



Office of the Superintendent of  
Financial Institutions Canada

Bureau du surintendant des  
institutions financières Canada

Office of the Chief Actuary

Bureau de l'actuaire en chef



# ACTUARIAL REPORT

25<sup>th</sup>

on the

# CANADA PENSION PLAN

as at 31 December 2009

**Office of the Chief Actuary**

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3 November 2010

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

Dear Minister:

In accordance with section 115 of the *Canada Pension Plan*, 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-Fifth Actuarial Report on the Canada Pension Plan, prepared as at 31 December 2009.

Yours sincerely,

A handwritten signature in black ink that reads "Jean-Claude Ménard". The signature is written in a cursive, flowing style.

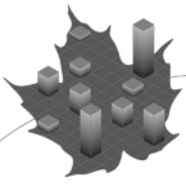
Jean-Claude Ménard, F.S.A., F.C.I.A.  
Chief Actuary





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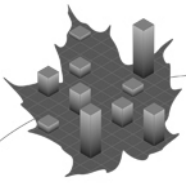
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## I. Executive Summary

This is the Twenty-Fifth 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 2009. The previous triennial report was the 23<sup>rd</sup> Actuarial Report on the Canada Pension Plan as at 31 December 2006, which was tabled in the House of Commons on 29 October 2007. An independent panel of actuaries reviewed the 23<sup>rd</sup> CPP Actuarial Report and released a report in March 2008. The Office of the Chief Actuary gave due consideration to the review panel’s recommendations and action was taken accordingly.

The Canada Pension Plan was subject to a series of amendments since the 23<sup>rd</sup> CPP Actuarial Report pursuant to the adoption of Bill C-51 – *Economic Recovery Act (stimulus)*. Part 2 of Bill C-51 amended the *Canada Pension Plan* by allowing for the combination of any level of work income with receipt of the retirement pension, enhanced benefit coverage by providing the accrual of post-retirement benefits, and improved fairness in the pension adjustment factors for pension take-up prior to and after age 65. The amendments are described further in detail in section III Best-Estimate Assumptions of this report, and the details of the cost impact of the amendments can be found in the 24<sup>th</sup> CPP Actuarial Report, which was tabled in the House of Commons on 19 October 2009.

Bill C-51 received Royal Assent on 15 December 2009. According to the *Canada Pension Plan*, the formal approval of at least two-thirds of the provinces representing two-thirds of the population is required in order for amendments to the CPP to come into force. The changes to the *Canada Pension Plan* contained within Bill C-51 have received provincial approval. One set of changes comes into force on 1 September 2010, and the remaining changes will come into force on 1 January 2012. The amendments to the accompanying Regulations are expected to receive provincial approval in due course. This 25<sup>th</sup> CPP Actuarial Report includes the amendments to the Plan under Bill C-51.

### 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. The ministers may also recommend changes to the pension adjustment factors when they are specified by the Chief Actuary in his or her report. Section 113.1 identifies the factors they 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 income, expenditures and assets of the Plan over the next 75 years. Section V presents the reconciliation of the results with those presented in the 23<sup>rd</sup> CPP Actuarial Report. Section VI deals with the uncertainty of results and presents the impact that asset allocation and financial market volatility have on the financial status of the Plan. Section VI also includes a sensitivity analysis of the key best-estimate assumptions based on stochastic approaches. Section VII presents a general conclusion about the financial status of the Plan, while section VIII provides the actuarial opinion.

The various appendices provide supplemental information on the long-term financial sustainability of the Plan, the Plan provisions, a detailed reconciliation of the results with the previous triennial report and a description of the data, the assumptions and methods 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%, total assets are expected to increase significantly over the next 11 years and then will continue increasing at a slower pace. Total assets are expected to grow from \$127 billion at the end of 2009 to \$275 billion by the end of 2020. The ratio of assets to the following year's expenditures is projected to grow from 3.9 in 2010 to 4.7 by 2020 and 5.2 by 2050.
- With the legislated contribution rate of 9.9%, contributions are projected to be more than sufficient to cover the expenditures over the period 2011 to 2020. Thereafter, a proportion of investment income is required to make up the difference between contributions and expenditures. In 2050, 29% of investment income is required to pay for benefits.
- The minimum contribution rate, which is the lowest rate sufficient to sustain the Plan with respect to the two financing objectives without further increase, is 9.86% of contributory earnings for years 2013 to 2022 and 9.85% for years 2023 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 2010-2012.
- The minimum contribution rate consists of two separate components. First, the steady-state contribution rate, which is the lowest contribution rate that generally stabilizes the ratio of assets to expenditures over the long term, before the consideration of any full funding of increased or new benefits, is 9.84%. The steady-state rate is constant throughout the projection period and finances the Plan



without the full funding requirement. The second component is the full funding rate that is required to fully fund the expanded eligibility for disability benefits for long-term contributors following the amendments to the *Canada Pension Plan* in 2008. The full funding rate is 0.02% for years 2010 to 2022 and 0.01% for years 2023 and thereafter.

- With the minimum contribution rate of 9.86%, applicable for years 2013 to 2022 and 9.85% 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 3.9 in 2010 to 4.7 by 2022 and to be the same fifty years later in 2072.
- The number of contributors is expected to grow from 12.6 million in 2010 to 14.3 million by 2020. Contributions are expected to increase from \$37 billion in 2010 to \$56 billion in 2020.
- The proportion of retirement benefits relative to total expenditures is expected to increase from 72% in 2010 to 82% in 2050.

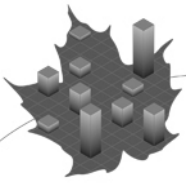
#### **D. Uncertainty of Results**

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.

A test focuses on 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 towards 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 such poor investment returns occurring.

Following the economic slowdown experienced since the last actuarial report, a sensitivity test was created to analyze the capacity of the CPP to withstand another such slowdown in the near future. This sensitivity test assumes that another economic slowdown occurs in 2012 before the economy is able to recover from the most recent slowdown. The impact on the minimum contribution rate would be relatively small if it is assumed that only the unemployment rate and real-wage differential are affected. However, if another large investment loss occurs, then this could result in the minimum contribution rate exceeding the legislated rate of 9.9%.

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



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Plan. These tests show that the minimum contribution rate could deviate significantly from its best-estimate of 9.85% if other than best-estimate assumptions were to be realized.

If recent short-term improvements in life expectancies continue, especially for ages 75 to 89, the long-term 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%.

Finally, two demographically based scenarios were developed that portray a generally younger and older population. These scenarios produced minimum contribution rates of 9.06% and 10.41%, respectively.

#### **E. Conclusion**

The results contained in this report confirm that the legislated contribution rate of 9.9% is sufficient to pay future expenditures and to accumulate assets worth \$275 billion (i.e. 4.7 times the annual expenditures) in 2020.

The minimum contribution rate required to financially sustain the Plan under this report is 9.86% for years 2013 to 2022 and 9.85% for years 2023 and thereafter, compared to 9.82% as determined for the 23<sup>rd</sup> CPP Actuarial Report. Experience over the period 2007 to 2009 was worse than anticipated overall, thus putting upward pressure on the minimum contribution rate. Investment losses and higher life expectancy increased the rate. Fertility, migration, and economic experience were all higher than expected and thus partially offset the impact on the minimum contribution rate. However, lower inflation expectations, lower assumed rates of return on investments, and expected continuing decreases in mortality rates, especially at the older ages, result in an overall increase to the rate.

Under the 9.9% legislated contribution rate, the assets are projected to grow rapidly over the next 11 years 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 5.2 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.



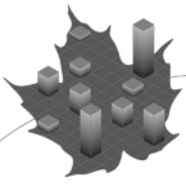
## II. Methodology

The actuarial examination of the Canada Pension Plan (CPP or the “Plan”) involves projections of its revenue and expenditures over a long period of time, so that the future impact of historical and projected trends in demographic and economic factors can be properly assessed. The actuarial estimates in this report are based on the current provisions of the *Canada Pension Plan* as well as the amendments to the Plan under Part 2 of Bill C-51 – *Economic Recovery Act (stimulus)*, data regarding the starting point for the projections, and “best-estimate” assumptions regarding future demographic and economic experience. The details of the amendments to the *Canada Pension Plan* under Bill C-51 and the cost impact on the Plan can be found in the 24<sup>th</sup> CPP Actuarial Report.

The revenue of the Plan includes 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.

Expenditures are made up of the benefits paid out and administrative expenses. Newly emerging benefits are projected by applying demographic assumptions regarding retirement, disability and death to the eligible populations, together with the benefit provisions and the earnings histories of the participants. The projection of total benefits, which includes the continuation of benefits already in pay at the valuation date, requires further assumptions, along with an assumption regarding the rate of increase in prices. Administrative expenses are projected by considering the historical relationship between expenses and total employment earnings, as well as the assumed short-term growth in operating expenses of the Canada Pension Plan Investment Board (CPPIB).

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 improved disability benefits (lower required minimum qualifying period for long-time contributors) following the 2008 amendments to the Plan and is referred to as the “steady-state” contribution rate. It is defined as the lowest level contribution rate applicable after the end of the review period, to the nearest 0.001%, that results in the ratio of assets at the end of a year to expenditures of the following year (the asset/expenditure ratio) being the same in the 10<sup>th</sup> and 60<sup>th</sup> year following the end of the review period. For this Report, the end of the review period is 2012. Therefore, the steady-state contribution rate is applicable for years 2013 and thereafter, and the relevant years for the determination of the steady-state contribution rate are 2022 and 2072. The second component of the minimum contribution rate consists of the full funding rate required



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to fully fund the improved disability benefits following the 2008 amendments to the Plan. Both the steady-state rate and the full funding rate are rounded to the nearest 0.01%.

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

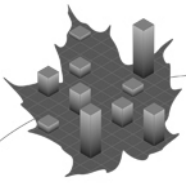
#### A. Introduction

The information required by statute, which is presented in section IV of the 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 23<sup>rd</sup> Actuarial Report on the CPP (the previous triennial report on the Plan) and released a report in March 2008. 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 23<sup>rd</sup> CPP Actuarial Report was prepared in accordance with professional standards of practice and statutory requirements. The Review Panel found that the 23<sup>rd</sup> 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, and communication of results. 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 document adequately addressed the issues set out in the terms of reference. For this 25<sup>th</sup> Actuarial Report on the CPP, the OCA gave due consideration to the review panel's recommendations and acted on them accordingly.

The Canada Pension Plan was subject to a series of amendments since the 23<sup>rd</sup> CPP Actuarial Report pursuant to adoption of Part 2 of Bill C-51 – *Economic Recovery Act (stimulus)*. Bill C-51 amends the *Canada Pension Plan* as follows:

- To remove the Work Cessation Test as of 1 January 2012 for those who opt for their retirement benefit prior to age 65.
- To increase the General Drop-Out Provision from 15 percent to 16 percent in 2012 and 17 percent in 2014.
- Starting 1 January 2012, individuals under age 65 who receive a retirement benefit and work, as well as their employer, will be required to make CPP contributions that will increase their retirement benefit. For individuals aged 65 to 69, contributing after starting their retirement benefit will be voluntary, but employers of those opting to participate in the Plan will be required to contribute. As under the current Plan, contributions are not permitted once age 70 is reached.



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- To change the pension adjustment factors in order to gradually restore the factors to their actuarially fair values.
- For early take-up (before age 65, earliest at age 60) of the retirement pension, the downward pension adjustment factor is increased from 0.5% to 0.6% for each month between the start of the pension and age 65. This reduction is permanent and will be implemented gradually over the five-year period 2012-2016.
- For late take-up (after age 65) of the retirement pension, the upward pension adjustment factor is increased from 0.5% to 0.7% for each month between age 65 and the start of the pension (latest age 70). This increase is permanent and will be implemented over the three-year period 2011-2013.
- To require the Chief Actuary to report on the fair level of the pension adjustment factors in at least every third Actuarial Report (and more frequently, if required) starting in 2016.

The details of the cost impact of the amendments of Bill C-51 can be found in the 24<sup>th</sup> CPP Actuarial Report, which was tabled on 19 October 2009 in the House of Commons. Bill C-51 received Royal Assent on 15 December 2009. According to the *Canada Pension Plan*, the formal approval of at least two-thirds of the provinces representing two-thirds of the population is required in order for amendments to the CPP to come into force. The changes to the *Canada Pension Plan* contained within Bill C-51 have received provincial approval. One set of changes comes into force on 1 September 2010, and the remaining changes will come into force on 1 January 2012. The amendments to the accompanying Regulations are expected to receive provincial approval in due course. This 25<sup>th</sup> CPP Actuarial Report includes the amendments to the Plan under Bill C-51.

In addition, materials presented during a recent conference and seminar were used by the Office of the Chief Actuary in preparing this report. Specifically, the Office of the Superintendent of Financial Institutions Canada (OSFI) and the Department of Human Resources and Skills Development Canada co-hosted the 16<sup>th</sup> International Conference of Social Security Actuaries and Statisticians in Ottawa, Canada from the 16<sup>th</sup> to 18<sup>th</sup> of September 2009. The Conference covered four themes relating to improvements in life expectancy and the sustainability of social security schemes, optimal financing and self-adjusting mechanisms for sustainable retirement systems, the financial crisis and its impact on the long-term sustainability of pension plans, and assumptions in the actuarial evaluation process. International experts in the fields of actuarial science, statistics, and economics gave presentations and discussed current issues affecting social security systems around the globe. Representatives of the OCA also attended a seminar on the demographic, economic and financial outlook for 2009-2030 held by the Québec Pension Plan (QPP) on 27 November 2009. The various presentation materials from both the Conference and QPP seminar 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 D of this report.





**Table 1 Best-Estimate Demographic and Economic Assumptions**

Canada	25 <sup>th</sup> Report (as at 31 December 2009)		23 <sup>rd</sup> Report (as at 31 December 2006)	
Total fertility rate	1.65 (2015+)		1.6 (2010+)	
Mortality	Canadian Human Mortality Database (CHMD 2006) with assumed future improvements		2000-02 Life Tables for Canada with assumed future improvements	
Canadian life expectancy at birth in 2010	Males	Females	Males	Females
at age 65 in 2010	85.4 years	88.3 years	84.7 years	87.9 years
Net migration rate	0.58% of population for 2023+		0.54% of population for 2020+	
Participation rate (age group 15-69)	75.2% (2030)		74.2% (2030)	
Employment rate (age group 15-69)	70.6% (2030)		69.4% (2030)	
Unemployment rate	6.1% (2022+)		6.3% (2007+)	
Rate of increase in prices	2.3% (2019+)		2.5% (2016+)	
Real-wage differential	1.3% (2019+)		1.3% (2015+)	
Real rate of return	4.0% (2017+)		4.2% (2016+)	
Retirement rates for cohort at age 60	Males	38% (2016+)	Males	40% (2009+)
	Females	41% (2016+)	Females	45% (2009+)
CPP disability incidence rates (per 1,000 eligible)	Males	3.3 (2015+)	Males	3.5 (2011+) <sup>(1)</sup>
	Females	3.6 (2015+)	Females	3.8 (2011+) <sup>(1)</sup>

(1) The disability incidence rates of the 23<sup>rd</sup> CPP Actuarial Report have been adjusted to reflect the new methodology.

## B. Demographic Assumptions

The population projections start with the Canada and Québec populations on 1 July 2009, 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 over the last three decades, relative to the baby boom generation born between the mid-1940s to the mid-1960s. The total fertility rate in Canada has dropped rapidly from an average level of about 4.0 per woman in the 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. In recent years, the total fertility rate for Canada has risen to over 1.6. Canada is one of many industrialized countries that have seen an increase in their fertility rates in recent years.

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. The increase in the Québec rate has been significant in recent years, the rate reaching over 1.7 in 2008. In 2006, the Québec rate exceeded Canada's level for the first time since 1958.

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 total fertility rates have increased in recent years, 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 decrease slightly from its 2007 level of 1.66 to an ultimate level of 1.65 in 2015. The total fertility rate for Québec is assumed to decrease from its 2008 level of 1.74 to the same ultimate level of 1.65 in 2015. The ultimate levels for Canada and Québec are set to be the same since the gap between the rates for Canada and Québec is assumed to disappear over time.

## 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 33% between 1966 and 2006, rising from 13.6 to 18.1 years. For women, life expectancy at age 65 (without future improvements) increased 25%, from 16.9 to 21.2 years over the same period. Although the overall rates of increase in life expectancy since 1966 are relatively similar for males and females, more than half of the increase in life expectancy at age 65 occurred after 1991 for males, while for females, 65% 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 2006. 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 year 2031 correspond to about half the average rates experienced for females over the 15-year period ending in 2006. Rates of improvement for the period 2007 to 2011 are assumed to vary by age and sex, and correspond to the average rates experienced over the 15-year period ending in 2006. After 2011, the rates are assumed to gradually reduce to their ultimate levels in 2031.

## 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.

An ultimate best-estimate assumption of 0.58% of the population has been established for years 2023 and thereafter. However, the net migration rate based on average experience over the last three years (2007-2009) was 0.62% and over the last 30 years (1980-2009) was 0.53%. Based on a continuation of the average experience over the last 30 years, it is assumed that net migration rates will reduce from 0.62% to 0.53% by 2014 and remain stable



at that level until 2018. In the long run, a possible labour shortage resulting from the retirement of the baby boom generation could prompt an increase in immigration to supply the required workforce. This is why the net migration rate is projected to increase from 0.53% in 2018 to 0.58% in 2023. The ultimate net migration rate represents the average experience over the last 15 years. In projecting the Québec population, the net migration rate averages 0.4% 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 by more than half during the projection period, from 4.6 in 2010 to 2.2 in 2050.

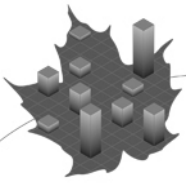
**Table 2 Population of Canada less Québec**  
(thousands)

Year	Total	Age 0-19	Age 20-64	Age 65 and Over	Ratio of 20-64 to 65 and Over
2010	26,198	6,098	16,486	3,615	4.6
2011	26,485	6,085	16,675	3,726	4.5
2012	26,769	6,083	16,804	3,882	4.3
2013	27,050	6,091	16,925	4,034	4.2
2014	27,328	6,107	17,040	4,180	4.1
2015	27,606	6,127	17,149	4,330	4.0
2020	29,002	6,357	17,475	5,170	3.4
2025	30,398	6,658	17,594	6,146	2.9
2030	31,686	6,840	17,700	7,146	2.5
2040	33,883	6,950	18,744	8,188	2.3
2050	35,773	7,267	19,608	8,898	2.2
2075	40,462	8,135	21,883	10,444	2.1

#### C. Economic Assumptions

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

One of the key elements underlying the best-estimate economic assumptions relates to the possible labour shortage due to the aging of the population and the retirement of the baby boom generation between 2015 and 2030. Labour force growth is projected to weaken as the working-age population expands at a slower pace. The outlook for the participation rates also points to slower labour force growth. Growing labour shortages, especially after 2015, are



assumed to force higher real wage growth. The higher real wages may 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 participation is lower and, as a result, the labour force participation rates for Canadians aged 15 and over are expected to decline from 67.2% in 2010 to 62.2% 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 74.9% in 2010 to 75.2% in 2030. The participation rates of those aged 60 to 69 are gradually increased after 2009. Moreover, the narrowing of the gap between the age-specific participation rates of men and women is assumed to continue but at a much slower pace than in the past.

Prior to 2009, significant increases in labour force participation rates were experienced in both younger and older age groups for both males and females. The recent economic downturn slightly reduced the participation rates mainly for younger age groups. It is anticipated that these rates will rebound to levels similar to those in 2008 by 2012. In general, participation rates for females are projected to increase 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 79.0% in 2010 and in 2030, while the female participation rate for the same age group is expected to increase from 70.9% in 2010 to 71.5% in 2030. Therefore, the current gap of 8.1% between males and females in this age group is expected to slightly decrease to 7.6%.

The job creation rate in Canada was, on average, 1.7% from 1976 to 2009 based on available employment data, and it is assumed that the number of jobs will increase by 1.1% in 2010. The job creation rate assumption is determined on the basis of expected moderate economic growth and the unemployment rate which is expected to gradually decrease from its 2009 level of 8.3% to an ultimate rate of 6.1% for years 2022 and thereafter. The job creation rate is on average about 0.9% from 2010 to 2014 and 0.7% from 2015 to 2021, and is slightly higher than the labour force growth rate. For years 2022 and thereafter, the job creation rate follows the labour force growth rate and is about 0.4% due to the aging of the population.

### 2. Price Increases

Price increases, as measured by changes in the Consumer Price Index, tend to fluctuate from year to year. In 2006, the Bank of Canada and the Government renewed their commitment to keep inflation between 1% and 3% until the end of 2011. It is assumed that this commitment will be renewed for another five years following 2011. Therefore, a price increase rate of 2.0% is assumed for years 2010 to 2016. Beginning in 2017, the rate is assumed to uniformly increase until it reaches an ultimate rate of 2.3% in 2019.



### 3. Real Wage Increases (Average Annual Employment Earnings)

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 of nominal wage increases less inflation represents increases in the real wage and is also referred to as the “real-wage differential”. This differential affects the long-term projected financial status of the Plan.

Growth in real wages is linked primarily with growth in labour productivity, as well as with various other economic factors. For instance, it is linked to the growth in the average number of hours worked, growth in total earnings as a share of total compensation, and growth in total compensation as a share of GDP.

Given an assumed relatively high unemployment rate in 2010 of 8.4% and moderate economic growth, a real-wage differential of 0% is assumed for 2010. It is then set to gradually increase to the ultimate assumption of 1.3% by 2019. The ultimate real-wage differential is developed taking into account the relationships described above, historical trends and a possible labour shortage. The ultimate real-wage differential assumption combined with the ultimate price increase assumption results in an assumed annual increase in nominal wages of 3.6% in 2019 and thereafter.

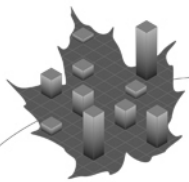
The assumptions regarding the increase in average real annual employment earnings and job creation rates result in projected average annual real increases in total employment earnings of about 1.8% for the period 2010 to 2020. After 2021, this decreases to about 1.7% on average over the remainder of the projection period, reflecting the assumed 1.3% real increase in annual wages and projected average 0.4% 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 increase rates 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 investment expenses.

The initial real rates of return reflect observed rates of return for the first six months of 2010. For the period 2010 to 2014, the annual real rates of return are slightly lower than the assumed



ultimate real rate of return of 4.0% in 2017 due to lower expected bond returns during the period. Equity returns are stable throughout the projection period, and an ultimate equity risk premium of 2.0% is assumed to be reached in 2015. The 4.0% long-term real rate of return on CPP assets is comparable to the last 45 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	Price Increase	Labour Force (Canada)			Labour Force Annual Increase	Real Rate of Return on Investments
				Participation Rate (Ages 15+)	Job Creation Rate	Unemployment Rate		
	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
2010	0.0	0.0	2.0	67.2	1.1	8.4	1.2	(0.2)
2011	0.3	0.3	2.0	67.2	1.1	8.4	1.1	3.2
2012	0.6	0.6	2.0	67.1	0.9	8.3	0.9	3.6
2013	0.7	0.7	2.0	66.9	0.8	8.3	0.8	3.6
2014	0.8	0.8	2.0	66.8	0.7	8.3	0.7	3.6
2015	0.9	0.9	2.0	66.6	0.7	8.2	0.6	4.1
2016	1.0	1.0	2.0	66.3	0.7	8.0	0.4	4.1
2017	1.1	1.1	2.1	66.0	0.7	7.7	0.4	4.0
2018	1.2	1.2	2.2	65.7	0.7	7.3	0.3	4.0
2019	1.3	1.3	2.3	65.4	0.7	6.9	0.3	4.0
2020	1.3	1.3	2.3	65.0	0.7	6.5	0.3	4.0
2025	1.3	1.3	2.3	63.4	0.4	6.1	0.4	4.0
2030	1.3	1.3	2.3	62.2	0.5	6.1	0.5	4.0
2040	1.3	1.3	2.3	60.9	0.4	6.1	0.4	4.0
2050	1.3	1.3	2.3	60.3	0.2	6.1	0.2	4.0

**D. Other Assumptions**

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

**1. Retirement Rates**

The sex-distinct retirement rate for any given age from age 60 and above corresponds to the number of emerging retirement beneficiaries divided by the product of the population and the retirement benefit eligibility rate for the given sex and age. The retirement rates also vary by cohort and thus vary by year a given age is reached. The normal retirement age under the Canada Pension Plan is 65. However, since 1987 a person can choose to receive a reduced retirement pension as early as age 60. This provision has 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 62 most recently in 2009.



Retirement rates at age 60 for the cohort reaching age 60 in 2012 are assumed to be 42% and 45% for males and females, respectively and 34% and 31%, respectively at age 65 in 2017. These rates reflect the expected increase in early retirement take-up rates that will result from two provisions of Bill C-51. First, it is expected that anticipation of the greater reductions in early retirement pensions due to the increased actuarial adjustments (starting in 2012) will cause an increase in early pension take-up leading up to 2012. Second, the removal of the Work Cessation Test in 2012 is further expected to increase the early pension take-up rates.

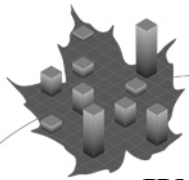
After peaking in 2012, the early pension take-up rates are assumed to decrease as the higher actuarial adjustments are phased in and the effect of the removal of the Work Cessation Test diminishes. For cohorts reaching age 60 in 2016 and thereafter, the retirement rates are assumed to decrease to 38% and 41% for males and females, respectively and to increase to 38% and 35%, respectively at age 65 in 2021 and thereafter. These rates reflect trends in recent experience.

## **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 historical Plan experience, the ultimate overall incidence rates for years 2015 and thereafter are assumed to be 3.3 per thousand eligible for males and 3.6 per thousand eligible for females.

The ultimate incidence rates correspond to the average experience over the period 1998 to 2008. Between 2009 and 2015, the rates are assumed to be higher than the ultimate assumption due to the recent economic downturn. Following the 2008 amendments to the Plan, these rates also account for the expanded eligibility for disability benefits for long-term contributors to the Plan.

The assumption recognizes that although incidence rates have been relatively stable since 1997, the current rates lie significantly below the levels experienced in the mid-1970s to early 1990s.



### 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 results include expected impacts from the amendments to the *Canada Pension Plan* under Bill C-51 that are described earlier in this report in section III Best-Estimate Assumptions. The key observations and findings are described below.

- With the legislated contribution rate of 9.9%, total assets are expected to increase significantly over the next 11 years and then will continue increasing at a slower pace. Total assets are expected to grow from \$127 billion at the end of 2009 to \$275 billion by the end of 2020. The ratio of assets to the following year's expenditures is projected to grow from 3.9 in 2010 to 4.7 by 2020 and 5.2 by 2050.
- With the legislated contribution rate of 9.9%, contributions are projected to be more than sufficient to cover the expenditures during the period 2011 to 2020. Thereafter, a proportion of investment income is required to make up the difference between contributions and expenditures. In 2050, 29% of investment income is required to pay for benefits.
- With the legislated contribution rate of 9.9%, investment income, which represents 16% of revenue (i.e. contributions and investment income) in 2011, will represent 23% of revenue in 2020. In 2050, investment income represents 27% of revenue. This clearly illustrates the importance of investment income as a source of revenue for the Plan.
- The minimum contribution rate, which is the lowest rate sufficient to sustain the Plan with respect to the Plan's two financing objectives and without further increase, is 9.86% of contributory earnings for years 2013 to 2022 and 9.85% for years 2023 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 2010-2012.
- The minimum contribution rate consists of two separate components. First, the steady-state contribution rate, which is the lowest contribution rate that generally stabilizes the ratio of assets to expenditures over the long term, before the consideration of any full funding of increased or new benefits, is 9.84%. The steady-state rate is constant throughout the projection period and finances the Plan without the full funding requirement. The second component is the full funding rate, which is required to fully fund the expanded eligibility for disability benefits for long-term contributors following the 2008 amendments to the Plan. The full funding rate is 0.02% for years 2013 to 2022 and 0.01% for years 2023 and thereafter.
- With the minimum contribution rate of 9.86%, applicable for years 2013 to 2022 and 9.85% 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 3.9 in 2010 to 4.7 by 2022 and to be the same fifty years later in 2072.

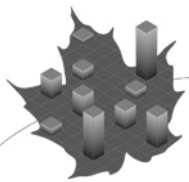
- Although the pay-as-you-go rate is expected to increase steadily from 8.6% in 2010 to 11.4% by the end of the projection period due to the retirement of the baby boom generation, the legislated contribution rate of 9.9% remains sufficient to sustain the Plan in the long term. The pay-as-you-go rate 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 4.6 in 2010 to 2.2 in 2050.
- The number of contributors is expected to grow from 12.6 million in 2010 to 14.3 million by 2020. Contributions are expected to increase from \$37 billion in 2010 to \$56 billion in 2020.
- By 2020, there will be 6.0 million retirement beneficiaries compared to 4.0 million today.
- There continues to be more female than male retirement beneficiaries and by 2020, there is expected to be approximately 200,000 (or 7%) more female than male retirement beneficiaries.
- The proportion of retirement benefits relative to total expenditures is expected to increase from 72% in 2010 to 82% in 2050.
- Total expenditures are expected to grow rapidly from \$32 billion in 2010 to \$56 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 from 12.6 million in 2010 to 13.6 million by 2015, after which the increase is limited due to the 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. The projected average contributory earnings in 2010 are \$31,354 for males and \$26,287 for females.

Contributions are expected to be \$36.9 billion in 2010 as shown in Table 4, which presents the projected components of contributions. Since the legislated contribution rate is constant at 9.9% for years 2010 and thereafter, contributions increase at the same rate as total contributory earnings over the projection period. The number of contributors and amount of contributory earnings increase in 2012 primarily due to the provision of Bill C-51 that requires working beneficiaries under age 65, as well as their employers, to make CPP contributions starting 1 January 2012.

**Table 4 Contributions**

<b>Year</b>	<b>Contribution Rate</b>	<b>Number of Contributors</b>	<b>Contributory Earnings</b>	<b>Contributions</b>
	(%)	(thousands)	(\$ million)	(\$ million)
<b>2010</b>	9.9	12,584	372,340	36,862
<b>2011</b>	9.9	12,771	386,384	38,252
<b>2012</b>	9.9	13,253	406,151	40,209
<b>2013</b>	9.9	13,411	422,153	41,793
<b>2014</b>	9.9	13,529	438,529	43,414
<b>2015</b>	9.9	13,649	455,598	45,104
<b>2020</b>	9.9	14,320	565,486	55,983
<b>2025</b>	9.9	14,719	697,860	69,088
<b>2030</b>	9.9	15,142	860,535	85,193
<b>2040</b>	9.9	16,157	1,315,993	130,283
<b>2050</b>	9.9	16,960	1,973,718	195,398
<b>2060</b>	9.9	17,654	2,937,762	290,838

**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 more than double over the next 20 years due to the aging of the population. Female retirement beneficiaries continue to outnumber their male counterparts, and by 2050 there is projected to be 546,000 or 12% 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 while Table 8 shows the same information but in millions of 2010 constant dollars. Projected expenditures in 2010 are \$32.2 billion and reach \$42.8 billion in 2015. 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 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 8.6% in 2010 to 11.4% 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**  
(thousands)

Year	Retirement <sup>(1)</sup>	Disability	Survivor <sup>(2)</sup>	Children	Death <sup>(3)</sup>
2010	3,988	382	1,143	220	129
2011	4,168	392	1,164	225	133
2012	4,382	399	1,185	229	136
2013	4,595	407	1,206	234	140
2014	4,802	413	1,226	239	144
2015	5,005	419	1,247	240	148
2020	6,020	446	1,353	247	169
2025	7,132	457	1,472	262	194
2030	8,043	456	1,609	278	224
2040	9,092	507	1,904	297	294
2050	9,952	552	2,102	296	339
2060	10,714	557	2,161	305	352

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

(2) A beneficiary who receives concurrently a retirement and a survivor's pension is counted in each category.

(3) This is the number of deceased contributors entitled to a death benefit during the given year.

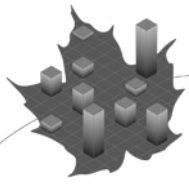
**Table 6 Beneficiaries by Sex**  
(thousands)

Year	Males				Females			
	Retirement <sup>(1)</sup>	Disability	Survivor <sup>(2)</sup>	Death <sup>(3)</sup>	Retirement <sup>(1)</sup>	Disability	Survivor <sup>(2)</sup>	Death <sup>(3)</sup>
2010	1,966	181	187	81	2,022	200	956	48
2011	2,050	185	194	82	2,118	207	970	50
2012	2,150	188	201	84	2,232	211	984	52
2013	2,250	191	209	86	2,346	215	997	54
2014	2,345	194	216	88	2,457	219	1,010	56
2015	2,439	196	224	90	2,566	223	1,023	58
2020	2,911	208	262	100	3,110	239	1,091	69
2025	3,434	212	301	112	3,698	245	1,171	82
2030	3,859	210	338	127	4,184	246	1,271	97
2040	4,310	232	394	160	4,782	275	1,510	134
2050	4,703	252	416	179	5,249	299	1,686	161
2060	5,075	253	422	183	5,639	304	1,739	169

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

(2) A beneficiary who receives concurrently a retirement and a survivor's pension is counted in each category.

(3) This is the number of deceased contributors entitled to a death benefit during the given year.



# ACTUARIAL REPORT

## CANADA PENSION PLAN

as at 31 December 2009

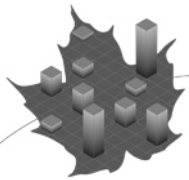
**Table 7 Expenditures**  
(\$ million)

Year	Retirement	Disability	Survivor	Children	Death	Administrative Expenses	Total
2010	23,079	3,562	3,927	512	293	820	32,192
2011	24,549	3,731	4,027	532	303	851	33,992
2012	26,269	3,873	4,124	554	313	883	36,016
2013	28,193	4,021	4,225	576	324	917	38,255
2014	30,141	4,167	4,327	599	335	950	40,518
2015	32,113	4,323	4,431	613	346	984	42,809
2016	34,093	4,477	4,537	627	357	1,022	45,113
2017	36,104	4,635	4,645	642	368	1,063	47,456
2018	38,254	4,799	4,761	659	380	1,107	49,961
2019	40,595	4,964	4,886	679	392	1,155	52,671
2020	43,142	5,132	5,021	702	405	1,206	55,608
2021	45,865	5,303	5,165	725	417	1,258	58,733
2022	48,739	5,471	5,316	750	431	1,307	62,014
2023	51,761	5,641	5,478	778	445	1,358	65,461
2024	54,914	5,818	5,653	807	459	1,411	69,062
2025	58,173	5,990	5,842	836	474	1,466	72,782
2026	61,514	6,157	6,047	866	490	1,525	76,599
2027	64,914	6,326	6,268	897	506	1,586	80,497
2028	68,391	6,492	6,508	928	523	1,650	84,492
2029	71,938	6,675	6,769	961	541	1,718	88,601
2030	75,521	6,886	7,053	995	560	1,789	92,803
2031	79,123	7,136	7,358	1,029	577	1,861	97,085
2032	82,738	7,417	7,686	1,063	595	1,939	101,438
2033	86,392	7,719	8,038	1,096	613	2,019	105,876
2034	90,113	8,040	8,413	1,130	631	2,103	110,430
2035	93,932	8,380	8,814	1,165	648	2,191	115,130
2036	97,879	8,734	9,237	1,198	666	2,282	119,997
2037	101,936	9,120	9,682	1,232	683	2,378	125,031
2038	106,108	9,532	10,148	1,265	700	2,478	130,231
2039	110,424	9,975	10,633	1,298	717	2,582	135,631
2040	114,938	10,431	11,139	1,332	733	2,689	141,263
2045	141,529	12,934	13,905	1,494	801	3,282	173,945
2050	176,979	15,481	16,958	1,666	848	3,978	215,909
2055	222,023	18,074	20,215	1,882	871	4,817	267,882
2060	275,727	21,209	23,828	2,159	878	5,865	329,666
2065	338,716	25,589	28,239	2,484	891	7,183	403,101
2070	415,531	31,397	33,970	2,836	921	8,807	493,461
2075	512,526	38,205	41,280	3,206	959	10,761	606,938
2080	634,727	45,751	50,041	3,614	989	13,104	748,226
2085	786,246	54,278	60,047	4,088	1,002	15,943	921,603

**Table 8 Expenditures (millions of 2010 constant dollars)<sup>(1)</sup>**

<b>Year</b>	<b>Retirement</b>	<b>Disability</b>	<b>Survivor</b>	<b>Children</b>	<b>Death</b>	<b>Administrative Expenses</b>	<b>Total</b>
<b>2010</b>	23,079	3,561	3,927	512	293	820	32,192
<b>2011</b>	24,104	3,663	3,953	522	298	836	33,376
<b>2012</b>	25,287	3,728	3,970	533	301	850	34,670
<b>2013</b>	26,607	3,794	3,987	544	306	865	36,104
<b>2014</b>	27,888	3,855	4,004	554	310	879	37,489
<b>2015</b>	29,130	3,921	4,019	556	314	893	38,833
<b>2016</b>	30,320	3,982	4,035	558	317	909	40,120
<b>2017</b>	31,479	4,041	4,050	560	321	927	41,376
<b>2018</b>	32,672	4,099	4,067	564	325	945	42,671
<b>2019</b>	33,931	4,148	4,084	568	328	965	44,025
<b>2020</b>	35,255	4,194	4,103	574	331	986	45,442
<b>2021</b>	36,637	4,236	4,125	579	333	1,005	46,916
<b>2022</b>	38,058	4,272	4,151	586	337	1,021	48,423
<b>2023</b>	39,509	4,306	4,181	594	340	1,037	49,966
<b>2024</b>	40,973	4,341	4,218	601	342	1,053	51,529
<b>2025</b>	42,429	4,369	4,261	610	346	1,069	53,084
<b>2026</b>	43,857	4,390	4,311	617	349	1,087	54,612
<b>2027</b>	45,240	4,408	4,368	625	353	1,105	56,101
<b>2028</b>	46,592	4,423	4,433	632	356	1,124	57,561
<b>2029</b>	47,907	4,444	4,508	639	360	1,144	59,003
<b>2030</b>	49,162	4,483	4,591	648	365	1,165	60,412
<b>2031</b>	50,349	4,541	4,683	655	367	1,184	61,778
<b>2032</b>	51,465	4,614	4,781	661	370	1,206	63,097
<b>2033</b>	52,530	4,693	4,887	666	373	1,228	64,377
<b>2034</b>	53,561	4,779	5,000	672	375	1,250	65,636
<b>2035</b>	54,575	4,869	5,121	676	376	1,273	66,892
<b>2036</b>	55,590	4,961	5,246	681	378	1,296	68,152
<b>2037</b>	56,592	5,063	5,375	684	379	1,320	69,414
<b>2038</b>	57,584	5,173	5,507	687	380	1,345	70,676
<b>2039</b>	58,579	5,292	5,641	689	380	1,370	71,951
<b>2040</b>	59,603	5,409	5,777	691	380	1,394	73,254
<b>2045</b>	65,505	5,986	6,436	691	371	1,519	80,508
<b>2050</b>	73,109	6,395	7,005	688	350	1,643	89,191
<b>2055</b>	81,859	6,664	7,453	694	321	1,776	98,767
<b>2060</b>	90,734	6,979	7,841	710	289	1,930	108,484
<b>2065</b>	99,483	7,516	8,294	730	262	2,110	118,393
<b>2070</b>	108,928	8,230	8,905	743	241	2,309	129,356
<b>2075</b>	119,915	8,939	9,658	750	224	2,518	142,004
<b>2080</b>	132,546	9,554	10,450	755	207	2,736	156,247
<b>2085</b>	146,541	10,116	11,192	762	187	2,971	171,769

(1) For a given year, the value in 2010 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 2010 in the projections.



**Table 9 Expenditures as Percentage of Contributory Earnings**  
(pay-as-you-go rates)

<b>Year</b>	<b>Retirement</b>	<b>Disability</b>	<b>Survivor</b>	<b>Children</b>	<b>Death</b>	<b>Administrative Expenses</b>	<b>Total</b>
	(%)	(%)	(%)	(%)	(%)	(%)	(%)
<b>2010</b>	6.20	0.96	1.05	0.14	0.08	0.22	8.65
<b>2011</b>	6.35	0.97	1.04	0.14	0.08	0.22	8.80
<b>2012</b>	6.47	0.95	1.02	0.14	0.08	0.22	8.87
<b>2013</b>	6.68	0.95	1.00	0.14	0.08	0.22	9.06
<b>2014</b>	6.87	0.95	0.99	0.14	0.08	0.22	9.24
<b>2015</b>	7.05	0.95	0.97	0.13	0.08	0.22	9.40
<b>2016</b>	7.19	0.94	0.96	0.13	0.08	0.22	9.51
<b>2017</b>	7.30	0.94	0.94	0.13	0.07	0.22	9.60
<b>2018</b>	7.40	0.93	0.92	0.13	0.07	0.21	9.67
<b>2019</b>	7.51	0.92	0.90	0.13	0.07	0.21	9.75
<b>2020</b>	7.63	0.91	0.89	0.12	0.07	0.21	9.83
<b>2021</b>	7.75	0.90	0.87	0.12	0.07	0.21	9.93
<b>2022</b>	7.90	0.89	0.86	0.12	0.07	0.21	10.05
<b>2023</b>	8.05	0.88	0.85	0.12	0.07	0.21	10.19
<b>2024</b>	8.20	0.87	0.84	0.12	0.07	0.21	10.31
<b>2025</b>	8.34	0.86	0.84	0.12	0.07	0.21	10.43
<b>2026</b>	8.46	0.85	0.83	0.12	0.07	0.21	10.54
<b>2027</b>	8.56	0.83	0.83	0.12	0.07	0.21	10.61
<b>2028</b>	8.64	0.82	0.82	0.12	0.07	0.21	10.68
<b>2029</b>	8.72	0.81	0.82	0.12	0.07	0.21	10.74
<b>2030</b>	8.78	0.80	0.82	0.12	0.07	0.21	10.78
<b>2031</b>	8.82	0.80	0.82	0.11	0.06	0.21	10.82
<b>2032</b>	8.84	0.79	0.82	0.11	0.06	0.21	10.84
<b>2033</b>	8.85	0.79	0.82	0.11	0.06	0.21	10.84
<b>2034</b>	8.84	0.79	0.83	0.11	0.06	0.21	10.84
<b>2035</b>	8.83	0.79	0.83	0.11	0.06	0.21	10.83
<b>2036</b>	8.82	0.79	0.83	0.11	0.06	0.21	10.81
<b>2037</b>	8.80	0.79	0.84	0.11	0.06	0.21	10.80
<b>2038</b>	8.78	0.79	0.84	0.10	0.06	0.21	10.77
<b>2039</b>	8.75	0.79	0.84	0.10	0.06	0.20	10.75
<b>2040</b>	8.73	0.79	0.85	0.10	0.06	0.20	10.73
<b>2045</b>	8.75	0.80	0.86	0.09	0.05	0.20	10.75
<b>2050</b>	8.97	0.78	0.86	0.08	0.04	0.20	10.94
<b>2055</b>	9.24	0.75	0.84	0.08	0.04	0.20	11.15
<b>2060</b>	9.39	0.72	0.81	0.07	0.03	0.20	11.22
<b>2065</b>	9.39	0.71	0.78	0.07	0.02	0.20	11.17
<b>2070</b>	9.37	0.71	0.77	0.06	0.02	0.20	11.12
<b>2075</b>	9.43	0.70	0.76	0.06	0.02	0.20	11.17
<b>2080</b>	9.57	0.69	0.75	0.05	0.01	0.20	11.28
<b>2085</b>	9.72	0.67	0.74	0.05	0.01	0.20	11.40



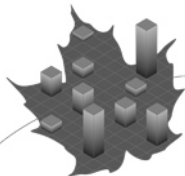
## **D. Financial Projections with Legislated Contribution Rate**

### **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 CPP Investment Board 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 \$126,836 million as at 31 December 2009.

### **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 2010 constant dollars, respectively. The projection of assets using the minimum contribution rate of 9.86% for years 2013 to 2022 and 9.85% for years 2023 and thereafter is discussed in section E.



# ACTUARIAL REPORT

## CANADA PENSION PLAN

as at 31 December 2009

**Table 10 Historical Results**  
(\$ million)

Year	PayGo Rate <sup>(1)</sup>	Contribution Rate	Contributions	Expenditures	Net Cash Flow	Investment Income <sup>(2)</sup>	Assets at 31 Dec. <sup>(3)</sup>	Yield/Return <sup>(3)</sup>	Asset/Expenditure Ratio
	(%)	(%)						(%)	
1966	0.05	3.6	531	8	523	2	525	0.7	52.50
1967	0.06	3.6	623	10	613	37	1,175	4.3	48.96
1968	0.13	3.6	686	24	662	79	1,916	5.1	35.48
1969	0.26	3.6	737	54	683	128	2,727	5.6	28.11
1970	0.45	3.6	773	97	676	193	3,596	6.2	24.13
1971	0.66	3.6	816	149	667	260	4,523	6.5	21.33
1972	0.88	3.6	869	212	657	333	5,513	6.8	19.83
1973	1.07	3.6	939	278	661	404	6,578	6.8	16.78
1974	1.17	3.6	1,203	392	811	498	7,887	7.0	14.06
1975	1.42	3.6	1,426	561	865	607	9,359	7.2	11.47
1976	1.80	3.6	1,630	816	814	747	10,920	7.6	10.48
1977	2.05	3.6	1,828	1,042	786	890	12,596	7.8	9.72
1978	2.31	3.6	2,022	1,296	726	1,043	14,365	7.9	9.03
1979	2.47	3.6	2,317	1,590	727	1,236	16,328	8.3	8.31
1980	2.72	3.6	2,604	1,965	639	1,466	18,433	8.7	7.64
1981	2.89	3.6	3,008	2,413	595	1,784	20,812	9.4	7.04
1982	2.91	3.6	3,665	2,958	707	2,160	23,679	10.0	6.58
1983	3.73	3.6	3,474	3,598	(124)	2,494	26,049	10.4	6.22
1984	3.66	3.6	4,118	4,185	(67)	2,829	28,811	10.7	5.97
1985	4.31	3.6	4,032	4,826	(794)	3,113	31,130	10.8	5.66
1986	4.20	3.6	4,721	5,503	(782)	3,395	33,743	10.9	4.73
1987	5.02	3.8	5,393	7,130	(1,737)	3,654	35,660	10.9	4.31
1988	5.41	4.0	6,113	8,272	(2,159)	3,886	37,387	11.0	3.98
1989	5.89	4.2	6,694	9,391	(2,697)	4,162	38,852	11.3	3.72
1990	5.82	4.4	7,889	10,438	(2,549)	4,386	40,689	11.4	3.53
1991	6.31	4.6	8,396	11,518	(3,122)	4,476	42,043	11.2	3.22
1992	7.07	4.8	8,883	13,076	(4,193)	4,497	42,347	11.0	2.97
1993	7.79	5.0	9,166	14,273	(5,107)	4,480	41,720	10.9	2.72
1994	8.33	5.2	9,585	15,362	(5,777)	4,403	40,346	11.0	2.52
1995	7.91	5.4	10,911	15,986	(5,075)	4,412	39,683	11.3	2.37
1996	8.71	5.6	10,757	16,723	(5,966)	4,177	37,894	11.0	2.16
1997	8.67	6.0	12,165	17,570	(5,405)	3,971	36,460	10.8	1.99
1998	8.11	6.4	14,473	18,338	(3,865)	3,938	36,535	10.9	1.94
1999	8.23	7.0	16,052	18,877	(2,825)	764	42,783	1.7	2.17
2000	7.69	7.8	19,977	19,683	294	4,446	47,523	9.9	2.32
2001	7.85	8.6	22,469	20,515	1,954	3,154	52,631	6.2	2.43
2002	8.16	9.4	24,955	21,666	3,289	187	56,107	0.3	2.47
2003	8.19	9.9	27,454	22,716	4,738	6,769	67,614	11.1	2.84
2004	8.29	9.9	28,459	23,833	4,626	6,475	78,715	8.9	3.15
2005	8.37	9.9	29,539	24,976	4,563	11,083	94,361	13.2	3.59
2006	8.22	9.9	31,657	26,270	5,387	14,433	114,181	14.4	4.13
2007	8.07	9.9	34,051	27,750	6,301	3,267	123,749	2.7	4.47
2008	7.97	9.9	36,318	29,248	7,070	(18,351)	112,468	(14.0)	4.07
2009	8.44	9.9	36,141	30,794	5,347	9,021	126,836	7.6	3.94

(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 2009 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.

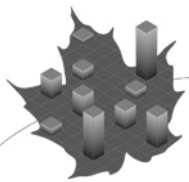




**Table 11 Financial Status**  
(\$ million)

Year	PayGo Rate	Contribution Rate	Contributory Earnings	Contributions	Expenditures	Net Cash Flow	Investment Income <sup>(1)</sup>	Assets at 31 Dec.	Return	Asset/Expenditure Ratio
	(%)	(%)							(%)	
2010	8.65	9.90	372,340	36,862	32,192	4,670	2,391	133,897	1.80	3.94
2011	8.80	9.90	386,384	38,252	33,992	4,260	7,268	145,425	5.20	4.04
2012	8.87	9.90	406,151	40,209	36,016	4,193	8,438	158,056	5.58	4.13
2013	9.06	9.90	422,153	41,793	38,255	3,538	9,112	170,705	5.56	4.21
2014	9.24	9.90	438,529	43,414	40,518	2,896	9,862	183,464	5.59	4.29
2015	9.40	9.90	455,598	45,104	42,809	2,295	11,571	197,330	6.12	4.37
2016	9.51	9.90	474,216	46,947	45,113	1,834	12,367	211,532	6.10	4.46
2017	9.60	9.90	494,453	48,951	47,456	1,495	13,225	226,251	6.09	4.53
2018	9.67	9.90	516,668	51,150	49,961	1,189	14,341	241,781	6.18	4.59
2019	9.75	9.90	540,315	53,491	52,671	820	15,476	258,077	6.25	4.64
2020	9.83	9.90	565,486	55,983	55,608	375	16,646	275,099	6.31	4.68
2021	9.93	9.90	591,677	58,576	58,733	(157)	17,753	292,695	6.32	4.72
2022	10.05	9.90	616,844	61,068	62,014	(946)	18,857	310,605	6.32	4.74
2023	10.19	9.90	642,678	63,625	65,461	(1,836)	19,975	328,744	6.32	4.76
2024	10.31	9.90	669,652	66,296	69,062	(2,766)	21,093	347,070	6.31	4.77
2025	10.43	9.90	697,860	69,088	72,782	(3,694)	22,303	365,680	6.33	4.77
2026	10.54	9.90	727,080	71,981	76,599	(4,618)	23,504	384,566	6.34	4.78
2027	10.61	9.90	758,553	75,097	80,497	(5,400)	24,704	403,869	6.34	4.78
2028	10.68	9.90	791,300	78,339	84,492	(6,153)	25,924	423,640	6.34	4.78
2029	10.74	9.90	824,784	81,654	88,601	(6,947)	27,160	443,853	6.34	4.78
2030	10.78	9.90	860,535	85,193	92,803	(7,610)	28,444	464,687	6.34	4.79
2031	10.82	9.90	897,069	88,810	97,085	(8,275)	29,764	486,176	6.34	4.79
2032	10.84	9.90	935,825	92,647	101,438	(8,791)	31,129	508,514	6.33	4.80
2033	10.84	9.90	976,463	96,670	105,876	(9,206)	32,554	531,861	6.33	4.82
2034	10.84	9.90	1,018,855	100,867	110,430	(9,563)	34,035	556,333	6.33	4.83
2035	10.83	9.90	1,063,407	105,277	115,130	(9,853)	35,542	582,023	6.32	4.85
2036	10.81	9.90	1,109,723	109,863	119,997	(10,134)	37,170	609,058	6.32	4.87
2037	10.80	9.90	1,158,133	114,655	125,031	(10,376)	38,891	637,573	6.32	4.90
2038	10.77	9.90	1,208,981	119,689	130,231	(10,542)	40,701	667,732	6.31	4.92
2039	10.75	9.90	1,261,488	124,887	135,631	(10,744)	42,634	699,622	6.31	4.95
2040	10.73	9.90	1,315,993	130,283	141,263	(10,980)	44,686	733,329	6.31	4.98
2045	10.75	9.90	1,617,807	160,163	173,945	(13,782)	56,742	929,721	6.33	5.12
2050	10.94	9.90	1,973,718	195,398	215,909	(20,511)	71,427	1,169,230	6.33	5.18
2055	11.15	9.90	2,403,391	237,936	267,882	(29,946)	88,477	1,446,259	6.33	5.18
2060	11.22	9.90	2,937,762	290,838	329,666	(38,828)	108,321	1,769,492	6.33	5.15
2065	11.17	9.90	3,608,577	357,249	403,101	(45,852)	132,554	2,166,125	6.33	5.16
2070	11.12	9.90	4,436,956	439,259	493,461	(54,202)	162,997	2,664,808	6.33	5.18
2075	11.17	9.90	5,435,534	538,118	606,938	(68,820)	200,536	3,277,586	6.33	5.18
2080	11.28	9.90	6,634,126	656,778	748,226	(91,448)	245,115	4,002,277	6.33	5.13
2085	11.40	9.90	8,087,024	800,615	921,603	(120,988)	296,556	4,835,939	6.33	5.03

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



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**Table 12 Financial Status (millions of 2010 constant dollars)**

Year	PayGo Rate (%)	Contribution Rate (%)	Contributory Earnings	Contributions	Expenditures	Net Cash Flow	Investment Income <sup>(1)</sup>	Assets at 31 Dec.
2010	8.65	9.90	372,340	36,862	32,192	4,670	2,391	133,897
2011	8.80	9.90	379,385	37,559	33,376	4,183	7,137	142,791
2012	8.87	9.90	390,975	38,707	34,670	4,036	8,122	152,150
2013	9.06	9.90	398,411	39,443	36,104	3,339	8,599	161,105
2014	9.24	9.90	405,751	40,169	37,489	2,680	9,125	169,750
2015	9.40	9.90	413,278	40,915	38,833	2,082	10,496	179,000
2016	9.51	9.90	421,732	41,751	40,120	1,631	10,999	188,121
2017	9.60	9.90	431,107	42,680	41,376	1,303	11,530	197,266
2018	9.67	9.90	441,282	43,687	42,671	1,016	12,248	206,503
2019	9.75	9.90	451,617	44,710	44,025	686	12,936	215,711
2020	9.83	9.90	462,103	45,748	45,442	307	13,603	224,805
2021	9.93	9.90	472,635	46,791	46,916	(125)	14,181	233,806
2022	10.05	9.90	481,661	47,684	48,423	(739)	14,724	242,535
2023	10.19	9.90	490,550	48,564	49,966	(1,401)	15,247	250,927
2024	10.31	9.90	499,647	49,465	51,529	(2,064)	15,738	258,960
2025	10.43	9.90	508,988	50,390	53,084	(2,694)	16,267	266,710
2026	10.54	9.90	518,377	51,319	54,612	(3,292)	16,758	274,179
2027	10.61	9.90	528,656	52,337	56,101	(3,764)	17,217	281,468
2028	10.68	9.90	539,080	53,369	57,561	(4,192)	17,661	288,608
2029	10.74	9.90	549,258	54,377	59,003	(4,627)	18,087	295,580
2030	10.78	9.90	560,182	55,458	60,412	(4,954)	18,516	302,497
2031	10.82	9.90	570,835	56,513	61,778	(5,266)	18,940	309,370
2032	10.84	9.90	582,109	57,629	63,097	(5,468)	19,363	316,309
2033	10.84	9.90	593,731	58,779	64,377	(5,598)	19,794	323,394
2034	10.84	9.90	605,579	59,952	65,636	(5,684)	20,230	330,669
2035	10.83	9.90	617,849	61,167	66,892	(5,725)	20,650	338,160
2036	10.81	9.90	630,263	62,396	68,152	(5,756)	21,110	345,912
2037	10.80	9.90	642,968	63,654	69,414	(5,760)	21,591	353,966
2038	10.77	9.90	656,108	64,955	70,676	(5,721)	22,088	362,375
2039	10.75	9.90	669,211	66,252	71,951	(5,699)	22,617	371,145
2040	10.73	9.90	682,430	67,561	73,254	(5,694)	23,173	380,280
2045	10.75	9.90	748,778	74,129	80,508	(6,379)	26,262	430,307
2050	10.94	9.90	815,329	80,718	89,191	(8,473)	29,506	483,001
2055	11.15	9.90	886,124	87,726	98,767	(11,041)	32,621	533,232
2060	11.22	9.90	966,737	95,707	108,484	(12,777)	35,645	582,291
2065	11.17	9.90	1,059,862	104,926	118,393	(13,467)	38,932	636,205
2070	11.12	9.90	1,163,109	115,148	129,356	(14,209)	42,728	698,556
2075	11.17	9.90	1,271,743	125,903	142,004	(16,102)	46,919	766,852
2080	11.28	9.90	1,385,360	137,151	156,247	(19,096)	51,186	835,769
2085	11.40	9.90	1,507,265	149,219	171,769	(22,550)	55,272	901,325

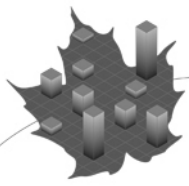
(1) Investment income includes both realized and unrealized gains and losses.



Assets are projected to increase significantly over the next 11 years, from \$127 billion at the end of 2009 to \$275 billion in 2020. Contributions and investment income are projected to be higher than expenditures over that period. Thereafter, revenue (i.e. contributions and investment income) continues to be higher than expenditures but to a lesser extent. This causes the assets to grow at a much slower pace. The assets reach a level of \$1,169 billion by 2050. Table 13 shows in more detail the sources of the revenue required to cover the expenditures.

From Table 13, several conclusions can be drawn.

- The assets grow continuously over the projection period. During the period 2010 to 2020, contributions are more than sufficient to cover expenditures.
- From 2021 onward, some of the investment income is required to fund net cash outflows. In 2050, 29% of investment income is required to pay for benefits.
- Investment income, which represents 16% of revenue in 2011, will represent 23% in 2020. In 2050, investment income represents 27% of revenue. This clearly illustrates the importance of investment income as a source of revenue for the Plan.



**Table 13 Sources of Revenue and Funding of Expenditures**  
(\$ billion)

<b>Year</b>	<b>Contributions</b>	<b>Expenditures</b>	<b>Shortfall</b>	<b>Investment Income<sup>(1)</sup></b>	<b>Total Revenue</b>	<b>Shortfall as % of Investment Income</b>	<b>Investment Income as % of Revenue</b>
						(%)	(%)
<b>2010</b>	36.9	32.2	0.0	2.4	39.3	0.0	6.1
<b>2011</b>	38.3	34.0	0.0	7.3	45.5	0.0	16.0
<b>2012</b>	40.2	36.0	0.0	8.4	48.6	0.0	17.3
<b>2013</b>	41.8	38.3	0.0	9.1	50.9	0.0	17.9
<b>2014</b>	43.4	40.5	0.0	9.9	53.3	0.0	18.5
<b>2015</b>	45.1	42.8	0.0	11.6	56.7	0.0	20.4
<b>2016</b>	46.9	45.1	0.0	12.4	59.3	0.0	20.9
<b>2017</b>	49.0	47.5	0.0	13.2	62.2	0.0	21.3
<b>2018</b>	51.2	50.0	0.0	14.3	65.5	0.0	21.9
<b>2019</b>	53.5	52.7	0.0	15.5	69.0	0.0	22.4
<b>2020</b>	56.0	55.6	0.0	16.6	72.6	0.0	22.9
<b>2021</b>	58.6	58.7	0.2	17.8	76.3	0.9	23.3
<b>2022</b>	61.1	62.0	0.9	18.9	79.9	5.0	23.6
<b>2023</b>	63.6	65.5	1.8	20.0	83.6	9.2	23.9
<b>2024</b>	66.3	69.1	2.8	21.1	87.4	13.1	24.1
<b>2025</b>	69.1	72.8	3.7	22.3	91.4	16.6	24.4
<b>2026</b>	72.0	76.6	4.6	23.5	95.5	19.6	24.6
<b>2027</b>	75.1	80.5	5.4	24.7	99.8	21.9	24.8
<b>2028</b>	78.3	84.5	6.2	25.9	104.3	23.7	24.9
<b>2029</b>	81.7	88.6	6.9	27.2	108.8	25.6	25.0
<b>2030</b>	85.2	92.8	7.6	28.4	113.6	26.8	25.0
<b>2031</b>	88.8	97.1	8.3	29.8	118.6	27.8	25.1
<b>2032</b>	92.6	101.4	8.8	31.1	123.8	28.2	25.2
<b>2033</b>	96.7	105.9	9.2	32.6	129.2	28.3	25.2
<b>2034</b>	100.9	110.4	9.6	34.0	134.9	28.1	25.2
<b>2035</b>	105.3	115.1	9.9	35.5	140.8	27.7	25.2
<b>2036</b>	109.9	120.0	10.1	37.2	147.0	27.3	25.3
<b>2037</b>	114.7	125.0	10.4	38.9	153.5	26.7	25.3
<b>2038</b>	119.7	130.2	10.5	40.7	160.4	25.9	25.4
<b>2039</b>	124.9	135.6	10.7	42.6	167.5	25.2	25.5
<b>2040</b>	130.3	141.3	11.0	44.7	175.0	24.6	25.5
<b>2045</b>	160.2	173.9	13.8	56.7	216.9	24.3	26.2
<b>2050</b>	195.4	215.9	20.5	71.4	266.8	28.7	26.8
<b>2055</b>	237.9	267.9	29.9	88.5	326.4	33.8	27.1
<b>2060</b>	290.8	329.7	38.8	108.3	399.2	35.8	27.1
<b>2065</b>	357.2	403.1	45.9	132.6	489.8	34.6	27.1
<b>2070</b>	439.3	493.5	54.2	163.0	602.3	33.3	27.1
<b>2075</b>	538.1	606.9	68.8	200.5	738.7	34.3	27.1
<b>2080</b>	656.8	748.2	91.4	245.1	901.9	37.3	27.2
<b>2085</b>	800.6	921.6	121.0	296.6	1,097.2	40.8	27.0

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

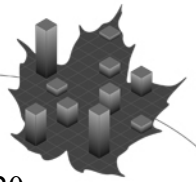
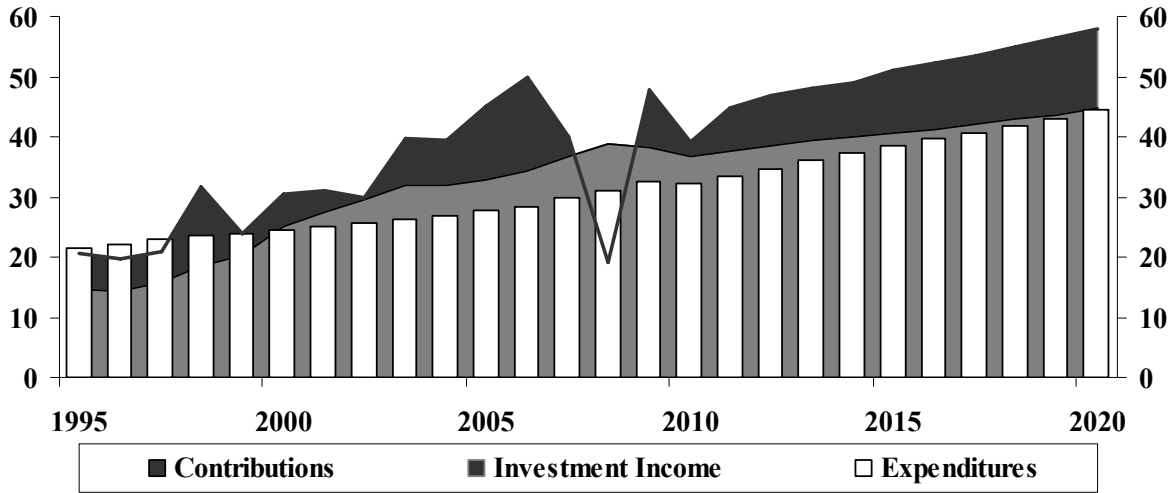


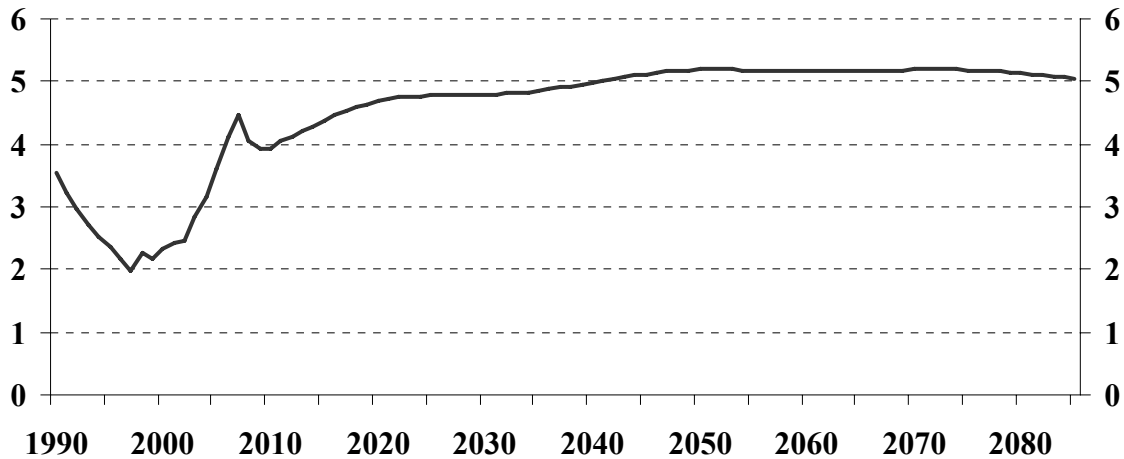
Chart 1 shows historical and projected revenue and expenditures for the period 1995 to 2020.

**Chart 1 Revenue and Expenditures**  
 (billions of 2010 constant dollars)

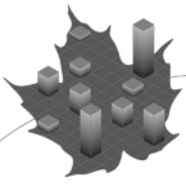


An important measure of the Plan’s financial status is the ratio of assets at the end of one year to the expenditures of the next year. As can be seen in Chart 2, under the legislated contribution rate of 9.9%, this ratio is projected to increase over the next ten years, reaching 4.7 by 2020. After 2020, it rises slowly to a value of 5.2 by 2050.

**Chart 2 Asset/Expenditure Ratio**  
 (9.9% contribution rate)



The slowdown in the growth of the ratio from 2020 to 2035 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.



## 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 projected to stabilize at a level of about 4.7. 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).

In 2008, the Plan was amended to relax the current contributory requirements for disability and disabled contributors' child benefits for individuals with twenty-five or more years of contributions such that they would meet the contributory requirements with valid contributions in three of the last six years. Valid contributions in four of the last six years continue to be required for all other CPP disability benefit applicants. Applicants still have to meet the existing medical criteria to qualify for the benefits.



The amendments came into force in accordance with subsection 114(2) of the *Canada Pension Plan* (i.e. following formal provincial consent to the change) on 3 March 2008. The financial impact of the amendments of 2008 is presented in the 22<sup>nd</sup> CPP Actuarial Report, which was tabled in the House of Commons on 4 December 2006.

## 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 in 2013 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 regulation 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 10<sup>th</sup> and 60<sup>th</sup> years following the end of the review period. For this report, the end of the review period is 2012. Therefore, the steady-state contribution rate is applicable for years 2013 and thereafter and the relevant years for the determination of the steady-state contribution rate are 2022 and 2072. The resulting steady-state contribution rate is rounded to the nearest 0.01% and is 9.84% for years 2013 and thereafter for this report.

It is important to note that the calculation of the steady-state contribution rate excludes any amendments that result in increased benefits or that add new benefits and that fall under the full funding requirements of paragraph 113.1(4)(d) of the *Canada Pension Plan*.

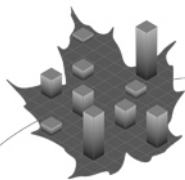
## 2. Full Funding Rate of New or Increased Benefits

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 regulation.

### *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 2010 of the projected increase in expenditures relating to Plan participation prior to the effective date and is estimated at \$132 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, thirteen years remain in the original amortization period. The increase in past liabilities



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is therefore amortized over the remaining thirteen years (2010-2022) with a temporary full funding contribution rate of 0.0030%. 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 2010 of contributory earnings over the remaining period 2010 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 2010 is estimated to be \$2.5 billion and is fully funded with a permanent contribution rate of 0.0136%. 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 2010.

The sum of the temporary and permanent full funding rates for the first thirteen years (2010-2022) is 0.0166% (0.0030% plus 0.0136%) and 0.0136% for years 2023 and thereafter. The rounded full funding rates are 0.02% for years 2010 through 2022 and 0.01% for years 2023 and thereafter. The Chief Actuary will review the full funding rates on a periodic basis to account for actual experience and any change in assumptions. The total actuarial liability as at 1 January 2010 resulting from the 2008 amendments to the Plan is estimated to be \$2,674 million. Table 14 summarizes the results.

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

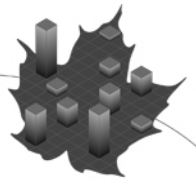
Present Value of Contributory Earnings (2010-2022)	Increase in Liability due to Participation Prior to Effective Date	Temporary Full Funding Rate (2010-2022)	Present Value of Contributory Earnings (2010+)	Increase in Liability due to Participation on or After the Effective Date	Permanent Full Funding Rate or “Current Service Cost” (2010+)	Permanent and Temporary Cost (2010-2022)
(A) <sup>(1)</sup>	(B) <sup>(2)</sup>	(C) = (B)/(A)	(D) <sup>(1)</sup>	(E) <sup>(2)</sup>	(F) = (E)/(D)	(G) = (C) + (F)
(\$ billion)	(\$ million)		(\$ billion)	(\$ million)		
4,476	132	0.0030%	18,734	2,542	0.0136%	0.0166%

- (1) As at 1/1/2010 based on the contributory earnings as projected under this report using a discount rate equal to the assumed overall rate of return on CPP assets.
- (2) Present values are taken as at 1/1/2010 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

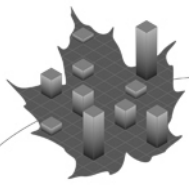
The minimum contribution rate is the sum of the Plan’s rounded steady-state contribution rate and the rounded full funding rate. For this report, the minimum contribution rate has been determined to be 9.86% for years 2013 to 2022 and 9.85% for years 2023 and thereafter. The minimum contribution rate will be recalculated in the next triennial actuarial report to be prepared as at 31 December 2012. 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 years 2013 and thereafter.

The results presented in Table 15 are based on the best-estimate assumptions but use the minimum contribution rate of 9.86% for 2013-2022 and 9.85% thereafter as opposed to the currently scheduled contribution rate of 9.9% for years 2013 and thereafter. The financial projections under the legislated rate of 9.9% were previously presented in Table 11.



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**Table 15 Financial Results - Minimum Contribution Rate**  
(\$ million)

Year	PayGo Rate	Contribution Rate <sup>(1)</sup>	Contributory Earnings	Contributions	Expenditures	Net Cash Flow	Investment Income <sup>(2)</sup>	Assets at 31 Dec.	Asset/Expenditure Ratio
	(%)	(%)							
2010	8.65	9.90	372,340	36,862	32,192	4,670	2,391	133,897	3.94
2011	8.80	9.90	386,384	38,252	33,992	4,260	7,268	145,425	4.04
2012	8.87	9.90	406,151	40,209	36,016	4,193	8,438	158,056	4.13
2013	9.06	9.86	422,153	41,624	38,255	3,369	9,106	170,531	4.21
2014	9.24	9.86	438,529	43,239	40,518	2,721	9,847	183,099	4.28
2015	9.40	9.86	455,598	44,922	42,809	2,113	11,543	196,755	4.36
2016	9.51	9.86	474,216	46,758	45,113	1,645	12,326	210,726	4.44
2017	9.60	9.86	494,453	48,753	47,456	1,297	13,168	225,192	4.51
2018	9.67	9.86	516,668	50,943	49,961	982	14,268	240,442	4.56
2019	9.75	9.86	540,315	53,275	52,671	604	15,384	256,430	4.61
2020	9.83	9.86	565,486	55,757	55,608	149	16,534	273,113	4.65
2021	9.93	9.86	591,677	58,339	58,733	(394)	17,619	290,338	4.68
2022	10.05	9.86	616,844	60,821	62,014	(1,193)	18,699	307,844	4.70
2023	10.19	9.85	642,678	63,304	65,461	(2,157)	19,789	325,476	4.71
2024	10.31	9.85	669,652	65,961	69,062	(3,101)	20,875	343,250	4.72
2025	10.43	9.85	697,860	68,739	72,782	(4,043)	22,049	361,256	4.72
2026	10.54	9.85	727,080	71,617	76,599	(4,982)	23,212	379,486	4.71
2027	10.61	9.85	758,553	74,717	80,497	(5,780)	24,369	398,076	4.71
2032	10.84	9.85	935,825	92,179	101,438	(9,259)	30,524	498,124	4.70
2037	10.80	9.85	1,158,133	114,076	125,031	(10,955)	37,880	620,340	4.76
2042	10.72	9.85	1,430,625	140,917	153,367	(12,450)	47,547	778,988	4.87
2047	10.81	9.85	1,753,473	172,717	189,531	(16,814)	59,848	978,983	4.95
2052	11.03	9.85	2,135,564	210,353	235,546	(25,193)	74,265	1,212,846	4.93
2057	11.20	9.85	2,602,572	256,353	291,420	(35,067)	90,564	1,476,673	4.86
2062	11.21	9.85	3,188,512	314,068	357,416	(43,348)	109,456	1,783,766	4.79
2067	11.14	9.85	3,920,853	386,204	436,850	(50,646)	132,509	2,159,842	4.75
2072	11.13	9.85	4,814,424	474,221	535,785	(61,564)	160,880	2,621,711	4.69
2077	11.21	9.85	5,888,432	580,011	659,897	(79,886)	194,472	3,165,461	4.60
2082	11.33	9.85	7,180,731	707,302	813,447	(106,145)	232,343	3,774,598	4.45
2087	11.43	9.85	8,755,988	862,465	1,001,136	(138,671)	273,488	4,432,518	4.25

(1) For years 2013 to 2022, the minimum contribution rate of 9.86% consists of the Plan's steady-state contribution rate of 9.84% and a rate of 0.02% to fully fund the 2008 amendments to the Plan. For 2023 and thereafter, the full funding rate decreases to 0.01%, resulting in a minimum contribution rate of 9.85%.

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



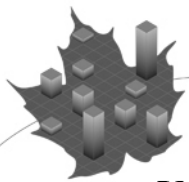
Table 16 is new in this report and was added in response to a recommendation made by the independent peer reviewers of the 23<sup>rd</sup> CPP Actuarial Report. The purpose of Table 16 is to show the progression of the minimum contribution rate over time under the best-estimate assumptions of this report.

**Table 16 Progression of Minimum Contribution Rate Over Time**

Valuation Year <sup>(1)</sup>	Target Years <sup>(2)</sup>	Steady State Target A/E ratio <sup>(3)</sup>	Steady-State Contribution Rate	Full Funding Rate		Minimum Contribution Rate (MCR) <sup>(4)</sup>		Average PayGo Rate Over Target Years Period
				Prior to 2023	2023+	Prior to 2023	2023+	
2009	2022 & 2072	4.70	9.84%	0.02%	0.01%	9.86%	9.85%	10.88%
2012	2025 & 2075	4.74	9.84%	0.02%	0.01%	9.86%	9.85%	10.93%
2015	2028 & 2078	4.76	9.84%	0.02%	0.01%	9.86%	9.85%	10.97%
2018	2031 & 2081	4.78	9.85%	0.02%	0.01%	9.87%	9.86%	11.01%
2021	2034 & 2084	4.83	9.85%	0.02%	0.01%	9.87%	9.86%	11.04%

- (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 2009, any changes to the steady-state rate will become effective 1 January 2013.
- (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 2009 and thus the target years are 2022 to 2072.
- (3) The steady-state target A/E ratio is the ratio obtained in the target years from 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 minimum contribution rate equals the sum of the rounded steady-state contribution rate and the rounded full funding rate.

As shown in Table 16, the minimum contribution rate is stable over the periods considered. In fact, if the best-estimate assumptions of this report are realized, the minimum contribution rate will increase by only 0.01% over the next five 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 2007 through 2009 and that projected in the 23<sup>rd</sup> 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 2007-2009) and other significant factors 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 C.

### B. Experience Update – 2007 to 2009

The major components of the change in the CPP assets from 31 December 2006 to 31 December 2009 are summarized in Table 17.

Contributions during the period 2007 to 2009 were about \$4.4 billion more than projected. Over that period, contributory earnings were greater than expected due to higher-than-expected levels of employment until 2008.

Expenditures during the period were \$206 million more than projected slightly offsetting the positive impact of higher contributions. This represents a deviation from the expected results of about 0.2%. The difference between actual and expected results is mainly due to an under-projection of retirement benefits, survivor benefits and administrative expenses that outweighs an over-projection of other expenditures. The details by type of expenditure are given in Table 18.

Investment income was 128% lower than anticipated due to the poor performance of financial markets over the period. As a result, the change in assets was \$24 billion or 65% lower than expected over the period. The resulting assets as at 31 December 2009 are 15% lower than projected.

**Table 17 Financial Status - 2007 to 2009**  
(cost accrual basis, \$ million)

	Actual <sup>(1)</sup>	Expected	Difference	
			Actual – Expected	% Change Difference/ Expected
<b>Assets at 31 December 2006</b>	<b>114,181</b>	<b>113,581</b>	<b>600</b>	<b>0.5%</b>
+ Contributions	106,510	102,125	4,385	4.3%
- Expenditures	87,793	87,587	206	0.2%
+ Investment Income	(6,061)	21,985	(28,046)	(128%)
<b>Change in Assets</b>	<b>12,656</b>	<b>36,523</b>	<b>(23,867)</b>	<b>(65%)</b>
<b>Assets at 31 December 2009</b>	<b>126,836</b>	<b>150,104</b>	<b>(23,267)</b>	<b>(15%)</b>

(1) Components do not sum to total due to rounding.



**Table 18 Summary of Expenditures - 2007 to 2009**  
(\$ million)

	Actual	Expected	Difference	% Change
			Actual – Expected	Difference/ Expected
<b>Retirement</b>	62,263	62,170	93	0.1%
<b>Disability</b>	10,013	10,014	(1)	(0.0%)
<b>Survivors</b>	11,260	11,206	54	0.5%
<b>Children</b>	1,476	1,514	(38)	(2.5%)
<b>Death</b>	812	839	(27)	(3.2%)
<b>Administrative Expenses</b>	1,969	1,844	125	6.8%
<b>Total Expenditures</b>	<b>87,793</b>	<b>87,587</b>	<b>206</b>	<b>0.2%</b>

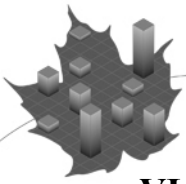
### C. Changes in the Minimum Contribution Rate

Table 19 presents the main elements of change in the minimum contribution rate since the 23<sup>rd</sup> CPP Actuarial Report. The minimum contribution rate is reduced mainly due to the provisions of Bill C-51. Changes made to demographic assumptions also act to reduce the rate. However, these reductions in the rate are more than offset by increases in the rate due to lower than anticipated investment performance between 2007 and 2009, lower assumed rates of return over the projection period as compared to the 23<sup>rd</sup> CPP Actuarial Report, as well as by other changes made to the methods and assumptions. A more detailed reconciliation of changes in the minimum contribution rate is provided in Table 38 in Appendix C of this report.

**Table 19 Reconciliation of Changes in Minimum Contribution Rate<sup>(1)</sup>**  
(% of contributory earnings)

	Steady-State Rate	Full Funding Rate		Minimum Rate	
		2010-2022	2023+	2010-2022	2023+
<b>23<sup>rd</sup> Report - After Rounding</b>	<b>9.80</b>	<b>0.02</b>	<b>0.02</b>	<b>9.82</b>	<b>9.82</b>
<b>23<sup>rd</sup> Report - Before Rounding</b>	<b>9.802</b>	<b>0.023</b>	<b>0.020</b>	<b>9.825</b>	<b>9.822</b>
<b>Amendments (Bill C-51)</b>	(0.172)	0.002	0.002	(0.170)	(0.170)
<b>Changes in Methods</b>	0.008	0.001	0.000	0.009	0.008
<b>Experience (2007 to 2009)</b>	0.043	(0.002)	0.000	0.041	0.043
<b>Changes in Demographic Assumptions</b>	(0.010)	0.000	0.000	(0.010)	(0.010)
<b>Changes in Benefit Assumptions</b>	0.017	(0.008)	(0.008)	0.009	0.009
<b>Changes in Economic Assumptions (other than investment assumptions)</b>	0.025	0.001	0.001	0.026	0.026
<b>Changes in Investment Assumptions</b>	0.122	0.000	0.000	0.122	0.122
<b>25<sup>th</sup> Report – Before Rounding</b>	<b>9.836</b>	<b>0.017</b>	<b>0.014</b>	<b>9.853</b>	<b>9.850</b>
<b>25<sup>th</sup> Report – After Rounding</b>	<b>9.84</b>	<b>0.02</b>	<b>0.01</b>	<b>9.86</b>	<b>9.85</b>

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



## **VI. Uncertainty of Results**

### **A. 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 present alternative scenarios. The alternatives presented illustrate the sensitivity of the long-term projected financial position of the Plan to changes in the future economic and demographic outlook.

Section B 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 C. 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 D. The slowdown is assumed to occur in 2012 and attempts to replicate the recent economic slowdown. Section E presents sensitivity tests on individual long-term assumptions based on stochastic modeling techniques.

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

### **B. Sensitivity of Investment Policy**

In 1996, a review was commissioned by the federal, provincial, and territorial finance ministers to determine the best ways to ensure the long-term financial sustainability of the Plan. It was acknowledged that, in order to do this, higher rates of return would be required on the assets and that continuing to invest solely in short-term and fixed income instruments would ultimately require a higher contribution rate and thus was not a viable option.

As a result of the review, the CPP Investment Board 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." The purpose of the CPP Investment Board is to meet this mandate by diversifying the



assets of the Plan through investments in equities and other asset classes with the aim of achieving higher returns. Over time, the role of the CPP Investment Board will become increasingly more important as assets are expected to grow rapidly over the next 11 years with contributions to the Plan projected to exceed expenditures over this period. After 2020, 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 2020, asset growth is still projected to continue.

Historically, equities have shown greater volatility than fixed income instruments (such as bonds), where volatility is a measure of the magnitude of fluctuation in returns. For instance, in the fifty, twenty-five, and ten years ending 2009, the volatility (standard deviation) of Canadian equities (indicated now by the S&P/TSX Total Return Index) was 16.6%, 16.8%, and 21.1%, respectively, as given in the Canadian Institute of Actuaries' *Report on Canadian Economic Statistics 1924 – 2009*. This compares with the volatility of long-term federal bonds of 10.1%, 9.8%, and 6.0% over the same periods.

Higher volatility of a security's returns implies a greater risk since the range of possible outcomes of returns increases. Hence, equities are viewed as being more risky than 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 higher returns exists along with that for lower 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.

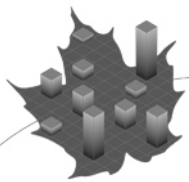


Table 20 shows the impact that various investment portfolios would have on the Plan’s real rate of return and minimum contribution rate, as well as the relative volatility present in each portfolio.

**Table 20 Investment Policy Impact on Minimum Contribution Rate**

<b>Portfolio</b>	<b>Fixed Income</b>	<b>Equity</b>	<b>Real Estate &amp; Infrastructure</b>	<b>Ultimate Real Rate of Return</b>	<b>One-Year Standard Deviation</b>	<b>Minimum Contribution Rate<sup>(1)</sup></b>
	(%)	(%)	(%)	(%)	(%)	(%)
1 <sup>(2)</sup>	100	0	0	2.8	9.0	10.49
2 <sup>(3)</sup>	100	0	0	3.2	8.1	10.31
3	80	15	5	3.5	8.0	10.13
4	60	30	10	3.9	9.1	9.97
<b>BE</b>	<b>40</b>	<b>42</b>	<b>18</b>	<b>4.0</b>	<b>10.5</b>	<b>9.85</b>
5	20	60	20	4.2	12.7	9.74
6	0	80	20	4.4	15.4	9.68

- (1) The minimum contribution rate in this table refers to the rate applicable for 2023 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 lower return is expected. Under this scenario, the low risk investments would cause the minimum contribution rate to increase to 10.49% for 2023 and thereafter. However, the portfolio’s volatility (one-year standard deviation) is relatively low when compared to the other portfolios. Portfolio #2 is assumed to be a marketable bond portfolio consisting of federal, provincial, corporate and real return bonds. Although this portfolio produces a higher real rate of return and lower volatility compared to Portfolio #1 because of the diversification from different bond classes, it is still not sufficient to earn the required real rate of return of 4.0%. Portfolio #2 is also 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 only 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), real estate and infrastructure. Portfolios #3 and #4 are more diversified than the first two portfolios and are invested 20% and 40%, respectively, in variable income securities (equity, real estate and infrastructure). This diversification increases the expected real rate of return earned on these portfolios while stabilizing or reducing their volatility compared to the first two portfolios, since the three broad asset classes are not perfectly correlated. However, despite an increased real return and stable or lower risk, these portfolios 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 more risky than the best-estimate portfolio because they consist of substantial investments in variable income securities (80% and 100%, respectively), which have much more volatile returns than fixed income. Both portfolios may result in returns higher than required to maintain the minimum contribution rate at or below the





legislated contribution rate of 9.9%. However, the volatility in these portfolios is also quite high. By investing in a less risky portfolio, the Plan's best-estimate real rate of return can still be achieved along with a lower degree of volatility. As will be demonstrated in the next section, portfolios invested in a high proportion of variable income securities have a greater likelihood of earning poor investment returns when market downturns occur.

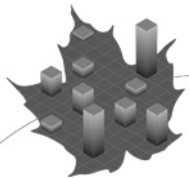
The best-estimate portfolio is invested 40% in fixed income, 42% in equity and 18% in real estate and infrastructure in the long-term. Such a portfolio produces an expected average annual real return of 4.0% with a one-year standard deviation of 10.5%. By observing the volatility of each of the portfolios in Table 20, 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 Canada Pension Plan and the ability of the Canada Pension Plan to meet its financial obligations on any given business day.

### C. Financial Market Tail Events

The following section analyzes the impacts that tail events in portfolio returns will have on the minimum contribution rate. To illustrate this, portfolio returns other than the best-estimate are assumed to occur in 2012 under various investment portfolios of the CPP. Two alternative portfolios were selected from section B to show the potential impacts of a less risky (Portfolio 3: 15% equity, 5% real estate and infrastructure, 80% fixed income) and a more risky (Portfolio 5: 60% equity, 20% real estate and infrastructure, 20% fixed income) portfolio in relation to the best-estimate portfolio.

It is assumed that the returns of the three portfolios follow a normal distribution. The mean and standard deviation for each portfolio is given in Table 20 in section B. Two probability levels were selected to analyze: 1/10 and 1/50. These levels can be thought of as the probabilities of earning 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 2012 at the two probability levels. Following the various portfolio returns in 2012, it is assumed that the returns revert back to their best-estimate values from 2013 onward. The nominal returns and the resulting impact on the minimum contribution rates are given in Table 21.



**Table 21 Impact of Various Portfolio Returns and Portfolios (2012)**

Probability of Return <sup>(1)</sup>	Tail	Portfolio 3: 15% Equities/ 80% Fixed Income/ 5% Real Estate & Infrastructure		Best-Estimate Portfolio		Portfolio 5: 60% Equities/ 20% Fixed Income/ 20% Real Estate & Infrastructure	
		Nominal Return in 2012	Impact on Minimum Contribution Rate	Nominal Return in 2012	Impact on Minimum Contribution Rate	Nominal Return in 2012	Impact on Minimum Contribution Rate
		(%)	(%)	(%)	(%)	(%)	(%)
1/10	Left	(5)	0.05	(7)	0.08	(10)	0.12
	Right	16	(0.05)	19	(0.09)	22	(0.12)
1/50	Left	(11)	0.08	(16)	0.14	(20)	0.20
	Right	22	(0.08)	28	(0.16)	32	(0.20)

(1) 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 a 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 -7% or less as well as a nominal return of +19% or more. As a result, the minimum contribution rate could increase by at least 0.08 percentage points or decrease by at least 0.09 percentage points.

If a smaller tail 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% or less while the right tail event is a nominal return of +28% or more. As a result of these two tail events, the minimum contribution rate could increase by at least 0.14 percentage points or decrease by at least 0.16 percentage points.

Portfolio 3, the low-risk portfolio, has the lowest proportion of variable income securities and thus, the lowest expected portfolio return. 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 expected portfolio return. Since it is more risky than the best-estimate portfolio, 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% or less may occur resulting in an absolute increase of at least 0.20% 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 towards 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 such poor investment returns occurring.

#### **D. Economic Slowdown**

Following the economic slowdown experienced since the last actuarial report, sensitivity tests were created to analyze the capacity of the CPP to withstand another such slowdown in the near future. The economy is currently in the early stages of recovery after the slowdown experienced in 2008-09. Under the best-estimate scenario, moderate economic growth is assumed. The sensitivity tests assume that another economic slowdown occurs in 2012 before the economy is able to fully recover from the most recent slowdown. A period of recovery is assumed to follow as economic assumptions return to their best-estimate values.

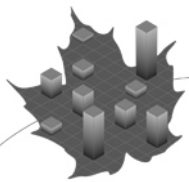
The first scenario focuses on the impact of changes to the economic assumptions, while the second scenario builds on the first one and adds a negative shock to the investment portfolio.

During the recent economic slowdown, the Canadian unemployment rate reached 8.3% in 2009 which is approximately 2 percentage points higher than its 2008 value of 6.1%. In addition, CPP assets declined from \$123 billion to \$106 billion.

Under the best-estimate scenario, the unemployment rate is assumed to be 8.3% for Canada in 2012. In addition, average real weekly earnings and average real annual earnings increase by 0.6% in 2012.

Under the first scenario, the unemployment rate is increased by an additional two percentage points in 2012 to reach 10.3%. It then gradually reverts to its best-estimate value over the following eleven years. The real increases in average weekly earnings and average annual earnings are reduced for 2012 to 0% and then return to their best-estimate values for 2013 and thereafter. As a result, total contributory earnings reduce by 2% in 2012 and continue to lag the best-estimate in all projections 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 return of -20% in 2012 and returns to its best-estimate value in the following year. As a result, the minimum contribution rate increases to 10.03%.



The results of these tests are summarized in Table 22.

**Table 22 Economic Slowdown (2012)**

<b>Canada</b>	<b>Slowdown</b>	<b>Best Estimate</b>
	(%)	(%)
<b>Scenario #1</b>		
Unemployment Rate	10.3	8.3
Real-wage Differential	0.0	0.6
<b>Minimum Contribution Rate<sup>(1)</sup></b>	<b>9.86</b>	<b>9.85</b>
<b>Scenario #2</b>		
Unemployment Rate	10.3	8.3
Real-wage Differential	0.0	0.6
Nominal investment return	(20.0)	5.5
<b>Minimum Contribution Rate<sup>(1)</sup></b>	<b>10.03</b>	<b>9.85</b>

(1) The minimum contribution rate in this table refers to the rate applicable for years 2023 and thereafter.

### **E. Individual Sensitivity Tests**

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

Most of the individual assumption sensitivity tests are determined based on stochastic modeling techniques that estimate the probability distribution of the outcome for each of the assumptions. These probability distributions are used to quantify a range of possible outcomes for each of the selected assumptions. The fluctuation in each variable is projected by using standard time-series modeling, a method designed to make inferences based on historical data. Generally, each variable is modeled by an equation that captures a relationship between current and prior years' values of the assumption and introduces year-by-year random variation, consistent with the variation observed in the historical period. For some assumptions, the equations additionally reflect interrelationships with other assumptions. Parameters for the equations are estimated using historical data for periods that range between 40 years and 82 years, depending on the data available. 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.

For each assumption that was stochastically analyzed, a minimum of 1,000 outcomes are generated for each year in the projection period. Next, an 80% confidence interval is calculated for each assumption to determine with 80% probability, the range of possible outcomes. The upper and lower values of this 80% confidence interval are used as either the



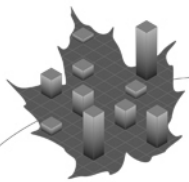
low-cost and high-cost assumptions, or vice versa depending on the assumption, for these individual sensitivity tests. These stochastically-generated values represent the range of the outcomes for the indicated variable over the entire 75-year projection period. Although the yearly outcome of each variable will fluctuate, it is the average outcome over the projection period that will determine the financial sustainability of the Plan. If a shorter projection period were to be considered, such as ten years, one could expect the average 80% confidence interval to be wider since the outcomes will not have had enough time to stabilize.

The results should be interpreted with caution and a full understanding of the inherent limitations of stochastic time-series modeling. Results are very sensitive to equation specifications, degrees of interdependence among variables and the historical periods used for the estimates. For some variables, using the variations exhibited in a relatively recent historical period may not provide a realistic representation of the potential variation for the future. In addition, results would differ if random variations had been applied to additional variables other than those mentioned above (such as labour force participation rates and retirement rates). 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 period available for most variables is relatively homogeneous and does not reflect substantial shifts. The time-series modeling reflects what occurred in the historical period. 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. For the remaining assumptions, alternative assumptions were determined based on judgment and are discussed in the sections below describing each individual test. Each of these sensitivity tests was categorized as either a low-cost scenario or a high-cost scenario. In the low-cost scenarios, the alternative assumptions have the effect of reducing the minimum contribution rate. Conversely, assumptions for the high-cost scenarios increase the minimum contribution rate.

The alternative assumptions selected are intended to cover an 80% confidence interval and 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 23 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 23 Individual Sensitivity Test Assumptions**

<b>Canada</b>		<b>Low-Cost</b>		<b>Best-Estimate</b>		<b>High-Cost</b>	
<b>1</b>	Total fertility rate	1.90		1.65		1.40	
Mortality:							
<b>2</b>	Canadian life expectancy at age 65 in 2050 with future improvements	Males	19.2	Males	22.6	Males	25.2
		Females	20.2	Females	24.6	Females	27.9
<b>3</b>	Net migration rate	0.61%		0.58%		0.54%	
<b>4</b>	Participation rate (aged 15-69) <sup>(1)</sup>	80% (2030)		75% (2030)		72% (2030)	
	Unemployment rate <sup>(1)</sup>	4.1%		6.1%		8.1%	
<b>5</b>	Rate of increase in prices	2.9%		2.3%		1.7%	
<b>6</b>	Real-wage differential	1.9%		1.3%		0.7%	
<b>7</b>	Real rates of return	4.8%		4.0%		3.2%	
<b>8</b>	CPP disability incidence rates (per 1,000 eligible)	Males	2.4	Males	3.3	Males	4.0
		Females	2.8	Females	3.6	Females	4.5

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

### 1. Fertility Rate

The best-estimate assumption is that the total fertility rate for Canada will decrease slightly from its 2007 level of 1.66 to an ultimate level of 1.65 in 2015. Based on fertility experience of the last 67 years (1941 to 2007), 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 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 10-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 below the national population replacement rate of 2.1. 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 7.3% 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 assumptions.

The high-cost assumption has the total fertility rate decreasing to an ultimate level of 1.4 in 2015. This is similar to the total fertility rates of Italy and Japan. Under this scenario, the population grows much more slowly, to a level in 2050 that is 7.0% 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 0.49 (or 2.0 workers per retiree).



## 2. Mortality Rates

Mortality improvements are expected to continue in the future. In fact, if recent improvements in life expectancy, especially for ages 75 to 89, continue, the long-term assumptions will need to be adjusted accordingly. This could in turn put additional pressure on the minimum contribution rate, causing it to increase possibly above 9.9%.

The best-estimate ultimate rates of mortality improvement were established based on trends in Canadian experience over the last 30 years by age and sex. For the first five years of the projection (2007-2011), mortality improvement rates are assumed to correspond to the experience over the last 15 years (1991-2006). These rates are then graded down to their ultimate values by 2031.

Based on the mortality experience by age and sex of the last 81 years (1926 to 2006), a stochastic approach was used to generate the low- and high-cost scenarios over the 75-year projection period. It was projected that, on average, the life expectancy of a male age 65 in 2050 will be in the range 19.2 years to 25.2 years with 80% probability. For a female age 65 in 2050, life expectancy is projected to be in the range 20.2 years to 27.9 years.

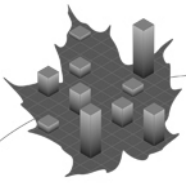
For the low-cost scenario, mortality is assumed to improve at a much slower rate than under the best-estimate scenario and for some age groups, mortality rates are assumed to increase from the current rates. This reflects to a certain degree the slowdown in mortality improvements under age 65 observed over the last few years and anticipates that current improvements above age 65 may not be sustainable. Under this scenario, the population grows to a level in 2050 that is 4.5% lower than under the best-estimate assumption. In addition, the dependency ratio decreases to 0.40 (or 2.5 workers per retiree) compared to a best-estimate of 0.46 since life expectancy is lower and there would be fewer retirees compared to the working-age population.

For the high-cost scenario, mortality is assumed to not only continue to improve, but also improve more rapidly, especially at the older ages consistent with what has been observed in recent years. Under this scenario, the population grows to a level in 2050 that is 2.7% higher than under the best-estimate assumption. The dependency ratio also increases to 0.50 (or 2.0 workers per retiree) since life expectancy is higher and there would be more retirees compared to the working-age population. Table 24 presents the life expectancies that would result in 2050 from the different rates of improvement.

**Table 24 Life Expectancy in 2050 Under Alternative Assumptions<sup>(1)</sup>**  
 (Canada)

		Low-Cost	Best-Estimate	High-Cost
<b>At Birth</b>	Males	80.1	88.1	92.8
	Females	80.5	90.5	95.9
<b>At Age 65</b>	Males	19.2	22.6	25.2
	Females	20.2	24.6	27.9

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



### **3. Net Migration Rate**

An ultimate best-estimate assumption of 0.58% of the population has been established for years 2023 and thereafter. However, the net migration rate based on average experience over the last three years (2007-2009) was 0.62% and over the last 30 years (1980-2009) was 0.53%. Based on a continuation of the average experience over the last 30 years, it is assumed that net migration rates will reduce from 0.62% to 0.53% by 2014 and remain stable at that level until 2018. In the long run, a possible labour shortage could prompt an increase in immigration in order to supply the required workforce. This is why the net migration rate is projected to increase from 0.53% in 2018 to 0.58% in 2023. This is consistent with experience over the last 15 years.

Based on the net migration experience of the last 51 years (1959 to 2009), 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 0.54% to 0.61% of the population with 80% probability. Instead, if a 10-year projection period is considered, then average net migration will be in the range 0.43% to 0.70% of the population.

The low-cost assumption has net migration reaching a level of 0.61% of the population in 2014 and remaining constant thereafter. This is very close to the average net migration rate of 0.62% over the three-year period ended 2009. Under this scenario, the population grows to a level in 2050 that is 2.2% 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) is 0.46 (or approximately 2.2 workers per retiree) in 2050. There is very little difference in the dependency ratio compared to the best-estimate.

The high-cost assumption has net migration reaching a level of 0.54% of the population in 2023 and remaining constant thereafter. This is very close to the average net migration rate of 0.53% over the thirty-year period ended 2009. Under this scenario, the population grows more slowly, to a level in 2050 that is 1.5% lower than under the best-estimate assumption. As well, the dependency ratio is 0.47 (or approximately 2.1 workers per retiree), compared to 0.46 for the best-estimate. The dependency ratio worsens only slightly compared to the best-estimate since the impact of a lower net migration rate 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.

### **4. Unemployment Rate - Participation Rates**

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 retirement patterns of older workers. The ultimate level of unemployment assumed to apply in 2022 and thereafter is 6.1%.





A deterministic model (instead of a stochastic model) was used to generate the low- 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 future labour shortage caused by the retirement of the baby boom generation is unlike any labour situation experienced in the past and thus, the historical data does 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 and unemployment.

For the low-cost scenario, the job creation rates are assumed to increase more rapidly, which results in an unemployment rate of 4.1% in 2022 and thereafter. For the high-cost scenario, the job creation rates are assumed to increase at the same rate as the labour force, resulting in the unemployment rate staying constant at 8.1% for the entire projection period.

Participation rates are used to estimate the active population (i.e. the labour force). The best-estimate scenario divides the projection period into three periods, i.e. 2010 to 2015, 2015 to 2030, and from 2030 onward. During the 2009 economic slowdown, labour force participation rates for the younger age groups decreased, while the older age groups experienced stable and even increasing participation rates. As the economy recovers, labour force participation rates are assumed to increase, particularly at the younger age groups where many of the jobs were lost. Thus, the labour force participation rate for ages 15-69 increases slightly from approximately 74.9% in 2009 to 75.1% in 2015.

From 2015 to 2030, baby boomers born between 1955 and 1965 will be reaching the ages of 50 to 75, while the first generation of boomers (1945 to 1955) will have already retired, thus creating downward pressure on the overall participation rate. It was thus assumed that those reaching ages 55 to 64 during this period will participate more because of the increased employment opportunities due to a possible labour shortage. As well, it is assumed that participation rates for those below age 55 will increase. Thus, the labour force participation rate for ages 15-69 is projected to increase slightly to 75.2% in 2030. For 2030 onward, the participation rates are kept constant.

For the low-cost scenario, male participation rates are assumed to reach their highest historical level by 2030 and females are assumed, over the same period, to close the gap between male and female participation rates by one-half. Participation rates are then held constant beyond 2030. This results in an overall participation rate of 79.6% for those aged 15 to 69 in 2030.

For the high-cost scenario, male and female participation rates are assumed to remain constant at their 2009 levels. This results in an overall participation rate of 72.4% for those aged 15 to 69 in 2030.

## **5. Price Increases**

An ultimate annual rate of price increase of 2.3% has been assumed for the best-estimate projections. The rate of price increase is assumed to be 2.0% from 2010 to 2016 and is then assumed to increase uniformly to its ultimate level of 2.3% in 2019.

Based on the overall inflation rate experience of the last 72 years (1938 to 2009), 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 rate of price increase during the 75-year projection period will be in the range 1.7% to 2.9% with 80% probability. Instead, if a 10-year projection period is considered, then the average annual rate of price increase will be in the range 0.0% to 4.0%.

For the low-cost scenario, the annual rate of price increase is assumed to rise to an ultimate level of 2.9% in 2019. This level of inflation is comparable to the average over the last 28 years. Although a higher rate of increase in prices results in higher CPP expenditures, it also results in higher contributory earnings. This is because the same real-wage differential is added to a higher base of inflation, producing a higher nominal rate of wage increase.

For the high-cost scenario, the annual rate of price increase is assumed to be 1.7% for years 2010 and thereafter. This level of inflation is comparable to that of the early 1960s and the mid-to-late 1990s.

### **6. Real-Wage Differential**

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 differential of 1.3% has been assumed in years 2019 and thereafter for the best-estimate projections. The ultimate real-wage differential assumption, combined with the ultimate price increase assumption of 2.3% yields the assumption for ultimate nominal annual increases in wages of 3.6% in 2019 and thereafter. During the initial years of the projection period, the real-wage differential is assumed to increase gradually to its ultimate level.

Based on the overall real-wage experience of the last 67 years (1943 to 2009), 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 differential throughout the 75-year projection period will be in the range 0.7% to 1.9% with 80% probability. Instead, if a 10-year projection period is considered, then the average real-wage differential will be in the range -0.9% to 2.5%.

For the low-cost scenario, the assumed real-wage differential increases to an ultimate level of 1.9% in 2019. For the high-cost scenario, the assumed real-wage differential increases according to the best-estimate assumption until a level of 0.7% is reached in 2013. It is then held constant thereafter.

### **7. 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 the overall rate of return experience of the last 72 years (1938 to 2009), 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 3.2% to



4.8% with 80% probability. Instead, if a 10-year projection period is considered, then the average annual real rate of return will be in the range 0.8% to 6.3%.

For the low-cost scenario, the real rate of return on investments is assumed to be 4.8% in 2020 and thereafter. For the high-cost scenario, the real rate of return on investments is assumed to be 3.2% in 2020 and thereafter.

The real rates of return have no effect on the pay-as-you-go rates, since they affect neither expenditures nor contributory earnings. However, real rates of return have an impact on the minimum contribution rate. Beginning in 2020 when net cash flows of the Plan are projected to turn negative, a portion of investment income will be required to pay Plan benefits. 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.

## 8. 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 years 2015 and later is 3.3 new disability beneficiaries per year among 1,000 eligible workers for males and 3.6 per thousand for females, on average.

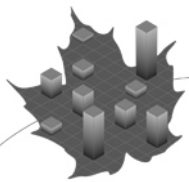
Based on the overall disability incidence rate experience of the last 39 years (1970 to 2008), a stochastic approach was used to generate the low- and high-cost scenarios over the 75-year projection period. It was projected that the average annual disability incidence rate for males during the 75-year projection period will be in the range 2.4 to 4.0 per 1,000 eligible workers with 80% probability. For females, the range of disability incidence rates is 2.8 to 4.5 per 1,000 eligible workers.

For the low-cost scenario, disability incidence rates are assumed to reach ultimate levels in 2015 of 2.4 per thousand for males and 2.8 per thousand for females. In the last ten years, male incidence rates have been below 3.0 only twice (2006 and 2007). Female incidence rates have not been below 3.0 since 1974.

For the high-cost scenario, disability incidence rates are assumed to reach ultimate levels in 2015 of 4.0 per thousand for males and 4.5 per thousand for females. These rates are lower than the high levels experienced in the early 1990s.

## 9. Results

Under each scenario, the contribution rate was projected to follow the current schedule through 2012 and a new minimum contribution rate was determined for years 2013 and thereafter. Table 25 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 25 Sensitivity of Minimum Contribution Rate**  
(percentages)

Assumption	Scenario	Minimum Contribution Rate <sup>(1)</sup>	First Year Expenditures Exceed Contributions <sup>(2)</sup>	Pay-As-You-Go Rates		
				2025	2050	2084
	Best-Estimate	9.85	2021	10.43	10.94	11.37
1 Total Fertility Rate	Low Cost	9.54	2017	10.42	10.37	10.19
	High Cost	10.16	2023	10.43	11.58	12.87
2 Mortality Rates	Low Cost	9.27	2015	10.24	10.15	9.98
	High Cost	10.25	2023	10.59	11.49	12.21
3 Net Migration Rate	Low Cost	9.76	2021	10.32	10.81	11.25
	High Cost	9.91	2021	10.45	11.09	11.54
4 Unemployment and Participation Rates	Low Cost	9.55	2021	9.92	10.57	11.50
	High Cost	10.11	2020	10.90	11.23	11.28
5 Price Increases	Low Cost	9.74	2020	10.35	10.76	11.24
	High Cost	9.99	2021	10.56	11.14	11.53
6 Real-Wage Differential	Low Cost	9.34	2016	9.86	9.95	10.34
	High Cost	10.33	2022	10.93	12.04	12.58
7 Real Rate of Return on Investments	Low Cost	9.45	2016	10.43	10.94	11.37
	High Cost	10.25	2024	10.43	10.94	11.37
8 Disability Rates	Low Cost	9.66	2020	10.25	10.72	11.17
	High Cost	10.03	2021	10.61	11.15	11.57

(1) The minimum contribution rate in this table refers to the rate applicable for 2023 and thereafter.

(2) Projections use the minimum contribution rate.

As shown in the Table 25, 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 three years by 2050, the minimum contribution rate in 2023 and thereafter would increase to 10.25%, 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 three and four years, respectively, the ultimate minimum contribution rate would decrease significantly to 9.27%.

The most sensitive economic assumptions are the real-wage differential and the real rate of return on investments. If an ultimate real-wage differential of 1.9% is assumed for 2019 and thereafter, the ultimate minimum contribution rate would decrease to 9.34%. However, if an ultimate real-wage differential of 0.7% is assumed for 2013 and thereafter, the ultimate minimum contribution rate would increase to 10.33%.

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 4.8% is assumed for 2020 and thereafter, the ultimate minimum contribution rate will decrease to 9.45%. However, if the real rate of return is assumed to be 3.2% for 2020 and thereafter, the ultimate minimum contribution rate increases to 10.25%.



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 25 would be adequate through 2084, 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 value, 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 26 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.

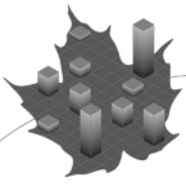
**Table 26 Sensitivity of Funding Levels**  
 (9.9% contribution rate)

Assumption	Scenario	First Year Expenditures Exceed Contributions	Asset/Expenditure Ratio		
			2025	2050	2084
	Best-Estimate	2021	4.77	5.18	5.06
1 Total Fertility Rate	Low Cost	2021	4.77	5.77	9.65
	High Cost	2021	4.78	4.59	- <sup>(1)</sup>
2 Mortality Rates	Low Cost	2022	5.00	7.46	15.20
	High Cost	2020	4.60	3.77	- <sup>(2)</sup>
3 Net Migration Rate	Low Cost	2022	4.85	5.59	6.17
	High Cost	2021	4.77	4.97	4.17
4 Unemployment and Participation Rates	Low Cost	2025	5.19	7.11	8.75
	High Cost	2018	4.41	3.57	1.73
5 Price Increases	Low Cost	2022	4.81	5.67	6.61
	High Cost	2020	4.68	4.54	3.10
6 Real-Wage Differential	Low Cost	2026	5.08	7.30	11.05
	High Cost	2019	4.58	3.16	- <sup>(3)</sup>
7 Real Rate of Return on Investments	Low Cost	2021	5.33	7.58	13.36
	High Cost	2021	4.27	3.43	0.71
8 Disability Rates	Low Cost	2023	5.02	6.16	7.77
	High Cost	2020	4.54	4.29	2.54

(1) Assets depleted by 2084.

(2) Assets depleted by 2083.

(3) Assets depleted by 2073.



## **F. Younger and Older Populations**

Demographic and labour force assumptions are modified in this section with the purpose of creating younger and older populations and not necessarily 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 assumptions (participation and unemployment rates) were modified to align with the new populations.

The demographic assumptions anticipated in these scenarios were determined using the stochastic time-series modeling techniques described in section E. An upper and lower confidence interval that corresponds to 80% was projected around each best-estimate assumption to determine a reasonable range of values over the 75-year projection period. The upper and lower bounds of these confidence intervals represent the demographic assumptions for the younger and older population scenarios.

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.

### **1. Younger Population**

Under the younger population scenario, it is assumed that the ultimate total fertility rate is 1.90 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 and for some age groups, life expectancy is projected to decrease. The result is that life expectancies at age 65 reduce from their projected best-estimate by approximately three years for males and four years for females by 2050. Finally, net migration to Canada is assumed to reach a level of 0.61% of the population by the year 2014.

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 0.38 (or 2.6 workers per retiree) in 2050. This is 18% lower than under the best-estimate scenario where the ratio reaches a level of 0.46 (or 2.2 workers per retiree) in 2050.

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 somewhat lower, especially for ages 55 and over. With a larger labour force there would be less pressure to work to a later age, and both employers and unions would more easily manage early retirement.



## 2. 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 three years for both males and females by 2050. Finally, net migration to Canada is assumed to fall to a level of 0.54% of the population by the year 2023.

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 0.54 (or 1.9 workers per retiree) in 2050. This is 17% 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.

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 somewhat higher, especially for ages 55 and over. With a smaller labour force there would be more pressure to work to a later age and early retirement would be more difficult to manage for both employers and unions.

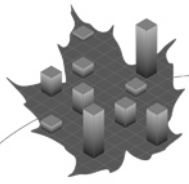
## 3. Results

Table 27 presents a summary of the assumptions used in this sensitivity analysis. Tables 28 and 29 present the financial results under both the younger and older population scenarios, respectively. Both projections assume the currently scheduled contribution rate of 9.9%. The minimum contribution rates are 9.06% and 10.41% for the younger and older population scenarios, respectively. Chart 3 shows the evolution of the asset/expenditure ratio under the younger, best-estimate and older population scenarios with the legislated contribution rate of 9.9%.

**Table 27 Younger and Older Populations Sensitivity Test Assumptions**

<b>Canada</b>	<b>Younger Population</b>		<b>Best-Estimate</b>		<b>Older Population</b>	
Total fertility rate	1.90		1.65		1.40	
Mortality:						
Canadian life expectancy at age 65 in 2050 with future improvements	Males	19.2	Males	22.6	Males	25.2
	Females	20.2	Females	24.6	Females	27.9
Net migration rate	0.61%		0.58%		0.54%	
Participation rate (age group 15-69)	72% (2030)		75% (2030)		80% (2030)	
<b>Minimum Contribution Rate<sup>(1)</sup></b>	<b>9.06%</b>		<b>9.85%</b>		<b>10.41%</b>	

(1) The minimum contribution rate in this table refers to the rate applicable for years 2023 and thereafter.



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**Table 28 Financial Status under Younger Population Scenario**  
(\$ billion)

Year	PayGo Rate	Contribution Rate	Contributory Earnings	Contributions	Expenditures	Net Cash Flow	Investment Income	Assets at 31 Dec.	Asset/Expenditure Ratio
	(%)	(%)							
2010	8.67	9.9	371.4	36.8	32.2	4.6	2.4	133.8	3.94
2011	8.84	9.9	384.6	38.1	34.0	4.1	7.3	145.1	4.03
2012	8.93	9.9	403.4	39.9	36.0	3.9	8.4	157.5	4.12
2013	9.13	9.9	418.5	41.4	38.2	3.2	9.1	169.8	4.20
2014	9.32	9.9	434.1	43.0	40.4	2.5	9.8	182.1	4.27
2015	9.48	9.9	450.2	44.6	42.7	1.9	11.5	195.5	4.35
2020	9.87	9.9	557.5	55.2	55.0	0.2	16.4	270.8	4.67
2025	10.39	9.9	685.4	67.9	71.2	(3.3)	22.0	360.3	4.82
2030	10.62	9.9	843.7	83.5	89.6	(6.0)	28.3	463.0	4.96
2040	9.99	9.9	1,323.8	131.1	132.3	(1.2)	48.3	799.9	5.82
2050	9.66	9.9	2,043.0	202.3	197.3	5.0	91.8	1,525.0	7.41
2075	8.74	9.9	6,126.3	606.5	535.2	71.3	502.5	8,419.9	15.07

**Table 29 Financial Status under Older Population Scenario**  
(\$ billion)

Year	PayGo Rate	Contribution Rate	Contributory Earnings	Contributions	Expenditures	Net Cash Flow	Investment Income	Assets at 31 Dec.	Asset/Expenditure Ratio
	(%)	(%)							
2010	8.65	9.9	372.3	36.9	32.2	4.7	2.4	133.9	3.94
2011	8.80	9.9	386.4	38.3	34.0	4.3	7.3	145.4	4.04
2012	8.87	9.9	406.2	40.2	36.0	4.2	8.4	158.1	4.13
2013	9.07	9.9	422.2	41.8	38.3	3.5	9.1	170.7	4.21
2014	9.25	9.9	438.6	43.4	40.6	2.9	9.9	183.4	4.28
2015	9.41	9.9	455.7	45.1	42.9	2.2	11.6	197.2	4.36
2020	9.75	9.9	575.6	57.0	56.1	0.9	16.7	276.4	4.66
2025	10.27	9.9	721.2	71.4	74.1	(2.7)	22.7	372.3	4.76
2030	10.63	9.9	897.7	88.9	95.4	(6.5)	29.4	480.2	4.80
2040	11.15	9.9	1,331.5	131.8	148.4	(16.6)	45.2	738.0	4.76
2050	11.97	9.9	1,930.1	191.1	230.9	(39.9)	62.9	1,015.9	4.21
2075	13.79	9.9	4,765.2	471.8	656.9	(185.1)	-	-	-



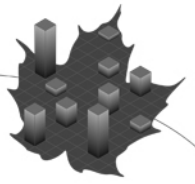
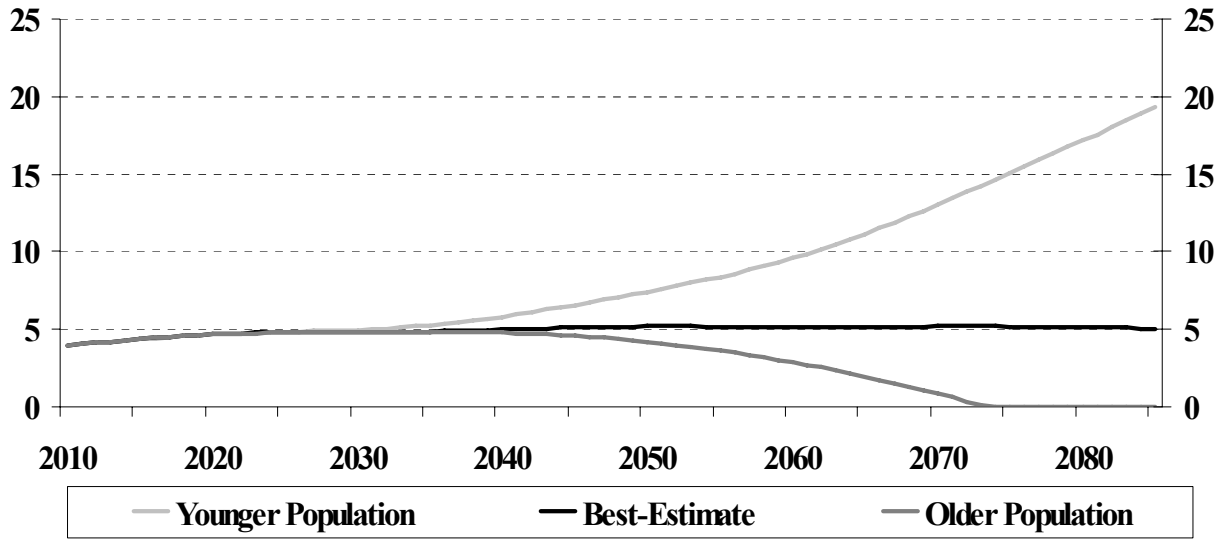


Chart 3 Asset/Expenditure Ratio under Alternative Population Scenarios (9.9%)





## VII. Conclusion

The results contained in this report confirm that the legislated contribution rate of 9.9% is sufficient to pay for future expenditures and accumulate assets of \$275 billion (4.7 times the annual expenditures) by 2020.

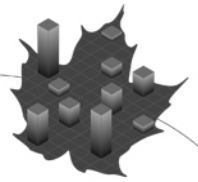
The minimum contribution rate determined under the best-estimate assumptions of this report is 9.86% for years 2013 to 2022 and 9.85% for years 2023 and thereafter, compared to 9.82% as determined for the 23<sup>rd</sup> CPP Actuarial Report. Experience over the period 2007 to 2009 was worse than anticipated overall, thus putting upward pressure on the minimum contribution rate. Investment losses and increases in life expectancy increased the rate. Fertility, migration, and economic experience were all better than expected and thus partially offset the impact on the minimum contribution rate. However, lower assumed rates of return on investments, and an expected continuing decrease in mortality rates, especially at the older ages, result in an overall increase to the rate.

Stakeholders adapted the CPP, through Bill C-51, to change the pension adjustment factors and to increase Plan flexibility by removing the Work Cessation Test for early pension take-up and allowing working beneficiaries to contribute. As a consequence, financial sustainability was enhanced. The result of this is that the minimum contribution rate remains below the legislated rate of 9.9% despite the upward pressure described above.

To measure the sensitivity of the long-term projected financial position of the Plan to changes in the future economic and demographic 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 9.85% if other than best-estimate assumptions were to be realized. If recent improvements in mortality, especially for ages 75 to 89, continue, the long-term assumptions will need to be adjusted accordingly. This will put additional pressure on the minimum contribution rate, which 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 11 years 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 5.2 by 2050. These are indicators that, despite the projected higher benefit expenditures due to an aging population, the Plan is expected to be able to meet its obligations and 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 2012.



## VIII. Actuarial Opinion

In our opinion, considering that this Twenty-Fifth 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 9.86% for years 2013 to 2022 and 9.85% for years 2023 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 Guidelines of Actuarial Practice for Social Security Programs of the International Actuarial Association.

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

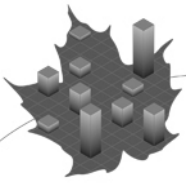
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Michel Montambeault, F.S.A., F.C.I.A.  
Senior Actuary

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Michel Millette, F.S.A., F.C.I.A.  
Senior Actuary

Ottawa, Canada  
3 November 2010



## **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/QPP cover most individuals with employment earnings. Finally, individuals may be covered by registered private pension plans (RPPs) and can purchase individual registered retirement savings plans (RRSPs) to supplement their retirement income.

Each tier is financed using a different approach: the OAS Program is financed through general tax revenue on a pay-as-you-go basis, the CPP is partially funded based on contributions on employment earnings and RPPs and RRSPs are intended to be fully funded. The variety in financing methods enables the retirement income system to be steered toward more or less funding by putting emphasis on the different tiers depending on the demographic and economic conditions. Therefore, to properly assess the appropriateness of the financing approach of the CPP in the long term, one must consider the whole retirement system in Canada rather than the CPP in isolation.

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 a pay-as-you-go scheme 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 PayGo 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 and higher life expectancies than expected, lower productivity, benefit enrichments and increased numbers of Canadians claiming disability benefits for longer periods.



In response to this, 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 CPP Investment Board to achieve higher rates of return. The changes also included that full funding of any future increases to or new benefits should be provided under the Plan. 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 expenditure is currently projected to stabilize at a level of about 4.7. 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.

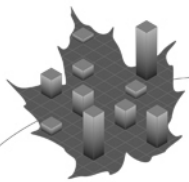
## II. Balance Sheet

This report presents the balance sheet of the Plan under two methodologies: a closed group approach and an open group approach. A closed group includes only current participants of the Plan, with no new entrants permitted and no new benefits accrued. In comparison, an open group is one which includes all current and future participants of the Plan.

### A. Closed group approach

For a closed group, only current Plan participants are considered as well as benefits earned with respect to participation in the Plan on or before the valuation date.

To determine the actuarial liability under the closed group approach, the benefits that will be paid in respect of CPP participation on or before the valuation date must first be projected. For beneficiaries in pay, expenditures are projected using the best-estimate assumptions described in Appendix D. For contributors, the projection is also based on the best-estimate assumptions described in Appendix D with the following exceptions:



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- no new entrants to the workforce are included;
- current Plan participants who are not receiving benefits at the valuation date are assumed to make no further contributions beyond that date. Their projected benefits are calculated by assuming they will have no pensionable earnings from the valuation date up to the year of benefit take-up; and
- the low-earnings drop-out provision is applied to the period up to the valuation date. This is a change from the methodology used in the 23<sup>rd</sup> CPP Actuarial Report where it was assumed that participants could drop 15% of the maximum contributory period. This change is made in order to bring the projection methodology in line with the Plan's provisions.

In accordance with the Plan's provisions, the YMPE is still projected to the year of benefit take-up and pre-valuation date pensionable earnings are still indexed to the year of benefit take-up using projected nominal wage increases, i.e. changes in the Consumer Price Index (CPI) plus real wage increases.

Next, the resulting projected expenditures are discounted using the projected rate of return on current CPP assets to determine their present value. This is the actuarial liability under the closed group approach. The assets under this approach consist of the Plan's current assets.

The actuarial position of the Plan as at 31 December 2009 and 31 December 2019 under the closed group approach is presented in Table 30. To determine the unfunded liability of the Plan, the Plan's assets are deducted from the actuarial liability at the valuation date.

**Table 30 Balance Sheet under the Closed Group Approach**

	As at 31 December 2009		As at 31 December 2019	
	Amount	As a % of Liability	Amount	As a % of Liability
	(\$ billion)		(\$ billion)	
<b>Actuarial liability</b>	874.8	100.0	1,308.9	100.0
<b>Assets</b>	126.8	14.5	258.1	19.7
<b>Unfunded liability</b>	748.0	85.5	1,050.8	80.3

With the changes introduced in 1998, the Plan has been moving away from pay-as-you-go financing (with a small contingency reserve) towards fuller funding. Table 30 shows that the assets of the Plan are projected to increase from 14.5% of its actuarial liability under the closed group approach as at 31 December 2009 to 19.7% as at 31 December 2019. However, from its inception, the CPP was never intended to be a fully funded plan. Although the relative size of the unfunded liability under the closed group may be used as a measure of the Plan's financial status, the key financial measure for evaluating the sustainability of the Plan is the steady-state contribution rate, specifically, its adequacy and stability over time.



## B. Open group approach

An open group is defined as one which 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.

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 using the best-estimate assumptions described in Appendix D. Next, these unlimited 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.

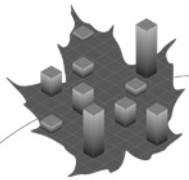
To determine the assets of the Plan under the open group approach, future contributions of current and future contributors are first projected using the best-estimate assumptions described in Appendix D and the legislated rate of 9.9%. These unlimited projected contributions are then discounted using 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 2009 and 31 December 2019 under the open group approach is presented in Table 31. To obtain the unfunded liability of the Plan, the Plan's assets are deducted from the actuarial liability at the valuation date.

**Table 31 Balance Sheet under the Open Group Approach**

	As at 31 December 2009		As at 31 December 2019	
	Amount	As a % of Liability	Amount	As a % of Liability
	(\$ billion)		(\$ billion)	
<b>Actuarial liability</b>	1,995.0	100.0	2,836.9	100.0
<b>Assets</b>	1,988.1	99.7	2,825.3	99.6
<b>Unfunded liability</b>	6.9	0.3	11.6	0.4

If the Plan's sustainability is to be measured based on its unfunded liability, it should be done on an open group basis. The Plan is intended to be long-term and enduring in nature, a fact that is reinforced by the federal, provincial and territorial governments' stewardship through the established strong governance and accountability framework of the Plan. Thus, an open group valuation that emphasizes the long-term nature of the Plan could be deemed to be the most appropriate. 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 75-year projection period.



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#### III. Current Service Cost

The current service cost represents the value of future benefits earned in a year with respect to all participants of the Plan who contribute during that year. The current service cost for the Plan, presented in Table 32, assumes limiting the low-earnings drop-out to the period prior to the valuation date. The current service cost is shown for the next three years ending 31 December 2012, which is the date of the next triennial report.

**Table 32 Current Service Cost**

<b>Year ending 31 December</b>	<b>Current Service Cost</b>	<b>Contributory Earnings</b>	<b>Current Service Cost</b>
	(\$ billion)	(\$ billion)	(% of contributory earnings)
<b>2010</b>	23.5	372.3	6.31
<b>2011</b>	23.9	386.4	6.20
<b>2012</b>	25.4	406.2	6.26

The current service cost is expected to remain stable at approximately 6.3% of projected contributory earnings during the next three years. The slight decrease in the current service cost as a percentage of contributory earnings in 2011 is due to the small increase in the rate of return. The difference between the legislated contribution rate of 9.9% and the current service cost is used to both fund benefits that have already accrued and improve the Plan's financial position.

#### IV. Reconciliation of Changes in the Unfunded Liability

The major factors that account for the changes in the unfunded liability under the closed group approach from the amount shown in the 23<sup>rd</sup> CPP Actuarial Report are identified in Table 33.





**Table 33 Reconciliation of the Unfunded Liability with Previous Report<sup>(1)</sup>**  
 (\$ billion)

<b>23<sup>rd</sup> CPP Actuarial Report Unfunded Liability as at 31 December 2006</b>	<b>619.9</b>
<b>Update Valuation Date to 31 December 2009:</b>	
Interest on unfunded liability	109.6
Contributions less current service cost	(41.7)
<b>Subtotal: Update Valuation Date</b>	<b>67.9</b>
<b>Experience Update</b>	
Actual investment returns lower than expected	25.9
Demographic, Economic and Benefit experience	(0.3)
<b>Subtotal: Experience Update</b>	<b>25.6</b>
<b>Changes in Key Assumptions</b>	
Fertility	0.1
Net Migration	2.7
Mortality	7.7
Retirement	3.2
Disability	0.9
Employment	0.1
Real-wage differential	(12.2)
Price increases	1.6
Real rate of return on investments	38.1
Asset mix	11.6
Others	7.6
<b>Subtotal: Assumption Changes</b>	<b>61.5</b>
<b>Amendments</b>	
Bill C-51	(5.0)
<b>Subtotal: Amendments</b>	<b>(5.0)</b>
<b>Changes in Methodology</b>	<b>(21.8)</b>
<b>25<sup>th</sup> CPP Actuarial Report Unfunded Liability as at 31 December 2009</b>	<b>748.0</b>

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

## V. Internal Rates of Return

The internal rate of return is, with respect to a group of CPP participants born in a given year (i.e. a cohort), the unique interest rate resulting 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 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 (set to change under Bill C-51) and the



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working beneficiaries provision of Bill C-51. 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 34 are rates based solely on contributions paid and benefits received; that is, administrative 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 34 Internal Rates of Return by Cohort**  
(annual percentages)

<b>Birth Year</b>	<b>Nominal</b>	<b>Real</b>
<b>1940</b>	10.4	6.3
<b>1950</b>	7.1	4.2
<b>1960</b>	5.3	3.0
<b>1970</b>	4.7	2.4
<b>1980</b>	4.6	2.3
<b>1990</b>	4.6	2.2
<b>2000</b>	4.6	2.3

The higher internal rates of return of the earlier cohorts mean that they are expected to receive better value from the CPP than those who follow. 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 real internal rate of return of about 2.3% for these cohorts provides a competitive return in a low interest rate environment. The CPP is able to provide such a return due to the Plan's size, financing method, and the resulting ability to mitigate risks.



## Appendix B – 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 Bill C-51 – *Economic Recovery Act (stimulus)* which received Royal Assent on 15 December 2009. The details of the cost impact of the amendments of Bill C-51 can be found in the 24<sup>th</sup> Actuarial Report supplementing the 23<sup>rd</sup> Actuarial Report on the Canada Pension Plan as at 31 December 2006. The changes to the CPP contained in Bill C-51 are set to come into force in two phases: a first set of changes come into force on 1 September 2010, and the remaining changes come into force on 1 January 2012. The amendments under Bill C-51 are included in this appendix.

### 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.

Under Bill C-51, 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, as under the current Plan, contributions are not permitted upon attaining age 70. This working beneficiaries provision is described further below.

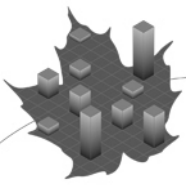
### III. Definitions

#### 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 Industrial Aggregate (the measure of the Average Weekly Earnings by Statistics Canada). If the amount so calculated is not a multiple of \$100, the next lower multiple of \$100 is used. The YMPE is set at \$47,200 in 2010.

#### 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. The YBE is \$3,500 in 2010.



**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 2012 during which beneficiaries contribute while in receipt of a retirement pension, as provided under Bill C-51.

**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 35 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 35 Schedule of Contribution Rates**

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

The legislation gives the federal and provincial ministers of finance the authority to make changes in contribution rates through regulation, in connection with a triennial review. However, year-over-year contribution rate increases cannot exceed 0.2 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 applies in order for a retirement pension to become payable before age 65. This test requires individuals who apply 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 may return to work and/or earn more without affecting the eligibility for or amount of the benefit. However, no further contributions to the CPP are allowed once benefits start being paid. There is no work cessation test for those aged 65 or older.

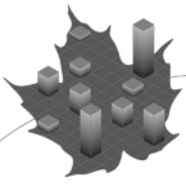
Commencing 1 January 2012, Bill C-51 amends the CPP to remove the Work Cessation Test. Individuals aged less than 65 who choose to work while receiving a CPP retirement benefit will be required, along with their employers, to contribute to the Plan. Working beneficiaries aged 65 or older will be given the option of continuing to contribute to the Plan; however, employers of those opting to do so will also be required to contribute. The contributions from working beneficiaries will be applied toward providing a post-retirement benefit. Under the Plan, contributions are not permitted upon attaining age 70.

### B. Amount of Pension

The initial amount of monthly retirement pension payable to a contributor under the basic 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 takes 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. Under Bill C-51, the general drop-out provision will increase to 16% on 1 January 2012 and 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 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 in 2010 is \$934.17.

**C. Adjustment for Early or Postponed Retirement Benefit**

The retirement pension is subject to an actuarial adjustment that depends on the contributor’s age at commencement of the retirement pension. The retirement pension is permanently adjusted downwards or upwards by 0.5% for each month between age 65 and the age when the pension commences or, if earlier, age 70. The factor of 0.5% applies to retirement pensions commencing before 2011. Under Bill C-51, the adjustment factors are 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 a period of five years starting in 2012. For those who take their benefit after age 65, the factor will gradually increase to 0.7% per month over a period of three years starting in 2011. The pension adjustment factors will come into effect according to the following schedule:

**Table 36 Schedule of New Pension Adjustment Factors**

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

The downward pension adjustment factor of 0.6% per month, applicable for years 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 years 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%). The pension adjustment factor is based on the year and age at benefit take-up.

**D. Working Beneficiaries**

Prior to 2012, those who receive a CPP retirement pension and then return to work (i.e. working beneficiaries) do not pay contributions and therefore do not continue to build their CPP pension. Under Bill C-51, commencing 1 January 2012, individuals under the age of 65 who receive a CPP retirement benefit and continue to work are required, along with their employers, to contribute to the Plan. Working beneficiaries aged 65 to 69 will not be



required to contribute, but will be given the option to do so. Employers of those working beneficiaries opting to contribute will also be 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 basic Plan per year of additional contributions and is adjusted for the earnings level and age of the contributor. The resulting total pension may be greater than the maximum pension payable.

## **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**

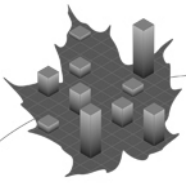
The amount of monthly benefit payable is the sum of a flat-rate portion (\$426.13 in 2010) depending only on the year in which the benefit is payable and an earnings-related portion equal, when it commences, to 75% of the retirement pension under the basic Plan that would be payable at the onset of disability 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. The maximum monthly disability benefit in 2010 is \$1,126.76.

## **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. If a surviving spouse or common-law partner is receiving a retirement pension or a disability benefit, the monthly amount of the survivor's benefit may be reduced. The following five cases are relevant:

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

The amount of monthly benefit payable until the surviving spouse 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 (\$166.26 in 2010), and an earnings-related benefit depending initially only on the contributor's record of pensionable earnings under the basic Plan as at the date of death. The initial earnings-related portion is equal to 37.5% of the retirement pension that would have been payable to the deceased contributor under the basic Plan if the contributory period ended at the time of death with no actuarial adjustment.

##### **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 the retirement pension of the deceased contributor under the basic Plan with no actuarial adjustment.

## **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 six times the monthly amount of retirement pension under the basic Plan accrued or payable in the year of death, adjusted to exclude any actuarial adjustments, 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 satisfying the contribution requirement for a survivor benefit is entitled to a flat-rate monthly benefit (\$214.85 in 2010). 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 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 amount of benefits.



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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 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 C – 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 2007 through 2009 and that projected in the 23<sup>rd</sup> CPP Actuarial Report for the same period were addressed in section V 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 other factors 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 23<sup>rd</sup> 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 37 and the discussion below.

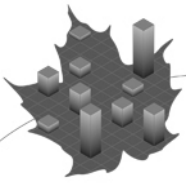
The amendments of Bill C-51 decreased the long-term pay-as-you-go rates.

The methodology described in Appendix D of this report reflects a number of improvements made to the methodology used in previous reports, mainly in the calculations of the market value of non-marketable bonds. The impact from the changes in methodology on the pay-as-you-go rates is minimal, since the changes mainly affect the assets of the Plan.

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 economic environment compared to the 23<sup>rd</sup> CPP Actuarial Report.

Changes made to the key assumptions since the previous triennial report were outlined in Table 1. The effects of these changes are summarized below.

- The assumed total fertility rates are higher than in the previous triennial report, and this decreases the long-term pay-as-you-go rates, because the higher projected growth in total contributory earnings outweighs the ultimate resulting increase in expenditures.
- 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 monthly 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 participation translates into higher benefit entitlements.
- The change in the real-wage assumption increases the pay-as-you-go rates in the short term due to somewhat lower expectations over that period, compared to the previous triennial report.
- The lower assumed inflation rate has the effect of increasing the pay-as-you-go rates. This counterintuitive result is caused by the fact that under a lower inflation assumption, the benefits are fully affected, while the contributory earnings (between YBE and YMPE) are partially affected since the YBE is frozen at \$3,500 over the entire projection period. The latter effect outweighs the expected decrease in pay-as-you-go rates due to lower benefits paid.

Some other assumptions, which are described in Appendix D, 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 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 assumed rates of return on investments and the assumed asset mix have no effect on the pay-as-you-go rates, they may have a significant impact on the minimum contribution rate. The ultimate asset mix, which is less risky than in the previous triennial report, causes the minimum contribution rate to increase by 0.026%. The equity risk premium is assumed to be lower over the projection period, which increases the minimum contribution rate by 0.096%. A reconciliation of the change in the minimum contribution rate from 9.82% as presented in the 23<sup>rd</sup> CPP Actuarial Report to the minimum rate of 9.86% for years 2010 to 2022 and 9.85% for years 2023 and thereafter determined for this report is provided in Table 38.

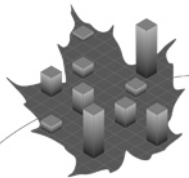
A progression of the minimum contribution rate over time based on target years of future triennial valuation reports and using the best-estimate assumptions of this report is shown in Table 16 of the Results section in this report. As shown in that table, the minimum contribution rate is projected to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



**Table 37 Reconciliation of Changes in Pay-As-You-Go Rates<sup>(1)</sup>**  
(% of contributory earnings)

	2010	2025	2050	2075
<b>23<sup>rd</sup> CPP Actuarial Report</b>	<b>8.78</b>	<b>10.67</b>	<b>11.29</b>	<b>11.40</b>
<b>I. Amendments (Bill C-51)</b>	<b>0.00</b>	<b>(0.19)</b>	<b>(0.23)</b>	<b>(0.21)</b>
<b>II. Improvements in Methodology</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
<b>III. Experience Update (2007-2009)</b>				
Demographic	(0.01)	0.03	(0.02)	0.07
Economic	0.04	(0.11)	(0.10)	(0.02)
Benefits	(0.10)	(0.04)	0.00	0.00
<b>Subtotal:</b>	<b>(0.07)</b>	<b>(0.12)</b>	<b>(0.12)</b>	<b>0.04</b>
<b>IV. Changes in Assumptions</b>				
Fertility	0.00	0.00	(0.11)	(0.24)
Net migration	(0.01)	(0.07)	(0.10)	(0.09)
Mortality	0.00	0.05	0.13	0.13
Retirement	(0.02)	(0.01)	0.04	0.05
Disability	0.00	(0.05)	(0.05)	(0.04)
Employment	(0.08)	(0.19)	(0.08)	0.00
Real-wage differential	0.00	0.18	0.01	0.00
Price increases	0.00	0.06	0.06	0.05
Other assumptions	0.05	0.09	0.09	0.07
<b>Subtotal:</b>	<b>(0.06)</b>	<b>0.07</b>	<b>0.00</b>	<b>(0.07)</b>
<b>Total of I to IV</b>	<b>(0.13)</b>	<b>(0.24)</b>	<b>(0.35)</b>	<b>(0.23)</b>
<b>25<sup>th</sup> CPP Actuarial Report</b>	<b>8.65</b>	<b>10.43</b>	<b>10.94</b>	<b>11.17</b>

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



**Table 38 Reconciliation of Changes in Minimum Contribution Rate<sup>(1)</sup>**  
(% of contributory earnings)

	Steady-State Rate	Full Funding Rate		Minimum Rate	
		2010-2022	2023+	2010-2022	2023+
<b>23<sup>rd</sup> CPP Actuarial Report - After Rounding</b>	<b>9.80</b>	<b>0.02</b>	<b>0.02</b>	<b>9.82</b>	<b>9.82</b>
<b>23<sup>rd</sup> CPP Actuarial Report - Before Rounding</b>	<b>9.802</b>	<b>0.023</b>	<b>0.020</b>	<b>9.825</b>	<b>9.822</b>
<b>I. Amendments (Bill C-51)</b>	<b>(0.172)</b>	<b>0.002</b>	<b>0.002</b>	<b>(0.170)</b>	<b>(0.170)</b>
<b>II. Improvements in Methodology</b>	<b>0.006</b>	<b>0.001</b>	<b>0.000</b>	<b>0.007</b>	<b>0.006</b>
<b>III. Experience Update (2007-2009)</b>					
Demographic	0.015	0.000	0.000	0.015	0.015
Economic	(0.087)	0.000	0.000	(0.087)	(0.087)
Benefits	(0.029)	(0.002)	0.000	(0.030)	(0.029)
Investments	0.144	0.000	0.000	0.144	0.144
<b>Subtotal:</b>	<b>0.043</b>	<b>(0.002)</b>	<b>0.000</b>	<b>0.041</b>	<b>0.043</b>
<b>IV. Changes in Assumptions</b>					
Fertility	(0.047)	0.000	0.000	(0.047)	(0.047)
Net Migration	(0.048)	0.000	0.000	(0.048)	(0.048)
Mortality	0.085	0.000	0.000	0.085	0.085
Retirement	0.031	0.000	0.000	0.031	0.031
Disability	(0.033)	(0.008)	(0.007)	(0.041)	(0.040)
Employment	(0.086)	0.001	0.001	(0.084)	(0.084)
Real-wage differential	0.063	0.001	0.001	0.064	0.064
Price increases	0.048	(0.002)	(0.002)	0.047	0.047
Asset mix	0.026	0.000	0.000	0.026	0.026
Real rate of return	0.096	0.000	0.000	0.096	0.096
Other assumptions	0.019	0.000	0.000	0.020	0.019
<b>Subtotal:</b>	<b>0.155</b>	<b>(0.007)</b>	<b>(0.007)</b>	<b>0.148</b>	<b>0.148</b>
<b>V. Others (Change in funding target from 2019-2069 to 2022-2072)</b>	<b>0.002</b>	<b>0.000</b>	<b>0.000</b>	<b>0.002</b>	<b>0.002</b>
<b>Total of I to V</b>	<b>0.034</b>	<b>(0.006)</b>	<b>(0.006)</b>	<b>0.028</b>	<b>0.028</b>
<b>25<sup>th</sup> CPP Actuarial Report - Before Rounding</b>	<b>9.836</b>	<b>0.017</b>	<b>0.014</b>	<b>9.853</b>	<b>9.850</b>
<b>25<sup>th</sup> CPP Actuarial Report - After Rounding</b>	<b>9.84</b>	<b>0.02</b>	<b>0.01</b>	<b>9.86</b>	<b>9.85</b>

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



## Appendix D – Assumptions and Methods

### I. Introduction

This section describes the assumptions and methods that underlie the financial projections in section IV 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 revenue 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; that is, the steady-state rate applies to the basic Plan only. The full funding rate is determined independently and is added to the steady-state rate to produce the minimum contribution rate for the Plan.

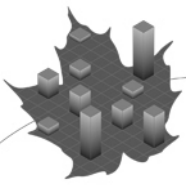
Although the economic and demographic assumptions have been developed using the best available information, the resulting estimates should be interpreted with caution. These estimates are not intended to be predictions, but rather projections of the future financial status of the CPP.

### 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 2009 are used as a starting point. The populations are then projected by age and sex from one year to the next by adding births and net migrants and subtracting deaths. Applying the fertility, mortality and migration assumptions to the starting population develops the annual numbers of births, deaths and net migrants. 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 2009**

The starting point for the demographic projections is based on the most recent Statistics Canada population estimates as at 1 July 2009 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 over into individual ages using the observed distribution of Old Age Security Program beneficiaries by age for ages 100 and over.

**B. Fertility Rates**

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

Total fertility rates have declined significantly since the baby boom period, when the rates peaked at nearly 4.0 per woman in the late 1950s for both Canada and Québec. The baby bust period that followed in the mid-1960s pulled down the total fertility rates by the mid-1980s to record lows of 1.4 for Québec and 1.6 for Canada. In recent years, the total fertility rate for Canada has risen to over 1.6. Canada is one of many industrialized countries that have seen an increase in their total fertility rates in recent years. In Québec, significant increases in its total fertility rate have recently occurred. In 2007, the total fertility rate for Canada was 1.66, while in 2008 the total fertility rate for Québec was 1.74. Fertility rates are affected by many factors, including social attitudes, reproductive technologies, and economic conditions.

In this report, it is assumed that the total fertility rate from 2015 onward is 1.65 for Canada and Québec. This assumed ultimate rate reflects historical trends in fertility rates by age group over the last 30 years. It is lower than the most recently observed rates, since it is not thought likely that the recent increases seen in total fertility rates will be sustained over the long term.

Finally, in accordance with the experience over the last 25 years, the assumed ratio of male to female newborns is 1.054, which is the same as for the 23<sup>rd</sup> CPP Actuarial Report. Table 39 shows the projected age-specific and total fertility rates for Canada, while Chart 4 shows the historical and assumed total fertility rates for both Canada and Québec.

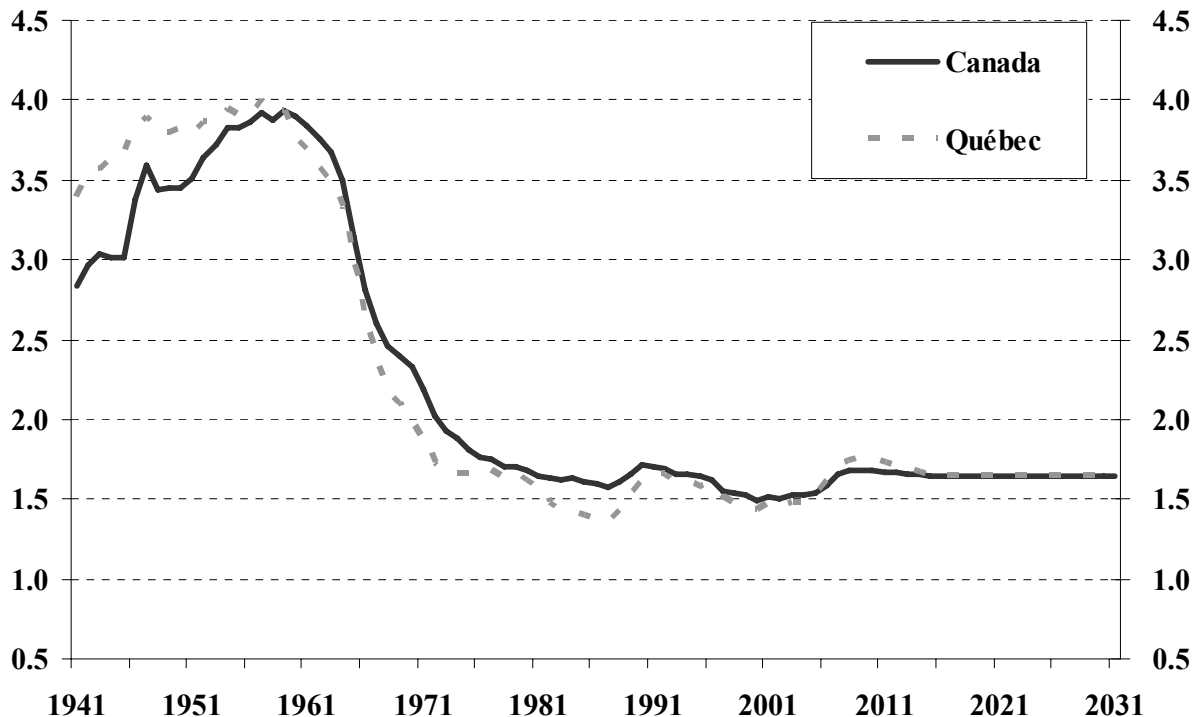
**Table 39 Fertility Rates for Canada**

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	
<b>2010</b>	12.9	50.8	103.6	110.1	48.9	8.3	0.4	1.68
<b>2011</b>	12.6	49.9	103.3	110.5	49.1	8.4	0.4	1.67
<b>2012</b>	12.3	48.9	102.9	110.9	49.2	8.4	0.4	1.67
<b>2013</b>	12.0	48.0	102.6	111.3	49.3	8.5	0.4	1.66
<b>2014</b>	11.7	47.1	102.2	111.6	49.5	8.5	0.4	1.66
<b>2015+</b>	11.4	46.2	101.9	112.0	49.6	8.6	0.4	1.65





**Chart 4 Historical and Assumed Total Fertility Rates**



**C. Mortality**

For this report, the mortality rate projections start from the 2006 mortality rates of the Canadian Human Mortality Database (CHMD). According to the CHMD, life expectancies at birth in 2006 for males and females in Canada were 78.3 and 82.9 years, respectively, based on the 2006 CHMD mortality rates without any assumed future improvements in mortality.

For 2007 to 2011, 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 1991 to 2006. Improvement rates for years 2012 to 2030 were obtained by linear interpolation between:

- the improvement rates of year 2011, and
- the ultimate improvement rates described below in respect of the period 2031 and thereafter.

For years 2031 and thereafter, 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 trends in Canadian experience over the period 1921 to 2006. 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 2031 onward. The ultimate mortality improvement rates for Québec are assumed to be the same as for Canada.



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The historical downward trend in mortality improvement rates is clear for both sexes in the age group 0-64. The ultimate rate for both sexes in this age group is based on the trend observed over the 30-year period 1976-2006 for females and is set at 0.8% per year from 2031 onward, where 0.8% represents about one-half the average rate observed for females over the 15-year period 1991-2006.

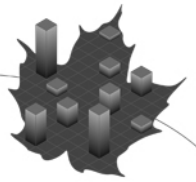
For age groups 65 and older, recent experience has shown an increasing trend for both sexes. The ultimate rates from 2031 onward for both sexes are set to one-half of the average rate experienced for females over the 15-year period 1991-2006. For ages 65 to 74, an ultimate improvement rate of 0.8% is assumed. The ultimate improvement rate is then set to reduce from 0.7% for the age group 75-84 to 0.3% for those aged 95 and older, consistent with observed experience that shows decreasing improvement rates with age.

Table 40 shows the initial (2007-2011), intermediate (2012-2030) and ultimate (2031+) assumed annual mortality improvement rates.

**Table 40 Annual Mortality Improvement Rates for Canada**

Age	Males			Females		
	2007-2011	2012-2030	2031+	2007-2011	2012-2030	2031+
	%	%	%	%	%	%
<b>0</b>	1.5	1.2	0.8	1.3	1.0	0.8
<b>1-14</b>	3.3	2.1	0.8	3.2	2.0	0.8
<b>15-44</b>	2.6	1.7	0.8	1.4	1.1	0.8
<b>45-64</b>	2.1	1.5	0.8	1.3	1.1	0.8
<b>65-74</b>	2.6	1.7	0.8	1.5	1.1	0.8
<b>75-84</b>	2.1	1.4	0.7	1.5	1.1	0.7
<b>85-89</b>	1.5	1.0	0.5	1.0	0.8	0.5
<b>90-94</b>	1.0	0.7	0.4	0.5	0.5	0.4
<b>95+</b>	0.2	0.2	0.3	0.1	0.2	0.3

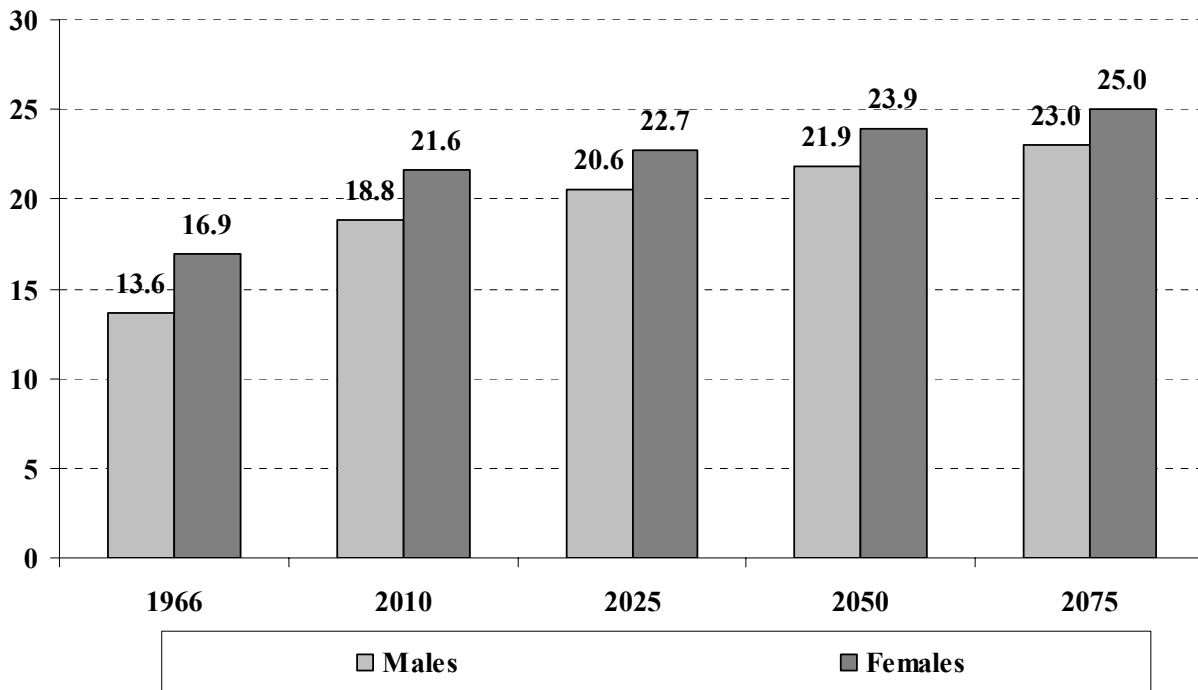
The projected mortality rates in Table 41 indicate a continuous decrease in mortality rates over the long term. For example, the mortality rate at age 65 for males is expected to decrease from about 12 deaths per thousand people in 2010 to 6 deaths per thousand people by 2075. The gap in mortality rates between males and females at each age is also expected to decrease over the projection period.



**Table 41 Mortality Rates for Canada**  
 (annual deaths per 1,000 people)

Age	Males				Females			
	2010	2025	2050	2075	2010	2025	2050	2075
0	5.22	4.31	3.51	2.87	4.45	3.77	3.08	2.52
10	0.09	0.06	0.05	0.04	0.07	0.05	0.04	0.03
20	0.77	0.58	0.47	0.38	0.32	0.27	0.22	0.18
30	0.69	0.50	0.40	0.33	0.35	0.28	0.23	0.19
40	1.31	1.01	0.82	0.67	0.81	0.68	0.55	0.45
50	3.23	2.57	2.08	1.70	2.12	1.79	1.46	1.20
60	7.75	5.86	4.74	3.88	4.95	4.13	3.36	2.75
65	12.29	9.07	7.32	5.99	7.97	6.61	5.38	4.40
70	19.50	14.47	11.68	9.55	12.85	10.63	8.65	7.08
75	31.79	24.26	19.90	16.53	20.90	17.35	14.33	11.90
80	53.64	42.04	34.90	29.28	35.63	29.64	24.71	20.73
85	92.49	75.91	65.09	56.28	65.20	56.22	48.38	41.83
90	154.42	134.14	119.45	106.98	119.52	109.05	97.48	87.30
100	333.59	317.33	294.26	272.97	304.69	297.01	275.93	255.97

**Chart 5 Life Expectancies at Age 65 for Canada<sup>(1)</sup>**



(1) These are calendar year life expectancies based on the mortality rates of the given year.

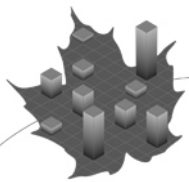


Chart 5 shows the historical and projected life expectancies at age 65 since the Plan’s inception in 1966, based on each given year’s mortality rates (i.e. without future mortality improvements). Table 42 shows projected Canadian life expectancies at various ages for the specified calendar years, also based on each given year’s mortality rates (without future improvements). Table 43 is similar to Table 42, 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 43 is considered to be more realistic than Table 42.

From 2010 to 2075, Canadian life expectancy at birth (with assumed future mortality improvements) is projected to grow from 85.4 to 89.4 years for males and from 88.3 to 91.7 years for females, as shown in Table 43. A narrowing of the gap between male and female life expectancies at birth has been observed over the last 30 years in Canada due to mortality improvement rates for males being higher than for females. The yearly increase in life expectancies in the early years of the projection reflects the significant increase observed over the last 30 years. Thereafter, there is a projected slowdown in the increase in life expectancies consistent with the lower rate of improvement in mortality assumed for years 2031 and thereafter.

**Table 42 Life Expectancies for Canada, without improvements after the year shown<sup>(1)</sup>**

Age	Males				Females			
	2010	2025	2050	2075	2010	2025	2050	2075
0	79.3	81.9	83.7	85.4	83.5	85.0	86.6	88.0
10	69.8	72.3	74.1	75.7	73.9	75.4	76.9	78.3
20	60.0	62.5	64.2	65.8	64.0	65.5	67.0	68.4
30	50.4	52.8	54.5	56.0	54.2	55.6	57.1	58.5
40	40.8	43.1	44.8	46.2	44.4	45.8	47.3	48.6
50	31.5	33.7	35.3	36.7	35.0	36.3	37.7	38.9
60	22.8	24.8	26.2	27.5	25.9	27.1	28.4	29.5
65	18.8	20.6	21.9	23.0	21.6	22.7	23.9	25.0
70	15.1	16.6	17.7	18.8	17.6	18.6	19.6	20.6
75	11.6	12.9	13.9	14.8	13.8	14.7	15.5	16.4
80	8.7	9.6	10.4	11.1	10.4	11.0	11.8	12.5
85	6.2	6.9	7.4	8.0	7.4	7.8	8.4	8.9
90	4.3	4.7	5.1	5.5	5.1	5.3	5.7	6.1
100	2.2	2.3	2.5	2.7	2.4	2.5	2.7	2.9

(1) These are calendar year life expectancies based on the mortality rates of the given attained year.

**Table 43 Life Expectancies for Canada, with improvements after the year shown<sup>(1)</sup>**

Age	Males				Females			
	2010	2025	2050	2075	2010	2025	2050	2075
0	85.4	86.5	88.1	89.4	88.3	89.2	90.5	91.7
10	75.3	76.3	77.8	79.3	78.2	79.0	80.3	81.6
20	64.8	65.8	67.4	68.8	67.7	68.6	69.9	71.2
30	54.5	55.5	57.1	58.5	57.3	58.2	59.5	60.8
40	44.2	45.2	46.7	48.2	46.9	47.8	49.2	50.5
50	34.2	35.2	36.7	38.1	36.9	37.7	39.1	40.3
60	24.7	25.8	27.1	28.4	27.2	28.1	29.3	30.4
65	20.2	21.3	22.6	23.7	22.6	23.5	24.6	25.7
70	16.1	17.1	18.2	19.3	18.3	19.1	20.1	21.1
75	12.3	13.3	14.2	15.1	14.3	15.0	15.9	16.8
80	9.0	9.8	10.6	11.4	10.6	11.2	12.0	12.7
85	6.4	7.0	7.5	8.1	7.5	8.0	8.5	9.1
90	4.4	4.8	5.2	5.6	5.1	5.4	5.8	6.2
100	2.2	2.3	2.5	2.7	2.4	2.5	2.7	2.9

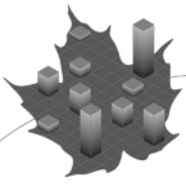
(1) These are cohort life expectancies that take into account future assumed improvements in mortality and therefore differ from calendar year life expectancies, which are based on the mortality rates of the given attained year.

#### D. Net Migration

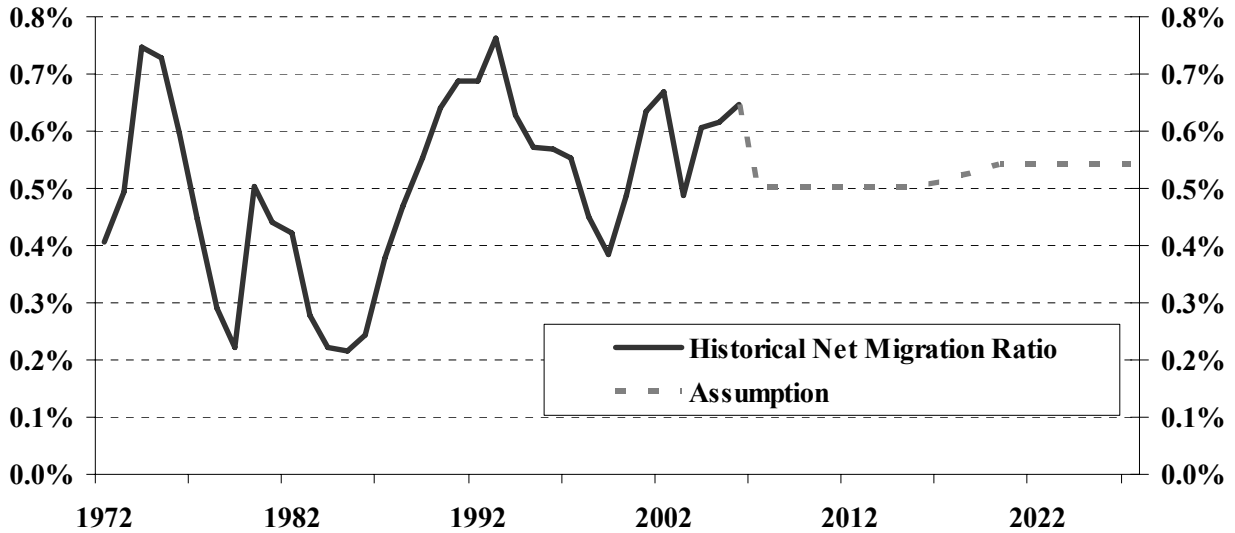
Immigration and emigration are generally recognized as being volatile parameters of future population growth since they are subject to a variety of demographic, economic, social and political factors. During the period from 1972 to 2009 annual immigration to Canada varied from 84,000 to 267,000, annual emigration from Canada fluctuated between 40,000 and 84,000, and the annual numbers of returning Canadians fluctuated between 14,000 and 39,000. Chart 6 shows the net migration (immigration less emigration, plus the numbers of returning Canadians) experience since 1972 and the assumed rate for the future.

Based on a continuation of the average experience over the last 30 years (0.53%), the net migration rate is assumed to decrease over the period 2009 to 2014 from 0.62% to 0.53% of the population. The rate is assumed to remain at 0.53% from 2014 to 2018. From 2019 to 2023, the rate is then assumed to gradually increase from 0.53% to 0.58% to take into account a possible labour shortage resulting from the retirement of the baby boom generation. Finally, from 2023 onward the rate is assumed to remain at 0.58%. The ultimate level of 0.58% reflects the average experience observed over the last 15 years.

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 net interprovincial emigration level for Québec of 10,700 in 2009 will decrease to 8,000 by 2014 and remain at that level thereafter. These assumptions result in a net migration rate averaging 0.4% over the projection period for Québec. The distributions of immigrants, emigrants and returning Canadians by age and sex used for the demographic projections were derived from Statistics Canada data averaged over the period 2004 to 2008.

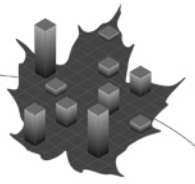


**Chart 6 Net Migration as % of Population  
(Canada)**

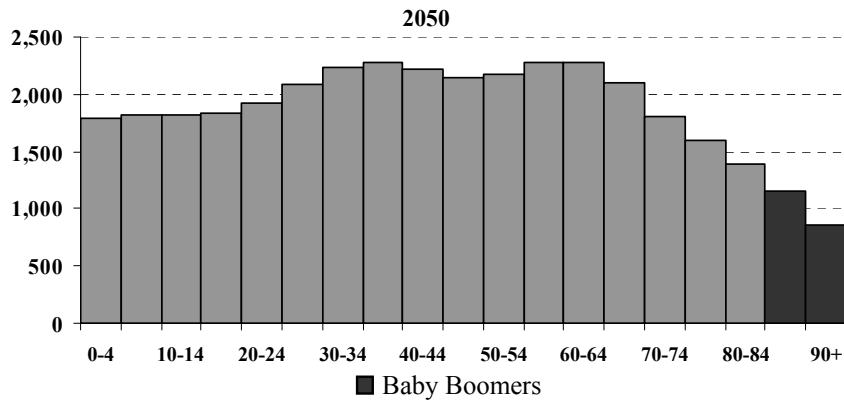
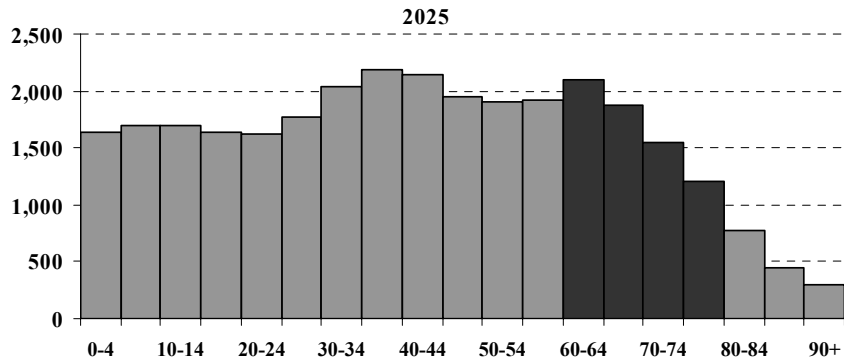
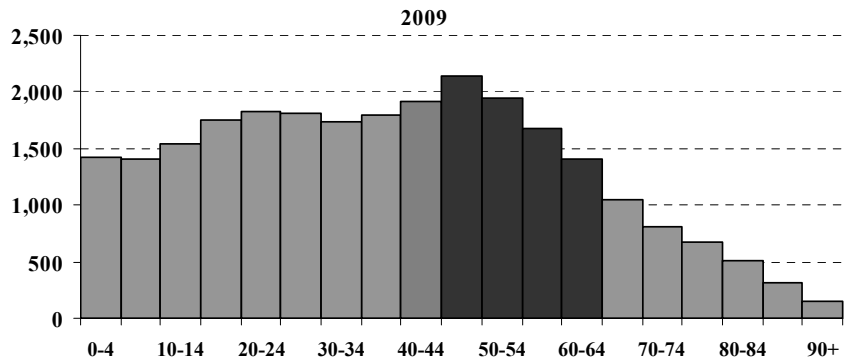
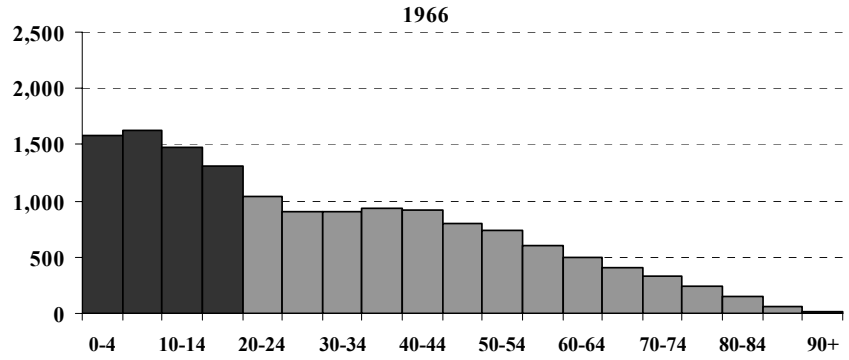


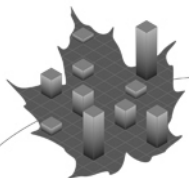
**E. Projected Population and its Characteristics**

The evolution of the Canada less Québec population age distribution since the inception of the Plan is shown in Chart 7. 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 and baby bust can be seen. The chart also reveals that the number of people aged 85 and over is expected to increase dramatically over the next 40 years.



**Chart 7 Population Age Distribution of Canada less Québec (thousands)**





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The population of Canada as at 1 July 2009 is 33.7 million, while the population of Canada less Québec is 25.9 million. Tables 44 and 45 present the projected populations of Canada and Canada less Québec as at 1 July for selected years, while Chart 8 shows the evolution of the population of Canada less Québec and of those aged 20 to 64 from 1975 to 2075.

Table 46 shows the variations in the relative size of various age groups for Canada less Québec throughout the projection period. The proportion of people aged 65 and over is expected to almost double from 13.8% in 2010 to 25.8% by 2075. The number of people aged 65 and over as a proportion of people aged 20 to 64 more than doubles over the same period, from 21.9% in 2010 to 47.7% by 2075. This proportion significantly affects the ratio of benefits to contributions under the CPP.

**Table 44 Population of Canada by Age**  
(thousands)

Year	0-17	18-69	70+	0-19	20-64	65+	Total
2010	6,912	23,821	3,355	7,830	21,432	4,825	34,088
2011	6,912	24,077	3,443	7,809	21,645	4,979	34,433
2012	6,923	24,312	3,537	7,802	21,789	5,182	34,773
2013	6,938	24,523	3,645	7,806	21,921	5,380	35,107
2014	6,964	24,711	3,760	7,819	22,042	5,573	35,435
2015	7,006	24,879	3,878	7,838	22,154	5,771	35,763
2020	7,339	25,347	4,708	8,112	22,414	6,868	37,393
2025	7,656	25,679	5,670	8,476	22,403	8,125	39,004
2030	7,751	25,964	6,747	8,649	22,441	9,373	40,462
2040	7,776	26,856	8,243	8,715	23,627	10,535	42,876
2050	8,160	28,086	8,665	9,080	24,512	11,318	44,911
2075	8,985	30,882	10,201	10,032	27,057	12,980	50,068

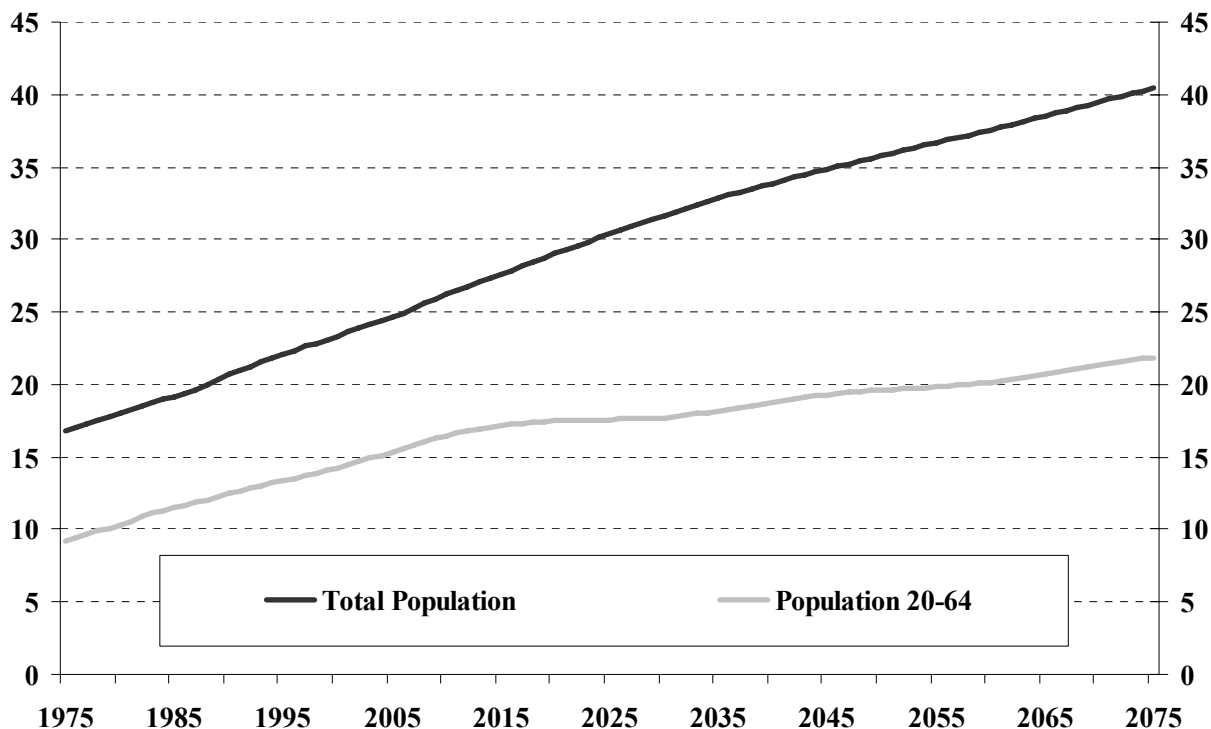
**Table 45 Population of Canada less Québec by Age**  
(thousands)

Year	0-17	18-69	70+	0-19	20-64	65+	Total
2010	5,386	18,282	2,530	6,098	16,486	3,615	26,198
2011	5,389	18,502	2,593	6,085	16,675	3,726	26,485
2012	5,401	18,708	2,661	6,083	16,804	3,882	26,769
2013	5,415	18,896	2,739	6,091	16,925	4,034	27,050
2014	5,439	19,068	2,821	6,107	17,040	4,180	27,328
2015	5,475	19,226	2,905	6,127	17,149	4,330	27,606
2020	5,745	19,723	3,534	6,357	17,475	5,170	29,002
2025	6,013	20,112	4,273	6,658	17,594	6,146	30,398
2030	6,137	20,437	5,113	6,840	17,700	7,146	31,686
2040	6,200	21,313	6,369	6,950	18,744	8,188	33,883
2050	6,526	22,456	6,791	7,267	19,608	8,898	35,773
2075	7,284	24,964	8,214	8,135	21,883	10,444	40,462





**Chart 8 Population of Canada less Québec  
 (millions)**



**Table 46 Analysis of Population of Canada less Québec by Age**

Year	% of Total Population			% of Total Population			Age 65 + as % of Age 20-64
	Ages 0-17	Ages 18-69	Ages 70+	Ages 0-19	Ages 20-64	Ages 65+	
2010	20.6	69.8	9.7	23.3	62.9	13.8	21.9
2011	20.3	69.9	9.8	23.0	63.0	14.1	22.3
2012	20.2	69.9	9.9	22.7	62.8	14.5	23.1
2013	20.0	69.9	10.1	22.5	62.6	14.9	23.8
2014	19.9	69.8	10.3	22.3	62.4	15.3	24.5
2015	19.8	69.6	10.5	22.2	62.1	15.7	25.3
2020	19.8	68.0	12.2	21.9	60.3	17.8	29.6
2025	19.8	66.2	14.1	21.9	57.9	20.2	34.9
2030	19.4	64.5	16.1	21.6	55.9	22.6	40.4
2040	18.3	62.9	18.8	20.5	55.3	24.2	43.7
2050	18.2	62.8	19.0	20.3	54.8	24.9	45.4
2075	18.0	61.7	20.3	20.1	54.1	25.8	47.7

Table 47 shows the components of population growth, which is defined by the projected number of births plus net migrants less the projected number of deaths for Canada less Québec from 2010 to 2075, and Chart 9 presents these figures graphically for the next 50 years. Over the period 2010 to 2020, the population of Canada less Québec is projected to



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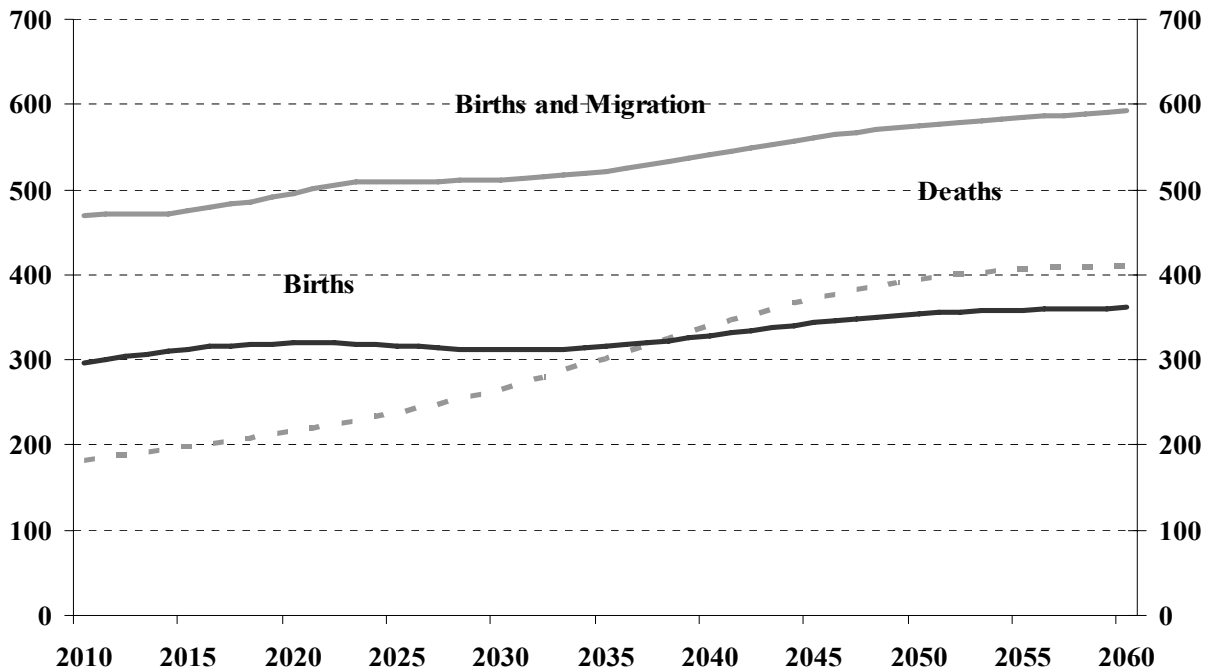
as at 31 December 2009

grow at about 1% per year. The annual growth slows to about 0.8% between 2020 and 2040 and to 0.5% thereafter. The population of Canada less Québec is expected to reach 40.5 million by 2075.

**Table 47 Births, Net Migrants and Deaths for Canada less Québec**  
(thousands)

Year	Population 1 <sup>st</sup> July	Births	Net Migrants	Deaths	Change in Population	Annual Percentage Change		
						20-64	65+	Total
						(%)	(%)	(%)
2010	26,198	301	170	185	287	1.1	3.1	1.1
2011	26,485	304	168	188	284	0.8	4.2	1.1
2012	26,769	307	165	191	281	0.7	3.9	1.1
2013	27,050	310	162	194	278	0.7	3.6	1.0
2014	27,328	313	163	197	279	0.6	3.6	1.0
2015	27,606	315	164	201	279	0.6	3.5	1.0
2020	29,002	320	181	219	282	0.2	3.6	1.0
2025	30,398	315	195	242	268	0.1	3.3	0.9
2030	31,686	311	202	272	241	0.4	2.1	0.8
2040	33,883	332	213	346	199	0.6	0.8	0.6
2050	35,773	355	223	398	180	0.2	0.9	0.5
2075	40,462	391	247	441	197	0.4	0.6	0.5

**Chart 9 Components of Population Growth for Canada less Québec**  
(thousands)





### III. Economic Projections

The list of assumptions required to project the various economic indices, 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 form part of the investment assumptions described in section IV. All of these factors must be considered together and form part of an overall economic perspective.

#### A. Economic Perspective

The future revenue 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 recent economic downturn, a moderate but sustainable growth in the economy will persist throughout the projection period.

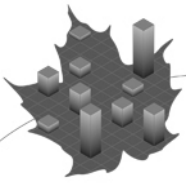
The actuarial examination of the CPP involves the projection of its revenue and expenditures over a long period of time. Although best judgment is used regarding future economic trends, it is nonetheless difficult to anticipate all of the social and economic changes that may occur during the projection period. There will always be a certain 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 and downward since. For example, the average annual increase in the CPI for the 50, 20 and 10-year periods ending in 2009 were 4.1%, 2.2% and 2.1%, respectively. Going forward, the Bank of Canada has reaffirmed its objective of keeping the inflation rate within a target range of 1% to 3% until the end of 2011.

For 2010 to 2016, 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 target range. On the other hand, the ultimate assumption for price increases for 2019 and thereafter has



been set at 2.3%. This is lower than the assumption of 2.5% used in the 23<sup>rd</sup> CPP Actuarial Report but remains higher than the level of inflation that has been experienced over the last decade, and is in the upper part of the current Bank of Canada target range. The main reasons for the choice of an ultimate assumption of 2.3% are as follows:

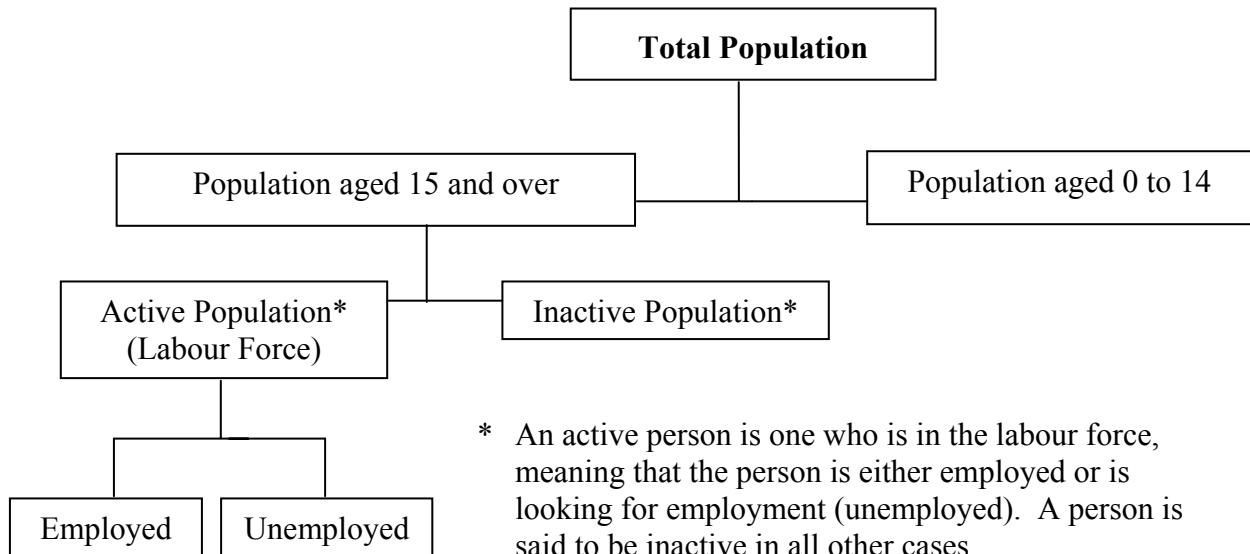
- The Bank of Canada’s long-term monetary policy is known only until the end of 2011. When compared to the 75-year projection period of the CPP, the monetary policy of the Bank of Canada could be viewed as short-term.
- The expected upward pressure on real wages due to a possible labour shortage may create upward pressure on prices.
- There is uncertainty about future energy costs.

Finally, for years 2017 to 2019 the inflation rate assumption is projected to increase gradually from 2.0% to 2.3% by increments of 0.1% each year.

**C. Labour Market**

Chart 10 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 10 Components of the Labour Market**



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. The proportion of earners and contributors assumptions (described in this section and section F) rely on the projected active population given in this report.



## 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 2009 clearly show a narrowing of the gap between male and female rates. The increase in the participation rates of females aged 15 to 69 has been significant over the past decades. Male participation rates for those aged 55 and older have partially rebounded in the last decade.

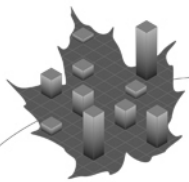
In 1976, overall male participation was about 78% compared to only 46% for females, which represents a gap of 32%. This gap has narrowed to 9% in 2009 with male and female participation at 72% and 63%, respectively. It is assumed that females will continue to narrow the gap in participation rates but 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.

Tables 48 to 50 provide projections of the active and employed populations and associated participation, employment, and unemployment rates for Canada. Over the near term, it is assumed that females aged 50 and over will continue to increase their overall labour force participation compared to previous cohorts.

**Table 48 Active Population (Canada, ages 15 and over)**

Year	Population <sup>(1)</sup>			Active Population			Employed		
	Males	Females	Total	Males	Females	Total	Males	Females	Total
	(thousands)			(thousands)			(thousands)		
2010	13,628	14,037	27,665	9,813	8,784	18,597	8,932	8,104	17,035
2011	13,784	14,192	27,977	9,922	8,871	18,793	9,036	8,187	17,222
2012	13,932	14,335	28,267	10,015	8,942	18,956	9,124	8,254	17,377
2013	14,070	14,470	28,540	10,098	9,003	19,101	9,204	8,313	17,517
2014	14,201	14,598	28,799	10,175	9,057	19,232	9,277	8,363	17,640
2015	14,332	14,723	29,056	10,248	9,108	19,356	9,349	8,414	17,763
2020	14,954	15,312	30,266	10,426	9,254	19,680	9,700	8,693	18,393
2025	15,623	15,962	31,586	10,591	9,419	20,010	9,903	8,887	18,790
2030	16,296	16,624	32,920	10,808	9,663	20,471	10,103	9,119	19,222
2040	17,412	17,787	35,200	11,311	10,135	21,446	10,573	9,565	20,138
2050	18,174	18,602	36,775	11,694	10,468	22,163	10,932	9,879	20,811
2060	18,949	19,365	38,313	12,084	10,825	22,909	11,296	10,216	21,512

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



**Table 49 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
		(%)			(%)			(%)	
2010	72.0	62.6	67.2	65.5	57.7	61.6	9.0	7.7	8.4
2011	72.0	62.5	67.2	65.6	57.7	61.6	8.9	7.7	8.4
2012	71.9	62.4	67.1	65.5	57.6	61.5	8.9	7.7	8.3
2013	71.8	62.2	66.9	65.4	57.4	61.4	8.9	7.7	8.3
2014	71.6	62.0	66.8	65.3	57.3	61.3	8.8	7.7	8.3
2015	71.5	61.9	66.6	65.2	57.1	61.1	8.8	7.6	8.2
2020	69.7	60.4	65.0	64.9	56.8	60.8	7.0	6.1	6.5
2025	67.8	59.0	63.4	63.4	55.7	59.5	6.5	5.6	6.1
2030	66.3	58.1	62.2	62.0	54.9	58.4	6.5	5.6	6.1
2040	65.0	57.0	60.9	60.7	53.8	57.2	6.5	5.6	6.1
2050	64.3	56.3	60.3	60.2	53.1	56.6	6.5	5.6	6.1
2060	63.8	55.9	59.8	59.6	52.8	56.1	6.5	5.6	6.1

**Table 50 Labour Force Participation Rates (Canada)**

Age Group	Males				Females			
	2010	2015	2030	2050	2010	2015	2030	2050
	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
15-19	52.0	55.0	56.0	56.0	54.8	58.0	59.0	59.0
20-24	79.4	81.5	83.0	83.0	75.9	77.0	80.0	80.0
25-29	90.1	91.5	93.0	93.0	82.1	83.0	86.0	86.0
30-34	91.8	93.0	94.0	94.0	82.0	82.5	85.0	85.0
35-39	92.7	93.7	94.0	94.0	82.0	83.0	86.0	86.0
40-44	92.0	93.0	94.0	94.0	83.9	85.0	87.0	87.0
45-49	90.9	92.0	94.0	94.0	84.2	85.0	87.0	87.0
50-54	88.4	89.0	91.0	91.0	79.7	81.0	84.0	84.0
55-59	76.7	78.0	80.0	80.0	67.2	68.0	70.0	70.0
60-64	57.5	58.0	58.0	58.0	43.8	44.0	44.0	44.0
65-69	29.0	29.0	29.0	29.0	16.0	16.0	16.5	16.5
70 and Over	8.3	8.3	8.5	8.5	2.9	3.0	3.0	3.0
15-69	79.0	79.5	79.0	79.1	70.9	70.8	71.5	71.5
15 and Over	72.0	71.5	66.3	64.3	62.6	61.9	58.1	56.3

The aging of the population exerts downward pressure on the overall labour force participation rate in Canada. The overall participation rate from Table 49 would fall from 67.2% in 2010 to 58.0% in 2050, instead of 60.3%, if current participation rates by age and sex were to apply throughout the projection period. This can be explained by the projected increase in the proportion of people aged 55 to 69 exceeding the recent increase in participation in this age group, as well as the projected increase in the proportion of people aged 70 and over. A reduction in the overall participation rates is inevitable under these



circumstances. To recognize this particular demographic trend, the projection period for purposes of projecting the participation rates has been divided into three periods: 2010 to 2015, 2015 to 2030, and from 2030 onward.

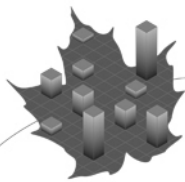
Individuals of the baby boom generation who were born between 1945 and 1955 and are presently active will be aged 55 to 70 within the period 2010 to 2015. This cohort, which is much more active compared to same-aged cohorts of past generations, will continue to put upward pressure on the participation rate for the age group 55 to 64. It is projected that by 2015 the labour force participation rate of this age group (55 to 64) will increase slightly from its current level. Nonetheless, the assumed increase in the participation rate for this age group, and more generally for those aged 50 and over, is not sufficient to offset the decrease in the overall participation rate due to the demographic shift. As the population ages and labour shortages possibly arise, the participation rates for people under the age of 55 are also assumed to increase. However, it is also expected that these gains in participation rates will be offset to some extent by productivity increases by way of increases in employment earnings. Overall, this results in labour force participation rates for those aged 15 to 69 of 79.5% and 70.8% for males and females, respectively in 2015.

From 2015 to 2030, the baby boomers born between 1955 and 1965, who are more numerous than the older baby boomers, will be reaching the ages of 50 to 75. The first generation of boomers (1945 to 1955) will have mostly retired and will create downward pressure on the overall participation rate. It is thus assumed that those aged 55 to 64 during this period will participate more because of increased employment opportunities due to a possible labour shortage. This change in work patterns might be expected since this generation of workers is more adaptable, flexible and better educated to prolong their work life. Since the early 1990s, young individuals under the age of 35 have entered the labour force later mainly due to longer schooling. For this reason, a later exit could be expected from the labour force. It is thus assumed that participation rates for those less than age 55 will increase. As for the previous period, it is also expected that during 2015 to 2030, the gains in participation rates will be partially offset by productivity increases through increases in employment earnings. Overall, this results in labour force participation rates for those aged 15 to 69 of 79.0% and 71.5% for males and females, respectively in 2030.

From 2030 onward, the participation rates are kept constant. This, combined with a slow growth in the working-age population, results in a low rate of growth of approximately 0.4% for the active population (that is, the labour force).

## 2. Employment

In Canada, the average annual job creation rate (that is, the change in the number of employed) has been about 1.7% since 1976. However, this rate has varied over the years. It is assumed that the job creation rate will be 1.1% in 2010, 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 2009 level of 8.3%.



# ACTUARIAL REPORT

## CANADA PENSION PLAN

as at 31 December 2009

Over the long term, the job creation rate is assumed to decrease gradually to the same growth rate as for the labour force of 0.4%. This is projected to occur since the unemployment rate is not expected to fall below the natural rate of unemployment without creating inflationary pressure. It is assumed that the unemployment rate will be slightly lower than in the 23<sup>rd</sup> CPP Actuarial Report, reaching 6.1% by 2022 and remaining at that level thereafter.

Table 51 shows the projected number of employed persons, aged 18 to 69, in Canada.

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

Year	Population		Employed		Employment Rate	
	Males	Females	Males	Females	Males	Females
	(thousands)		(thousands)		(%)	
2010	11,932	11,889	8,607	7,820	72.1	65.8
2011	12,058	12,019	8,710	7,904	72.2	65.8
2012	12,173	12,139	8,797	7,972	72.3	65.7
2013	12,278	12,246	8,876	8,033	72.3	65.6
2014	12,369	12,342	8,946	8,084	72.3	65.5
2015	12,453	12,426	9,016	8,136	72.4	65.5
2020	12,689	12,658	9,324	8,402	73.5	66.4
2025	12,861	12,817	9,461	8,555	73.6	66.7
2030	13,005	12,959	9,596	8,751	73.8	67.5
2040	13,436	13,421	10,002	9,167	74.4	68.3
2050	14,035	14,050	10,351	9,482	73.7	67.5
2060	14,396	14,434	10,661	9,787	74.1	67.8

Tables 52 and 53 show the projected active population, number of employed and labour force rates for Canada less Québec.

**Table 52 Active Population (Canada less Québec, ages 15 and over)**

Year	Population <sup>(1)</sup>			Active Population			Employed		
	Males	Females	Total	Males	Females	Total	Males	Females	Total
	(thousands)			(thousands)			(thousands)		
2010	10,423	10,734	21,158	7,581	6,780	14,361	6,917	6,255	13,172
2011	10,553	10,866	21,419	7,677	6,860	14,537	7,008	6,332	13,339
2012	10,676	10,988	21,664	7,758	6,927	14,685	7,085	6,394	13,479
2013	10,793	11,105	21,898	7,833	6,986	14,820	7,156	6,451	13,606
2014	10,906	11,217	22,123	7,905	7,042	14,947	7,221	6,501	13,722
2015	11,018	11,328	22,346	7,973	7,094	15,068	7,286	6,551	13,837
2020	11,555	11,852	23,407	8,166	7,263	15,428	7,617	6,829	14,447
2025	12,120	12,416	24,536	8,336	7,431	15,767	7,816	7,020	14,835
2030	12,697	12,996	25,693	8,537	7,651	16,188	8,002	7,229	15,231
2040	13,692	14,050	27,743	9,004	8,084	17,088	8,438	7,638	16,077
2050	14,412	14,830	29,242	9,380	8,408	17,788	8,790	7,943	16,734
2060	15,123	15,542	30,665	9,736	8,733	18,469	9,124	8,250	17,374

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

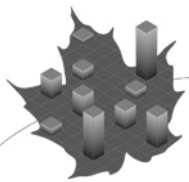


**Table 53 Labour Force Participation Rates (Canada less Québec)**

Age Group	Males				Females			
	2010	2015	2030	2050	2010	2015	2030	2050
	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
<b>15-19</b>	51.1	54.9	55.7	55.8	54.2	57.7	58.7	58.8
<b>20-24</b>	79.5	81.4	83.0	83.0	76.0	76.9	80.0	80.0
<b>25-29</b>	90.4	91.6	93.0	93.0	82.0	82.7	85.7	85.8
<b>30-34</b>	92.5	93.3	94.0	94.0	81.2	81.8	84.2	84.2
<b>35-39</b>	93.1	93.9	94.0	94.0	81.1	82.4	85.5	85.5
<b>40-44</b>	92.0	93.0	94.0	94.0	83.5	84.9	86.7	86.7
<b>45-49</b>	91.1	92.1	94.0	94.0	83.9	84.7	86.7	86.8
<b>50-54</b>	88.6	89.0	91.0	91.0	80.0	81.3	84.3	84.2
<b>55-59</b>	78.1	79.6	81.1	81.1	68.8	69.6	71.0	71.0
<b>60-64</b>	60.3	60.9	60.5	60.3	46.4	46.6	46.1	45.9
<b>65-69</b>	31.4	31.3	31.1	30.9	17.9	17.0	17.5	17.4
<b>70 and Over</b>	9.1	9.1	9.4	9.3	3.1	3.3	3.3	3.3
<b>15-69</b>	79.7	80.2	79.6	79.6	71.3	71.3	71.8	71.7
<b>15 and Over</b>	<b>72.7</b>	<b>72.4</b>	<b>67.2</b>	<b>65.1</b>	<b>63.2</b>	<b>62.6</b>	<b>58.9</b>	<b>56.7</b>

### 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 2007. Table 54 shows the projected average number of employed persons and the projected proportion of the population, aged 18 to 69, with earnings for Canada less Québec.



**Table 54 Employment of Population (Canada less Québec, ages 18 to 69)**

Year	Population		Employed		Employment Rate		Proportion with Earnings (Earners)	
	Males	Females	Males	Females	Males	Females	Males	Females
	(thousands)		(thousands)		(%)		(%)	
2010	9,146	9,135	6,663	6,037	72.9	66.1	77.1	71.8
2011	9,254	9,248	6,752	6,113	73.0	66.1	77.3	71.9
2012	9,354	9,354	6,827	6,176	73.0	66.0	77.4	71.9
2013	9,446	9,450	6,895	6,233	73.0	66.0	77.5	71.9
2014	9,528	9,539	6,957	6,283	73.0	65.9	77.4	71.7
2015	9,606	9,621	7,019	6,332	73.1	65.8	77.4	71.6
2020	9,849	9,874	7,313	6,598	74.3	66.8	78.4	72.4
2025	10,043	10,069	7,460	6,758	74.3	67.1	78.1	72.6
2030	10,201	10,236	7,590	6,938	74.4	67.8	78.3	73.3
2040	10,624	10,689	7,967	7,317	75.0	68.5	79.2	74.2
2050	11,187	11,269	8,307	7,620	74.3	67.6	78.2	73.1
2060	11,529	11,633	8,593	7,900	74.5	67.9	78.5	73.4

**D. Rate of Increase in Average Annual Employment Earnings**

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 increases in the AWE and the AAE has been relatively small over the period from 1966 to 2008; that is, an absolute difference of approximately 0.08% 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 2010 and thereafter.

The real-wage differential has fluctuated significantly from year to year. For example, the five-year average real-wage differential, as measured by the difference between the increase in the nominal AWE and the CPI, was -0.4% for the period ending in 2004, while it was 1.2% for the period ending in 2009. The average annual real-wage differential averaged 0.9% for the 45-year period ending in 2009.

The real-wage differential can also be measured using the difference between the increase in the nominal average wage and the CPI. 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 differential is related to the growth in total labour productivity as follows:

$$\text{Real-Wage Differential} = \text{Growth in Labour Productivity} + \text{Growth in Compensation Ratio} + \text{Growth in Earnings Ratio} + \text{Growth in Average Hours Worked} + \text{Growth in Price Differential}.$$



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.

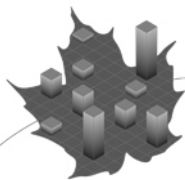
Labour productivity in the above equation is defined as the ratio of the real Gross Domestic Product (GDP) to total hours worked in the Canadian economy. The average annual growth in the labour productivity was 1.74% for the 47-year period ending in 2008 and 0.79% for the 8-year period ending in 2008. It is assumed that a possible labour shortage from the retirement of the baby boom generation could result in higher labour productivity. Labour productivity growth of 1.5% is assumed in the long term.

The compensation ratio is the ratio of the total compensation received by workers to the nominal GDP. The compensation ratio has decreased on average by 0.14% per year for the 47-year period ending 2008 with a more significant decrease between 1989 and 2000 (an average decrease of 0.48% per year). However during the more recent eight-year period ending in 2008, the trend reversed with an average increase in the compensation ratio of 0.12% per year. 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. The historical decline in the earnings ratio (0.18% per year from 1962 to 2008 and 0.21% per year from 2001 to 2008) has been primarily due to the faster growth in supplementary labour income, such as pension plan contributions, health benefits, and Employment Insurance, compared to earnings. Based on the historical trend, it is assumed that the long-term earnings ratio will decline by 0.2% per year.

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 -0.36% over the 47-year period ending in 2008 and -0.29% over the 8-year period ending in 2008. In the future, the assumed steady increases in productivity could continue to apply negative pressure on average hours worked. At the same time, the assumed future increases in life expectancy and a possible labour shortage could raise the labour force participation rates for older workers and may also increase average hours worked. It is assumed that average hours worked will continue to decrease but at a slower pace of 0.1% per year over the long term.

Finally, the price differential is the ratio of the GDP deflator 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 0.14% between 1961 and 2008 and 0.43% between 2000 and 2008. However, between 2003 and 2006, the price differential grew by approximately 0.9% per year as a direct consequence of rising commodity prices. It is assumed that the long-term increase in price differential will be 0.1% per year.



The result of the foregoing discussion is that the assumed real-wage differential increase is 1.30% per annum over the long term. Table 55 summarizes the historical information and the assumptions described above.

**Table 55 Real-Wage Differential Growth and Related Components**

	1961-2008 Average	2000-2008 Average	Long-Term Assumption
<b>Labour Productivity Growth</b>	<b>1.74%</b>	<b>0.79%</b>	<b>1.50%</b>
+ Compensation Ratio Growth	(0.14%)	0.12%	0.00%
+ Earnings Ratio Growth	(0.18%)	(0.21%)	(0.20%)
+ Average Hours Worked Growth	(0.36%)	(0.29%)	(0.10%)
+ Price Differential Growth	0.14%	0.43%	0.10%
<b>Real-Wage Differential Growth</b>	<b>1.20%</b>	<b>0.84%</b>	<b>1.30%</b>

The short-term real-wage differential assumption takes into account the recent economic downturn. As a result, the real-wage differential with respect to both the AWE and AAE is assumed to gradually increase from 0.0% in 2010 to 1.3% by 2019. This is consistent with the assumption that the economy will gradually return to a moderate level of growth. The long-term real-wage differential of 1.3% is consistent with the average of various economic forecasts and the upward pressure on real wages due to a possible labour shortage. Table 56 shows the assumptions regarding the annual increases in prices, real AAE and real AWE.

**Table 56 Inflation, Real AAE and AWE Increases**

Year	Price Increases	Real Average Annual Earnings (AAE)	Real Average Weekly Earnings (AWE)
	(%)	(%)	(%)
<b>2010</b>	2.00	0.00	0.00
<b>2011</b>	2.00	0.30	0.30
<b>2012</b>	2.00	0.60	0.60
<b>2013</b>	2.00	0.70	0.70
<b>2014</b>	2.00	0.80	0.80
<b>2015</b>	2.00	0.90	0.90
<b>2016</b>	2.00	1.00	1.00
<b>2017</b>	2.10	1.10	1.10
<b>2018</b>	2.20	1.20	1.20
<b>2019+</b>	2.30	1.30	1.30

**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. The ratio of female to male average employment earnings stood at about 48% in 1966 and was 71% in 2007. This ratio is projected to increase to 84% by 2050. Table 57 shows the projected average annual earnings by age group and sex for selected years.

**Table 57 Average Annual Earnings (Canada less Québec, ages 18 to 69)**

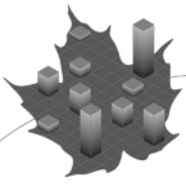
Age Group	Males			Females		
	2010	2025	2050	2010	2025	2050
	(\$)	(\$)	(\$)	(\$)	(\$)	(\$)
20-24	23,455	36,714	88,003	17,473	28,674	71,870
25-29	38,232	59,594	141,593	29,492	49,094	123,266
30-34	47,906	74,000	174,855	34,309	57,713	146,451
35-39	52,517	81,024	191,862	37,507	63,000	160,153
40-44	54,543	84,310	199,936	39,837	66,591	168,623
45-49	56,260	87,065	206,269	41,114	68,705	173,704
50-54	56,702	87,695	207,795	41,294	69,030	174,762
55-59	52,016	80,040	189,590	37,643	62,594	159,080
60-64	46,466	71,143	168,152	32,349	54,862	140,194
65-69	26,361	39,960	94,360	17,502	30,189	77,970
<b>All Ages</b>	<b>46,274</b>	<b>71,907</b>	<b>169,231</b>	<b>33,634</b>	<b>56,555</b>	<b>142,295</b>

Total earnings are the product of average earnings and the number of earners. Table 58 shows projected average earnings, the number of earners for each sex and the resulting total earnings and its annual percentage increase for Canada less Québec. The ultimate annual increase in total earnings is set to reach about 4.0%. This nominal increase is comprised of an ultimate inflation rate of 2.3%, real wage growth of 1.3% and population growth for the age group 18 to 69 of 0.4%.

**Table 58 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	(\$ million)	(%)
	(\$)	(\$)	(thousands)	(thousands)		
2010	46,274	33,634	7,048	6,557	546,672	3.5
2011	47,210	34,539	7,152	6,648	567,276	3.8
2012	48,307	35,571	7,240	6,723	588,912	3.8
2013	49,481	36,664	7,323	6,793	611,385	3.8
2014	50,742	37,820	7,379	6,841	633,169	3.6
2015	52,089	39,047	7,435	6,888	656,254	3.6
2020	60,793	46,771	7,718	7,151	803,677	4.3
2025	71,907	56,555	7,847	7,308	977,559	3.9
2030	85,176	68,260	7,986	7,504	1,192,427	4.1
2040	119,896	98,761	8,419	7,932	1,792,819	4.1
2050	169,231	142,295	8,743	8,238	2,651,773	3.9

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 distribution 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



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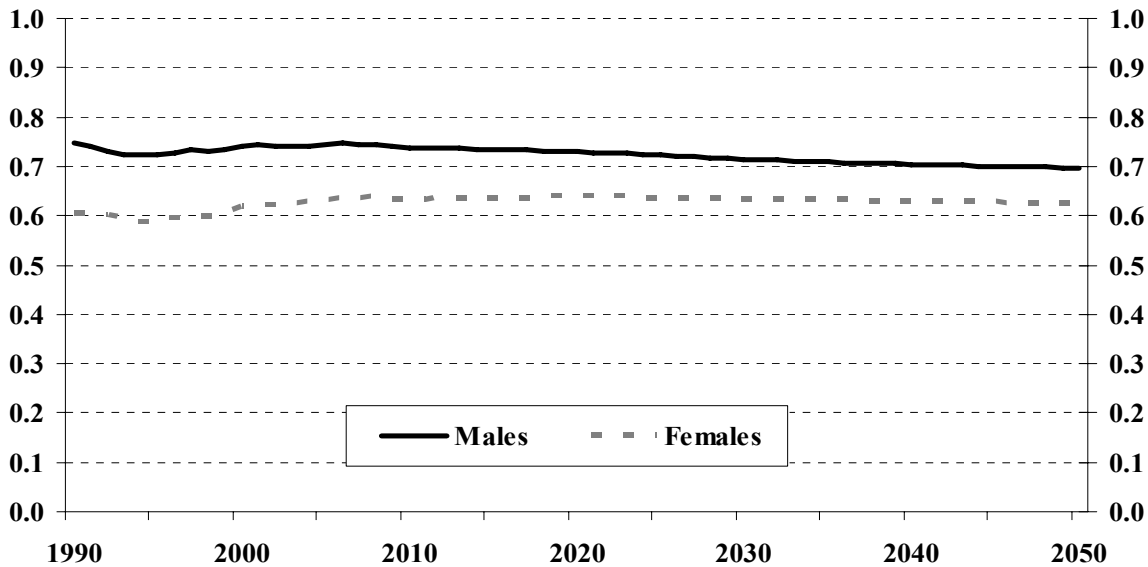
more than the YBE. For 2010, the YMPE and YBE are respectively \$47,200 and \$3,500. The YMPE is increased annually based on the average industrial aggregate wage in Canada as published by Statistics Canada. Table 59 shows the projected average pensionable earnings by age and sex for selected years.

**Table 59 Average Pensionable Earnings (Canada less Québec)**

Age Group	Males			Females		
	2010	2025	2050	2010	2025	2050
	(\$)	(\$)	(\$)	(\$)	(\$)	(\$)
20-24	23,837	36,232	84,170	19,187	29,994	71,707
25-29	33,047	50,873	119,549	28,539	45,034	107,744
30-34	36,609	56,434	133,280	30,637	48,538	116,638
35-39	37,757	58,254	138,094	32,013	50,764	122,322
40-44	38,316	59,194	140,548	33,086	52,493	126,716
45-49	38,690	59,821	142,152	33,704	53,555	129,370
50-54	38,572	59,565	141,342	33,736	53,541	129,050
55-59	36,645	56,172	131,806	32,011	50,453	120,500
60-64	34,724	46,975	106,952	30,103	42,459	98,941
65-69	25,618	38,413	81,448	21,831	33,190	72,699
<b>All Ages</b>	<b>34,854</b>	<b>53,038</b>	<b>123,865</b>	<b>29,787</b>	<b>46,720</b>	<b>111,215</b>

The evolution of the ratio of average pensionable earnings for males and females as a percentage of the YMPE is shown in Chart 11. 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 increases initially and then stabilizes, because the YBE effect is offset by the greater increase in their average pensionable earnings.

**Chart 11 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

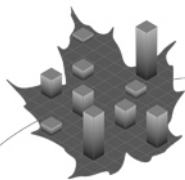
In order to be considered a contributor in any given calendar year, one must have employment earnings exceeding the YBE. Accordingly, the proportion of contributors is determined by multiplying the proportion of earners by the complement of the proportion of earners earning up to the YBE. This last proportion 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 2005 to 2007 and are assumed to remain constant in the future. Starting in 2012, the proportion of contributors is adjusted to reflect Bill C-51 that amends the *Canada Pension Plan* to require individuals under the age of 65 who receive a CPP retirement benefit and continue to work, as well as their employers, to make CPP contributions. Working beneficiaries aged 65 to 69 are not required to contribute to the Plan, but employers of those opting to do so are required to contribute. As under the current Plan, contributions are not permitted upon attaining age 70. As a result, in 2012 it is expected that 322,000 working beneficiaries will contribute to the CPP. Table 60 presents the proportions of contributors by selected age groups and years for males and females.

**Table 60 Proportions of Contributors by Age Group**

Age Group	Males			Females		
	2010	2025	2050	2010	2025	2050
	(%)	(%)	(%)	(%)	(%)	(%)
20-24	74.5	82.8	87.0	73.1	82.0	87.4
25-29	81.7	86.7	89.3	74.9	81.6	85.8
30-34	83.9	88.8	90.4	73.4	79.7	83.2
35-39	85.5	91.0	91.9	74.9	82.4	85.2
40-44	83.8	87.7	89.0	77.1	81.9	84.4
45-49	83.0	88.2	89.4	77.4	82.6	84.7
50-54	79.7	83.7	85.5	73.2	78.5	81.1
55-59	70.8	75.8	77.8	62.6	67.0	69.6
60-64	43.0	60.7	63.2	34.6	47.6	50.2
65-69	4.9	16.0	16.6	4.6	12.0	12.8
<b>All Ages</b>	<b>72.2</b>	<b>76.5</b>	<b>78.3</b>	<b>65.5</b>	<b>69.7</b>	<b>72.6</b>

### 2. Average Contributory Earnings

Average contributory earnings, which also reflect Bill C-51, are determined for each age, sex and year by subtracting the YBE from the average pensionable earnings as shown in Table 59. Table 61 shows the resulting average contributory earnings by age group and sex for selected years.



**Table 61 Average Contributory Earnings**

Age Group	Males			Females		
	2010	2025	2050	2010	2025	2050
	(\$)	(\$)	(\$)	(\$)	(\$)	(\$)
20-24	20,337	32,732	80,670	15,687	26,494	68,207
25-29	29,547	47,373	116,049	25,039	41,534	104,244
30-34	33,109	52,934	129,780	27,137	45,038	113,138
35-39	34,257	54,754	134,594	28,513	47,264	118,822
40-44	34,816	55,694	137,048	29,586	48,993	123,216
45-49	35,190	56,321	138,652	30,204	50,055	125,870
50-54	35,072	56,065	137,842	30,236	50,041	125,550
55-59	33,145	52,672	128,306	28,511	46,953	117,000
60-64	31,224	43,475	103,452	26,603	38,959	95,441
65-69	22,118	34,913	77,948	18,331	29,690	69,199
<b>All Ages</b>	<b>31,354</b>	<b>49,538</b>	<b>120,365</b>	<b>26,287</b>	<b>43,220</b>	<b>107,715</b>

### 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 were 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 have 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 Human Resources and Skills Development Canada, and the information from the Canada Revenue Agency on CPP contribution refunds were used to calculate the adjustment. The adjustment is about 2.2% in 2007 and gradually reduces to 2.1% 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.

Another adjustment is made to account for the effect of working beneficiaries provision of Bill C-51. This working beneficiaries provision of that Act is assumed to further reduce the adjustment to 2.0%.

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 62 presents the projected components of total unadjusted contributory earnings, the total adjusted contributory earnings, as well as the projected YMPE. The number of contributors and





amount of contributory earnings increase in 2012 primarily due to the working beneficiaries provision of Bill C-51.

**Table 62 Total Adjusted Contributory Earnings**

Year	Unadjusted Average Contributory Earnings			Contributors		Total Adjusted Contributory Earnings	Annual Increase in Total Adjusted Contributory Earnings
	Males	Females	YMPE	Males	Females		
	(\$)	(\$)	(\$)	(thousands)	(thousands)	(\$ million)	(%)
2010	31,354	26,287	47,200	6,601	5,982	372,340	3.7
2011	32,015	26,930	48,100	6,697	6,074	386,384	3.8
2012	32,409	27,416	49,100	6,976	6,277	406,151	5.1
2013	33,245	28,212	50,300	7,060	6,351	422,153	3.9
2014	34,201	29,093	51,700	7,121	6,408	438,529	3.9
2015	35,180	30,008	53,100	7,182	6,467	455,598	3.9
2020	41,418	35,772	62,000	7,516	6,804	565,486	4.7
2025	49,538	43,220	74,000	7,695	7,025	697,860	4.2
2030	59,201	52,075	88,300	7,872	7,270	860,535	4.3
2040	84,515	75,057	125,800	8,365	7,791	1,315,993	4.3
2050	120,365	107,715	179,100	8,768	8,192	1,973,718	4.0

#### IV. Investment Assumptions

##### A. Investment Strategy

The CPP Investment Board (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 inflation-sensitive assets. Equities consist of Canadian, foreign developed market and emerging market equities. Fixed income securities consist of bonds which are usually a mix of federal, provincial, corporate and real return bonds. Inflation-sensitive assets include such categories as real estate and infrastructure.

The total assets of the CPP portfolio (\$126.8 billion as at 31 December 2009) consist of amounts invested by the CPPIB (\$123.9 billion), the amount held in the CPP Account (\$35 million) and amounts receivable (\$2.9 billion). As at 31 December 2009, the asset mix of the CPPIB consisted of 56% equity, 33% fixed income securities (including real return bonds) and 11% inflation-sensitive assets. The CPPIB has an approved Reference Portfolio which consists of 65% equity (45% foreign developed market equities, 15% Canadian equities and 5% emerging market equities) and 35% debt (25% Canadian nominal bonds, 5% Canadian real return bonds and 5% foreign sovereign bonds). According to research conducted by the CPPIB, the Reference Portfolio “could reasonably be expected to produce the long-term average annual return needed to help sustain the CPP at its current 9.9% contribution rate”. However, the CPPIB’s Reference Portfolio is not necessarily representative of actual holdings of the CPPIB. Therefore, the initial CPP portfolio asset mix is derived using the actual



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amount held in the CPP Account, amounts receivable, and investments reported by the CPPIB as at 31 December 2009.

The initial asset mix of the CPP portfolio at the beginning of 2010 consists of 55% equity, 35% fixed income securities (including 3% in short-term investments) and 10% inflation-sensitive assets.

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 Plan participants age, the ratio of contributors to beneficiaries decreases, and the proportion of investment income required to pay benefits increases. Starting in 2021, contributions will be insufficient to cover all expenditures, and a portion of investment income will be required to cover the contribution shortfall. Therefore, it is assumed that the CPPIB will increase its investments in fixed income securities and inflation-sensitive assets to reduce the exposure of the CPP portfolio to market fluctuations and to provide more stable cash flows. For these reasons, the long-term asset mix of the CPP portfolio is projected to stabilize by the year 2035 and to consist of 42% equity, 40% fixed income securities, and 18% inflation-sensitive assets. The 42% of the portfolio invested in equity is composed of 15% Canadian equities, 22% foreign developed market equities, and 5% emerging market equities. The 40% invested in fixed income securities is composed of 39% bonds, including marketable and non-marketable bonds, and 1% in short-term investments.

The transition from the initial CPP portfolio asset mix in 2010 to the ultimate asset mix in 2035 is expected to occur in two phases. From 2010 to 2014, real rates of return of bonds are expected to be low and as a consequence, it is expected that new investments in fixed income will be limited. Equity investments are assumed to remain stable, and investments in real estate and infrastructure are assumed to increase. At the end of 2013, the assumed asset mix consists of 55% equity, 31.5% fixed income securities and 13.5% inflation-sensitive assets. The 55% equity component is assumed to consist of 15% Canadian equities, 35% foreign developed market equities, and 5% emerging market equities. The 31.5% invested in fixed income securities is assumed to consist of 30.5% bonds, including marketable and non-marketable bonds, and 1% short-term investments, such as cash. During the second phase, which is expected to take place between 2014 and 2035, investments in developed market equities are expected to decrease, while investments in fixed income securities and inflation-sensitive assets (to a lesser extent) are expected to increase to provide more stable cash flows.

When deriving the ultimate assumed asset mix of the CPP portfolio, consideration was also given to the asset mix policy of other major Canadian pension plans. Table 63 shows the assumed asset mix of the CPP portfolio at the end of selected years of the projection period.



**Table 63 Asset Mix**

End of Year	Equity			Fixed Income			Inflation-Sensitive
	Canadian	Foreign Developed Market	Emerging Market	Marketable Bonds	Non-Marketable Bonds	Short Term	Real Estate and Infrastructure
	(%)	(%)	(%)	(%)	(%)	(%)	(%)
2010	15.0	35.5	5.0	15.7	15.8	1.0	12.0
2011	15.0	35.5	5.0	16.8	14.2	1.0	12.5
2012	15.0	35.5	5.0	17.7	12.8	1.0	13.0
2013	15.0	35.0	5.0	18.8	11.7	1.0	13.5
2014	15.0	33.5	5.0	20.7	10.8	1.0	14.0
2015	15.0	32.0	5.0	22.7	10.1	1.0	14.2
2020	15.0	27.6	5.0	30.1	6.1	1.0	15.2
2025	15.0	25.6	5.0	34.1	3.1	1.0	16.2
2030	15.0	23.6	5.0	35.7	2.5	1.0	17.2
2035	15.0	22.0	5.0	37.1	1.9	1.0	18.0
2044+	15.0	22.0	5.0	39.0	0.0	1.0	18.0

## B. Investment Income

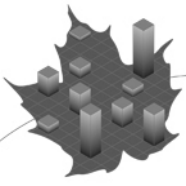
In general, investment income is the product of the market value of a specific asset component and the projected nominal rate of return of that component (which is obtained by adding the applicable projected real rate of return, as described in section C below, to the projected inflation rate).

The investment income of the CPPIB is based on the assumed real rate of return applicable to each type of asset, projected inflation and the projected asset mix. Investment income is also adjusted downward to recognize investment expenses. Based on the experience of the CPPIB, the investment expenses are assumed to reduce the gross rate of return by 0.15% for the entire projection period.

## C. Real Rates of Return

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 of the real rates of return described in this section are net of investment expenses and include an allowance for rebalancing and diversification.

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. It is assumed that 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. Hence, it is assumed that currency variations will not have an impact on the long-term real rates of return.



### Real Rates of Return on Assets under the Management of the CPP Investment Board

As discussed earlier, CPP Investment Board assets are invested in three broad categories of investments: equity, fixed income securities, and inflation-sensitive assets. The projected real rates of return for these three asset classes have been determined by taking into consideration various economic forecasts.

In determining the annual real rates of return for each asset category, consideration was given to the current economic environment, its future outlook, 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 by the recent credit crisis. 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.

#### 1. Equity

Most CPP Investment Board assets are currently invested in equity, specifically in 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 these 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.

Since the last triennial actuarial valuation, equity returns have been very volatile. Equity returns were almost non-existent in 2007 and negative in 2008. However, they rebounded greatly in 2009. It is anticipated that the high returns in 2009 were enough to bring equity values back to their long-term means. Thus, equity returns are assumed to be stable throughout the projection period.

Consistent with the assumption that risk taking must be rewarded, equity returns are developed by adding an equity risk premium to the long-term federal bond real rate of return. Historical equity risk premiums 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. However, the equity risk premium is assumed to be higher in the first five years of the projection (starting at 5.5% in 2010, decreasing to 3.6% in 2014 and to 2.0% for years 2015 and thereafter), reflecting assumed low bond returns over the next 5 years, before reaching its ultimate rate of 2.0% for Canadian and foreign developed markets. The equity risk premium for emerging market equities is expected to be 1.0% higher than for Canadian and foreign developed market equities, reflecting the additional risk inherent with investments in emerging countries. As described in the following section, the long-term federal bond real rate of return is set at 2.8% for years 2015 and thereafter.

Real rates of return for developed market equity investments are projected to be 4.8% (5.8% for emerging markets) throughout the projection period.



## 2. Fixed Income Securities

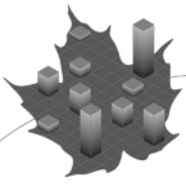
The CPP Investment Board currently has 33% of its portfolio invested in fixed income securities. It is expected that fixed income securities will represent an important portion of CPPIB investments in the future. The assumed asset mix at the beginning of 2010 is 55% equity, 35% fixed income securities, and 10% inflation-sensitive assets. In 2035, it is assumed that an asset mix of 42% equity, 40% fixed income securities, and 18% inflation-sensitive assets will be achieved. The percentage of fixed income securities held is assumed to increase through time in order to attain more stability in investment income, which will be required to pay benefits. This may be achieved by implementing a lower risk investment strategy.

### Non-Marketable Bond Portfolio and Rollover Rates (Loans to Provinces)

The non-marketable bond portfolio at the end of 2009 represents 18% of all CPP assets and is composed of bonds with various terms to maturity, consisting of loans made to the provinces. The provinces are allowed to roll over at maturity any bonds that were purchased prior to the CPP amendments (that came into effect on 1 January 1998) for a further 20-year term. 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, a total principal amount not exceeding the principal amount of the bond maturing and total successive terms not exceeding 30 years. During the 11-year period from 1999 to 2009, 59% of provincial bonds available for rollover were rolled over. The rollover proportion increases to 67% when considering the three-year period from 2007 to 2009, and to 84% when considering only 2009. Using this rollover experience and considering current stakeholders' balance sheets, it is assumed that the rollover rate will be approximately 92% for 2010 and thereafter.

On the basis of the average long-, medium-, and short-term experience of the spread between the annual yield on federal and provincial investments, the current outlook of the economy, and data on rollovers since 1999, a spread over the federal yield was determined for each province. The spreads on rollover bonds are set at the actual market spreads at the end of 2009 for provincial bonds issued by the given province. The ultimate spreads, applicable starting at the end of 2011, are set at the average spreads for the last 10 years for provincial bonds issued by the given province. The ultimate long-term real federal yield is assumed at 2.8%. The weighted long-term average spread for all provinces is approximately 55 basis points. Therefore, an ultimate yield of approximately 3.35% for provincial rollover bonds is assumed for 2015 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. Therefore, unless the yield is stable from year to year, real rates of return will vary from one year to the next.



### Marketable Bond Portfolio

As the non-marketable bond portfolio matures over the next 30 years, it is assumed that the proceeds will be mostly invested in marketable bonds and that this marketable bond portfolio will consist of federal, provincial, corporate and real return bonds. The initial asset mix of the marketable bond portfolio is based on actual CPPIB investments as at 31 December 2009; that is, 54% federal, 11% provincial, 5% corporate and 30% real return bonds.

It is assumed that the CPPIB will purchase a variety of federal, provincial, corporate and real return bonds in proportions consistent with their investment strategy. It is also assumed that a greater proportion of corporate and provincial bonds, compared to the other bond types, will be purchased bringing CPPIB holdings closer to the Canadian bond market mix. It is further assumed that the CPPIB will aim to overweight its provincial bond investments compared to federal bonds in order to achieve a greater return with little additional risk. Lastly, it is assumed that the ultimate marketable bond mix (when the non-marketable bond portfolio matures) will be composed of 30% federal, 35% provincial, 25% corporate and 10% real return bonds.

As discussed earlier, the assumed ultimate yield on long-term federal bonds is 2.8%. The initial spreads over the federal bond yield are assumed to be 70 basis points for provincial bonds and 145 basis points for corporate bonds. These spreads are much higher than in the last report and reflect the current economic environment. The ultimate spreads for provincial and corporate bonds are assumed to be 45 basis points and 90 basis points, respectively, and are reached at the end of 2012. Corporate bond spreads are net of the expected default rate. Real return bonds, on the other hand, yield less than long-term federal bonds, since the real return is guaranteed and will not vary with inflation. Thus, the initial spread on real return bonds is assumed to be -50 basis points and to reach its ultimate value of -40 basis points at the end of 2011. 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 long-term yield rates. Since the long-term federal bond yield is assumed to increase between 2009 and 2014 and only stabilize at the end of 2014, bond returns are quite low for the first five years of the projection. The assumed ultimate real rate of return for long-term federal bonds is 2.8% starting in 2015. An ultimate real rate of return of 3.2% is assumed for the bond portfolio for 2033 and thereafter.

### Short-Term Investments and CPP Account

Historically, the CPP Account comprised an Operating Balance and short-term investments. The CPP Account, held by the federal Department of Finance, was 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 0.5% for 2010 and thereafter. CPPIB short-term investments are also assumed to earn a real rate of return of 0.5% for the entire projection period.



### 3. Inflation-Sensitive Assets

Inflation-sensitive 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 debt 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. Thus, the assumed real return for inflation-sensitive assets increases from -0.5% in 2010 to 4.0% in the long term.

Table 64 summarizes the assumed real rates of return by asset type throughout the projection period. The real rates of return for 2010 reflect the observed CPPIB portfolio return for the first six months of 2010.

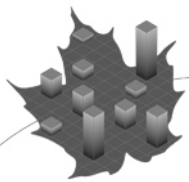
**Table 64 Real Rates of Return by Asset Type**

Year	Equity			Fixed Income			Inflation-Sensitive
	Canadian	Foreign Developed Market	Emerging Markets	Marketable Bonds	Non-Marketable Bonds	Short Term	Real Estate and Infrastructure
	(%)	(%)	(%)	(%)	(%)	(%)	(%)
2010	(0.4)	(0.4)	0.7	(0.6)	0.5	0.5	(0.5)
2011	4.8	4.8	5.8	(0.6)	2.2	0.5	2.1
2012	4.8	4.8	5.8	1.3	2.0	0.5	3.0
2013	4.8	4.8	5.8	1.2	2.2	0.5	3.0
2014	4.8	4.8	5.8	1.3	2.3	0.5	3.1
2015	4.8	4.8	5.8	3.0	3.4	0.5	3.9
2020	4.8	4.8	5.8	3.0	2.8	0.5	3.9
2025	4.8	4.8	5.8	3.1	3.1	0.5	4.0
2030	4.8	4.8	5.8	3.1	3.4	0.5	4.0
2035	4.8	4.8	5.8	3.2	2.6	0.5	4.0
2044+	4.8	4.8	5.8	3.2	0.0	0.5	4.0

Table 65 was prepared based on the Canadian Institute of Actuaries' *Report on Canadian Economic Statistics 1924 – 2009* and presents the real rates of return in Canadian dollars for various asset classes as well as inflation levels for the period ending December 2009.

**Table 65 Historical Inflation and Real Rates of Return by Asset Type**

Length of Period Ending 2009 (years)	35	50	65	75
	(%)	(%)	(%)	(%)
Level of Inflation	4.2	4.1	4.0	3.8
Real Return on Canadian Equity	7.0	5.6	6.8	6.5
Real Return on U.S. Equity	7.7	5.5	6.9	n/a
Real Return on Canadian Real Estate	6.8	n/a	n/a	n/a
Real Return on Long-Term Federal Bonds	5.5	3.9	2.4	2.2

**D. Overall Rate of Return**

The assumed rate of return for total assets was calculated as the weighted average rate of return on all types of assets, using the market values of the assets as weights. The resulting rates are shown in Table 66. Excluding the year 2010, the projected average real rate of return over the following 74 years is 4.0%.

**Table 66 Rates of Return on CPP Assets**

<b>Year</b>	<b>Nominal</b>	<b>Real</b>
	(%)	(%)
<b>2010</b>	1.8	(0.2)
<b>2011</b>	5.2	3.2
<b>2012</b>	5.6	3.6
<b>2013</b>	5.6	3.6
<b>2014</b>	5.6	3.6
<b>2015</b>	6.1	4.1
<b>2016</b>	6.1	4.1
<b>2017</b>	6.1	4.0
<b>2018</b>	6.2	4.0
<b>2019</b>	6.3	4.0
<b>2020+</b>	6.3	4.0
<b>2010-2014</b>	4.7	2.7
<b>2010-2084</b>	6.2	3.9

**V. Expenditures**

The actuarial 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 this 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 given 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 (2010). This is done for the following reasons:

- The valuation methodology can be validated for the historical period up to the valuation year (1966 to 2009) 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 2009) 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 and average monthly benefits payable as at 31 December 2009 are shown in Table 67.

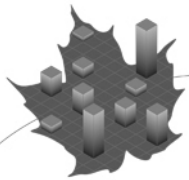
**Table 67 Pensions Payable as at 31 December 2009**

Benefit Type	Number of Beneficiaries		Average Monthly Benefit	
	Males	Females	Males	Females
	(in thousands)		(\$)	
Retirement	1,883	1,931	624	380
Survivor				
- Aged less than 65	58	205	302	372
- Aged 65 and over	122	737	90	310
Disability	176	192	856	774
Benefit Type	Number of Beneficiaries		Average Monthly Benefit	
	Males and Females		Males and Females	
	(in thousands)		(\$)	
Orphans	93		214	
Disabled Contributor's Child	122		214	

#### A. Adjustments to Pensionable Earnings and Proportion of Contributors

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 are also adjusted to take into account retirement pensions emerging prior to age 65. These pensions have the effect of reducing the amount of contributions that would otherwise have been made to the CPP. This effect is already taken into account in the determination of average pensionable earnings for contributory earnings purposes described earlier (see Table 59). For benefit computation purposes, however, this effect must be removed in respect of contributors not yet retired at a given age before 65. The resulting adjusted proportion of contributors and average pensionable earnings for benefit computation purposes appear in Tables 68 and 69, respectively.



**Table 68 Proportion of Contributors (adjusted for benefit purposes)**

Age Group	Males			Females		
	2010	2025	2050	2010	2025	2050
	(%)	(%)	(%)	(%)	(%)	(%)
20-24	75.6	83.6	87.7	75.5	83.7	88.4
25-29	83.7	88.3	90.7	79.6	85.2	88.5
30-34	86.4	90.8	92.1	79.4	84.6	87.3
35-39	87.8	92.6	93.4	80.4	86.5	88.7
40-44	86.2	89.7	90.8	81.3	85.4	87.4
45-49	85.2	89.8	90.9	80.7	85.3	87.1
50-54	81.6	85.4	87.0	76.1	81.0	83.3
55-59	72.5	77.3	79.2	65.2	69.4	71.9
60-64	44.1	46.1	48.6	36.2	39.1	41.7
65-69	4.9	5.5	6.2	4.6	6.0	6.9
<b>All Ages</b>	<b>73.9</b>	<b>75.3</b>	<b>77.0</b>	<b>68.8</b>	<b>70.7</b>	<b>73.3</b>

**Table 69 Average Pensionable Earnings (adjusted for benefit purposes)**

Age Group	Males			Females		
	2010	2025	2050	2010	2025	2050
	(\$)	(\$)	(\$)	(\$)	(\$)	(\$)
20-24	23,291	35,607	83,099	18,869	29,718	71,394
25-29	31,555	49,061	116,119	27,688	44,098	106,138
30-34	34,286	53,578	127,456	29,695	47,500	114,678
35-39	35,601	55,770	132,941	31,128	49,949	120,703
40-44	36,434	56,844	135,674	32,261	51,482	124,602
45-49	37,035	57,839	138,019	32,984	52,714	127,563
50-54	37,071	57,673	137,402	32,977	52,572	126,995
55-59	35,285	54,382	128,017	31,202	49,315	118,017
60-64	35,980	54,399	123,711	31,186	48,707	113,507
65-69	29,070	38,878	82,611	24,484	34,398	75,553
<b>All Ages</b>	<b>33,429</b>	<b>51,888</b>	<b>121,709</b>	<b>29,142</b>	<b>46,407</b>	<b>110,746</b>

**B. Benefit Eligibility Rates**

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

Benefit eligibility rates 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 2007. 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.



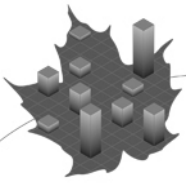
The disability and survivor benefit eligibility rates developed above must be adjusted for purposes of computing the earnings-related portion of these two types of benefits. Since eligibility rules for disability and survivor benefits are more stringent than for retirement pensions, contributors eligible for either a disability or survivor benefit have, on average, fewer years of low earnings at or below the YBE than contributors solely eligible for a retirement pension. Table 70 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 70 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
2010	1.06	0.98	0.98	0.63
2011	1.06	0.99	0.99	0.64
2012	1.08	1.02	0.99	0.65
2013	1.06	1.00	0.99	0.66
2014	1.06	1.01	0.99	0.68
2015	1.06	1.00	1.00	0.69
2020	1.03	0.99	1.00	0.74
2025	1.02	0.98	0.99	0.78
2030	1.01	0.97	0.98	0.80
2040	1.01	0.98	0.96	0.81
2050	1.02	0.99	0.96	0.83
Year	Survivor/Death Benefit Eligibility Rate at Ages 20-64		Disability Benefit Eligibility Rate at Ages 20-64	
	Males	Females	Males	Females
2010	0.79	0.70	0.73	0.65
2011	0.79	0.71	0.72	0.65
2012	0.79	0.71	0.73	0.65
2013	0.79	0.73	0.74	0.66
2014	0.80	0.73	0.75	0.67
2015	0.80	0.74	0.75	0.67
2020	0.82	0.76	0.77	0.69
2025	0.83	0.78	0.78	0.71
2030	0.84	0.79	0.79	0.73
2040	0.85	0.81	0.80	0.74
2050	0.86	0.82	0.80	0.75

### C. Average Earnings-Related Benefit Factor

The average earnings-related benefit factor is designed to produce, when multiplied by the eligible population and the Pension Index of a given calendar year successively for each sex



and all relevant ages, the total emerging annual earnings-related benefit expenditures for that year.

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

- the sum over all 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 benefit factor described above, in respect of an individual, are the lowest ratios for a number of years equal to the sum of the child-rearing period, disability period and 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 benefit factor 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 factor is finally determined by multiplying the gross factor above, adjusted for the drop-out provisions, by the earnings index, which takes into account the wage indexation provision underlying the calculation of the initial benefit rate when it emerges.

Table 71 shows the resulting projected average retirement benefit factor at ages 60 and 65 by sex and year of birth for various cohorts of contributors. The average benefit factor for males at age 65 is about 10 percentage points lower than at age 60 due to the longer contributory period and the 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 benefit factors for males are expected to 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 benefit factors is expected to decrease over time.



**Table 71 Average Retirement Benefit Factor as Percentage of Maximum**

Year of Birth	Average Retirement Benefit Factor (%)			
	Males		Females	
	Age 60	Age 65	Age 60	Age 65
1950	78	69	57	55
1951	78	68	57	55
1952	78	68	58	55
1953	78	68	58	55
1954	77	67	59	55
1955	77	67	59	55
1960	74	64	58	54
1965	71	61	58	53
1970	70	60	58	53
1980	72	61	61	55
1990	72	61	62	56
2000	73	62	63	57
2010	73	62	64	57
2020+	73	62	64	58

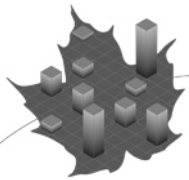
#### D. Retirement Expenditures

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 from 1967 to 2085, an average retirement benefit factor was computed by age, sex and calendar year of emergence of the pension, as the product of:

- the assumed proportion of contributors electing to opt for their retirement benefit;
- the actuarial adjustment factor in connection with the flexible retirement age provision, and starting in 2011 the changes introduced by Bill C-51; and
- the average earnings-related benefit factor.

The assumed proportions by age, sex and calendar year of contributors electing to start receiving the retirement pension at a given age 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 2009. 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 benefit take-up rates at age 60 for the cohort reaching age 60 in 2012 are assumed to be 42% and 45% for males and females, respectively. These rates reflect the expected increase in early retirement take-up rates that will result from two provisions of Bill C-51. First, it is expected that anticipation of the greater reductions in early retirement pensions due to the increased actuarial adjustments (starting in 2012) will cause an increase in early pension



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take-up leading up to 2012. Second, the removal of the Work Cessation Test in 2012 is further expected to increase the early pension take-up rates.

After peaking in 2012, the early pension take-up 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 38% and 41% for males and females, respectively. These rates reflect trends in recent experience.

For each year in the projection period, the retirement take-up rates for ages 61 to 64 and 66 and above are determined by using the observed averages over the last five years ending in 2009. A small proportion of contributors elect to start receiving their retirement pension after age 65.

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 by age 79. Table 72 shows the projected retirement rates by age for both males and females.

**Table 72 Retirement Benefit Take-Up Rates**

Age	Male Cohort Aged 60 in			Female Cohort Aged 60 in		
	2010	2012 <sup>(1)</sup>	2016+	2010	2012 <sup>(1)</sup>	2016+
	(%)	(%)	(%)	(%)	(%)	(%)
60	38.0	42.0	38.0	41.5	45.0	41.0
61	6.0	6.0	6.0	6.0	6.0	6.0
62	5.5	5.5	5.5	5.5	5.5	5.5
63	4.5	4.5	4.5	4.5	4.5	4.5
64	4.0	4.0	4.0	4.5	4.5	4.5
65	37.7	33.7	37.7	34.0	30.5	34.5
66	1.0	1.0	1.0	0.7	0.7	0.7
67	0.6	0.6	0.6	0.5	0.5	0.5
68	0.5	0.5	0.5	0.4	0.4	0.4
69	0.6	0.6	0.6	0.5	0.5	0.5
70	0.5	0.5	0.5	0.6	0.6	0.6
71+	1.1	1.1	1.1	1.3	1.3	1.3
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

(1) In 2012, the Work Cessation Test is removed due to Bill C-51.

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.

After 2012, the post-retirement benefits earned by working beneficiaries are added to this product in accordance with Bill C-51. The resulting total pension may be greater than the maximum pension.

The mortality rates of CPP retirement beneficiaries 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 2009 (*Canada Pension Plan Mortality Study: Actuarial Study No. 7* by the Office of the Chief Actuary, published in July 2009). The resulting mortality rates and life expectancies are shown in Tables 73 and 74.

**Table 73 Mortality Rates of Retirement Beneficiaries**  
(annual deaths per 1,000)

Age	Males				Females			
	2010	2025	2050	2075	2010	2025	2050	2075
60	6.1	4.7	3.8	3.1	3.5	3.0	2.4	2.0
65	12.2	9.2	7.4	6.0	8.1	6.8	5.5	4.5
70	19.6	14.8	11.9	9.7	12.7	10.6	8.6	7.0
75	32.8	25.3	20.8	17.3	20.9	17.4	14.4	11.9
80	55.5	43.9	36.4	30.6	34.9	29.0	24.3	20.4
85	96.5	79.4	68.2	59.0	65.6	56.6	48.8	42.2
90	164.5	142.8	127.2	114.0	122.9	112.6	100.7	90.1
100	348.1	329.8	305.6	283.6	314.2	309.8	287.9	265.6

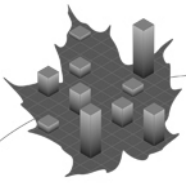
**Table 74 Life Expectancies of Retirement Beneficiaries<sup>(1)</sup>**

Age	Males				Females			
	2010	2025	2050	2075	2010	2025	2050	2075
60	24.5	25.5	26.8	28.1	27.3	28.1	29.3	30.4
65	19.9	21.0	22.2	23.4	22.6	23.4	24.5	25.6
70	15.8	16.8	17.9	18.9	18.2	19.0	20.0	21.0
75	12.0	12.9	13.8	14.8	14.2	14.9	15.8	16.6
80	8.8	9.5	10.3	11.0	10.6	11.1	11.9	12.6
85	6.1	6.7	7.2	7.8	7.4	7.8	8.4	8.9
90	4.1	4.5	4.9	5.2	5.0	5.2	5.6	6.0
100	2.2	2.3	2.5	2.7	2.4	2.4	2.6	2.8

(1) These are cohort life expectancies that take into account future assumed improvements in mortality 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 2009, experience adjustment factors at emergence are applied to all future emerging retirement



pensions calculated using the methodology previously described, and are shown in Table 75. Table 76 shows the projected number of new retirement beneficiaries along with their projected average monthly retirement benefit by sex and year.

**Table 75 Retirement Benefit Experience Adjustment Factors**

	Age at Emergence		
	60-65	66 and Over	All Ages
<b>Males</b>	1.00	0.54	0.98
<b>Females</b>	0.97	0.50	0.95

**Table 76 New Retirement Pensions**

Year	Number of Beneficiaries			Average Monthly Pension		
	Males	Females	Total	Males	Females	Total
				(\$)	(\$)	(\$)
<b>2010</b>	150,834	142,511	293,345	581.95	417.26	501.94
<b>2011</b>	154,842	149,776	304,619	591.93	431.73	513.16
<b>2012</b>	172,275	170,239	342,514	612.48	454.78	534.10
<b>2013</b>	173,745	171,375	345,120	613.12	458.49	536.34
<b>2014</b>	171,472	172,159	343,631	619.21	471.39	545.16
<b>2015</b>	172,747	171,135	343,882	624.56	478.19	551.72
<b>2020</b>	191,413	190,154	381,567	691.96	549.11	620.77
<b>2025</b>	206,201	202,809	409,010	792.81	647.04	720.53
<b>2030</b>	196,745	192,177	388,922	921.50	772.52	847.89
<b>2040</b>	193,537	194,890	388,427	1,315.32	1,124.82	1,219.74
<b>2050</b>	231,562	226,921	458,483	1,892.98	1,647.51	1,771.49

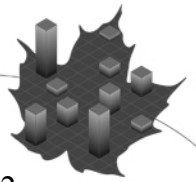
**E. Disability Expenditures**

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

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

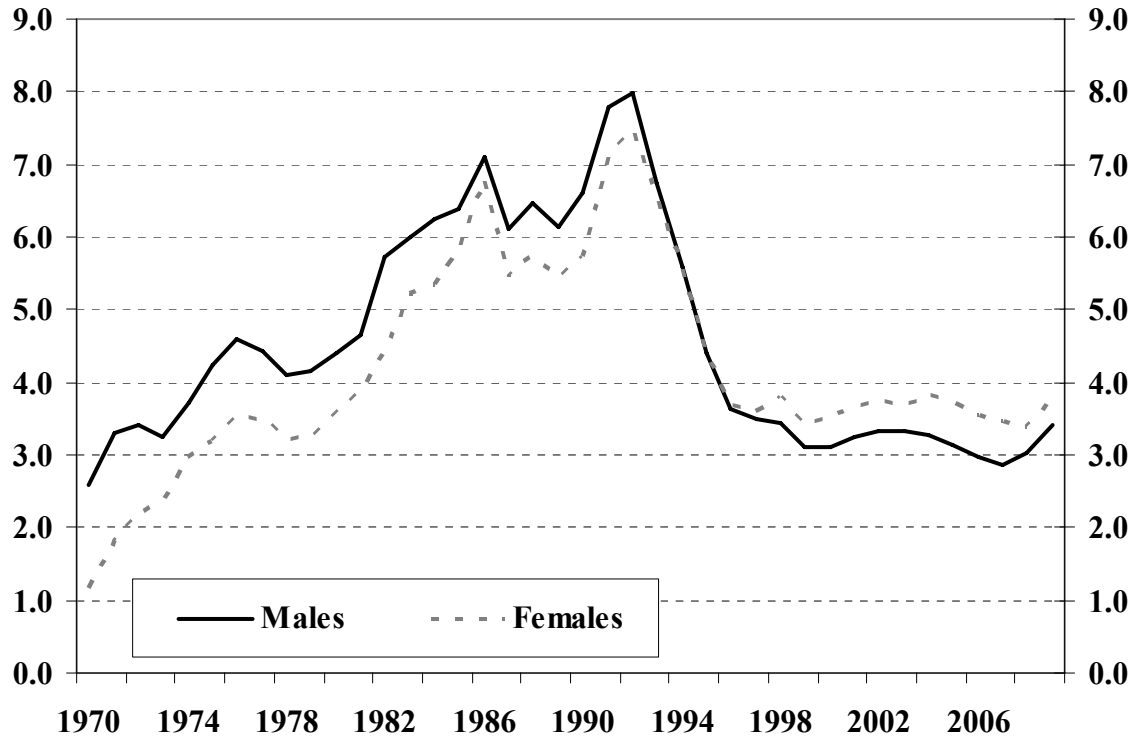
The initial value of the earnings-related benefit by age and sex is equal to 75% of the average retirement earnings-related benefit factor adjusted upward to reflect the fact that eligibility rules are more stringent for disability than for retirement benefits. These emerging benefits are then projected 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 12 and Table 77, respectively.

**Chart 12 Historical Disability Incidence Rates**  
(per 1,000 eligible)



**Table 77 Ultimate Disability Incidence Rates (2015+)**  
(per 1,000 eligible)

Age	Males	Females
25	0.5	0.4
30	0.7	1.0
35	1.1	1.6
40	1.6	2.4
45	2.5	3.3
50	3.9	4.9
55	7.2	7.7
60	11.8	11.0
61	12.2	11.1
62	12.5	11.3
63	12.9	11.5
64	13.3	11.6
<b>All Ages</b>	<b>3.3</b>	<b>3.6</b>

It can be seen from Chart 12 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 1992. Disability incidence rates then declined rapidly between 1992 and 2000 and have remained relatively stable since then up to year 2008. Factors that strongly influenced the decline after 1992 are related to administrative changes put in place in the mid-1990s. The following factors 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 2009 population for weights) ultimate incidence rate for 2015 and thereafter is projected to be 3.3 and 3.6 per thousand eligible for males and females, respectively. These rates take into account the adjustments for the 2008 amendments to the Plan and correspond to the average experience over the years 1998 to 2008. The ultimate aggregate rates are then distributed by age in accordance with the 2009 eligible population for each sex. Disability incidence rates for 2009 are assumed to be about 15% to 20% higher than the rates in 2008 (3.0 per thousand for males, 3.2 per thousand for females) due to the impact of the recent economic downturn and the increased number of applicants between 2008 and 2009. This increase in the number of applicants results in an estimated 41,000 new cases in 2009 based on an assumed 56% approval rate and 73,000 applications. Considering that the 2009 recession was milder than the recessions of the early 1980s and early 1990s, the assumed increase in incidence rates for 2009 is less than the increases in incidence rates observed during earlier recessions. The rates in 2009 are assumed to remain at the same level for 2010.

For years 2011 to 2014, male and female rates by age are then assumed to decrease gradually from their 2010 levels toward their assumed aggregate ultimate levels in 2015 and thereafter.

The projected disability termination rates presented in Tables 78 and 79 apply by age, sex and duration on an attained calendar year basis. The average graduated experience over the period 2000 to 2009 is assumed to apply for 2010. For 2011 and subsequent calendar years, the 2000 to 2009 rates are projected by age at onset of disability and duration of disability based on trends in recovery and mortality improvement rates during the period 2000 to 2009.



**Table 78 Disability Termination Rates in 2010**  
 (per 1,000 people)

Age	Males						Females					
	1 <sup>st</sup> Year	2 <sup>nd</sup> Year	3 <sup>rd</sup> Year	4 <sup>th</sup> Year	5 <sup>th</sup> Year	6+ Year	1 <sup>st</sup> Year	2 <sup>nd</sup> Year	3 <sup>rd</sup> Year	4 <sup>th</sup> Year	5 <sup>th</sup> Year	6+ Year
30	54	59	61	49	56	24	29	46	41	41	44	24
40	53	49	45	30	31	22	39	47	36	27	25	17
50	84	77	52	39	37	25	59	64	42	29	22	15
60	91	78	51	39	39	0	60	63	35	31	30	0

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

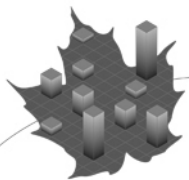
Age	Males						Females					
	1 <sup>st</sup> Year	2 <sup>nd</sup> Year	3 <sup>rd</sup> Year	4 <sup>th</sup> Year	5 <sup>th</sup> Year	6+ Year	1 <sup>st</sup> Year	2 <sup>nd</sup> Year	3 <sup>rd</sup> Year	4 <sup>th</sup> Year	5 <sup>th</sup> Year	6+ Year
30	47	56	60	46	56	23	26	44	40	39	43	24
40	45	45	43	27	30	20	34	43	34	26	24	16
50	72	70	48	35	34	22	50	57	39	26	20	13
60	78	70	45	34	35	0	51	55	31	27	26	0

Based on comparisons of actual results and projections for 1966 to 2009, 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
<b>Males</b>	1.00	0.96
<b>Females</b>	1.00	0.93

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**

Year	Number of Beneficiaries			Average Monthly Pension			Average Pension as % of Maximum	
	Males	Females	Total	Males	Females	Total	Males	Females
				(\$)	(\$)	(\$)	(%)	(%)
2010	21,312	21,079	42,391	894.69	809.17	852.17	79.4	71.8
2011	21,079	21,241	42,321	911.92	828.77	870.19	79.1	71.9
2012	21,438	21,472	42,910	931.85	849.96	890.88	79.0	72.1
2013	21,705	21,736	43,440	948.86	868.58	908.69	78.8	72.1
2014	21,757	21,841	43,598	968.86	889.73	929.22	78.7	72.3
2015	21,818	21,888	43,706	987.86	910.14	948.94	78.5	72.3
2020	23,503	23,426	46,929	1,106.15	1,033.79	1,070.03	77.4	72.3
2025	23,744	23,930	47,674	1,270.63	1,199.89	1,235.12	76.4	72.2
2030	23,878	24,441	48,319	1,475.26	1,399.46	1,436.92	76.0	72.1
2040	26,041	26,797	52,838	2,011.88	1,919.72	1,965.14	75.8	72.3
2050	27,442	28,193	55,635	2,738.11	2,632.82	2,684.75	75.2	72.3

**F. Survivor Expenditures**

Starting in 1968, the number of male and female contributor deaths, taken 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 death to produce the number of survivor beneficiaries emerging by age, sex and calendar year.

The assumed proportion of contributors married or in a common-law relationship at the time of death is determined from benefit statistics as at 31 December 2009. For each age and sex, the actual proportions for years 2006 to 2008 (2007 on average) are smoothed with slight adjustments. On the basis of the trends shown over the period 1996 to 2008, the proportions assumed for the projection period are extrapolated from 2007 to 2012 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 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 initial benefit amount;
- 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 initial value of the earnings-related survivor benefit factor is equal to 37.5% or 60% of the average retirement earnings-related benefit factor 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, as well as by the age and sex of the surviving spouse or common-law partner, are then projected to each subsequent year using the Pension Index and incorporating assumed mortality rates, adjusted using results of an 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, published in July 2009) to reflect the higher mortality of widows and widowers as compared to that of the general population.

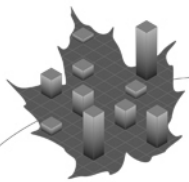
Based on comparisons of actual results and projections for 1966 to 2009, experience adjustment factors are applied to survivor pensions calculated using the methodology described above. Survivor experience adjustment factors reflect both methodology and assumption adjustments. The adjustment factors for the number of survivors and average amounts of benefits are set at their latest known values for 2009 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	1	2
30	28	31
40	53	63
50	60	66
60	67	61
70	72	51
80	66	28
90	52	9

**Table 83 Survivor Benefit Experience Adjustment Factors**

	Number	Average Benefit
Widows	1.03	0.96
Widowers	0.95	0.80



**Table 84 New Survivor Pensions**

Year	Number of Beneficiaries			Average Monthly Pension	
	Under 65	65 and Over	Total	Under 65	65 and Over
				(\$)	(\$)
<b>2010</b>	23,577	46,126	69,704	363.75	280.15
<b>2011</b>	23,708	47,536	71,244	370.31	283.43
<b>2012</b>	23,811	49,018	72,829	377.39	285.22
<b>2013</b>	23,929	50,264	74,192	383.55	287.29
<b>2014</b>	24,093	51,652	75,745	391.24	289.11
<b>2015</b>	24,189	53,098	77,287	398.68	291.46
<b>2020</b>	24,392	61,351	85,744	446.25	313.64
<b>2025</b>	24,192	71,547	95,739	509.84	358.17
<b>2030</b>	23,766	83,660	107,426	586.40	421.98
<b>2040</b>	23,114	105,696	128,809	791.41	594.73
<b>2050</b>	22,927	114,888	137,816	1,075.88	817.47

**G. 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 retirement earnings-related benefit factor (the lump sum death benefit is equivalent to six months of retirement pension) reduced, using the maximum retirement pension and the assumed distribution of average retirement pensions, to allow for the provision limiting the death benefit to 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 2009, experience adjustment factors were derived. To account for the maximum death benefit, which is set at \$2,500 for 1998 and thereafter, adjustment factors for average benefits are set at their current level but are gradually increased to a value of one for years 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
<b>Males</b>	0.95	0.96	0.95	1.00
<b>Females</b>	1.00	0.89	1.00	1.00

**Table 86 Number of Death Benefits**

Year	Males	Females	Total
<b>2010</b>	80,762	48,272	129,034
<b>2011</b>	82,412	50,204	132,616
<b>2012</b>	84,079	52,122	136,201
<b>2013</b>	85,914	54,123	140,037
<b>2014</b>	87,731	56,175	143,907
<b>2015</b>	89,558	58,218	147,776
<b>2020</b>	99,587	69,166	168,753
<b>2025</b>	111,817	81,870	193,687
<b>2030</b>	127,155	97,242	224,398
<b>2040</b>	160,032	133,548	293,580
<b>2050</b>	178,561	160,887	339,449

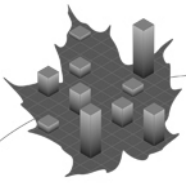
## H. Children's Expenditures

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 children 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 2010 rate in accordance with the Pension Index.

Based on historical data from 1966 to 2009, the assumption for the number of children under age 18 is adjusted by a factor of about 0.84 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 0.64 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**

<b>Year</b>	<b>Disabled Contributor's Child</b>	<b>Orphans</b>	<b>Total</b>
<b>2010</b>	15,481	9,497	24,978
<b>2011</b>	15,369	9,661	25,030
<b>2012</b>	15,557	9,821	25,378
<b>2013</b>	15,854	10,043	25,897
<b>2014</b>	16,041	10,242	26,284
<b>2015</b>	16,003	10,193	26,196
<b>2020</b>	17,281	10,070	27,351
<b>2025</b>	18,658	10,238	28,896
<b>2030</b>	19,886	10,490	30,377
<b>2040</b>	21,260	10,500	31,760
<b>2050</b>	21,670	9,914	31,584

## **I. Administrative Expenses**

The administrative expenses of the CPP have historically arisen from different sources including Human Resources and Skills Development Canada, the Canada Revenue Agency, Public Works and Government Services Canada, the Office of the Superintendent of Financial Institutions, the Department of Finance, and the CPP Investment Board. In the calendar year 2009, administrative expenses from all sources amounted to about \$711 million.

Based on recent experience from 2005 to 2009, the annual administrative expenses (excluding the CPPIB) were on average about 0.089% of total annual employment earnings, and were 0.092% in 2009. From 2007 to 2009, CPPIB's administrative expenses as a percentage of total annual employment earnings increased from 0.030% to 0.043%, and are expected to reach 0.055% by 2010 and 0.060% by 2013. By including the administrative expenses of the CPPIB and taking into consideration the expected growth in these expenses in the coming years, the projected total administrative expenses of the CPP in terms of total annual employment earnings are projected to be 0.15% for years 2010 and thereafter.

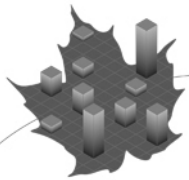




Table 88 shows total administrative expenses as a percentage of each of total expenditures, assets, and earnings over the last three years 2007 to 2009 as well as their projected values.

**Table 88 Administrative Expenses**  
(\$ million)

Year	Total Administrative Expenses	Total Expenditures	Total Administrative Expenses as % of Total Expenditures (%)	Total Assets	Total Administrative Expenses as % of Total Assets (%)	Total Earnings	Total Administrative Expenses as % of Total Earnings (%)
2007	611	27,750	2.2	123,749	0.49	509,119	0.12
2008	647	29,248	2.2	112,468	0.58	531,796	0.12
2009	711	30,794	2.3	126,836	0.56	527,996	0.13
2010	820	32,192	2.5	133,897	0.61	546,672	0.15
2011	851	33,992	2.5	145,425	0.59	567,276	0.15
2012	883	36,016	2.5	158,056	0.56	588,912	0.15
2013	917	38,255	2.4	170,705	0.54	611,385	0.15
2014	950	40,518	2.3	183,464	0.52	633,169	0.15
2015	984	42,809	2.3	197,330	0.50	656,254	0.15
2020	1,206	55,608	2.2	275,099	0.44	803,677	0.15
2025	1,466	72,782	2.0	365,680	0.40	977,559	0.15
2030	1,789	92,803	1.9	464,687	0.38	1,192,427	0.15
2040	2,689	141,263	1.9	733,329	0.37	1,792,819	0.15
2050	3,978	215,909	1.8	1,169,230	0.34	2,651,773	0.15



## ACTUARIAL REPORT

### CANADA PENSION PLAN

as at 31 December 2009

#### VI. Assets

The total assets of the CPP at the end of any given year throughout the projection period are simply determined by adding together the total assets at the end of the previous year, projected investment income and contribution revenue of the given year and then subtracting the projected benefits and administrative expenses of the given year.

The actual value of the CPP assets on a market value accrual basis as at 31 December 2009 was \$126,836 million. This is the sum of the CPP Account (\$35 million) and the CPPIB Invested Assets (\$123,939 million) for a total of \$123,974 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 in 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 2009.

**Table 89 Net Assets as at 31 December 2009**  
(\$ million)

CPP Account	35
CPPIB Invested Assets	123,939
<b>Subtotal CPP Account and CPPIB Invested Assets</b>	<b>123,974</b>
<b>Plus Amounts Receivable</b>	
Contributions	2,984
Benefit Overpayments	34
Net Transfers Due from QPP	122
<b>Minus Amounts Payable</b>	
Operating Expenses	1
Pensions and Other Benefits	156
Amounts Due to CRA	121
<b>Net Assets</b>	<b>126,836</b>



## Appendix E – 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, Department of Demography, Université de Montréal, provided 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.

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