's lifetime and is increased in accordance with inflation each January 1st.

The maximum monthly post-retirement benefit at age 65 in 2013 is $25.31.

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 prior to age 65 and is not receiving a CPP retirement pension is eligible for a disability benefit provided that contributions have been made, at the time of disablement, for at least four of the previous six calendar years, counting only years included wholly or partly in the contributory period. Since 2008, contributors with 25 or more years of contributions to the Plan can meet the eligibility requirement with contributions in three of the last six years. 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 ($453.52 in 2013) 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 under the Plan that would be payable at the onset of disability if the contributory period ended on that date and no actuarial adjustment applied. The automatic conversion of a disability benefit into a retirement pension at age 65 is based on the pensionable earnings at the time of disablement, price-indexed to age 65. In other words, the indexing from the time of disablement to age 65, which determines the initial rate of the retirement pension, is in line with increases in prices rather than wages.

In the case that both a disability and survivor benefit are payable, the monthly amount of the disability benefit is reduced. The maximum monthly disability benefit in 2013 is $1,212.90.

VII. Survivor Benefit

A. Eligibility Requirements

A legal spouse, a separated legal spouse not cohabiting with a common-law partner, or a common-law partner of a deceased contributor, is eligible for a survivor benefit if the following conditions are met as at the date of the contributor's death:

- 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 for less than three years.

- If the surviving spouse is the separated legal spouse of the deceased contributor, there must be no cohabiting common-law partner at the time of death. If the survivor is the common-law partner of the deceased contributor, the couple must have cohabited for not less than one year immediately before the death of the contributor. If the common-law partner is of the same-sex as the deceased contributor, the death must have occurred on or after 17 April 1985.

- The surviving spouse or common-law partner must have dependent children, be disabled, or be at least 35 years of age. A surviving spouse or common-law partner with dependent children means a surviving spouse who wholly or substantially supports a child of the deceased contributor where the child is under age 18, 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. In the case that both a survivor and retirement benefit are payable, the monthly amount of the survivor's benefit is reduced. The following five cases are relevant:

1.   New Survivor Age 45 to 65

The amount of monthly benefit payable until the surviving spouse or common-law partner attains age 65 is composed of two portions: a flat-rate benefit depending only on the year in which the survivor benefit is payable ($176.95 in 2013), and an earnings-related benefit depending initially only on the contributor's record of pensionable earnings under the Plan as at the date of death. The initial earnings-related portion (maximum of $379.69 in 2013) is equal to 37.5% of either the retirement pension of the deceased contributor if he or she had been receiving a pension, or the retirement pension that would have been payable to the deceased contributor if the contributory period had ended at the time of death, with no actuarial adjustment in either case.

2.   New Survivor under Age 45

An eligible spouse or common-law partner, without dependent children 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 if she or he becomes disabled (see 4) or attains age 65 (see 5). If such a survivor is between 35 and 45 years of age, she or he is entitled to a benefit amount calculated as described in 1 above but reduced (until the earlier of disablement or attainment of age 65) by 1/120 of such an 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 or common-law partner who becomes widowed prior to age 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 survivor no longer has any dependent children. 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.
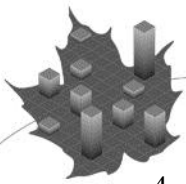
4.   Disabled Survivor under Age 65

An eligible surviving spouse or common-law partner 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 or common-law partner 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 becoming widowed at a later age, an eligible surviving spouse or common-law partner is entitled to a monthly benefit equal to 60% of either the retirement pension (maximum of $607.50 in 2013) of the deceased contributor if he or she had been receiving a pension, or the retirement pension that would have been payable to the deceased contributor if the contributory period had ended at the time of death, with no actuarial adjustment in either case.

VIII. Death Benefit

A lump sum benefit is payable to the estate of a deceased contributor if the eligibility rules for survivor benefits are met. The amount of the death benefit is equal to the lesser of six times the monthly amount of retirement pension under the Plan accrued or payable in the year of death, adjusted to exclude any actuarial adjustments, and ten percent of the YMPE for the year of death, subject to a maximum of $2,500.

IX. Child Benefits

Each child under age 18 and each full-time student aged 18 to 25 who is dependent on a contributor eligible for a CPP disability benefit or was dependent on a deceased contributor who satisfied the contribution requirement for a survivor benefit is entitled to a flat-rate monthly benefit ($228.66 in 2013). Furthermore, a child may receive more than one child benefit simultaneously.

X.   Inflation Adjustments

All monthly CPP benefits 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 spouses or common-law partners) for each month the couple lived together. Pensionable earnings are used to establish eligibility for CPP benefits and to calculate the amounts of benefits. Contributors may obtain a credit split even if they have remarried. However, pensionable earnings cannot be split for any year in which the total earnings of the former couple do not exceed twice the YBE. Credit splitting also does not apply for any period of cohabitation during which a former spouse or common-law partner received a CPP retirement pension.

XII. Pension Sharing

Couples (legal spouses or common-law partners) in an ongoing relationship may voluntarily (at the request of one of them) share their CPP retirement pensions corresponding to the number of years during which they cohabited. This applies provided both spouses have reached the minimum age requirement to receive a retirement pension. Sharing is possible even if only one of the spouses has participated in the Plan. Pension sharing ceases upon separation, divorce, or death.

Appendix D – Detailed Reconciliations with Previous Report

The results presented in this report differ from those previously projected for a variety of reasons. Differences between the actual experience from 2010 through 2012 and that projected in the 25th CPP Actuarial Report for the same period were addressed in the Reconciliation with Previous Report section of this report. Since historical results provide the starting point for the projections shown in this report, these historical differences between actual and projected experience have an effect on the projections. The impact of the experience update and changes in the assumptions and methodology that have significantly changed the projected results are addressed in this section.

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 and corresponds to the contribution rate that would need to be paid if there were no assets. One way of understanding the differences between the best-estimate projections in this report and those presented in the 25th CPP Actuarial Report is to look 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 33 and the discussion below.

The experience update had the effect of reducing the pay-as-you-go rates in the short and medium term mainly due to better than anticipated demographic and benefits experience compared to the 25th CPP Actuarial Report. The impacts on the pay-as-you-go rates from the experience over the period 2010 to 2012 are shown in Table 33. In particular:

- The level of net migration including an increase in the number of non-permanent residents was higher than expected, which decreases the pay-as-you-go rates over the near and medium term of the projection.

- Overall lower than expected benefit expenditures that resulted from an over-projection of retirement, death, and children's benefits outweighing an under-projection of other expenditures leads to a substantial decrease in the pay-as-you-go rates over the near to medium term.

- Lower than anticipated growth in total employment earnings increases the pay-as-you-go rates. However, this increase due to economic experience is more than offset by the decrease for demographic and benefits experience over the near to medium term.

In previous CPP actuarial reports, CPPIB operating expenses were included in Plan expenditures along with other operating and benefit expenditures. In response to a recommendation made by the independent peer reviewers of the 25th CPP Actuarial Report, the valuation methodology was improved by including CPPIB operating expenses in the investment expenses assumption, instead of as a component of CPP operating expenses. This change in the methodology results in a reduction in the projected pay-as-you-go rates.

Changes made to the key assumptions since the previous triennial report were outlined in Table 1. The effects of these changes on the pay-as-you-rates are also shown in Table 33 and are summarized below.

- The assumed total fertility rates are similar to those assumed in the previous triennial report, and as such, have little impact on the pay-as-you-go rates.
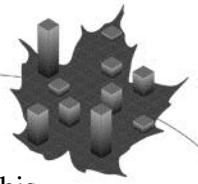
- The assumed level of net migration is higher than in the previous triennial report, and this decreases the pay-as-you-go rates, because the higher growth in total contributory earnings outweighs the ultimate increase in expenditures.

- The higher mortality improvement rates at ages 65 and older assumed for this report increase the pay-as-you-go rates, because beneficiaries are expected to receive their benefits over longer periods of time.

- Changes in retirement benefit-related assumptions decrease the pay-as-you-go rate in the medium term while increasing it in the long term.

- Changes in disability benefit-related assumptions reduce the pay-as-you-go rates over the projection period.

- The higher assumed labour force participation and employment rates decrease the pay-as-you-go rates, although the effect diminishes with time as the higher employment translates into higher benefit entitlements.

- The change in the real wage increase assumption causes the pay-as-you-go rates to rise due to the lower increase in contributory earnings compared to the previous triennial report.

- The lower assumed inflation rate has the effect of increasing the pay-as-you-go rates. Although a lower rate of increase in prices produces lower CPP expenditures, this decrease in cost is outweighed by the lower nominal contributory earnings.

Some other assumptions, which are described in Appendix E, were also changed. For example, the proportion of contributors married or in a common-law relationship at time of death and the experience adjustment factors used in the projection of benefits were revised to reflect more recent experience. Overall, the changes in these other assumptions had the effect of slightly increasing the projected pay-as-you-go rates over the long term.

Factors that lead to changes in the pay-as-you-go rates do not always have comparable effects on the minimum contribution rate. Furthermore, while the investment experience and assumptions have no effect on the pay-as-you-go rates, they may have a significant impact on the minimum contribution rate. Investment income was 96% higher than anticipated over the period 2010 to 2012 due to the strong performance of financial markets over that period. This results in a substantial decrease of 0.057% in the minimum contribution rate, as shown in Table 34. Regarding the real rates of return assumptions, changes compared to the previous triennial report include lower portfolio real rates of return over the short term due to an assumed increase in bond yields. In addition, real rates of return for bonds and real assets are lower over the projection period. However, these changes are partially offset by modifications to the asset mix that increase the proportion of assets invested in equities and real assets. A reconciliation of the change in the minimum contribution rate of 9.86% for years 2010 to 2022 and 9.85% for 2023 and thereafter as presented in the 25th CPP Actuarial Report to the minimum contribution rate of 9.84% for this report is provided in Table 34.

A progression of the minimum contribution rate over time based on target years of future triennial valuation reports and using the best-estimate assumptions of this report is shown in Table 16 of the Results section of this report. As shown in that table, the minimum contribution rate is projected to remain relatively stable over time.

Table 33   Reconciliation of Changes in Pay-As-You-Go Rates[1]
(% of contributory earnings)

		2013	2025	2050	2075
25th CPP Actuarial Report		**9.06**	**10.43**	**10.94**	**11.17**
I.	**Improvements in Methodology**	**(0.06)**	**(0.07)**	**(0.08)**	**(0.09)**
II.	**Experience Update (2010-2012)**				
	Demographic	(0.02)	(0.07)	(0.06)	0.02
	Economic	0.03	0.02	0.04	0.01
	Benefits	(0.16)	(0.08)	(0.01)	(0.01)
	Subtotal:	**(0.15)**	**(0.12)**	**(0.03)**	**0.02**
III.	**Changes in Assumptions**				
	Fertility	0.00	0.00	(0.01)	(0.05)
	Net migration	(0.01)	(0.09)	(0.10)	(0.01)
	Mortality	0.00	0.07	0.13	0.14
	Retirement	(0.05)	(0.09)	(0.03)	0.07
	Disability	(0.00)	(0.03)	(0.03)	(0.03)
	Labour Market	(0.05)	(0.02)	(0.03)	0.01
	Real wage increases	0.03	0.17	0.20	0.20
	Price increases	0.02	0.03	0.03	0.02
	Other assumptions	0.00	0.00	0.01	0.01
	Subtotal:	**(0.06)**	**0.05**	**0.17**	**0.35**
Total of I to III		**(0.28)**	**(0.15)**	**0.07**	**0.28**
26th CPP Actuarial Report		**8.78**	**10.28**	**11.01**	**11.45**

(1)   Components may not sum to totals due to rounding.
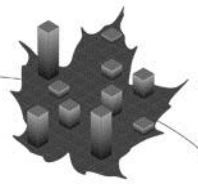
Table 34   Reconciliation of Changes in Minimum Contribution Rate[1,2]
(% of contributory earnings)

	Steady-State Rate	Full Funding Rate		Minimum Rate	
		2013-2022	2023+	2013-2022	2023+
25th CPP Actuarial Report - After Rounding	9.84	0.02	0.01	9.86	9.85
25th CPP Actuarial Report - Before Rounding	9.836	0.017	0.014	9.853	9.850
I. Improvements in Methodology	**(0.067)**	**(0.001)**	**(0.000)**	**(0.068)**	**(0.067)**
II. Experience Update (2010-2012)					
Demographic	(0.037)	(0.000)	(0.000)	(0.037)	(0.037)
Economic	0.034	(0.001)	(0.000)	0.032	0.034
Benefits	(0.054)	(0.003)	(0.003)	(0.056)	(0.057)
Investments	(0.057)	0.000	0.000	(0.057)	(0.057)
Subtotal:	**(0.114)**	**(0.004)**	**(0.004)**	**(0.119)**	**(0.118)**
III. Changes in Assumptions					
Fertility	(0.004)	0.000	0.000	(0.004)	(0.004)
Net Migration	(0.049)	0.000	0.000	(0.049)	(0.049)
Mortality	0.097	(0.000)	0.000	0.097	0.097
Retirement	(0.022)	0.000	0.001	(0.022)	(0.022)
Disability	(0.025)	(0.000)	(0.000)	(0.026)	(0.026)
Labour Market	(0.024)	0.000	0.000	(0.024)	(0.024)
Real wage increases	0.120	0.000	0.000	0.121	0.121
Price increases	0.028	(0.000)	(0.001)	0.027	0.027
Real Rates of Return	0.040	0.000	0.000	0.041	0.040
Other assumptions	0.011	0.000	0.001	0.011	0.011
Subtotal:	**0.172**	**0.000**	**0.001**	**0.172**	**0.173**
IV. Others (Change in funding target from 2022-2072 to 2025-2075)	**(0.001)**	**(0.000)**	**(0.000)**	**(0.001)**	**(0.001)**
Total of I to IV	**(0.010)**	**(0.005)**	**(0.003)**	**(0.016)**	**(0.014)**
Rates before Rounding and Adjustment	**9.826**	**0.012**	**0.011**	**9.838**	**9.837**
Rounded Rates, in accordance with CPP Regulations[3]	**9.83**	**0.01**	**0.01**	**9.84**	**9.84**
Adjustment to Rates, in accordance with CPP Regulations[3]	**0.01**	**(0.01)**	**(0.01)**	**0.00**	**0.00**
26th CPP Actuarial Report	**9.84**	**0.00**	**0.00**	**9.84**	**9.84**

(1)   Components may not sum to totals due to rounding.

(2)   For each triennial CPP actuarial report, the minimum contribution rate is determined for all years following the three-year review period in which the report is prepared, with the legislated contribution rate applied during the review period. For the 25th CPP Actuarial Report, the minimum contribution rate was determined for the year 2013 and thereafter, with the legislated rate of 9.9% applied for the 2010-2012 review period. For the 26th CPP Actuarial Report, the minimum contribution rate is determined from 2016 onward, with 9.9% applied for 2013-2015.

(3)   The rounded full funding rate for the years 2013-2022 in respect of the 2008 amendments to the Plan is determined to be 0.01%, which is lower than the minimum level of 0.02% required by the CPP *Calculation of Contribution Rates Regulations, 2007*. According to the Regulations, the full funding rate is thus deemed to be zero, and as a result, the corresponding funding for the 2008 amendments is provided by the steady-state rate, as shown by the adjustments to the rates in the table.

Appendix E – Assumptions and Methodology

I. Introduction

This section describes the assumptions and methodology that underlie the financial projections in the Results section of this report.

Future cash flows are projected over a long period of time, i.e. 75 years, and depend on assumptions such as those regarding fertility, mortality, migration, labour force participation, job creation, unemployment, 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 revenues from contributions and investment income 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. The steady-state contribution rate is determined in this way before the consideration of any full funding requirement for increased or new benefits. The full funding rate is determined independently of the steady-state rate. It is added to the steady-state rate to produce the minimum contribution rate.

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

II. Demographic Projections

Both the historical and projected populations 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 2012 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, migration, and mortality assumptions to the starting population develops the annual numbers of births, net migrants, and deaths. The relevant population for the CPP, which is the population of Canada less Québec, is 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 the Royal Canadian Mounted Police (RCMP). Consequently, the approach used above to determine the CPP population does not make an 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 number of people with earnings and the proportion of contributors as described in section III of this Appendix.

A. Initial Population as at 1 July 2012

The starting point for the demographic projections is based on the most recent Statistics Canada population estimates as at 1 July 2012 for Canada and Québec, by age and sex. The estimates are based on the 2006 Census. The estimates are adjusted by ungrouping ages 100 and older into
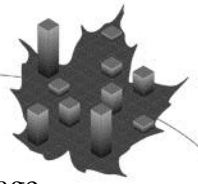
individual ages using the observed distribution of Old Age Security Program beneficiaries by age for ages 100 and older.

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.

The total fertility rate in Canada has declined significantly since the baby boom period, when the rate peaked at nearly 4.0 per woman in the late 1950s. The baby bust period that followed in the mid-1960s pulled down the total fertility rates by the mid-1980s to a record low of 1.6 children per woman. The total fertility rate rose slightly in the early 1990s, but then generally declined to a level of 1.5 by the late 1990s. Canada is one of many industrialized countries that have seen an increase in their total fertility rates since 2000. By 2008, the total fertility rate for Canada reached 1.68. However, in some industrialized countries, including Canada, the total fertility rate has decreased since 2008, which could be attributed to the economic downturn experienced in recent years. In 2010, the total fertility rate for Canada was 1.63.

Similar to Canada, the total fertility rate in Québec fell from a high of 4.0 per woman in the 1950s; however, the Québec rate fell to a greater degree, reaching 1.4 by the mid-1980s. The Québec rate then recovered somewhat in the early 1990s to over 1.6 and subsequently declined to below 1.5 by the late 1990s. There was a significant increase in the Québec rate since the year 2000, with the rate reaching 1.74 by 2008. In 2006, the Québec rate exceeded Canada's level for the first time since 1958. However, similar to Canada's fertility rate, the fertility rate for Québec has been decreasing in recent years. In 2011, the total fertility rate for Québec was 1.69.

Fertility rates are affected by many factors, including social attitudes, reproductive technologies, and economic conditions. It is assumed for this report that the recent economic downturn has caused a temporary downward effect on total fertility rates, with couples choosing to postpone having any or more children until economic conditions improve. This effect was taken into consideration along with historical trends in fertility rates by age group over the last 20 years. The short periods of growth in the fertility rates that have occurred in recent decades are assumed to be temporary in nature, rather than having any long-term effects. Lastly, it is assumed that the difference between Canada's and Québec's fertility rates will disappear over time. In this report, it is thus assumed that the total fertility rate from 2015 onward for both Canada and Québec will be 1.65 children per woman. This ultimate rate is the same as was assumed for the 25th CPP Actuarial Report.

Finally, in accordance with the average experience over the last 10, 20, and 30 years, the assumed ratio of male to female newborns is 1.054, which is the same as for the 25th CPP Actuarial Report. Table 35 shows the projected age-specific and total fertility rates by calendar year for Canada. In comparison, total cohort fertility rates per woman together with each cohort's age-specific rates, all based on the year of birth of a woman, are shown in Table 36. Cohort fertility rates provide a more reliable measure of the level of fertility, since they reflect the experience of real cohorts of women as opposed to the experience of synthetic cohorts, which is based on calendar years and used to derive the total fertility rates. Chart 3 shows the historical and projected total and cohort fertility rates for Canada.

Table 35   Fertility Rates for Canada

Year	Annual Fertility Rates by Age Group (per 1,000 women)							Total Fertility Rate per Woman
	15-19	20-24	25-29	30-34	35-39	40-44	45-49	
2013	11.4	44.3	93.2	111.1	56.9	10.9	0.5	1.64
2014	10.7	43.0	92.1	112.9	58.6	11.3	0.5	1.65
2015+	10.0	41.8	91.0	114.7	60.4	11.6	0.6	1.65

Table 36   Cohort Fertility Rates by Age and Year of Birth
(Canada)

Year of Birth of Woman[1]	Annual Fertility Rates by Age Group (per 1,000 women)[2]							Cohort Fertility Rate per Woman[2]
	15-19	20-24	25-29	30-34	35-39	40-44	45-49	
1956 – 1960	34.8	95.2	120.7	83.5	31.3	5.9	0.3	1.86
1961 – 1965	27.0	81.5	122.6	86.8	33.9	7.1	0.4	1.80
1966 – 1970	23.3	79.2	109.7	85.1	42.1	9.9	0.6	1.75
1971 – 1975	25.5	70.6	96.8	97.4	51.6	11.6	0.6	1.77
1976 – 1980	24.5	58.3	97.3	105.7	60.4	11.6	0.6	1.79
1981 – 1985	17.3	50.4	96.4	114.7	60.4	11.6	0.6	1.76
1986 – 1990	13.4	48.0	91.0	114.7	60.4	11.6	0.6	1.70
1991 – 1995	13.5	41.8	91.0	114.7	60.4	11.6	0.6	1.67
1994 – 1998	11.4	41.8	91.0	114.7	60.4	11.6	0.6	1.66
1996 – 2000+	10.0	41.8	91.0	114.7	60.4	11.6	0.6	1.65

(1) Ranges for years of birth correspond to the oldest to youngest ages for an age group. For example, in the first row of the table, 1956 is the year of birth for those aged 19, 24, 29, etc., 1957 is the year of birth for those aged 18, 23, 28, etc., and so forth.

(2) Fertility rates below and to the right of the dotted line are projected.

Chart 3   Historical and Assumed Total and Cohort Fertility Rates for Canada[1]
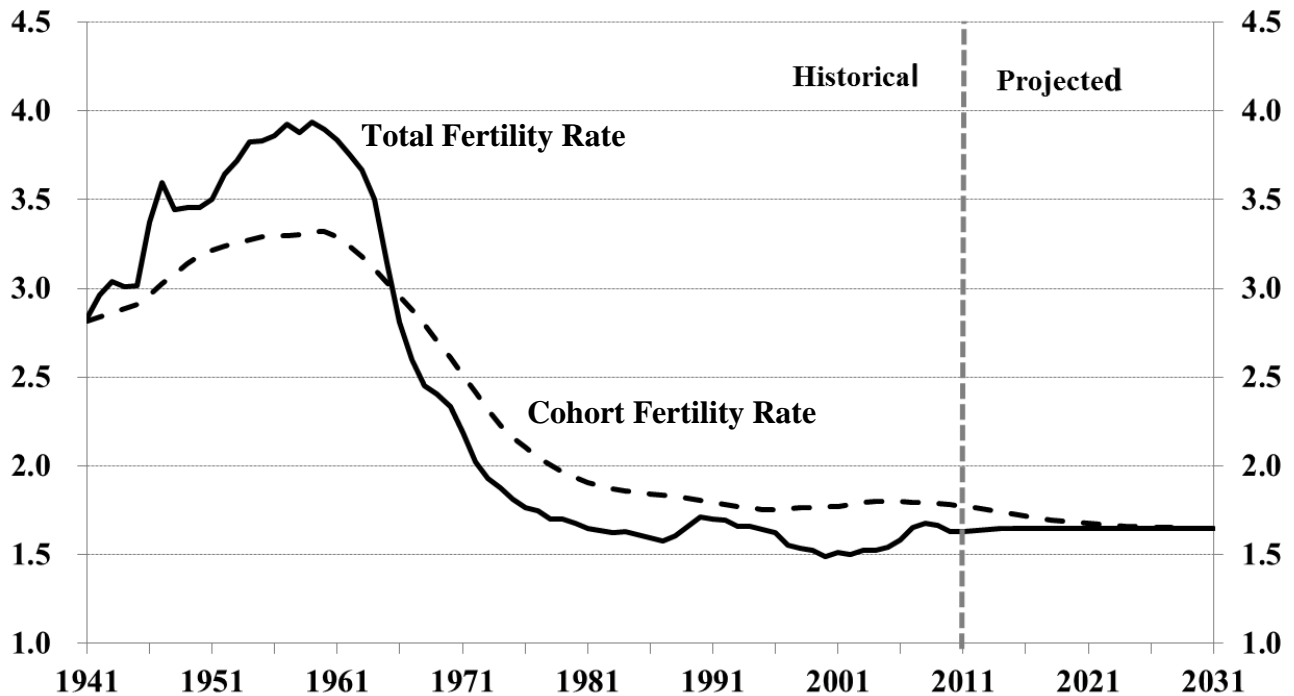
(1)   Cohort fertility rates are based on the age of a woman being 29 in a given calendar year.

C.   Mortality

For this report, the mortality rate projections start from the 2009 mortality rates of the Canadian Human Mortality Database (CHMD). According to the CHMD, life expectancies at birth in 2009 for males and females in Canada were 79.0 and 83.4 years, respectively, without any assumed future improvements in mortality.

For 2010, the annual rates of mortality improvement, varying by age and sex, were set equal to the average annual improvement rates experienced in Canada and Québec over the 15-year period 1994 to 2009.

The analysis of trends in Canadian mortality over the period 1921 to 2009 shows that Canadian males born between the mid-1930s and the late 1940s experienced historically higher improvement rates at most ages compared to males born at earlier or later periods. This observed phenomenon of people born in a certain period experiencing more rapid improvements in mortality than generations born outside of this period is referred to as a 'cohort effect'.

Mortality improvement rates for any given age, sex, and year may be regarded as a combination of age, year and cohort components or effects. Improvement rates for years 2011 to 2029 were determined by cubical interpolation between:

- the improvement rates of year 2010 after removing the cohort component value, where applicable, and

- the ultimate improvement rates described below in respect of the period 2030 and thereafter for Canada, and 2025 and thereafter for Québec.
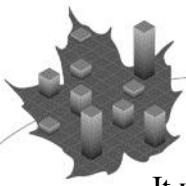
It was then assumed that the cohort effect will impact improvement rates for males aged 60 to 74 in 2010. This effect is assumed to gradually disappear by 2020.

For the year 2030 and thereafter for Canada, the ultimate annual rates of mortality improvement vary by age only and not by sex or calendar year. The ultimate mortality improvement rates are derived by analyzing Canadian experience over the period 1921 to 2009. Male improvement rates at most ages are currently higher than female improvement rates but are assumed to decrease to the same level as female rates from 2030 onward. The ultimate mortality improvement rates for Québec are assumed to be the same as for Canada but are expected to be reached five years earlier in 2025 to reflect the expected convergence of mortality levels between Québec and the rest of Canada.

The historical downward trend in mortality improvement rates is clear for both sexes in the age group 0-59. For age groups 60 and older, recent experience has shown a stabilization of improvement rates for both sexes. The ultimate rate for both sexes for ages 0 to 84 is set at 0.8% per year from 2030 onward for Canada (2025 onward for Québec), where 0.8% represents about one-half of the average rates observed for females over the 15 and 20-year periods ending in 2009. The ultimate improvement rate is then set to reduce from 0.6% for the age group 85-89 to 0.2% for those aged 95 and older, consistent with observed experience that shows decreasing improvement rates with age.

Table 37 shows the initial (2010), intermediate (2011-2029) and ultimate (2030+) assumed annual mortality improvement rates for Canada.

Table 37   Annual Mortality Improvement Rates for Canada

Age	Males			Females		
	2010	2011-2029	2030+	2010	2011-2029	2030+
	(%)	(%)	(%)	(%)	(%)	(%)
0	1.3	1.0	0.8	0.8	0.8	0.8
1-14	3.1	1.9	0.8	3.5	2.2	0.8
15-44	2.6	1.6	0.8	1.3	1.1	0.8
45-64	2.0	1.4	0.8	1.5	1.1	0.8
65-74	3.0	1.8	0.8	1.8	1.3	0.8
75-84	2.6	1.7	0.8	1.7	1.3	0.8
85-89	2.0	1.3	0.6	1.5	1.1	0.6
90-94	1.3	0.8	0.4	1.2	0.8	0.4
95+	0.4	0.3	0.2	0.4	0.3	0.2

The projected mortality rates in Table 38 indicate a continuous decrease in mortality rates over the long term. For example, the mortality rate at age 65 for males is expected to decrease from about 12 deaths per thousand people in 2013 to 6 deaths per thousand people by 2075. The gap in mortality rates between males and females at each age is also expected to decrease over the projection period.

Table 38 Mortality Rates for Canada
(annual deaths per 1,000 people)

	Males				Females			
Age	**2013**	**2025**	**2050**	**2075**	**2013**	**2025**	**2050**	**2075**
0	4.85	4.28	3.50	2.86	4.58	4.17	3.41	2.79
10	0.11	0.09	0.07	0.06	0.10	0.07	0.06	0.05
20	0.62	0.51	0.42	0.34	0.27	0.24	0.19	0.16
30	0.73	0.59	0.48	0.39	0.38	0.34	0.28	0.23
40	1.17	0.99	0.81	0.66	0.79	0.69	0.56	0.46
50	3.20	2.78	2.27	1.86	2.08	1.85	1.51	1.24
60	7.32	6.03	4.92	4.02	4.78	4.08	3.33	2.72
65	11.56	9.52	7.76	6.35	7.42	6.34	5.18	4.24
70	17.91	14.45	11.78	9.64	11.79	10.07	8.22	6.72
75	29.20	22.99	18.73	15.32	19.43	16.59	13.55	11.08
80	50.08	40.37	32.91	26.92	33.95	28.99	23.67	19.37
85	85.15	71.11	59.77	50.40	61.47	53.37	44.92	37.87
90	142.28	125.35	110.90	98.33	110.05	98.21	86.93	77.08
100	319.64	302.44	280.38	260.09	287.41	271.95	252.12	233.87

Chart 4 shows the historical and projected life expectancies at age 65 since the Plan's inception in 1966, based on each given year's mortality rates (i.e. without future mortality improvements). Table 39 shows projected Canadian life expectancies at various ages for the specified calendar years, also based on each given year's mortality rates (without future improvements). Table 40 is similar to Table 39, the only difference being that it takes into account the assumed mortality improvements after the specified calendar years (with future improvements). Given the continuing trend in increased longevity, Table 40 is considered to be more realistic than Table 39, especially for the older ages. At the same time, the extended length of the projection period increases the uncertainty of the results presented in Table 40 for younger ages.

From 2013 to 2075, Canadian life expectancy at age 65 (with assumed future mortality improvements) is projected to grow from 20.9 to 24.3 years for males and from 23.3 to 26.5 years for females, as shown in Table 40. The yearly increase in life expectancies at age 65 in the early years of the projection reflects the significant increase observed over the last decades. Thereafter, there is a projected slowdown in the increase in life expectancies consistent with the lower rate of improvement in mortality assumed for 2030 and thereafter.

Chart 4   Life Expectancies at Age 65 for Canada[1]
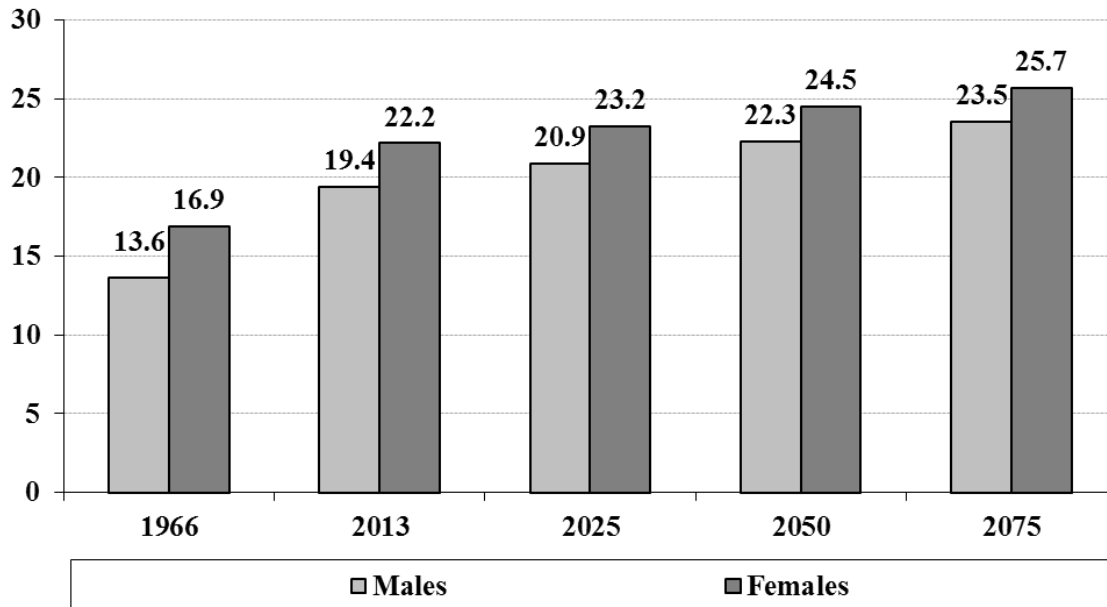
(1)   These are calendar year life expectancies based on the mortality rates of the given year.

Table 39   Life Expectancies for Canada, without improvements after the year shown[1]

Age	Males				Females			
	2013	**2025**	**2050**	**2075**	**2013**	**2025**	**2050**	**2075**
0	80.0	82.0	83.9	85.7	84.0	85.4	87.1	88.6
10	70.5	72.4	74.3	76.0	74.5	75.8	77.4	78.9
20	60.7	62.6	64.4	66.1	64.6	65.9	67.5	69.0
30	51.1	52.9	54.7	56.4	54.8	56.1	57.6	59.1
40	41.5	43.3	45.0	46.6	45.0	46.3	47.8	49.3
50	32.2	33.9	35.5	37.1	35.5	36.8	38.2	39.6
60	23.5	25.1	26.5	27.9	26.5	27.6	29.0	30.2
65	19.4	20.9	22.3	23.5	22.2	23.2	24.5	25.7
70	15.6	17.0	18.2	19.3	18.1	19.0	20.2	21.3
75	12.1	13.3	14.3	15.3	14.2	15.1	16.1	17.1
80	9.1	10.0	10.8	11.6	10.7	11.5	12.3	13.1
85	6.6	7.2	7.8	8.4	7.8	8.3	8.9	9.5
90	4.6	5.0	5.4	5.8	5.4	5.8	6.2	6.6
100	2.3	2.5	2.7	2.9	2.6	2.7	2.9	3.1

(1)   These are calendar year life expectancies based on the mortality rates of the given attained year.
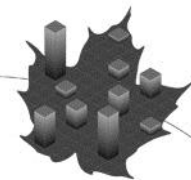
Table 40   Life Expectancies for Canada, with improvements after the year shown[1]

Age	Males				Females			
	2013	**2025**	**2050**	**2075**	**2013**	**2025**	**2050**	**2075**
0	86.1	86.9	88.6	90.1	89.1	89.9	91.3	92.5
10	75.9	76.7	78.4	79.9	79.0	79.7	81.1	82.4
20	65.3	66.2	67.9	69.4	68.5	69.2	70.7	72.0
30	55.0	55.8	57.5	59.1	58.1	58.8	60.3	61.6
40	44.7	45.5	47.2	48.7	47.7	48.4	49.9	51.3
50	34.7	35.5	37.1	38.6	37.6	38.3	39.8	41.1
60	25.3	26.1	27.5	28.9	27.9	28.6	30.0	31.2
65	20.9	21.7	23.0	24.3	23.3	24.0	25.3	26.5
70	16.7	17.5	18.7	19.9	19.0	19.6	20.8	21.9
75	12.9	13.6	14.7	15.7	14.9	15.5	16.5	17.5
80	9.5	10.2	11.0	11.9	11.2	11.7	12.5	13.4
85	6.8	7.3	7.9	8.5	8.0	8.4	9.1	9.7
90	4.7	5.0	5.4	5.8	5.5	5.8	6.3	6.7
100	2.4	2.5	2.7	2.9	2.6	2.7	2.9	3.1

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

D.   Net Migration

Immigration and emigration are generally recognized as being 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 2012, annual immigration to Canada varied from 84,000 to 271,000, annual emigration from Canada fluctuated between 40,000 and 84,000 and the annual numbers of returning Canadians fluctuated between 14,000 and 41,000. During the period from 1972 to 2012, the annual net increase in the number of non-permanent residents fluctuated between -71,000 and 141,000.

In previous CPP actuarial reports, the average annual net increase of non-permanent residents was assumed to be zero, because of the large historical variations (both positive and negative) in this migration component. However, over the last 15 years, the number of non-permanent residents has constantly increased in Canada, and it is believed that non-permanent residents will continue filling the need for jobs in fields where it is difficult to recruit Canadian workers. It is expected that the annual net increase of non-permanent residents will remain at a positive but lower level in the future. It is projected that the annual net increase of non-permanent residents will reduce from its current level of 55,000 to an ultimate level of about 3,500 per year by 2017.

It is assumed that the net migration rate will reduce from its 2012 level of 0.77% of the population to 0.60% in 2017 and will remain stable at that level for the remainder of the projection period. The ultimate level of 0.60% generally corresponds to the average experience over the last 30 to 40 years. Chart 5 shows the net migration (immigration less emigration, plus the number of returning Canadians, plus the net increase of non-permanent residents) experience since 1972 and the assumed rate for the future.
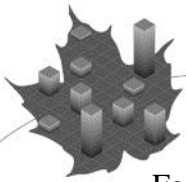
For the purpose of projecting the population of Québec, historical percentages of the Canadian migration components attributed to Québec were determined. In addition, based on historical data, it is assumed that the net interprovincial emigration level for Québec of 3,900 in 2012 will increase to 8,000 by 2017 and remain at that level thereafter. These assumptions result in a net migration rate averaging 0.5% over the projection period for Québec. The distributions of immigrants, emigrants, returning Canadians, and non-permanent residents by age and sex used for the demographic projections were derived from Statistics Canada data averaged over the period 2008 to 2012.

Chart 5   Net Migration Rate
(Canada)
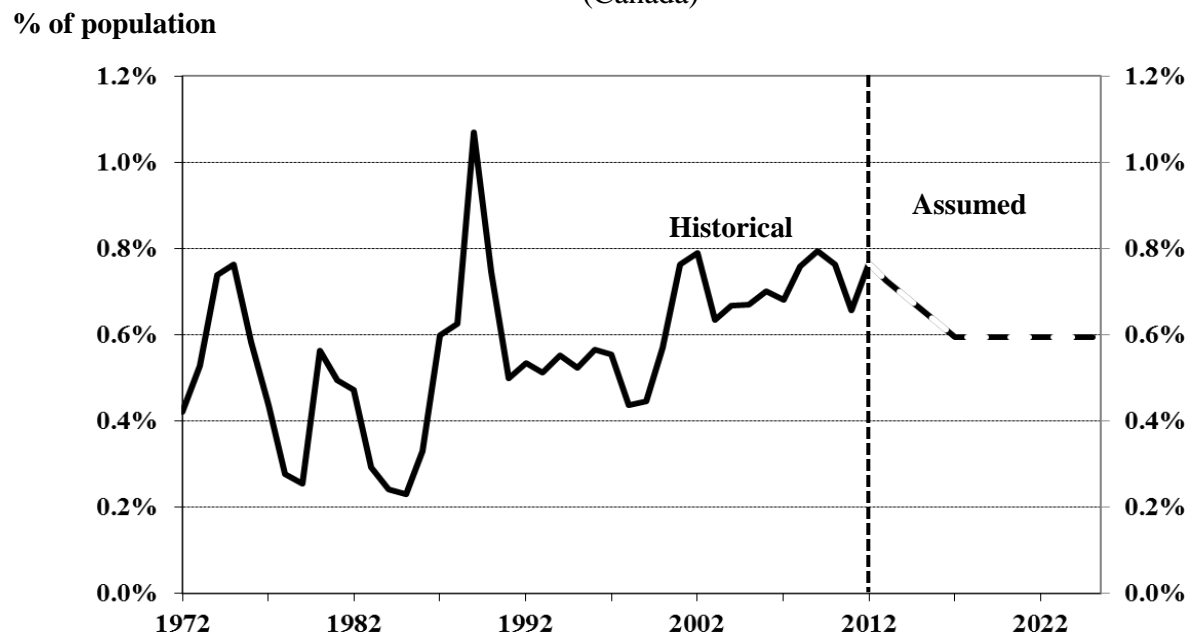
% of population

E.   Projected Population and its Characteristics

The evolution of the Canada less Québec population age distribution since the inception of the Plan is shown in Chart 6. One can easily observe that the triangular shape of the 1960s has become more rectangular over time. This is projected to continue and indicates an aging population. The effects of the baby boom, baby bust, and echo generations can be seen. The chart also reveals that the number of people aged 85 and over is expected to increase dramatically over the next 40 years.
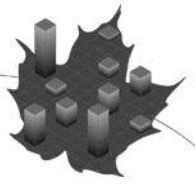
Chart 6   Age Distribution of the Population of Canada less Québec
(thousands)

1966

2012

2025

2050

■ Baby Boomers
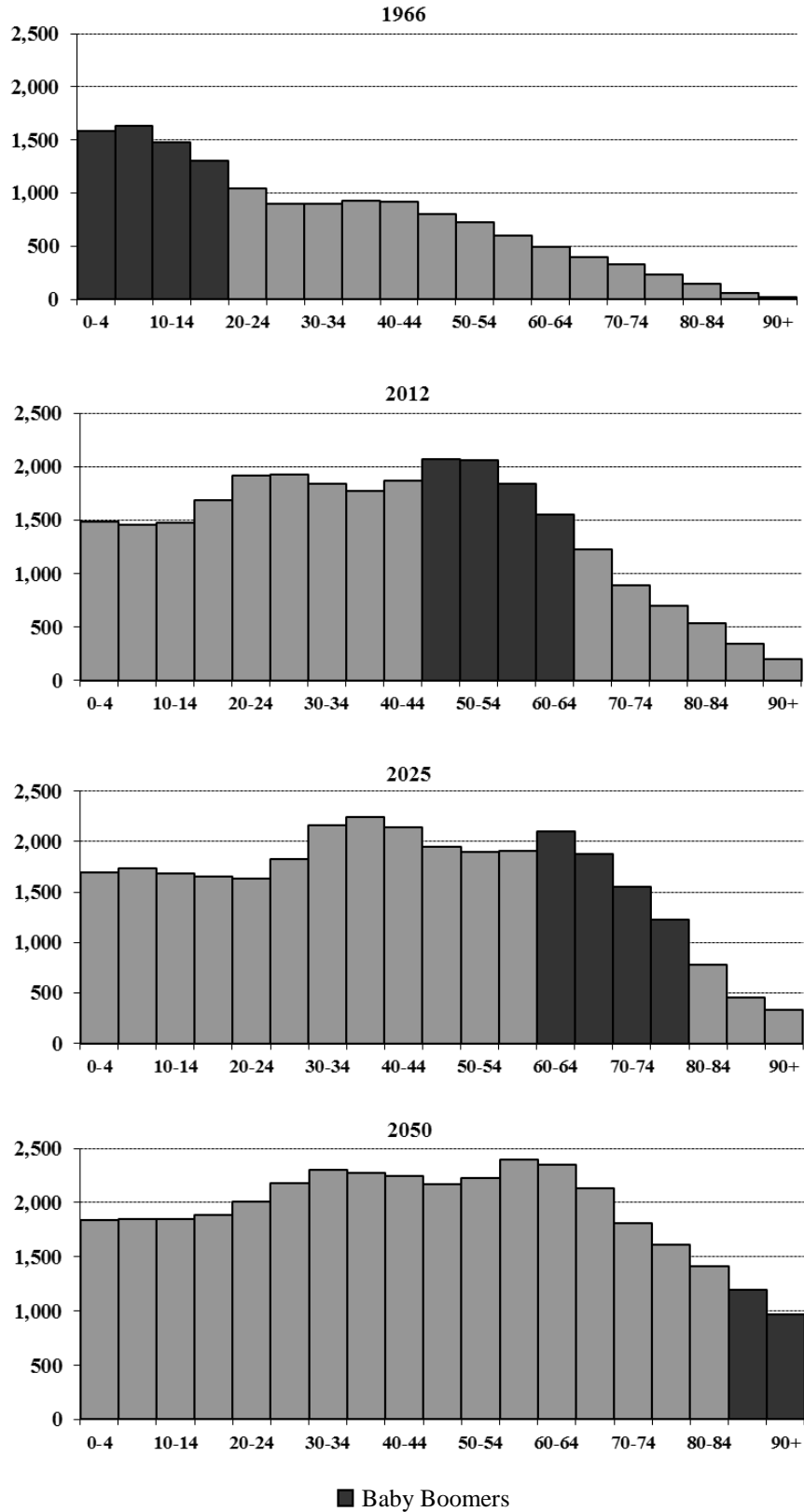
The population of Canada as at 1 July 2012 is 34.9 million, while the population of Canada less Québec is 26.8 million. Tables 41 and 42 present the projected populations of Canada and Canada less Québec as at 1 July for selected age groups and years, while Chart 7 shows the evolution of the total population of Canada less Québec and of those aged 20 to 64 from 1975 to 2075. Table 43 shows the variations in the relative proportions of various age groups for Canada less Québec throughout the projection period. The proportion of people aged 65 and over is expected to increase significantly from 14.9% of the total population in 2013 to 26.2% by 2075. The number of people aged 65 and older as a proportion of the number of people aged 20 to 64 more than doubles over the same period, from 23.8% in 2013 to 48.8% by 2075. This proportion significantly affects the ratio of benefits to contributions under the CPP.

Table 41   Population of Canada by Age
(thousands)

Year	0-17	18-69	70+	0-19	20-64	65+	Total
2013	6,941	24,685	3,654	7,838	22,052	5,390	35,280
2014	6,976	24,924	3,775	7,863	22,224	5,590	35,676
2015	7,031	25,134	3,900	7,889	22,382	5,794	36,065
2016	7,100	25,305	4,040	7,926	22,517	6,002	36,444
2017	7,176	25,411	4,227	7,979	22,621	6,213	36,814
2018	7,256	25,519	4,408	8,051	22,695	6,437	37,183
2019	7,346	25,620	4,586	8,134	22,742	6,677	37,553
2020	7,440	25,714	4,767	8,219	22,774	6,928	37,920
2025	7,834	26,112	5,761	8,667	22,821	8,218	39,706
2030	8,029	26,430	6,864	8,911	22,918	9,493	41,322
2040	8,053	27,527	8,424	9,032	24,247	10,726	44,005
2050	8,397	29,010	8,934	9,352	25,358	11,630	46,340
2075	9,404	32,105	10,856	10,505	28,154	13,706	52,365

Table 42   Population of Canada less Québec by Age
(thousands)

Year	0-17	18-69	70+	0-19	20-64	65+	Total
2013	5,409	18,997	2,745	6,111	16,998	4,041	27,151
2014	5,438	19,206	2,831	6,133	17,151	4,192	27,475
2015	5,481	19,395	2,919	6,156	17,293	4,346	27,795
2016	5,535	19,555	3,020	6,186	17,420	4,504	28,110
2017	5,593	19,661	3,164	6,230	17,523	4,665	28,418
2018	5,655	19,768	3,304	6,286	17,603	4,837	28,727
2019	5,726	19,871	3,439	6,350	17,665	5,021	29,036
2020	5,800	19,968	3,577	6,417	17,714	5,214	29,345
2025	6,122	20,394	4,344	6,776	17,864	6,220	30,860
2030	6,322	20,724	5,209	7,009	18,001	7,246	32,256
2040	6,380	21,715	6,520	7,157	19,116	8,342	34,615
2050	6,651	23,028	6,999	7,415	20,136	9,127	36,679
2075	7,527	25,654	8,711	8,413	22,498	10,981	41,892

Chart 7 Population of Canada less Québec
(millions)
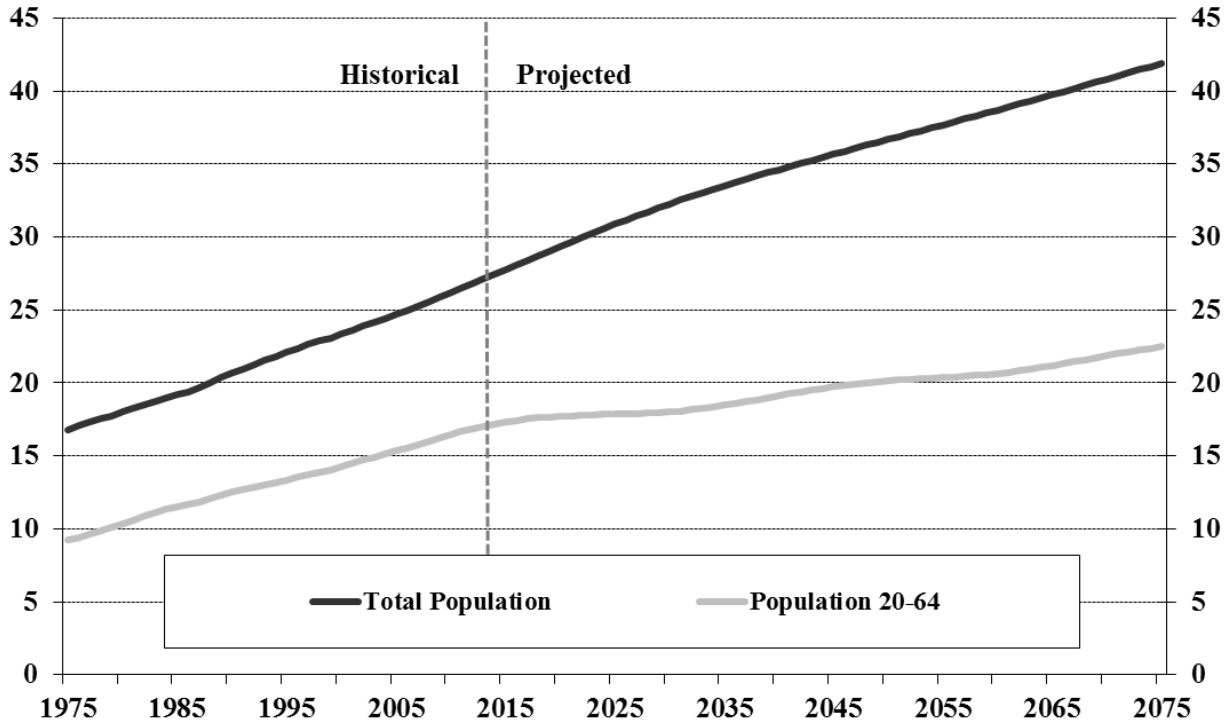
Table 43 Analysis of Population of Canada less Québec by Age

Year	% of Total Population			% of Total Population			Age 65 + as % of Age 20-64
	0-17	18-69	70+	0-19	20-64	65+	20-64
2013	19.9	70.0	10.1	22.5	62.6	14.9	23.8
2014	19.8	69.9	10.3	22.3	62.4	15.3	24.4
2015	19.7	69.8	10.5	22.1	62.2	15.6	25.1
2016	19.7	69.6	10.7	22.0	62.0	16.0	25.9
2017	19.7	69.2	11.1	21.9	61.7	16.4	26.6
2018	19.7	68.8	11.5	21.9	61.3	16.8	27.5
2019	19.7	68.4	11.8	21.9	60.8	17.3	28.4
2020	19.8	68.0	12.2	21.9	60.4	17.8	29.4
2025	19.8	66.1	14.1	22.0	57.9	20.2	34.8
2030	19.6	64.2	16.2	21.7	55.8	22.5	40.3
2040	18.4	62.7	18.8	20.7	55.2	24.1	43.6
2050	18.1	62.8	19.1	20.2	54.9	24.9	45.3
2075	18.0	61.2	20.8	20.1	53.7	26.2	48.8

Table 44 shows the components of population growth, which is defined as the projected number of births plus net migrants less the projected number of deaths for Canada less Québec from 2013 to 2075, and Chart 8 presents these figures graphically for the next 50 years. Over the period
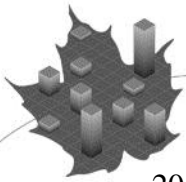
2013 to 2020, the population of Canada less Québec is projected to grow by about 1.1% per year. The annual growth slows to about 0.8% between 2020 and 2040 and to 0.6% thereafter. The population of Canada less Québec is expected to reach 41.9 million by 2075.

Table 44   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
						(%)	(%)	(%)
2013	27,151	303	211	189	325	0.9	4.0	1.2
2014	27,475	312	204	192	324	0.9	3.7	1.2
2015	27,795	317	198	194	320	0.8	3.7	1.2
2016	28,110	321	191	197	315	0.7	3.6	1.1
2017	28,418	324	184	201	308	0.6	3.6	1.1
2018	28,727	327	186	204	309	0.5	3.7	1.1
2019	29,036	329	188	207	309	0.3	3.8	1.1
2020	29,345	330	190	211	309	0.3	3.8	1.1
2025	30,860	331	198	233	296	0.1	3.5	1.0
2030	32,256	323	206	263	267	0.2	2.6	0.8
2040	34,615	333	219	335	217	0.7	0.9	0.6
2050	36,679	364	231	393	202	0.3	1.1	0.6
2075	41,892	400	260	444	215	0.6	0.6	0.5

Chart 8   Components of Population Growth for Canada less Québec
(thousands)
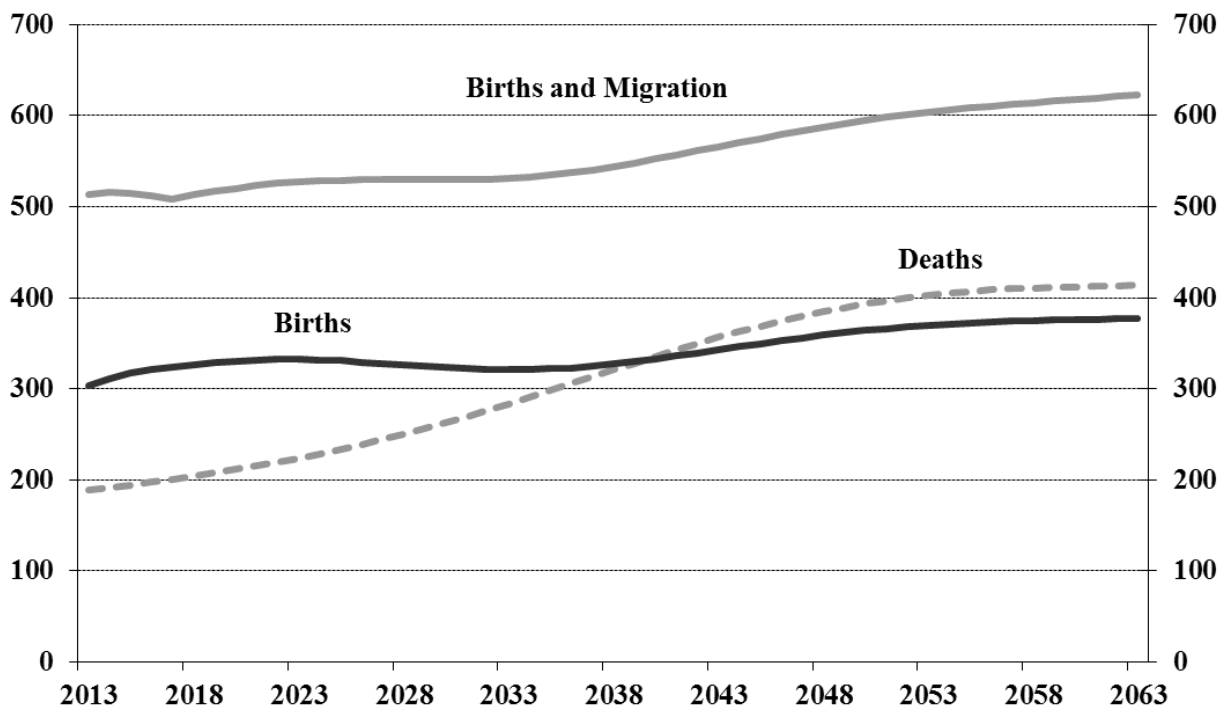
III. Economic Projections

The list of assumptions required to project the various economic indices, as well as CPP contributions and expenditures is quite extensive. The following sections cover the more important assumptions.

The economic outlook rests on the assumed evolution of the labour market, that is, labour force participation, employment, unemployment, inflation, and the increase in average employment earnings. Rates of return on CPP assets reflect the financial markets and are part of the investment assumptions described in section IV of this Appendix. All of these factors must be considered together and form part of an overall economic perspective.

A. Economic Perspective

The future revenues 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, it is assumed that, despite the modest pace of recovery from the recent economic downturn and an uncertain short-term economic outlook for major foreign economies, a moderate and sustainable growth in the Canadian economy will persist throughout the projection period.

The actuarial examination of the CPP involves the projection of its revenues and expenditures over a long period of time. Although best judgment is used regarding future economic trends, it is nonetheless difficult to anticipate all of the social and corresponding economic changes that may occur during the projection period. There will always be some degree of uncertainty. The projected aging of the population combined with the retirement of the baby boom generation over the next few 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 from what has been historically observed and what has been assumed for the purpose of this report.

B. 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, the Year's Maximum Pensionable Earnings, and the nominal rates of return on investments.

Price increases, as measured by changes in the Consumer Price Index, tend to fluctuate from year to year. Over the last 50 years, the trend was generally upward through the early 1980s then downward until the introduction of the inflation-control targets in the early 1990s, at which point inflation began to stabilize. For example, the average annual increases in the CPI for the 50, 20 and 10-year periods ending in 2012 were 4.2%, 1.9% and 2.0%, respectively. Going forward, the Bank of Canada has reaffirmed its objective of keeping the inflation rate within a control range of 1% to 3%, with a target of 2%, until the end of 2016.

To reflect recent experience and the short-term expectation that inflation will remain subdued in the coming quarters, the price increase assumption was set at 1.5% in 2013. For 2014 to 2019, it is assumed that the Bank of Canada will maintain its inflation target policy. An assumption of 2.0% is set for this period, which corresponds to the average forecast from various economists and falls in the middle of the Bank of Canada control range. Subsequently, the inflation rate is
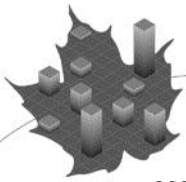
assumed to increase to 2.1% in 2020 and the ultimate assumption for price increases for 2021 and thereafter has been set at 2.2%. This is lower than the assumption of 2.3% used in the 25th CPP Actuarial Report but remains higher than the level of inflation that has been experienced over the last decade, and is slightly higher than the Bank of Canada's target. The main reasons for the choice of an ultimate assumption of 2.2% are as follows:

- The long-term nature of the 75-year projection period of the CPP.

- The expected upward pressure on real wages due to a possible labour shortage may create upward pressure on prices.

- The uncertainty about future energy costs.

C. Labour Market

Chart 9 shows the main components of the labour market that are used to determine the number of earners and contributors by age, sex, and calendar year.

Chart 9   Components of the Labour Market

* An active person is one who is in the labour force, meaning that the person is either employed or is looking for employment (unemployed). A person is said to be inactive in all other cases.
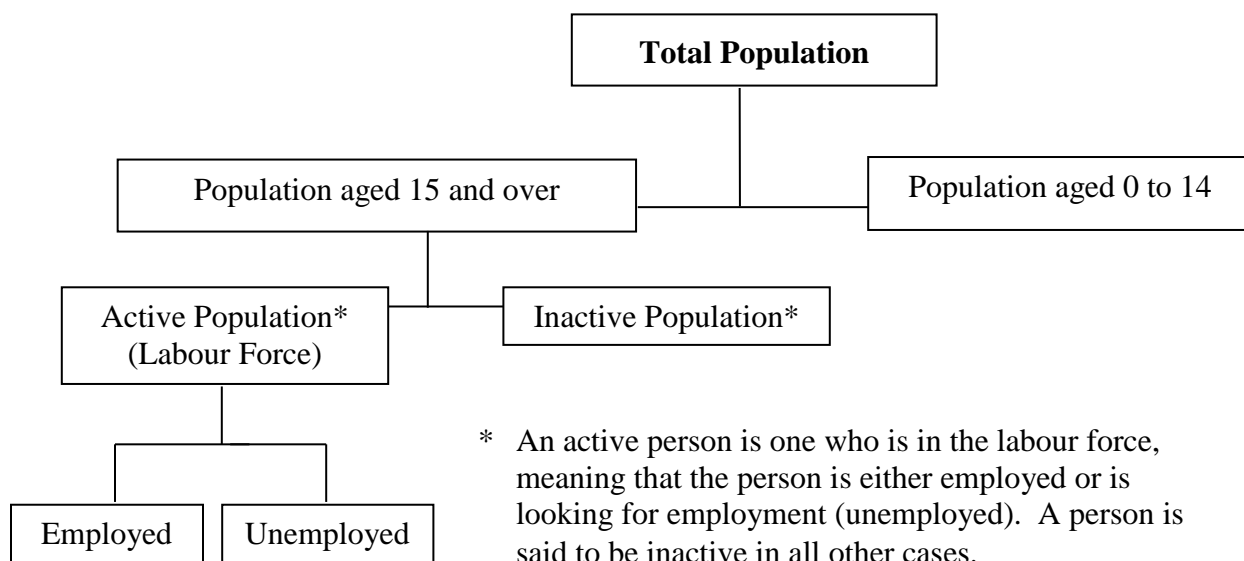
The number of earners is defined as the number of persons who had earnings during a given calendar year. The earners become contributors if they have earnings during the year above the Year's Basic Exemption (YBE) and they are between the ages of 18 and 70. This refers to all earners excluding working beneficiaries aged 65 to 70. For the latter group, contributing to the CPP is optional.

The proportion of earners and contributors assumptions (described in this section and section F) rely on the projected active population given in this report. The projected effect of working beneficiaries is reflected in all these assumptions.

1.   Active Population

The overall labour force participation rates in Canada (the active population expressed as a proportion of the population aged 15 and over) from 1976 to 2012 clearly show a narrowing of the gap between male and female rates. Although the increase in participation rates of females aged 15 to 69 has slowed down since the mid-2000s, the increase has been significant over the past decades. Furthermore, participation rates for those aged 55 and older have increased significantly over the last decade for both men and women.

In 1976, overall male participation was about 78% compared to only 46% for females, which represents a gap of 32%. This gap has narrowed to 9% in 2012, with male and female participation at 71% and 62%, respectively. It is assumed that females will continue to narrow the gap in participation rates but at a slower pace, with the gap gradually reducing to about 8% by 2030 and further reducing slightly by the end of the projection period. In addition, over the next two decades, it is assumed that the participation of males and females aged 55 and over will continue to increase. Tables 45 to 47 provide projections of the active and employed populations and associated participation, employment, and unemployment rates for Canada.

Table 45   Active Population (Canada, ages 15 and over)

Year	Population[1]			Active Population			Employed		
	Males	**Females**	**Total**	**Males**	**Females**	**Total**	**Males**	**Females**	**Total**
	(thousands)			(thousands)			(thousands)		
2013	14,140	14,533	28,674	10,081	9,029	19,110	9,316	8,430	17,747
2014	14,300	14,688	28,988	10,184	9,114	19,298	9,424	8,519	17,943
2015	14,454	14,838	29,292	10,281	9,194	19,475	9,526	8,604	18,130
2016	14,598	14,978	29,576	10,368	9,266	19,634	9,619	8,681	18,300
2017	14,734	15,109	29,843	10,441	9,328	19,769	9,700	8,748	18,448
2018	14,869	15,242	30,111	10,508	9,386	19,894	9,776	8,812	18,587
2019	15,008	15,377	30,384	10,574	9,442	20,017	9,850	8,875	18,725
2020	15,145	15,511	30,655	10,637	9,495	20,132	9,922	8,934	18,855
2025	15,858	16,220	32,079	10,921	9,804	20,725	10,227	9,254	19,481
2030	16,556	16,923	33,479	11,247	10,175	21,423	10,533	9,604	20,137
2040	17,818	18,245	36,062	11,870	10,749	22,619	11,114	10,148	21,262
2050	18,725	19,221	37,946	12,365	11,184	23,549	11,578	10,558	22,136
2060	19,612	20,101	39,713	12,785	11,564	24,349	11,972	10,916	22,888

(1) Adjusted to the basis used by Statistics Canada in its Labour Force Survey.
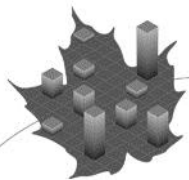
Table 46   Labour Force Participation, Employment, and Unemployment Rates
(Canada, ages 15 and over)

Year	Labour Force Participation Rate			Employment Rate			Unemployment Rate		
	Males	**Females**	**Total**	**Males**	**Females**	**Total**	**Males**	**Females**	**Total**
	(%)			(%)			(%)		
2013	71.3	62.1	66.6	65.9	58.0	61.9	7.6	6.6	7.1
2014	71.2	62.1	66.6	65.9	58.0	61.9	7.5	6.5	7.0
2015	71.1	62.0	66.5	65.9	58.0	61.9	7.3	6.4	6.9
2016	71.0	61.9	66.4	65.9	58.0	61.9	7.2	6.3	6.8
2017	70.9	61.7	66.2	65.8	57.9	61.8	7.1	6.2	6.7
2018	70.7	61.6	66.1	65.7	57.8	61.7	7.0	6.1	6.6
2019	70.5	61.4	65.9	65.6	57.7	61.6	6.9	6.0	6.5
2020	70.2	61.2	65.7	65.5	57.6	61.5	6.7	5.9	6.3
2025	68.9	60.4	64.6	64.5	57.1	60.7	6.4	5.6	6.0
2030	67.9	60.1	64.0	63.6	56.8	60.1	6.4	5.6	6.0
2040	66.6	58.9	62.7	62.4	55.6	59.0	6.4	5.6	6.0
2050	66.0	58.2	62.1	61.8	54.9	58.3	6.4	5.6	6.0
2060	65.2	57.5	61.3	61.0	54.3	57.6	6.4	5.6	6.0

Table 47   Labour Force Participation Rates (Canada)

Age Group	Males				Females			
	2013	**2020**	**2030**	**2050**	**2013**	**2020**	**2030**	**2050**
	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
15-19	49.1	54.0	56.0	56.0	51.4	56.0	59.0	59.0
20-24	77.6	81.0	83.0	83.0	75.2	77.0	80.0	80.0
25-29	90.1	91.0	93.0	93.0	81.9	83.0	86.0	86.0
30-34	92.6	93.0	94.0	94.0	81.3	82.0	85.0	85.0
35-39	93.1	94.0	94.0	94.0	82.5	84.0	86.0	86.0
40-44	92.6	93.0	94.0	94.0	83.8	85.0	87.0	87.0
45-49	90.2	92.0	93.0	93.0	84.4	85.0	87.0	87.0
50-54	88.0	89.0	91.0	91.0	81.1	82.0	85.0	85.0
55-59	79.2	81.0	84.0	84.0	69.7	72.0	75.0	75.0
60-64	58.1	59.0	62.0	62.0	46.1	49.0	52.0	52.0
65-69	30.2	31.0	33.0	33.0	19.5	21.0	23.0	23.0
70 and Over	10.2	11.0	12.0	12.0	4.1	5.0	6.0	6.0
15-69	78.5	79.3	80.2	80.2	70.7	71.3	73.4	73.4
15 and Over	**71.3**	**70.2**	**67.9**	**66.0**	**62.1**	**61.2**	**60.1**	**58.2**

Given that participation rates start to decline mostly after age 50, the aging of the population will exert downward pressure on the overall labour force participation rate in Canada. If current participation rates by age and sex were to apply throughout the projection period, the effect of population aging would cause the overall participation rate from Table 46 to fall from 66.6% in 2013 to 58.5% in 2050, instead of 62.1% as projected under the best-estimate assumption.
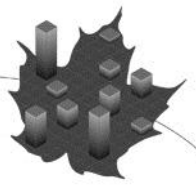
However, it is expected that a number of factors will contribute toward partially offsetting the decline that results from population aging.

The main assumption underlying the future overall participation rate is a significant increase in participation rates for those aged 55 and over as a result of an expected continued trend toward delayed retirement. Government policies aimed at increasing participation rates of older workers, the removal of the work cessation test to receive the CPP retirement pension, the increase in life expectancy, and possible insufficient retirement savings are assumed to encourage older workers to delay their retirement and exit the labour force at a later age.

However, despite the assumed future increase in participation rates of older workers and a reliance on skilled immigrant workers, it is still expected that there will be moderate labour shortages in the future as the working-age population expands at a slower pace and as baby boomers retire and exit the labour force. The participation rates for all age groups are expected to increase due to the attractive employment opportunities resulting from labour shortages.

It is also expected that future participation rates will increase with the aging of cohorts that have a stronger labour force attachment compared to previous cohorts. The stronger labour force attachment of later cohorts is attributable to different reasons, including higher attained education. The aging of more educated workers with higher labour force attachment, and the exit from the workforce of less educated older workers is expected to create upward pressure on participation rates. Over the shorter term, the participation rates of younger age groups are assumed to gradually increase to their pre-recession levels. Finally, although historical increases in participation rates for women are not expected to continue in the future, their participation rates are expected to increase faster than the participation rates for men.

Based on the foregoing, the participation rates of both men and women are expected to increase over the projection period from their 2012 levels for all age groups, especially for those aged 55 and over. Nonetheless, these increases in participation rates are not sufficient to offset the decrease in the overall participation rate due to the demographic shift.

For the purpose of projecting the participation rates, the projection period has been divided into three periods: 2013 to 2020, 2020 to 2030, and from 2030 onward. From 2013 to 2020, and from 2020 to 2030, the projected participation rates are based on the expected impact of the above-mentioned factors through time for each age group and sex. From 2030 onward, the participation rates are kept constant. This long-term assumption combined with a slow growth in the working-age population, results in a low rate of growth of approximately 0.5% for the Canadian active population (that is, the labour force) after 2030.

2. Employment

In Canada, the average annual job creation rate (i.e. the change in the number of persons employed) has been about 1.6% since 1976. However, this rate has varied over the years. It is assumed that the job creation rate will be 1.4% in 2013, based on the most recent experience and various economic forecasts. It is further assumed that the job creation rate over the short term will be slightly higher than the labour force growth rate so that the unemployment rate slowly decreases from its 2012 level of 7.2%.

Over the long term, the job creation rate is assumed to be the same as the labour force growth of 0.5%. This is projected to occur since the unemployment rate is not expected to fall below 6.0%, which is in line with various economic forecasts and reflects moderate economic growth. It is
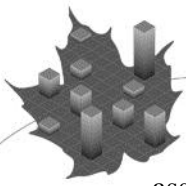
assumed that the unemployment rate will be slightly lower than in the 25th CPP Actuarial Report, reaching 6.0% by 2023 and remaining at that level thereafter.

Table 48 shows the projected number of employed persons, aged 18 to 69, in Canada.

Table 48   Employment of Population (Canada, ages 18 to 69)

Year	Population		Employed		Employment Rate	
	Males	Females	Males	Females	Males	Females
	(thousands)		(thousands)		(%)	
2013	12,367	12,318	8,964	8,139	72.5	66.1
2014	12,486	12,438	9,064	8,224	72.6	66.1
2015	12,591	12,543	9,159	8,305	72.7	66.2
2016	12,675	12,630	9,244	8,379	72.9	66.3
2017	12,727	12,683	9,313	8,440	73.2	66.5
2018	12,781	12,738	9,376	8,496	73.4	66.7
2019	12,832	12,788	9,435	8,549	73.5	66.9
2020	12,879	12,834	9,491	8,598	73.7	67.0
2025	13,082	13,029	9,710	8,852	74.2	67.9
2030	13,238	13,191	9,925	9,139	75.0	69.3
2040	13,779	13,748	10,405	9,618	75.5	70.0
2050	14,512	14,498	10,851	10,019	74.8	69.1
2060	14,919	14,924	11,174	10,335	74.9	69.2

Given that the CPP covers contributors in all provinces except Québec, economic assumptions were developed for Québec, and the results for Canada less Québec were derived. Tables 49 and 50 show the projected active population, number of employed, and labour force participation rates for Canada less Québec.

Table 49   Active Population (Canada less Québec, ages 15 and over)

Year	Population[1]			Active Population			Employed		
	Males	Females	Total	Males	Females	Total	Males	Females	Total
	(thousands)			(thousands)			(thousands)		
2013	10,828	11,153	21,981	7,788	6,975	14,764	7,216	6,518	13,734
2014	10,960	11,286	22,246	7,879	7,055	14,935	7,310	6,600	13,909
2015	11,088	11,414	22,502	7,966	7,132	15,097	7,400	6,679	14,079
2016	11,208	11,535	22,743	8,044	7,202	15,246	7,483	6,753	14,236
2017	11,323	11,649	22,972	8,112	7,263	15,374	7,556	6,817	14,373
2018	11,437	11,764	23,202	8,175	7,321	15,496	7,625	6,880	14,505
2019	11,555	11,882	23,437	8,238	7,378	15,616	7,694	6,942	14,636
2020	11,671	11,999	23,670	8,297	7,432	15,730	7,760	7,000	14,760
2025	12,264	12,604	24,868	8,554	7,712	16,267	8,033	7,289	15,322
2030	12,850	13,208	26,058	8,833	8,030	16,862	8,294	7,588	15,882
2040	13,938	14,368	28,306	9,378	8,529	17,907	8,804	8,062	16,866
2050	14,750	15,257	30,006	9,833	8,927	18,760	9,230	8,437	17,668
2060	15,520	16,038	31,557	10,193	9,256	19,449	9,570	8,746	18,316

(1) Adjusted to the basis used by Statistics Canada in its Labour Force Survey.

Table 50   Labour Force Participation Rates (Canada less Québec)

Age Group	Males				Females			
	2013	**2020**	**2030**	**2050**	**2013**	**2020**	**2030**	**2050**
	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
15-19	48.2	53.7	55.7	55.7	50.2	55.5	58.7	58.7
20-24	77.2	80.7	83.0	83.0	74.4	76.5	80.0	80.0
25-29	90.2	91.3	93.0	93.0	81.2	82.4	85.7	85.7
30-34	92.8	93.0	94.0	94.0	80.4	81.2	84.2	84.2
35-39	93.6	94.3	94.0	94.0	81.6	83.4	85.4	85.5
40-44	92.9	93.0	94.0	94.0	83.4	84.4	86.7	86.7
45-49	89.9	92.0	93.0	93.0	83.8	84.5	86.7	86.8
50-54	87.8	89.0	91.0	91.0	81.0	82.0	85.3	85.2
55-59	80.3	82.5	85.1	85.1	71.5	73.8	76.3	76.3
60-64	61.2	61.5	64.6	64.3	48.4	51.5	53.9	53.7
65-69	32.9	33.3	35.1	35.0	21.9	23.3	25.0	24.8
70 and Over	10.7	11.7	12.6	12.6	4.6	5.7	6.3	6.3
15-69	79.0	80.0	80.7	80.7	70.9	71.7	73.8	73.6
15 and Over	**71.9**	**71.1**	**68.7**	**66.7**	**62.5**	**61.9**	**60.8**	**58.5**

3.   Number of Earners

The number of earners for any given year, namely anyone who had employment earnings during the year, is always more than the employed population and sometimes even close to the labour force because it includes all individuals who had earnings at any time during the year, whereas the employed population only indicates the average number of employed in any given year. The projected number of earners is obtained by a regression based on a highly correlated historical relationship between the number of employed persons and the number of earners over the period 1976 to 2010. Table 51 shows the projected average number of employed persons and the projected number and proportion of earners (relative to the population) aged 18 to 69, for Canada less Québec. The projected number and proportion of earners shown in Table 51 pertain to all earners, including those who are CPP retirement beneficiaries. The effect of CPP retirement beneficiaries with earnings, that is, working beneficiaries, is discussed more in detail in section V-E of this Appendix.

Table 51   Employment of Population (Canada less Québec, ages 18 to 69)

Year	Population Males	Population Females	Employed Males	Employed Females	Earners Males	Earners Females	Proportion of Earners (earners as % of population) Males	Proportion of Earners (earners as % of population) Females
	(thousands)		(thousands)		(thousands)		(%)	
2013	9,502	9,495	6,942	6,289	7,569	6,945	79.7	73.1
2014	9,604	9,602	7,029	6,367	7,670	7,041	79.9	73.3
2015	9,697	9,698	7,112	6,443	7,764	7,130	80.1	73.5
2016	9,774	9,781	7,188	6,513	7,850	7,212	80.3	73.7
2017	9,825	9,836	7,251	6,572	7,913	7,270	80.5	73.9
2018	9,877	9,891	7,309	6,627	7,969	7,321	80.7	74.0
2019	9,927	9,943	7,365	6,680	8,024	7,373	80.8	74.1
2020	9,975	9,993	7,419	6,730	8,077	7,421	81.0	74.3
2025	10,185	10,209	7,625	6,971	8,281	7,667	81.3	75.1
2030	10,343	10,381	7,814	7,222	8,466	7,930	81.9	76.4
2040	10,829	10,887	8,234	7,637	8,937	8,394	82.5	77.1
2050	11,482	11,546	8,642	8,002	9,382	8,788	81.7	76.1
2060	11,842	11,925	8,922	8,275	9,675	9,080	81.7	76.1

D.   Real Wage Increases

The assumed increase in average annual employment earnings (AAE) is used to project the total employment earnings of CPP contributors, while the assumed increase in Average Weekly Earnings (AWE) is used to project the increase in the YMPE from one year to the next. The difference between real (net of inflation) increases in the AWE and the AAE has been relatively small over the period from 1966 to 2011, that is, an absolute difference of approximately 0.01% per year. For several years in the 1990s this difference was more pronounced; however, the real increases in AAE and AWE have shown a tendency to converge toward each other over time. Taking these factors into consideration, the real increases in AWE and AAE are assumed to be the same for 2013 and thereafter.

The real wage increase has fluctuated significantly from year to year. For example, the ten-year average annual real wage increase, as measured by the difference between the increases in the nominal AWE and the CPI, was -0.1% for the period ending in 2002 and 0.9% for the period ending in 2012. The average annual real wage increase was 0.9% for the 46-year period ending in 2012.

The real wage increase can also be measured using the difference between the increase in the nominal average wage and the CPI. In this case, the nominal average wage is defined as the ratio of the total nominal earnings to total civilian employment in the Canadian economy as a whole. Historically, the nominal average wage increase has been similar to the nominal AAE increase, and therefore it is assumed that they can be used interchangeably.

The growth in the real wage increase is related to the growth in total labour productivity as follows:

Real Wage Increase = Growth in Labour Productivity + Growth in Compensation Ratio + Growth in Earnings Ratio + Growth in Average Hours Worked + Growth in Price Differential.

In addition to the factors included in the above equation, labour demand has a significant impact on real wage increases. Real wages are subject to downward pressure as the demand for workers decreases. On the other hand, one could expect upward pressure on wages if the size of the labour force fails to keep pace with a growing economy.

Labour productivity in the above equation is defined as the ratio of the real Gross Domestic Product (GDP) to total hours worked in the Canadian economy. The average annual growth in labour productivity was 1.7% for the 50-year period ending in 2011, and 0.8% for the 11-year period ending in 2011. Long-term productivity is expected to increase as a result of the anticipated labour shortages and the government's policies aimed at enhancing productivity growth. At the same time, increasing labour force participation rates of older workers and a reliance on immigration for future labour force growth are expected to moderate the labour shortage and its impact on productivity. Labour productivity growth of 1.3% is assumed for the long term.

The compensation ratio is the ratio of the total compensation received by workers to the nominal GDP. Changes in the compensation ratio reflect the extent to which changes in productivity are shared between labour and capital. The compensation ratio has decreased on average by 0.1% per year for the 50-year period ending in 2011 with a more significant decrease between 1991 and 2000 (an average decrease of 1.0% per year). However, starting in 2000 the compensation ratio stabilized with a negligible average increase over the period 2000 to 2011. It is assumed that there will be no growth in the compensation ratio over the long term.

The earnings ratio is the ratio of total workers' earnings, defined as the sum of total wages, salary disbursements, and total self-employment earnings, to total compensation. Changes in the earnings ratio reflect changes in the compensation structure offered to employees. The historical decline in the earnings ratio of 0.2% per year from 1961 to 2011 has been primarily due to the faster growth in supplementary labour income, such as employer contributions to pension plans, health benefit plans, the CPP, and the Employment Insurance program, compared to earnings. Given that a significant portion of the historical decrease in the earnings ratio can be explained by the increase in CPP contributions resulting from the increase in the contribution rate from 3.6% in 1986 to 9.9% in 2003, the earnings ratio is not expected to decline as fast as it has in the past. However, as a result of the aging of the population, it is expected that the cost of pension plans and health programs will continue to increase in the future and exert downward pressure on the earnings ratio. Based on the foregoing, it is assumed that the long-term earnings ratio will decline by 0.1% per year.

The average hours worked is defined as the ratio of total hours worked to total employment in the Canadian economy. The average annual growth rate for average hours worked was -0.4% over the 50-year period ending in 2011. The decrease in the average hours worked was significant between 1976 and 1983, with an average annual decrease over that period of 0.7% per year. Despite short-term fluctuations, the average hours worked stabilized after 1983, with an average decrease of 0.1% per year between 1983 and 2011. In the future, the assumed steady increases in
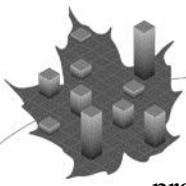
productivity and the higher participation rates of older workers, who generally work fewer hours, could continue to apply negative pressure on the average hours worked. However, higher wages due to productivity gains may encourage workers to work longer hours, and the assumed future increases in life expectancy may encourage older workers to work longer hours than in the past. It is assumed that in the long term, the average hours worked will decrease by 0.1% per year, which is at a slower pace than observed over various periods in the past, but in line with the average experience since 1983.

Finally, the price differential or "labour's terms of trade" is the ratio of the GDP deflator (defined as the ratio of nominal to real GDP) to the CPI. Including this ratio is necessary because labour productivity is expressed in real terms by using real GDP, while current dollar earnings are converted to real earnings using the CPI. The average annual growth in the price differential was 0.1% between 1961 and 2011. However, during this period, the price differential experienced significant fluctuations. It increased at an average rate of 1.1% per year between 1961 and 1976 and decreased at an average rate of 0.6% per year between 1976 and 2002. In more recent years, the decline has reversed, such that between 2002 and 2011 the price differential increased by 0.6% per year. This recent trend is due to Canada's improving international terms of trade. However, it is not clear for how long such growth could be sustained. It is assumed that the long-term increase in the price differential will be 0.1% per year, which is lower than recent experience, but in line with the average growth since 1961.

The result of the foregoing discussion is that the assumed real wage increase is 1.2% per year over the long term. Table 52 summarizes the historical information and the assumptions described above.

Table 52   Real Wage Increase and Related Components[1]

	1961-2011 Average	1990-2011 Average	2000-2011 Average	Ultimate Assumption
Labour Productivity Growth	**1.7%**	**1.3%**	**0.8%**	**1.3%**
+ Compensation Ratio Growth	-0.1%	-0.3%	0.0%	0.0%
+ Earnings Ratio Growth	-0.2%	-0.2%	-0.2%	-0.1%
+ Average Hours Worked Growth	-0.4%	-0.2%	-0.4%	-0.1%
+ Price Differential Growth	0.1%	0.1%	0.4%	0.1%
Real Wage Increase	**1.1%**	**0.6%**	**0.6%**	**1.2%**

(1) Components may not sum to totals due to rounding.

The real wage increase in 2013 is assumed to be 0.5%, which is based on the average annual increase in the real AWE over the last 15 years (1997 to 2012). The real wage increase is then assumed to rise linearly to 1.2% by 2020. This is consistent with the assumed moderate economic growth implicitly reflected in the assumption on the unemployment rate, which is expected to decrease linearly until it reaches its ultimate level in 2023.

Table 53 shows the assumptions regarding the annual increases in prices, real AAE, and real AWE.

Table 53   Inflation, Real AAE and AWE Increases

Year	Price Increases	Real Increases Average Annual Earnings (AAE)	Real Increases Average Weekly Earnings (AWE), (YMPE)
	(%)	(%)	(%)
2013	1.50	0.50	0.50
2014	2.00	0.60	0.60
2015	2.00	0.70	0.70
2016	2.00	0.80	0.80
2017	2.00	0.90	0.90
2018	2.00	1.00	1.00
2019	2.00	1.10	1.10
2020	2.10	1.20	1.20
2021+	2.20	1.20	1.20

E.   Average Annual Earnings, Pensionable Earnings and Total Earnings

Average annual earnings are projected by taking into account past and expected structural demographic changes as well as the narrowing of the gap between average female and male employment earnings. As part of these projections, the average annual earnings of working beneficiaries are also taken into account. The ratio of female to male average employment earnings stood at about 48% in 1966 and was 75% in 2010. This ratio is projected to increase to 86% by 2050. Table 54 shows the projected average annual earnings by age group and sex for selected years.

Table 54   Average Annual Earnings (Canada less Québec, ages 18 to 69)

Age Group	Males			Females		
	2013	2025	2050	2013	2025	2050
	($)	($)	($)	($)	($)	($)
20-24	23,927	33,798	77,638	18,317	26,717	63,730
25-29	40,175	56,711	128,770	31,896	47,141	112,729
30-34	50,342	70,548	159,526	37,501	55,821	134,930
35-39	55,860	77,957	176,575	41,577	61,718	149,484
40-44	57,663	80,747	182,993	44,081	65,329	157,476
45-49	58,461	81,901	185,612	45,098	66,789	160,574
50-54	58,833	82,315	186,581	45,092	67,005	161,220
55-59	54,421	76,015	172,179	41,662	61,577	148,533
60-64	47,132	65,286	147,275	34,518	51,152	123,738
65-69	32,241	43,927	98,850	22,743	34,456	84,127
All Ages	**47,986**	**67,646**	**152,013**	**36,633**	**54,542**	**130,322**

Total earnings are the product of average earnings and the number of earners. Table 55 shows the projected average earnings and number of earners for each sex, the resulting total earnings, and the annual percentage increase in total earnings for Canada less Québec. The ultimate annual increase in total earnings is set to reach about 3.9%. This nominal increase comprises an ultimate inflation rate of 2.2%, real wage growth of 1.2%, and population growth for the age group 18 to 69 of 0.5%.

Table 55   Total Earnings (Canada less Québec, ages 18 to 69)

Year	Average Annual Earnings		Earners		Total Earnings	Annual Increase in Total Earnings
	Males	Females	Males	Females		
	($)	($)	(thousands)	(thousands)	($ million)	(%)
2013	47,986	36,633	7,569	6,945	617,660	3.6
2014	49,093	37,680	7,670	7,041	641,857	3.9
2015	50,286	38,798	7,764	7,130	667,064	3.9
2016	51,564	39,986	7,850	7,212	693,173	3.9
2017	52,939	41,258	7,913	7,270	718,862	3.7
2018	54,430	42,619	7,969	7,321	745,778	3.7
2019	56,012	44,061	8,024	7,373	774,282	3.8
2020	57,749	45,633	8,077	7,421	805,050	4.0
2025	67,646	54,542	8,281	7,667	978,361	3.9
2030	79,402	65,163	8,466	7,930	1,189,013	4.0
2040	109,803	92,453	8,937	8,394	1,757,364	4.0
2050	152,013	130,322	9,382	8,788	2,571,355	3.7
2060	210,664	183,708	9,675	9,080	3,706,251	3.8

Average pensionable earnings are computed by removing from average annual earnings the earnings of those earning less than the YBE and the portion of earnings in excess of the YMPE. Such removal is made using the distributions of earners and earnings, which are based on individual earnings statistics. 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 YMPE for a cohort of earners earning more than the YBE. For 2013, the YMPE and YBE are respectively $51,100 and $3,500. The YMPE is increased annually based on the average industrial aggregate wage in Canada as published by Statistics Canada. Table 56 shows the projected average pensionable earnings by age and sex for selected years.

Table 56   Average Pensionable Earnings (Canada less Québec)

Age Group	Males			Females		
	2013	2025	2050	2013	2025	2050
	($)	($)	($)	($)	($)	($)
20-24	24,561	33,839	74,960	20,126	28,248	64,080
25-29	34,947	48,839	109,452	30,631	43,580	99,506
30-34	38,993	54,584	123,046	33,196	47,370	108,680
35-39	40,480	56,655	128,211	34,893	49,780	114,495
40-44	40,920	57,341	129,914	36,075	51,529	118,644
45-49	41,214	57,779	130,931	36,632	52,380	120,649
50-54	41,135	57,615	130,407	36,624	52,421	120,527
55-59	39,217	54,683	122,572	34,922	49,673	113,315
60-64	32,498	46,000	100,310	28,510	41,146	91,592
65-69	29,576	39,564	81,140	25,317	35,085	73,502
All Ages	**36,637**	**51,305**	**114,102**	**32,012**	**45,661**	**103,415**
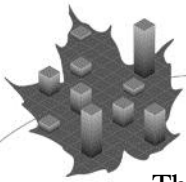
The evolution of the ratio of average pensionable earnings for males and females as a percentage of the YMPE is shown in Chart 10. The freezing of the YBE has the effect that, over time, fewer and fewer workers are exempt from participating in the CPP. This, in turn, has the effect of increasing the number of earners with low earnings participating in the Plan. The ratio reduces over time for males mainly due to this YBE effect. For females, the ratio is stable as the YBE effect is offset by the greater increase in their average pensionable earnings.

Chart 10   Ratio of Average Pensionable Earnings to Maximum
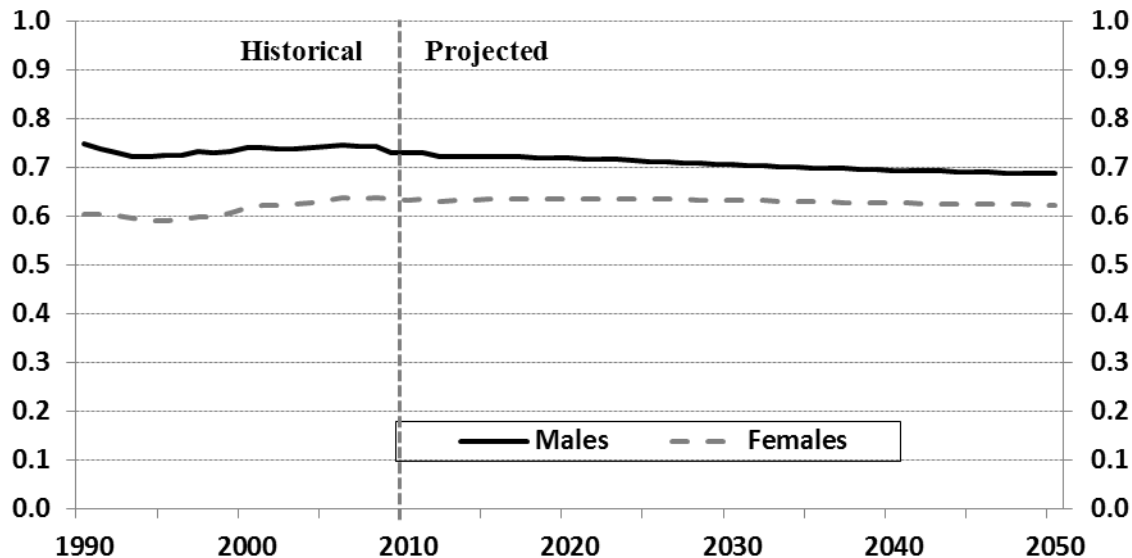
F.   Contributions

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

1.   Proportion of Contributors

In order to be considered a contributor in any given calendar year, one must have employment earnings exceeding the YBE. Accordingly, the proportion of contributors is determined by multiplying the proportion of earners by the complement of the proportion of earners earning up to the YBE. This last proportion is determined for each age, sex, and calendar year by expressing the YBE as a percentage of average employment earnings and using the distributions of earners and their earnings. These distributions were determined using earnings statistics from 2008 to 2010 and are assumed to remain constant in the future. Starting in 2012, the proportion of contributors is adjusted to reflect working beneficiaries. Table 57 presents the proportions of contributors by selected age groups and years for males and females.

Table 57   Proportions of Contributors by Age Group

Age Group	Males 2013	Males 2025	Males 2050	Females 2013	Females 2025	Females 2050
	(%)	(%)	(%)	(%)	(%)	(%)
20-24	74.9	83.1	87.8	71.9	80.9	86.8
25-29	83.1	87.8	90.5	75.3	81.3	85.7
30-34	86.3	88.7	91.0	75.1	79.6	83.9
35-39	87.9	91.1	92.5	77.2	81.9	85.1
40-44	85.5	88.1	89.6	78.4	82.0	84.8
45-49	84.0	88.5	89.8	78.9	82.7	85.4
50-54	81.2	84.5	86.4	75.5	79.8	82.8
55-59	72.7	77.8	80.2	64.0	69.6	72.5
60-64	54.6	58.4	62.2	45.3	50.1	53.7
65-69	19.2	19.1	20.1	12.9	13.5	14.5
All Ages	**74.6**	**77.0**	**79.3**	**67.0**	**70.3**	**73.6**

2.   Average Contributory Earnings

Average contributory earnings, which also reflect working beneficiaries, are determined for each age, sex, and year by subtracting the YBE from the average pensionable earnings as shown in Table 56. Table 58 shows the resulting average contributory earnings by age group and sex for selected years.

Table 58   Average Contributory Earnings

Age Group	Males 2013	Males 2025	Males 2050	Females 2013	Females 2025	Females 2050
	($)	($)	($)	($)	($)	($)
20-24	21,061	30,339	71,460	16,626	24,748	60,580
25-29	31,447	45,339	105,952	27,131	40,080	96,006
30-34	35,493	51,084	119,546	29,696	43,870	105,180
35-39	36,980	53,155	124,711	31,393	46,280	110,995
40-44	37,420	53,841	126,414	32,575	48,029	115,144
45-49	37,714	54,279	127,431	33,132	48,880	117,149
50-54	37,635	54,115	126,907	33,124	48,921	117,027
55-59	35,717	51,183	119,072	31,422	46,173	109,815
60-64	28,998	42,500	96,810	25,010	37,646	88,092
65-69	24,346	33,448	72,490	20,483	29,370	65,489
All Ages	**33,108**	**47,747**	**110,484**	**28,494**	**42,121**	**99,831**
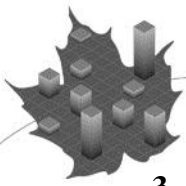
3. Total Contributory Earnings

Contributory earnings for each given age, sex, and year are calculated as the product of the proportion of contributors, average contributory earnings, and the corresponding population. Total contributory earnings for each year are obtained by summing contributory earnings for each age and sex in that year.

Total contributory earnings are then adjusted upward to take into account the non-refundable portion of employer contributions arising generally in respect of (1) employees with multiple employers during a given year, (2) employees earning less than the YBE during a given year, and (3) employees who work only part of the year and do not h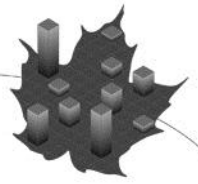ave full access to the YBE. The amount of non-refundable employer contributions increases total CPP contributions, which indicates higher underlying contributory earnings.

The records of earnings from Service Canada, the annual report on contributors published by the Department of Employment and Social Development Canada, and the information from the Canada Revenue Agency on CPP contribution refunds were used to calculate the adjustment. The adjustment is about 2.1% in 2013 and gradually reduces to 1.9% 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.

Annual contributions are equal to the product of adjusted contributory earnings and the contribution rate. The contribution rate is set by law and has been 9.9% since 2003. Table 59 presents the projected components of total unadjusted contributory earnings, the total adjusted contributory earnings, as well as the projected YMPE.

Table 59   Total Adjusted Contributory Earnings

Year	Unadjusted Average Contributory Earnings Males	Unadjusted Average Contributory Earnings Females	YMPE	Contributors Males	Contributors Females	Total Adjusted Contributory Earnings	Annual Increase in Total Adjusted Contributory Earnings
	($)	($)	($)	(thousands)	(thousands)	($ million)	(%)
2013	33,137	28,512	51,100	7,087	6,366	427,762	3.6
2014	33,926	29,266	52,200	7,176	6,454	444,048	3.8
2015	34,787	30,085	53,400	7,265	6,541	461,583	3.9
2016	35,816	31,032	54,900	7,350	6,627	481,371	4.3
2017	36,872	32,014	56,400	7,424	6,698	501,091	4.1
2018	37,978	33,045	58,000	7,495	6,767	521,723	4.1
2019	39,148	34,137	59,700	7,562	6,831	543,322	4.1
2020	40,403	35,309	61,500	7,622	6,890	566,009	4.2
2025	47,805	42,161	72,500	7,847	7,174	695,678	4.2
2030	56,602	50,320	85,700	8,070	7,479	854,642	4.2
2040	79,180	71,063	119,800	8,616	8,044	1,285,576	4.2
2050	110,602	99,915	167,400	9,101	8,503	1,904,295	3.8
2060	154,765	140,642	233,900	9,435	8,851	2,772,797	3.9

IV. Investment Assumptions

A. Investment Strategy

The CPPIB invests funds according to its own investment policies that take into account the needs of contributors and beneficiaries, as well as financial market constraints. For the purpose of this report, the investments have been grouped into three broad categories: equities, fixed income securities, and real assets. Equities consist of Canadian, foreign developed market, and emerging market equities. Fixed income securities consist of federal, provincial, corporate, and real return bonds, and short-term investments. Real assets include such categories as real estate and infrastructure.

The total assets of the CPP portfolio ($175.1 billion as at 31 December 2012) consist of amounts invested by the CPPIB ($172.6 billion), the amount held in the CPP Account ($133 million) and amounts receivable ($2.4 billion). As at 31 December 2012, the asset mix of the CPPIB consisted of 50% equities, 33% fixed income securities, and 17% real assets. The CPPIB has an approved CPP reference portfolio which consists of 65% equities (55% global equities and 10% Canadian equities) and 35% debt (30% Canadian nominal bonds and 5% foreign sovereign bonds). According to the CPPIB, the CPP reference portfolio "can reasonably be expected to generate the long-term returns needed to help sustain the CPP at its current [9.9%] contribution rate"[1].

The CPP reference portfolio is not necessarily representative of the actual holdings of the CPPIB. Therefore, the initial CPP portfolio asset mix is derived using the actual amount held in the CPP Account, amounts receivable, and investments reported by the CPPIB as at 31 December 2012. The initial asset mix of the CPP portfolio as at 31 December 2012 consists of 49% equities, 34% fixed income securities, and 17% real assets. It is assumed that investment in real assets, which accounted for only 10% of the portfolio in 2009, will continue to grow, reaching 20% of the portfolio in 2016. Bond yields are expected to gradually increase over the next six years. Thus, bond returns are assumed to be low over that period. It is therefore assumed that equity allocation will be slightly higher between 2014 and 2018 to mitigate the impact of low bond returns. In 2019, once bond yields have stabilized, equity allocation is assumed to reduce, and investments in equities and fixed income securities will represent 50% and 30% of the portfolio, respectively.

This report provides a projection over the next 75 years. As such, a long-term asset mix assumption is required. As the CPP matures and the Plan's participants age, the ratio of contributors to beneficiaries will decrease, and the proportion of investment income required to pay benefits will increase. Starting in 2023, it is expected that contributions will be insufficient to cover all expenditures, and that a proportion of investment income will be required to cover the contribution shortfall. The contribution shortfall will be small as a proportion of total assets at the beginning (0.2% in 2023) and will increase as the Plan matures, reaching 1.6% of total assets in 2050.

Over the period 2023 to 2030, it is expected that the assumed asset mix of 50% equities, 30% fixed income securities, and 20% real assets will generate enough investment income through fixed income security coupons to cover the contribution shortfall. After 2030, investment income from fixed income security coupons and dividends on equities are assumed to be sufficient to cover the larger shortfall, such that the risk that assets of the CPP portfolio have to be sold at an inopportune time to cover expected contribution shortfalls is minimal. Thus, the assumed

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[1] CPPIB, 2012 Annual Report, March 31, 2012, p. 24.
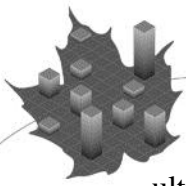
ultimate asset mix of the CPP portfolio consists of 50% equities, 30% fixed income securities, and 20% real assets, which differs slightly from the actual CPPIB asset mix as at 31 December 2012 in order to reflect an expected increase over time in allocations to real assets. The assumed ultimate asset mix is equivalent to a portfolio invested 60% in equities and 40% in fixed income securities, assuming real assets behave half like equities and half like fixed income securities.

When deriving the assumed ultimate asset mix of the CPP portfolio, consideration was also given to the asset mix policy of other major Canadian pension plans. Table 60 shows the assumed asset mix of the CPP portfolio for selected years of the projection period.
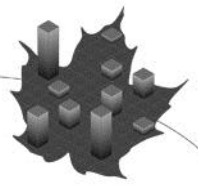
Table 60   Asset Mix

	Equity			Fixed Income Securities			Real Assets (Real Estate and Infrastructure)
Year	Canadian	Foreign Developed Market	Emerging Market	Marketable Bonds	Non-Marketable Bonds	Short Term	
	(%)	(%)	(%)	(%)	(%)	(%)	(%)
2013	9	33	7	19	14	1	17
2014	11	35	7	15	13	1	18
2015	11	35	7	16	11	1	19
2016	11	35	7	16	10	1	20
2017	11	35	7	17	9	1	20
2018	11	35	7	18	8	1	20
2020	10	33	7	22	7	1	20
2025	10	33	7	26	3	1	20
2030	10	33	7	27	2	1	20
2035	10	33	7	27	2	1	20
2044+	10	33	7	29	0	1	20

B.   Investment Income

In general, investment income from a given asset within a portfolio is the product of the market value of that asset and its projected nominal rate of return (which is obtained by adding the applicable projected real rate of return, as described in section C below, to the projected inflation rate).

The investment income of the CPP is based on the assumed real rate of return applicable to each type of asset, projected inflation, and the projected asset mix and cash flows. Investment income is also adjusted downward to recognize investment expenses (discussed in section D).

C.   Real Rates of Return

For comparison purposes with the discussion and assumptions described in this section, the following Table 61 presents the real rates of return based on Canadian dollars for various asset classes as well as inflation levels for periods ending 31 December 2012. Table 61 was prepared based on the Canadian Institute of Actuaries' *Report on Canadian Economic Statistics 1924 – 2012*.

Table 61   Historical Inflation and Real Rates of Return by Asset Type

Length of Period ending 31 December 2012 (years)	25	50	65	75
	(%)	(%)	(%)	(%)
Level of Inflation	2.2	4.1	3.7	3.7
Real Return on Canadian Equity	6.0	5.4	6.8	6.3
Real Return on U.S. Equity	6.2	5.4	7.2	n/a
Real Return on Canadian Real Estate	6.9	n/a	n/a	n/a
Real Yield on Long-Term Federal Bonds	3.9	3.3	2.8	2.4
Real Return on Long-Term Federal Bonds	7.6	4.1	2.9	2.6
Average Real Return on Diversified Portfolios	5.9	4.2	n/a	n/a

Real rates of return are required for the projection of revenue arising from investment income. They are assumed for each year of the projection period and for each of the main asset categories in which CPP assets are invested. All real rates of return described in this section are shown before reduction for assumed investment expenses.

In addition, the assumed real rate of return for each asset class includes an allowance for rebalancing and diversification to take into account the beneficial effect of reduced volatility that comes from diversification within a portfolio. If the expected rates of return for each asset class were not increased to reflect their respective share of this allowance, then the expected long-term portfolio rate of return calculated as the weighted average rate of return of each asset class would be underestimated.

The real rates of return were developed by looking at historical returns (expressed in Canadian dollars) and adjusting the returns upward or downward to reflect expectations that differ from the past. Future currency variations will impact the real rates of return over the projection period, creating gains and losses. However, as the projection period is 75 years, these gains and losses are expected to offset each other over time. Thus, it is assumed that currency variations will not have an impact on the real rates of return.

Real Rates of Return on Assets under the Management of the CPPIB

As discussed earlier, CPPIB assets are invested in three broad categories of investments: equities, fixed income securities, and real assets. The projected annual real rates of return for each of these asset classes have been determined by taking into consideration the current economic environment, various economic forecasts, as well as historical experience.

The future outlook is based on the assumption that, over the short term, federal bond yields are expected to increase, since their recent low levels were prompted mainly by large government economic stimulus interventions and a flight to quality assets following the global recession of 2008-2009. The projected real rates of return for different types of investments also reflect that

projections are over a 75-year time horizon and thus, should be generally consistent with the long-term averages of real rates of return.

With the exception of fixed income securities, real rates of return for all asset classes are assumed to be constant for the entire projection period. The current context of extremely low bond yields and the general expectation that bond yields will increase over the coming years are reflected in the expected real rates of return for fixed income securities. A constant real rate of return is assumed for the more volatile asset classes, reflecting the difficulty in projecting yearly market returns.

1. Fixed Income Securities

As at 31 December 2012, the CPPIB had 33% of its portfolio invested in fixed income securities, split between a non-marketable bond portfolio composed of bonds with various terms to maturity, representing loans made to the provinces, and a marketable bond portfolio consisting of federal, provincial, corporate, and real return bonds.
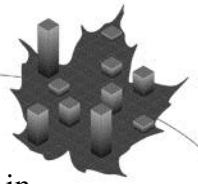
Non-Marketable Bond Portfolio and Rollover Rates (Loans to Provinces)

The non-marketable bond portfolio at the end of 2012 represented 14% of all CPP assets. The provinces are allowed to roll over at maturity for a further 20-year term any bonds that were purchased prior to the 1997 CPP amendments (that came into effect on 1 January 1998). In lieu of exercising their statutory rollover right, an agreement between the provinces and the CPPIB permits each province to repay a bond and contract a replacement bond or bonds for a term of at least five years, with a total principal amount not exceeding the principal amount of the maturing bond and total successive terms not more than 30 years. During the 14-year period 1999 to 2012, 67% of provincial bonds available for rollover were rolled over. The rollover proportion increases to 91% when considering the four-year period from 2009 to 2012, and to 98% when considering only 2012. Using this rollover experience and considering current stakeholders' balance sheets, it is assumed that the rollover rate will be approximately 97% for 2013 and thereafter. The last non-marketable bond is expected to mature in 2043.

On the basis of the average long-, medium-, and short-term experience of the spread between the annual yields on federal and provincial bonds, the current outlook of the economy, and data on rollovers since 1999, a spread over the federal yield was determined for each province. The initial spreads on rollover bonds are set at the actual market spreads at the end of 2012 for provincial bonds issued by the given province. The ultimate spreads, applicable starting at the end of 2017, are set at the average spreads for the 10-year period ending in 2009 for provincial bonds issued by the given province. Spreads over the last three years (2010-2012) were abnormally high due to the current extremely low federal bond yield environment and were thus ignored in the determination of the ultimate spreads. The ultimate annual long-term real federal yield is assumed to be 2.8%, as discussed in the following section. This is consistent with the long-term average of long-term real federal yields. The weighted long-term average spread for all provinces is approximately 55 basis points. Therefore, an ultimate annual real yield of approximately 3.35% for provincial rollover bonds is assumed for 2018 and thereafter.

The real rate of return of the non-marketable bond portfolio is calculated by taking into consideration any coupon payments made throughout the year, as well as the change in the market value of the portfolio due to changes in the assumed yield rates and in the term to maturity of each

bond. Coupons paid and redemption values of bonds at maturity are assumed to be reinvested in the marketable bond portfolio.

Marketable Bond Portfolio

As the non-marketable bond portfolio matures over the next 30 years, it is assumed that the proceeds will be invested in marketable bonds and that this marketable bond portfolio will consist of federal, provincial, corporate, and real return bonds in varying proportions. The initial asset mix of the marketable bond portfolio is based on actual CPPIB investments as at 31 December 2012, that is, 39% federal, 30% provincial, 23% corporate, and 8% real return bonds.

It is assumed that the CPPIB will purchase a variety of federal, provincial, and corporate bonds in proportions consistent with the CPPIB's investment strategy. It is also assumed that since the real return bonds asset class has been removed from the CPP reference portfolio, there will be no more investments in real return bonds. It is also assumed that a greater proportion of corporate bonds, compared to other bond types, will be purchased. It is thus assumed that the ultimate marketable bond mix applicable for 2015 and thereafter will be composed of 35% federal, 30% provincial, 35% corporate, and 0% real return bonds.

The real yield on long-term federal bonds as at 31 December 2012 is 0.88% and is assumed to gradually increase to 2.8% for 2019 and thereafter. The real yields for federal bonds of shorter maturities as well as for provincial, corporate, and real return bonds are based on the real yield on long-term federal bonds adjusted based on historical spreads. The initial spreads over the federal long-term bond real yield are based on spreads prevailing as at 31 December 2012 and reflect the current economic environment. The assumed average maturity of federal, provincial, and corporate bonds are estimated based on CPPIB's holdings as at 31 December 2012 and are assumed to remain constant throughout the projection period. The average maturity of the marketable bond portfolio is therefore much shorter than in the previous CPP actuarial report where the marketable bond portfolio was assumed to be invested in long-term bonds. Since bond yields are expected to increase in the next few years, a marketable bond portfolio with a shorter average maturity is desirable as it is less negatively impacted by the increase in bond yields. This shorter maturity bond portfolio will result in higher returns than a portfolio with a longer average maturity during periods of increasing bond yields. However, the assumed real rate of return of the marketable bond portfolio once bond yields have stabilized is lower than the corresponding assumed real rate of return of the previous actuarial report (2.9% instead of 3.35% before investment expenses).

The real rate of return for the marketable bond portfolio is calculated for each year using the proportion invested in each bond type and the bonds' real rates of return. The expected real rates of return for individual bonds take into account the coupons and market value fluctuations due to the expected movement of their respective yield rates. Since the long-term federal bond yield is assumed to increase between 2013 and 2018 and only stabilize at the end of 2018, bond returns are quite low for the first six years of the projection. The assumed ultimate real rate of return for long-term federal bonds is 2.8% starting at the end of 2018. The assumed average ultimate real rates of return for federal, provincial, and corporate bonds of various maturities are 2.3%, 2.9% and 3.4%, respectively. An ultimate real rate of return of 2.9% is assumed for the bond portfolio for 2019 and thereafter.
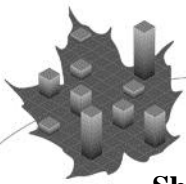
Short-Term Investments and CPP Account

The CPP Account is established in the accounts of Canada to record the transactions of the Plan and amounts transferred to and from the CPPIB. Historically, the CPP Account, held by the federal Department of Finance, consisted of an operating balance and short-term investments. The assets of the CPP Account not needed to meet immediate Plan obligations were transferred to the CPPIB in monthly installments between September 2004 and August 2005. As such, the balance in the CPP Account is now minimal, serving only as a flow-through account with investments solely in short-term securities. The Account is assumed to earn a real rate of return of 1.0% for 2019 and thereafter. CPPIB short-term investments are also assumed to earn a real rate of return of 1.0% for 2019 and thereafter. The initial assumed real rate of return is lower, reflecting the current environment, with a smooth transition assumed from the initial to ultimate assumption of 1.0%.

2. Equity

The CPPIB assets invested in equities are currently diversified among Canadian, foreign developed, and emerging market equities. In the derivation of the real rates of return for these equity investments, consideration was given to the long-term equity risk premiums for the respective equity classes. The rates of return also include dividends from the equities and market value fluctuations. No distinction is made between realized and unrealized capital gains.

Consistent with the assumption that risk taking must be rewarded, equity real rates of returns are developed by adding an equity risk premium to the long-term federal bond real rate of return. The historical equity risk premium over long-term government bond returns for 19 countries, representing almost 90% of global stock market value, for the 113-year and 50-year periods ending in 2012 were 3.2% and 0.9% respectively (3.4% and 1.0% for Canada)[1]. Historical equity risk premiums over the 113-year period were higher than expected due to several non-repeatable factors (mainly diversification and globalization). As a result, the long-term expected equity risk premium is assumed to be lower than what was realized in the past 113 years. However, the equity risk premium is assumed to be higher in the first six years of the projection, reflecting assumed low bond returns over the same period, before reaching an assumed ultimate rate of 2.2% for Canadian and foreign developed markets. The equity risk premium for emerging market equities is expected to be 100 basis points higher than for Canadian and foreign developed market equities, reflecting the additional risk inherent with investments in emerging countries.

As described in the previous section, the annual long-term federal bond real rate of return is set at 2.8% for 2019 and thereafter. The real rates of return are thus projected at 5.0% for developed market equities and 6.0% for emerging market equities throughout the projection period.

3. Real Assets

Real assets such as real estate and infrastructure are considered to be a hybrid of debt and equity, usually in equal proportions. If these assets are considered to be an equal split between marketable bonds and developed market equities, then the assumed return should be composed of half the return on marketable bonds and half the return on developed market equities. Considering the inherent difficulties in modeling short-term returns for volatile assets, real rates of return for real assets are projected to be 3.9% throughout the projection period.

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[1]   Source: Elroy Dimson, Paul Marsh and Mike Staunton, Credit Suisse Global Investment Returns Yearbook 2013.
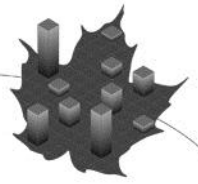
Table 62 summarizes the assumed real rates of return by asset type throughout the projection period, before reduction for investment expenses. Prior CPP actuarial reports showed real rates of return after expenses. To obtain comparative values, real rates of return shown in Table 62 must be reduced by 20 basis points (see the following section D).

**Table 62   Real Rates of Return by Asset Type (before investment expenses)**

Year	Equity			Fixed Income Securities			Real Assets (Real Estate and Infrastructure)	Total Real Rate of Return[1]
	Canadian	Foreign Developed Market	Emerging Markets	Marketable Bonds	Non-Marketable Bonds	Short Term		
	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
2013	5.0	5.0	6.0	(1.4)	(0.4)	(0.5)	3.9	2.9
2014	5.0	5.0	6.0	(1.2)	(2.1)	(0.4)	3.9	3.0
2015	5.0	5.0	6.0	(0.8)	(0.9)	(0.3)	3.9	3.2
2016	5.0	5.0	6.0	(0.3)	(0.4)	0.0	3.9	3.4
2017	5.0	5.0	6.0	0.3	0.0	0.3	3.9	3.6
2018	5.0	5.0	6.0	0.4	(0.2)	0.6	3.9	3.6
2019	5.0	5.0	6.0	2.9	3.1	1.0	3.9	4.2
2020	5.0	5.0	6.0	2.9	2.4	1.0	3.9	4.2
2025	5.0	5.0	6.0	2.9	3.4	1.0	3.9	4.2
2030	5.0	5.0	6.0	2.9	3.5	1.0	3.9	4.2
2035	5.0	5.0	6.0	2.9	2.9	1.0	3.9	4.2
2044+	5.0	5.0	6.0	2.9	0.0	1.0	3.9	4.2

(1) The assumed total real rate of return is shown before reduction for investment expenses. The assumed total real rate of return net of expenses is obtained by reducing the total real rate of return by 20 basis points.

D. Investment Expenses

In the previous CPP actuarial report, operating expenses of the CPPIB were included as part of the CPP operating expenses and were treated as expenditures. In this report, following a recommendation made by the external peer reviewers of the previous CPP actuarial report, CPPIB operating expenses are included as a reduction to the rates of return, while CPP operating expenses arising from the Department of Employment and Social Development Canada, the Canada Revenue Agency, Public Works and Government Services Canada, the Office of the Superintendent of Financial Institutions Canada, and the Department of Finance Canada are still treated as expenditures. Over the last three calendar years, CPPIB's total investment expenses consisting of operating expenses, transaction costs, and investment management fees have averaged 0.82% of average assets. The majority of those investment expenses were incurred through active management decisions. It is assumed that going forward CPPIB investment expenses will be 0.80% of average assets.

The active management objective is to generate returns in excess of those from the CPP reference portfolio, after reduction for the additional expenses incurred from active management. Thus, the additional returns from a successful active management program should equal at least the cost incurred to pursue active management. For the purpose of this report, it is assumed that the additional returns generated by active management will equal the additional expenses incurred
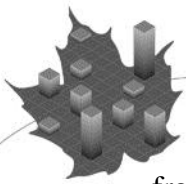
from active management. Those expenses are assumed to be 0.6%, which is the difference between the assumed total investment expenses of 0.8% and the investment expenses of 0.2% that would be incurred from passive management of the portfolio, given that part of the portfolio is invested in real estate and infrastructure. The assumed investment expenses of 0.2% represent $363 million and $574 million in years 2013 and 2020, respectively.

The next section shows the overall rate of return on CPP assets net of investment expenses.

E. Overall Rate of Return on CPP Assets

The best-estimate rate of return on total assets is derived from the weighted average assumed rate of return on all types of assets, using the assumed asset mix proportions as weights. The best-estimate rate of return is further increased to reflect additional returns due to active management and reduced to reflect all investment expenses. The ultimate real rate of return is developed as follows:

	Nominal	Real
Weighted average rate of return (before investment expenses)	6.4%	4.2%
Additional rate of return due to active management	0.6%	0.6%
Expected investment expenses		
Expenses due to passive management	-0.2%	-0.2%
Additional expenses due to active management	-0.6%	-0.6%
Total expected investment expenses	-0.8%	-0.8%
Ultimate rate of return	**6.2%**	**4.0%**

The resulting nominal and real rates of return for each projection year are shown in Table 63. Excluding the first six years, the projected average real rate of return for the period 2019 and thereafter is 4.0%.

Table 63   Rates of Return on CPP Assets

Year	Nominal	Real
	(%)	(%)
2013	4.2	2.7
2014	4.8	2.8
2015	5.0	3.0
2016	5.2	3.2
2017	5.4	3.4
2018	5.4	3.4
2019	6.0	4.0
2020	6.1	4.0
2021	6.2	4.0
2022	6.2	4.0
2023+	6.2	4.0
Average over:		
2013-2018	5.0	3.1
2019+	6.2	4.0

V. Expenditures

The approach used in this report to project future benefits paid is based on macrosimulation, which means that the projections rely on grouped data. The amount of benefit expenditures is determined by taking into account the administrative agreement between the Canada Pension Plan and the Québec Pension Plan for beneficiaries who contributed to both plans.

The initial average annual retirement pension of all persons born in a given calendar year, split by sex, is obtained for the cohort by summing for each year over the contributory period the product of the proportion of contributors and the average pensionable earnings deemed to apply to the cohort, dividing this sum by the number of years included in the contributory period, and then multiplying by 25%.

All benefit projections are done using 1966 as the starting point instead of the beginning of the statutory projection period (2013). This is done for the following reasons:

- The valuation methodology can be validated for the historical period up to the valuation year (1966 to 2012) by comparing for that period the projected values (contributions, benefits, beneficiaries, etc.) with actual experience.

- The projection of those benefits already in pay as at the valuation date (31 December 2012) is fully integrated with the projection of benefits emerging after that date, thus ensuring full consistency between past experience and the future.

The estimated number of beneficiaries in pay and average monthly benefits payable as at 31 December 2012 are shown in Table 64.

Table 64   Pensions Payable as at 31 December 2012

Benefit Type	Number of Beneficiaries in pay		Average Monthly Benefit	
	Males	**Females**	**Males**	**Females**
	(in thousands)		($)	($)
Retirement	2,087	2,174	639	410
Survivor				
- Aged less than 65	52	179	329	392
- Aged 65 and over	130	686	99	347
Disability	155	176	891	808

Benefit Type	Number of Beneficiaries in pay	Average Monthly Benefit
	Males and Females	**Males and Females**
	(in thousands)	($)
Orphan	70	225
Disabled Contributor's Child	86	225
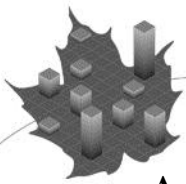
A. Adjustments to Proportion of Contributors and Pensionable Earnings

The effect of credit-splitting of unadjusted pensionable earnings between spouses or common-law partners in the event of divorce or separation is accounted for by adjusting the projected proportion of contributors and average pensionable earnings of the respective spouses or common-law partners.
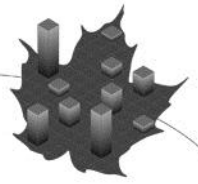
The average pensionable earnings used to determine the initial amounts of the retirement pensions are also adjusted to exclude the earnings of those who are already receiving their retirement pension. The resulting adjusted proportion of contributors and average pensionable earnings for benefit computation purposes appear in Tables 65 and 66, respectively.

Table 65   Proportion of Contributors (adjusted for benefit computation purposes)

Age Group	Males			Females		
	2013	2025	2050	2013	2025	2050
	(%)	(%)	(%)	(%)	(%)	(%)
20-24	75.9	83.9	88.4	74.8	83.0	88.2
25-29	84.9	89.3	91.7	80.1	85.2	88.7
30-34	88.5	90.6	92.6	80.9	84.5	87.8
35-39	89.9	92.7	93.9	82.4	86.1	88.6
40-44	87.6	90.0	91.3	82.4	85.4	87.7
45-49	86.0	90.0	91.2	81.9	85.4	87.7
50-54	83.1	86.1	87.9	78.2	82.1	84.8
55-59	74.3	79.2	81.5	66.5	71.9	74.6
60-64	41.1	46.4	50.2	35.4	40.8	44.4
65-69	6.5	6.9	8.1	4.3	5.0	6.0
All Ages	**74.1**	**75.9**	**78.1**	**68.7**	**71.1**	**73.9**

Table 66   Average Pensionable Earnings (adjusted for benefit computation purposes)

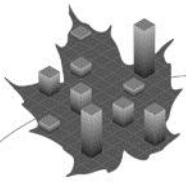| Age Group	Males			Females		
	2013	2025	2050	2013	2025	2050
	($)	($)	($)	($)	($)	($)
20-24	23,991	33,251	73,974	19,720	27,931	63,698
25-29	33,403	47,109	106,351	29,697	42,629	97,938
30-34	36,736	51,893	117,992	32,231	46,305	106,904
35-39	38,394	54,272	123,613	34,026	48,905	112,925
40-44	39,085	55,172	125,686	35,190	50,494	116,617
45-49	39,593	55,955	127,379	35,862	51,527	118,955
50-54	39,662	55,913	127,096	35,846	51,518	118,744
55-59	37,859	53,091	119,405	34,084	48,687	111,283
60-64	38,618	52,476	114,547	34,179	47,624	106,371
65-69	31,615	42,518	87,521	27,300	37,639	79,049
All Ages	**35,599**	**50,286**	**112,615**	**31,640**	**45,461**	**103,430**

B.   Benefit Eligibility Rates

As described in Appendix C (Plan Provisions), eligibility for benefits varies according to the type of benefit. Benefit eligibility rates (the proportions of the population eligible to benefits, for each age and sex) 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 for retirement, disability, and survivor benefits are computed using regression formulae that were developed to closely reproduce historical eligibility rates observed from the CPP records of earnings data for the period 1966 to 2010. The projected eligibility rates take into account the applicable eligibility rules for each type of benefit, the proportion of contributors, and the length of the contributory period for existing and future cohorts of earners.

The disability and survivor benefit eligibility rates developed as above must be adjusted for the purpose of computing the earnings-related portion of these two types of benefits. Table 67 shows the resulting eligibility rates for the various benefit types by sex and age for selected years. The retirement eligibility rates for some ages and years are greater than 100% due to individuals who contributed to the CPP and then left the country with no further information available as to their status. Since these individuals are not counted in the population, the retirement eligibility rates can be higher than 100%.

Table 67 Benefit Eligibility Rates by Type of Benefit

Year	Retirement Benefit Eligibility Rate at Age 65		Survivor/Death Benefit Eligibility Rate at Age 65	
	Males	Females	Males	Females
2013	1.07	1.01	1.00	0.66
2014	1.07	1.01	1.00	0.68
2015	1.07	1.01	1.00	0.69
2016	1.07	1.01	1.00	0.70
2017	1.06	1.01	1.00	0.71
2018	1.06	1.00	1.00	0.72
2019	1.05	1.00	1.00	0.73
2020	1.05	1.00	1.00	0.74
2025	1.03	1.00	1.00	0.78
2030	1.01	0.99	0.98	0.80
2040	1.01	0.99	0.97	0.82
2050	1.02	1.01	0.97	0.83
2060	1.02	1.01	0.97	0.84

Year	Survivor/Death Benefit Eligibility Rate at Ages 20-64		Disability Benefit Eligibility Rate at Ages 20-64	
	Males	Females	Males	Females
2013	0.79	0.72	0.73	0.65
2014	0.80	0.73	0.74	0.66
2015	0.80	0.74	0.74	0.66
2016	0.80	0.74	0.74	0.66
2017	0.80	0.74	0.74	0.66
2018	0.80	0.74	0.75	0.67
2019	0.81	0.75	0.76	0.68
2020	0.81	0.75	0.76	0.68
2025	0.83	0.77	0.78	0.70
2030	0.84	0.79	0.80	0.73
2040	0.85	0.80	0.80	0.74
2050	0.86	0.81	0.80	0.74
2060	0.86	0.82	0.81	0.75
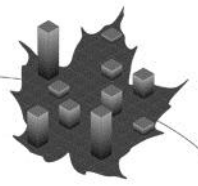
C. Average Earnings-Related Benefit

The average earnings-related benefit is used in the calculation of the total emerging earnings-related benefit expenditures for a given calendar year, for each sex, and all relevant ages.

The gross (i.e. before taking into account the drop-out provisions and earnings index) average earnings-related benefit is determined by sex and calendar year for each attained age from 18 to 70 as the product of the retirement benefit proportion (25%), the MPEA, and the ratio of:
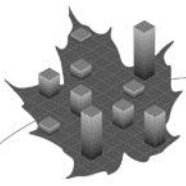
- the sum over all years in the elapsed contributory period (i.e. from age 18 to the attained age) of the ratio in each year of:

  ➢ the average pensionable earnings of contributors (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 average earnings-related benefit 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 general drop-out period. However, since the general approach is based on macrosimulation (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 general 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 must be dropped from the elapsed contributory period (the denominator of the gross average earnings-related benefit described above) is computed as the sum of the three periods determined in respect of the disability, child-rearing, and general drop-out provisions.

The average earnings-related benefit is finally determined by adjusting the gross average earnings-related benefit determined above for the drop-out provisions.

Table 68 shows the resulting projected average earning-related benefit as a percentage of the maximum benefit at ages 60 and 65 by sex and year of birth for various cohorts of contributors. The average earnings-related benefit for males at age 65 as a percentage of the maximum is about 10 to 13 percentage points lower than at age 60 due to the fact that males who take their benefit at age 65 have a longer contributory period and an historical lower earnings profile than those who take an early benefit at age 60. For females, the difference between age 60 and 65 is less pronounced. The earnings-related benefits for males as a percentage of the maximum are expected to generally decrease over time because of the lower participation and pensionable earnings (as a proportion of the YMPE) of younger contributors in the early years of their contributory period. For females, this decline is offset by the expected higher earnings of future female cohorts. As a result, the gap between the male and female average earnings-related benefits is expected to decrease over time.

Table 68   Average Earnings-Related Benefit as Percentage of Maximum Benefit

| | Average Earnings-Related Benefit (%) | | | |
| | Males | | Females | |
Year of Birth	Age 60	Age 65	Age 60	Age 65
1950	79	67	58	53
1951	79	66	59	54
1952	79	66	62	54
1953	77	66	59	54
1954	78	65	60	54
1955	78	65	60	54
1960	75	63	60	53
1965	71	60	60	52
1970	71	59	60	52
1980	73	60	63	54
1990	72	60	64	55
2000	74	61	66	56
2010	74	61	66	57
2020+	74	61	66	57

D.   Retirement Expenditures

For each cohort of contributors taking their retirement pension at a given age starting from age 60 or above in each of the calendar years starting in 1967, an average retirement benefit was computed to determine the emerging retirement benefit expenditures. The average retirement benefit is computed by age, sex, and calendar year of emergence of the pension as the product of:

- the assumed proportion of contributors electing to opt for their retirement benefit;

- the actuarial adjustment factor in connection with the flexible retirement age provision; and

- the average earnings-related benefit.

The assumed proportions by age, sex, and calendar year of contributors electing to start receiving the retirement pension at a given age were determined by taking into account the assumed future work patterns of earners aged 60 and over and the corresponding CPP experience from 1996 to 2012. 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 (i.e. the ratio of the number of new retirement beneficiaries to the eligible population).

Retirement rates at age 60 for the cohort reaching age 60 in 2012 are 41% and 44% for males and females, respectively. These rates reflect the increase in early retirement rates that may have resulted from two provisions of the *Economic Recovery Act (stimulus)*. First, the removal in 2012 of the work cessation test to receive the pension early (prior to age 65) may have increased the early retirement rates. Second, the anticipation of the greater reductions in early retirement pensions due to the increased actuarial adjustments (starting in 2012 and phased in by 2016) may have also contributed toward the observed increase in pension take-up at age 60 in 2012.
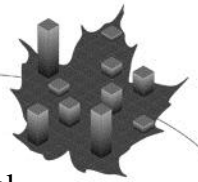
After peaking in 2012, the early retirement rates are assumed to decrease as the higher actuarial adjustments are phased in and the effect of the removal of the work cessation test diminishes. For cohorts reaching age 60 in 2016 and thereafter, the retirement rates are assumed to decrease to 34% and 38% for males and females, respectively and to increase to 41% and 39%, respectively at age 65 in 2021 and thereafter. These rates reflect trends in recent experience.

For each year in the projection period after 2015, the retirement rates for ages 61 to 64 are determined based on the observed averages over the five-year period ending in 2011. The retirement rates for ages 66 and above are determined based on the observed rates in 2012. Most contributors elect to commence receiving their retirement pensions on or before age 65, with only a small proportion of contributors electing to start their pensions after that age.
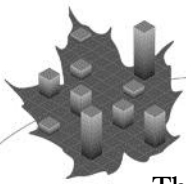
The rates at age 65 are derived such that the sum of the retirement rates for each cohort is 100%. With this approach, it is implicitly assumed that all eligible contributors will have applied for their retirement pension before they reach age 80. Table 69 shows the projected retirement rates by age for both males and females.

Table 69   Retirement Rates

Age	Male Cohort Aged 60 in		Female Cohort Aged 60 in	
	2012[1]	2016[2]+	2012[1]	2016[2]+
	(%)	(%)	(%)	(%)
60	41.3	34.0	43.7	38.0
61	8.2	6.0	8.0	6.0
62	6.1	5.0	6.1	5.0
63	4.5	4.0	4.5	4.0
64	4.0	4.0	4.0	4.0
65	29.5	40.6	29.9	39.2
66	1.2	1.2	0.9	0.9
67	1.1	1.1	0.6	0.6
68	1.1	1.1	0.6	0.6
69	1.0	1.0	0.6	0.6
70	0.6	0.6	0.5	0.5
71+	1.4	1.4	0.6	0.6
Total	**100.0**	**100.0**	**100.0**	**100.0**

(1) As of 1 January 2012, the work cessation test is removed in accordance with the *Economic Recovery Act (stimulus)*.

(2) By 2016, the new pension adjustment factors for early or late pension take-up will be fully phased in accordance with the *Economic Recovery Act (stimulus)*.

The retirement pension expenditures for each year following the year of benefit take-up for a given age, sex, and cohort is computed as the product of:

- the population of retirement beneficiaries at emergence;

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

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

- the Pension Index, which recognizes the annual inflation adjustment to a pension each 1 January after the pension's emergence.

The mortality rates of CPP retirement beneficiaries used in the projections vary by age, sex, calendar year, and level of emerging pension. The mortality rates were developed based on CPP retirement beneficiaries' mortality experience over the period 1966 to 2012 and the July 2009 actuarial study of the mortality of CPP retirement and survivor beneficiaries (*Canada Pension Plan Mortality Study: Actuarial Study No. 7* by the Office of the Chief Actuary) adjusted to reflect recent experience and the mortality improvement assumptions for the general population in this report. The resulting mortality rates and life expectancies are shown in Tables 70, 71, and 72.

Table 70   Mortality Rates of Retirement Beneficiaries
(annual deaths per 1,000)

Age	Males				Females			
	2013	2025	2050	2075	2013	2025	2050	2075
60	5.6	4.6	3.7	3.0	3.3	2.8	2.3	1.9
65	12.1	9.9	8.1	6.6	7.6	6.5	5.3	4.3
70	18.2	14.6	11.9	9.7	11.8	10.0	8.2	6.7
75	30.2	23.6	19.2	15.7	19.6	16.6	13.6	11.1
80	52.1	41.7	34.1	27.9	34.7	29.6	24.2	19.8
85	90.8	75.3	63.3	53.5	62.5	54.2	45.6	38.5
90	157.3	137.8	121.9	108.1	114.1	101.3	89.7	79.6

Table 71   Life Expectancies of Retirement Beneficiaries[1]

Age	Males				Females			
	2013	2025	2050	2075	2013	2025	2050	2075
60	25.0	25.8	27.3	28.6	27.9	28.6	29.9	31.1
65	20.5	21.3	22.6	23.9	23.2	23.9	25.1	26.3
70	16.4	17.2	18.4	19.5	18.8	19.4	20.6	21.6
75	12.5	13.3	14.3	15.3	14.7	15.3	16.3	17.3
80	9.1	9.8	10.6	11.5	11.0	11.5	12.3	13.1
85	6.4	6.9	7.5	8.1	7.8	8.3	8.9	9.5
90	4.4	4.7	5.1	5.5	5.3	5.6	6.0	6.5

(1)   These are cohort life expectancies that take into account assumed future improvements in mortality of the general population and therefore differ from calendar year life expectancies, which are based on the mortality rates of the given attained year.
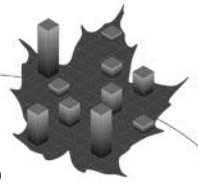
Table 72   Life Expectancies of Retirement Beneficiaries by Level of Pension (2013)[1]

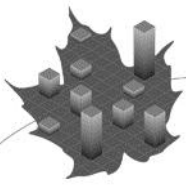| Age	CPP Level of Pension as % of Maximum Males				CPP Level of Pension as % of Maximum Females			
	< 37.5%	37.5-75%	75-100%	100%	< 37.5%	37.5-75%	75-100%	100%
60	23.5	24.1	25.2	26.2	27.3	28.2	28.5	29.1
65	19.5	19.7	20.5	21.5	22.7	23.4	23.6	24.2
70	15.8	15.8	16.4	17.1	18.5	18.9	19.1	19.5
75	12.1	12.1	12.5	13.0	14.5	14.8	14.9	15.2
80	8.9	8.9	9.1	9.5	10.8	11.0	11.2	11.3
85	6.2	6.2	6.4	6.6	7.7	7.8	7.9	8.0
90	4.3	4.3	4.4	4.4	5.3	5.3	5.4	5.4

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

The amounts of all retirement pensions payable during any given calendar year are obtained by simply summing the annual expenditures applicable for the year as described above, in respect of all age and sex cohorts having emerged in the given and all previous calendar years.

Based on comparisons between actual experience and projections for 1966 to 2012, experience adjustment factors at emergence are applied to all future emerging retirement pensions calculated using the methodology previously described, and are shown in Table 73. A final calibration factor based on experience for the benefits in pay is further applied to all future benefit in pay. Table 74 shows the projected number of new retirement beneficiaries along with their projected average monthly retirement benefits by sex and year.

Table 73   Retirement Benefit Experience Adjustment Factors

	Age at Emergence		
	60-65	66 and Over	All Ages
Males	0.99	0.57	0.97
Females	0.98	0.60	0.96

Table 74   New Retirement Pensions

	Number of Beneficiaries			Average Monthly Pension		
Year	**Males**	**Females**	**Total**	**Males**	**Females**	**Total**
				($)	($)	($)
2013	179,870	177,827	357,697	608.06	465.94	537.41
2014	172,094	173,329	345,423	615.31	479.62	547.22
2015	171,025	171,311	342,335	623.93	489.49	556.65
2016	168,128	169,415	337,543	633.46	501.33	567.14
2017	160,221	163,860	324,081	639.21	509.53	573.64
2018	170,629	173,706	344,334	655.55	525.89	590.14
2019	180,165	182,668	362,833	673.39	544.35	608.43
2020	190,175	191,523	381,697	689.47	561.03	625.02
2025	205,726	206,479	412,205	780.73	652.85	716.67
2030	195,791	197,154	392,945	899.02	774.87	836.73
2040	190,732	198,966	389,698	1,261.18	1,111.51	1,184.76
2050	236,017	238,878	474,895	1,768.56	1,580.40	1,673.91
2060	227,143	232,469	459,612	2,502.86	2,268.64	2,384.39

E.   Post-Retirement Benefits

Under the *Economic Recovery Act (stimulus)*, individuals younger than age 65 who receive the CPP retirement benefit and work, as well as their employers, are required to make CPP contributions. Contributing to the Plan is voluntary for retirement beneficiaries aged 65 to 69 who continue to work, but employers of those opting to continue to contribute to the CPP are required to contribute also. Contributions to the Plan are not permitted upon attaining age 70. Contributions from working beneficiaries will be applied toward providing a post-retirement benefit with the result that the total pension received from the combination of the retirement pension and the post-retirement benefit could exceed the maximum pension payable under the CPP. The post-retirement benefit is earned at a rate of 1/40th of the maximum pension amount for each year of additional contributions post-benefit take-up and is adjusted for the earnings level and age of the beneficiary. This working beneficiaries provision came into effect on 1 January 2012.

To estimate the cost impact of the working beneficiaries provision, it is first necessary to project the number and proportions of working beneficiaries by age and sex. To project these figures, Canada Revenue Agency and Service Canada data were used. The proportions of working beneficiaries by age and sex were derived from these data using years 2005 to 2009 to reflect recent experience. The proportions observed over those years were projected to 2012 based on the trends observed over the years 2005 to 2009. The projected proportions of working beneficiaries by age and sex for 2012 are also assumed to apply for all subsequent years in order to project the number of working CPP retirement beneficiaries. The assumed proportions are presented in Table 75. Since contributing to the Plan is voluntary for beneficiaries aged 65 to 69 who also work, the proportion of working beneficiaries aged 65 to 69 who contribute is assumed to be 50%, and this is reflected in the proportions shown in Table 75.
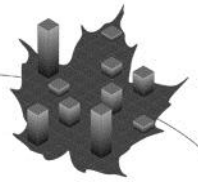
Table 75 Proportions of CPP Retirement Beneficiaries who are Contributors

Age	Males	Females
60	41.0%	31.0%
61	41.0%	33.0%
62	41.0%	31.0%
63	38.0%	29.0%
64	35.0%	25.0%
65	16.5%	12.0%
66	15.5%	11.5%
67	14.0%	10.5%
68	12.0%	7.5%
69	11.0%	7.0%

In order to project the additional contributions that will result from working beneficiaries, an assumption is required with respect to their average contributory earnings (i.e., average earnings between the YBE and YMPE on which contributions are made). Based on data for the years 2005 to 2009, the average contributory earnings of working beneficiaries aged 60 to 64 are about 35% to 45% lower than the contributory earnings of contributors of the same age who are not yet beneficiaries. For those aged 65 to 69, their contributory earnings are slightly lower than the contributory earnings of contributors who are not beneficiaries. Contributory earnings of working beneficiaries aged 60 to 64 are assumed to be 40% for males and 45% for females lower than for contributors of the same age who are not beneficiaries. For ages 65 to 69, contributory earnings of working beneficiaries are assumed to be 5% lower for both sexes than for contributors who are not beneficiaries. The resulting average annual contributory earnings for working beneficiaries are presented in Table 76.

Table 76 Average Contributory Earnings of Working Beneficiaries

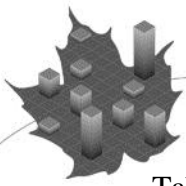| Year	Below Age 65		Age 65 and Above	
	Males	**Females**	**Males**	**Females**
	($)	($)	($)	($)
2013	20,336	15,639	23,813	19,988
2014	20,897	16,124	24,244	20,494
2015	21,464	16,619	24,671	21,012
2016	22,130	17,186	25,245	21,596
2017	22,660	17,656	25,846	22,231
2018	23,265	18,179	26,527	22,907
2019	23,954	18,740	27,250	23,628
2020	24,669	19,321	28,023	24,390
2025	29,287	23,096	32,566	28,644
2030	34,341	27,503	38,040	33,569
2040	47,416	38,307	51,899	46,496
2050	65,851	53,346	70,374	63,641
2060	91,854	74,676	94,690	86,241

Table 77 shows the projected number of working beneficiaries with the additional contributions and resulting post-retirement benefits by year. The additional contributions from working beneficiaries are projected to be about $838 million in 2012 and $4.2 billion by 2050. The post-retirement benefits start to be payable in 2013 and are projected to be about $62 million that year and $4.7 billion by 2050. The projected number of working beneficiaries who contribute, their corresponding earnings, and contributions are reflected in all other tables in this report that present contributors, earnings, and contributions projections, unless otherwise indicated. Similarly, the post-retirement benefits are presented in combination with the retirement benefits as total retirement expenditures in all other tables in this report where expenditures are shown by type of benefit.

Table 77   Working Beneficiaries – Contributors, Contributions, and Post-Retirement Benefits

| Year	Number of Contributing Working Beneficiaries (000s)	Total Contributions ($ million)	Total Post-Retirement Benefits ($ million)
2012	431	838	-
2013	458	914	62
2014	478	979	129
2015	493	1,035	202
2016	504	1,089	280
2017	506	1,123	362
2018	509	1,162	448
2019	516	1,213	536
2020	526	1,275	628
2025	578	1,655	1,169
2030	558	1,889	1,824
2040	539	2,499	3,180
2050	651	4,158	4,718
2060	658	5,799	7,101

F.   Disability Expenditures

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

- the population;
- the probability of being eligible for disability benefits;
- the actual or assumed disability incidence rate; and
- the annual amount of the benefit (flat-rate and average earnings-related benefits).

The value of the emerging earnings-related benefit by age and sex is equal to 75% of the average retirement earnings-related benefit adjusted upward to reflect the fact that eligibility rules are more stringent for disability than for retirement benefits. These emerging benefits are then projected by age and sex for each future year until termination (due to recovery, death, or
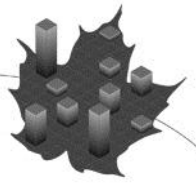
attainment of age 65) using the disability termination rates for the appropriate duration and the Pension Index. Historical and projected disability incidence rates are shown in Chart 11 and Table 78, respectively.

**Chart 11   Historical Disability Incidence Rates**
(per 1,000 eligible)
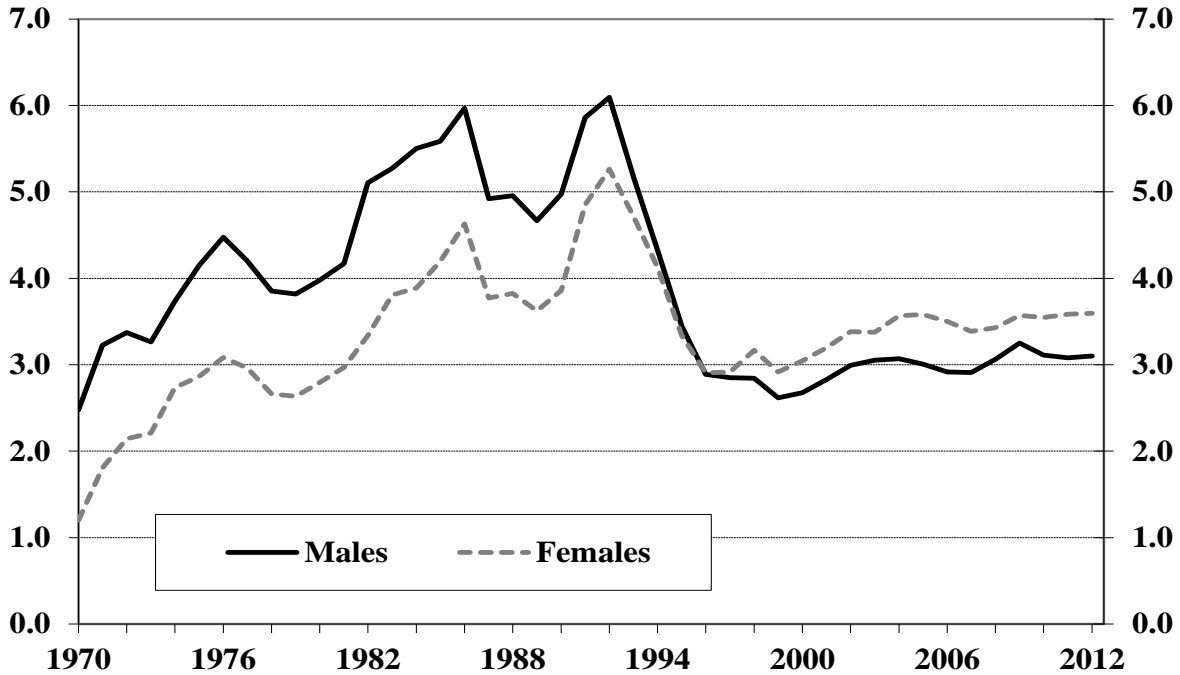
Table 78   Ultimate Disability Incidence Rates (2017+)[1]
(per 1,000 eligible)

Age	Males	Females
25	0.39	0.36
30	0.67	0.87
35	1.09	1.56
40	1.58	2.28
45	2.56	3.49
50	4.00	4.92
55	7.12	7.68
60	10.96	10.59
61	11.25	10.73
62	11.54	10.86
63	11.85	11.00
64	12.16	11.14
All Ages	**3.30**	**3.75**

(1)   The disability incidence rates shown are adjusted by the eligible population in 2012.

It can be seen from Chart 11 that the incidence of new CPP disability cases (i.e. the number of new cases as a proportion of the eligible population) generally increased from 1970 to the early
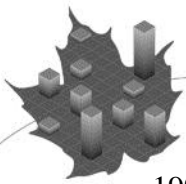
1990s. The annual rate of change in incidence rates was particularly acute between 1989 and the recession of the early 1990s. After reaching a peak in 1992, disability incidence rates then declined rapidly during the 1990s and have remained relatively stable since the early 2000s up to recently. The decline after 1992 reflects the economic recovery that occurred following the 1990-91 recession as well as the administrative changes put in place in the mid-1990s. The following changes to the CPP disability program contributed to the reduction in disability incidence rates:
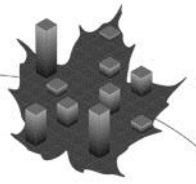
- beginning in 1994, the CPP administration initiated a range of measures designed to effectively manage the growing pressure on the disability program;

- in September 1995, the guidelines for the determination of disabilities were revised to put the emphasis back on a medical basis and to de-emphasize the use of socioeconomic 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 and the fact that the overall female incidence rate has been higher than the overall male incidence rate since 1996, the aggregate (all ages combined using the 2012 population for weights) ultimate incidence rate for 2017 and thereafter is projected to be 3.30 and 3.75 per thousand eligible for males and females, respectively. These projected ultimate aggregate rates are then distributed by age in accordance with the 2012 eligible population for each sex. The projected ultimate aggregate rates take into account the adjustments for the 2008 amendments to the Plan and correspond to the average experience over the years 1998 to 2012.

For year 2012, the male and female disability incidence rates are determined to be 3.10 and 3.59 per thousand eligible, respectively. For the years 2013 to 2016, the male and female rates by age are then assumed to increase gradually from their 2012 levels toward their assumed aggregate ultimate levels in 2017 and thereafter.

The projected disability termination rates presented in Table 79 apply by age, sex, and duration of disability (i.e. receipt of the disability benefit) on an attained calendar year basis. The average graduated experience over the period 1997 to 2011 is used to produce base year rates for 2010 from which termination rates are projected for 2013 and thereafter. For 2013 and subsequent calendar years, the disability termination rates are projected for each sex by age at onset of disability and duration of disability, based on expected corresponding recovery and mortality improvement rates.

Both recovery and mortality improvement rates for disability beneficiaries are assumed to trend to ultimate levels by 2018. Recovery improvement rates are assumed to trend to an ultimate level of 0% (i.e. recovery rates are assumed to be constant after 2018), since the degree to which recovery from disability occurs can vary significantly by age, sex, and year. Mortality improvement rates of disability beneficiaries are assumed to trend to an ultimate level of 0.8%, which is consistent with the assumed ultimate mortality improvement rate for the general CPP population aged younger than 65.

Table 79 Disability Termination Rates in 2013 and 2030
(per 1,000 people)

	2013											
	Males						Females					
Age	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	45	54	62	51	51	23	33	48	46	46	48	24
40	43	47	46	28	29	19	32	49	43	28	30	17
50	73	82	54	39	35	24	52	66	47	31	24	16
60	80	80	53	41	42	0	55	60	36	30	29	0

	2030											
	Males						Females					
Age	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	39	50	61	49	49	21	29	46	46	45	49	24
40	37	43	44	27	27	17	28	46	42	27	30	17
50	62	76	51	37	33	22	45	62	46	30	23	15
60	68	73	48	38	38	0	47	55	33	28	26	0

Based on comparisons of actual results and projections for 1966 to 2012, experience adjustment factors are applied to all future emerging disability pensions calculated using the methodology described above. These factors appear in Table 80.

Table 80 Disability Benefit Experience Adjustment Factors

	Number	Average Benefit
Males	1.00	0.94
Females	1.01	0.89

Table 81 shows the projected number of new disability beneficiaries along with their projected average disability benefit by sex and year.

Table 81   New Disability Pensions

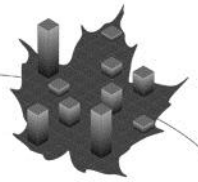|	Number of Beneficiaries			Average Monthly Pension			Average Pension as % of Maximum	
Year	Males	Females	Total	Males	Females	Total	Males	Females
				($)	($)	($)	(%)	(%)
2013	19,452	20,013	39,464	944.32	860.10	901.61	77.9	70.9
2014	19,869	20,383	40,252	961.83	878.52	919.64	77.7	71.0
2015	20,607	20,950	41,557	980.74	898.85	939.46	77.5	71.0
2016	21,205	21,434	42,639	1,001.10	920.46	960.56	77.2	71.0
2017	21,817	21,952	43,769	1,020.89	941.82	981.23	77.0	71.1
2018	22,295	22,416	44,711	1,041.90	964.20	1,002.94	76.8	71.1
2019	22,597	22,730	45,327	1,063.93	987.48	1,025.59	76.5	71.0
2020	22,673	22,825	45,499	1,087.53	1,012.14	1,049.71	76.3	71.0
2025	23,164	23,564	46,729	1,235.62	1,161.46	1,198.22	75.5	70.9
2030	23,433	24,353	47,786	1,424.28	1,343.76	1,383.25	75.1	70.9
2040	25,887	27,012	52,899	1,906.90	1,809.29	1,857.05	74.7	70.9
2050	27,653	28,502	56,155	2,549.26	2,436.08	2,491.81	74.1	70.8
2060	27,244	28,683	55,927	3,413.42	3,267.67	3,338.67	73.3	70.2

G.   Survivor Expenditures

Starting in 1968, the number of male and female contributor deaths, derived from the demographic projections for each individual aged 18 and over, is multiplied by the survivor eligibility rates and the proportion of contributors married or in a common-law partnership at the time of death to produce the number of survivor beneficiaries emerging by age, sex, and calendar year.

For each age and sex, the actual proportions of contributors married or in a common-law relationship at the time of death are determined from benefit statistics. The smoothed averages from recent experience over the years 2009 to 2011, with further adjustments for younger and older ages, are used to determine the assumed proportions for future years. On the basis of the trends shown over the period 1999 to 2011, the proportions are extrapolated to 2014 and kept constant thereafter. These proportions account for benefits extended to same-sex couples. Values are shown in Table 82.

For the purpose of projecting emerging survivor pensions, the number of spousal deaths by sex and calendar year was categorized by the age of the surviving spouse using the age distributions of spouses, and each resulting number was multiplied by:

- the annual amount of the benefit (flat-rate and average earnings-related benefits);

- the probability of the deceased contributor being eligible for a survivor benefit;

- the appropriate factor taking into account the reductions to survivor pensions in respect of survivors emerging under age 45 without dependent children and who are not disabled; and

- if applicable, the appropriate factor taking into account the limits applying to combined survivor-disability pensions and/or to combined survivor-retirement pensions.

The value of the emerging earnings-related survivor benefit is equal to 37.5% or 60% of the average retirement earnings-related benefit depending on whether the surviving spouse or common-law partner is under age 65 or aged 65 or older. It is further adjusted upward to account for the fact that eligibility rules are more stringent for survivor benefits than for retirement benefits.

All survivor pensions emerging by year, age, and sex of the surviving spouse or common-law partner are then projected to each subsequent year using the Pension Index and assumed mortality rates to reflect the higher mortality of widows and widowers as compared to that of the general population. The assumed survivor mortality rates are developed based on survivor beneficiaries' mortality experience over the period 1966 to 2012 and the July 2009 actuarial study of the mortality of CPP retirement and survivor beneficiaries (*Canada Pension Plan Mortality Study: Actuarial Study No. 7* by the Office of the Chief Actuary) adjusted to reflect recent experience and the mortality improvement assumptions for the general population in this report.
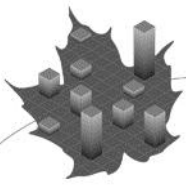
Based on comparisons of actual results and projections for 1966 to 2012, experience adjustment factors are applied to survivor pensions, calculated using the methodology described above. Survivor experience adjustment factors reflect both methodology and assumption adjustments. The adjustment factors for the number of survivors and average amounts of benefits correspond to the average of the last five known values (2008-2012) and are shown in Table 83. The projected number of new survivor beneficiaries and average monthly survivor pensions by sex for selected years are shown in Table 84.

Table 82   Proportion of Contributors Married or in Common-Law Relationship at Death

Age	Males	Females
	(%)	(%)
20	2	1
30	24	30
40	52	63
50	58	65
60	64	58
70	70	49
80	67	30
90	52	10

Table 83   Survivor Benefit Experience Adjustment Factors

	Number	Average Benefit
Widows	1.04	1.00
Widowers	0.95	0.79

Table 84   New Survivor Pensions

	Number of Beneficiaries			Average Monthly Pension	
Year	Under 65	65 and Over	Total	Under 65	65 and Over
				($)	($)
2013	23,614	49,754	73,369	391.27	294.36
2014	23,765	51,241	75,006	398.43	297.81
2015	23,831	52,521	76,352	405.91	300.41
2016	23,863	53,891	77,754	414.19	303.59
2017	23,856	55,346	79,202	423.07	306.14
2018	23,888	56,890	80,778	432.17	309.91
2019	23,973	58,536	82,509	441.69	314.45
2020	23,985	60,277	84,262	451.63	319.90
2025	23,872	70,584	94,456	510.37	358.63
2030	23,646	83,260	106,905	582.68	416.86
2040	23,169	105,638	128,807	774.76	574.27
2050	23,195	115,051	138,246	1,037.87	778.05
2060	22,274	116,890	139,164	1,389.64	1,058.31

H. Death Expenditures

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

- the number of deaths, derived for individuals aged 18 and over, consistent with the population data and projections;

- 50% of the average annual earnings-related benefit (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 a maximum of 10% of the YMPE for the year of death prior to 1998 and to $2,500 thereafter; and

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

Based on the comparison of actual results and projections for the years 1966 to 2012, experience adjustment factors were derived. To account for the maximum death benefit, which is set at $2,500 for 1998 and thereafter, initial adjustment factors for average benefits are set at their current level and then are gradually increased to a value of one for the year 2030 and thereafter for both males and females. Table 85 shows the experience adjustment factors, and Table 86 shows the projected number of death benefits by sex for selected years.

Table 85   Death Benefit Experience Adjustment Factors

	Initial		Ultimate	
	Number	**Average Benefit**	**Number**	**Average Benefit**
Males	0.94	0.95	0.93	1.00
Females	1.00	0.89	1.00	1.00

Table 86   Number of Death Benefits

| Year	Males	Females	Total
2013	83,667	53,090	136,757
2014	85,253	54,939	140,192
2015	86,763	56,805	143,569
2016	88,381	58,780	147,161
2017	90,033	60,773	150,806
2018	91,814	62,842	154,656
2019	93,812	65,004	158,816
2020	96,023	67,205	163,228
2025	108,088	79,743	187,831
2030	123,541	95,249	218,790
2040	155,679	131,605	287,284
2050	175,374	161,246	336,620
2060	180,652	172,583	353,235

I.   Children's Expenditures

The number of disabled contributor's child and orphan benefits emerging each year starting in 1970 and 1968, respectively, are determined using the assumed fertility rates to correspond to the number of children of emerging beneficiaries of disability and/or survivor pensions. The resulting number of emerging child beneficiaries by age, sex, and calendar year are thereafter projected 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 (by reason of recovery, death, or attainment of age 65) of the parent's disability benefits.

Total eligible children's benefits are then obtained for any given calendar year as the product of the aggregate number of child beneficiaries who emerged before and during the year and survived to the applicable year, and the applicable annualized amount of the child flat-rate benefit obtained by adjusting the 2013 rate in accordance with the Pension Index.

Based on historical data from 1966 to 2012, the assumption for the number of children under age 18 is adjusted by a factor of about 0.90 for both disabled contributors' children and orphans. The
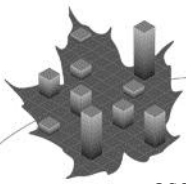
assumption for the number of children aged 18 and over attending school full-time is adjusted by a factor of about 0.59 for both disabled contributors' children and orphans. Table 87 shows the projected number of new children's benefits by type and year.

Table 87   New Children's Benefits

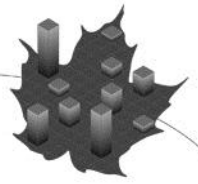| Year	Disabled Contributor's Child	Orphans	Total
2013	15,334	10,355	25,689
2014	15,926	10,515	26,440
2015	16,542	10,554	27,096
2016	17,015	10,561	27,575
2017	17,568	10,560	28,128
2018	17,994	10,582	28,575
2019	18,450	10,670	29,120
2020	18,787	10,729	29,516
2025	20,709	11,110	31,818
2030	22,626	11,676	34,302
2040	24,776	12,076	36,851
2050	25,088	11,376	36,464
2060	26,352	10,953	37,305

J.   Operating Expenses

The operating expenses of the CPP have historically arisen from different sources including the Department of Employment and Social Development Canada, the Canada Revenue Agency, Public Works and Government Services Canada, the Office of the Superintendent of Financial Institutions Canada, the Department of Finance Canada, and the CPPIB. Since the 23rd CPP Actuarial Report, operating expenses from all above-mentioned sources were projected as part of the same assumption. In response to a recommendation made by the independent peer reviewers of the 25th CPP Actuarial Report, operating expenses of the CPPIB are now included in the investment expenses assumption. In the calendar year 2012, operating expenses from all sources other than the CPPIB amounted to about $735 million, of which $108 million was a one-time charge for the settlement of legal proceedings for medical adjudicators. Another $61 million of this settlement remains to be charged in 2013.

Based on recent experience from 2008 to 2012, the annual operating expenses (excluding the CPPIB and the one-time charge described above) were on average 0.097% of total annual employment earnings, and were 0.107% in 2012. The large increase in the CPP operating expenses for 2012 is in part a consequence of implementation costs resulting from the changes emanating from the *Economic Recovery Act (stimulus)*, which should not be permanent. In light of the above, it is assumed that the CPP operating expenses will represent 0.097% of total annual earnings for 2013 and thereafter which equals the average over the last 5 years. However, considering the remaining $61 million to be charged in 2013 for the settlement of legal proceedings, the 2013 operating expenses assumption is increased to 0.107% of total annual earnings.

Since the working beneficiaries provision only took effect in 2012, the total employment earnings basis used in the determination of the assumption and projection of operating expenses exclude

earnings from working beneficiaries. For future CPP actuarial reports, as experience data on working beneficiaries become available, the relative basis will be changed to include working beneficiaries' earnings.

Table 88 shows total operating expenses as a percentage of total earnings over the last three years 2010 to 2012 as well as their projected values.

Table 88   Operating Expenses[1]
($ million)

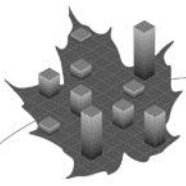| Year	Operating Expenses	Total Earnings[2]	Operating Expenses as % of Total Earnings
			(%)
2010	550	539,374	0.102
2011	530	564,108	0.094
2012	626	585,042	0.107
2013	648	605,660	0.107
2014	610	629,007	0.097
2015	634	653,488	0.097
2020	765	788,499	0.097
2025	928	957,019	0.097
2030	1,130	1,164,826	0.097
2040	1,673	1,724,896	0.097
2050	2,441	2,516,473	0.097

(1)   For this report, CPPIB operating expenses are not included in Plan operating expenses, but are accounted for separately in the investment expenses assumption. This represents a change from previous CPP actuarial reports.

(2)   Total earnings used to project operating expenses exclude earnings from working beneficiaries.

VI.   Net Assets as at 31 December 2012

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, projected investment income and contribution revenues of the given year and then subtracting the projected benefits and operating expenses of the given year.

The actual value of the CPP assets on a market value accrual basis as at 31 December 2012 was $175,095 million. This is the sum of the CPP Account ($133 million) and the CPPIB invested assets ($172,581 million) for a total of $172,714 million before being adjusted by the amounts receivable minus amounts payable. The CPP Account was established to record the contributions, interest, pensions, other benefits and operating expenses. It also records the amounts transferred to and received from the CPPIB. The receivables include the contributions due but not yet deposited into the CPP Account, benefit overpayments, and net transfers between the CPP and the QPP for dual contributors. The amounts payable include operating expenses, pensions and other benefits, as well as amounts due to the Canada Revenue Agency. Table 89 reconciles the assets as at 31 December 2012.
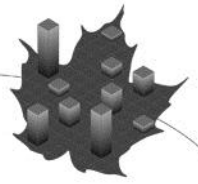
Table 89   Net Assets as at 31 December 2012
($ million)

CPP Account	133
CPPIB Invested Assets	172,581
Subtotal CPP Account and CPPIB Invested Assets	**172,714**
Plus Amounts Receivable	
Contributions	2,652
Benefit Overpayments	3
Net Transfers Due from QPP	117
Minus Amounts Payable	
Operating Expenses	4
Pensions and Other Benefits	250
Amounts Due to the Canada Revenue Agency	137
Net Assets	**175,095**

Appendix F – Acknowledgements

Service Canada provided statistics on the Canada Pension Plan contributors, beneficiaries, and assets.

The CPP Investment Board provided data on the Canada Pension Plan assets.

Statistics Canada provided information on Canadian demographic and economic variables.

The Canadian Human Mortality Database (CHMD) created by the Department of Demography, Université de Montréal has been used for the historical mortality data.

The Canada Revenue Agency provided information on Canada Pension Plan contributors and contributions.

The co-operation and able assistance received from the above-mentioned data providers deserve to be acknowledged.

The following people assisted in the preparation of this report:

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