23rd Actuarial Report on the Canada Pension Plan as at 31 December 2006 and its Peer Review Process

Presentation to the Board of Directors of the Canada Pension Plan Investment Board

16 June 2008
Presentation

• Purpose of the CPP Actuarial Report
• Demographic and Economic Assumptions
• CPP, a Partially Funded Pension Plan
• Uncertainty of Results
• Strengthening the Accountability and Peer Review
Purpose of the CPP Actuarial Report

• Tabled by the Minister of Finance on 29 October 2007

• Inform on the current and projected future financial status of the Canada Pension Plan

• Calculate the minimum contribution rate
Consultations on Assumptions

• CPP and QPP seminars were organized to get opinions from a wide range of experts in the fields of demography, economics and investments.

• Federal and provincial officials attended these seminars.
Presentation

- Purpose of the CPP Actuarial Report
- **Demographic and Economic Assumptions**
- CPP, a Partially Funded Pension Plan
- Uncertainty of Results
- Strengthening the Accountability and Peer Review
Fertility Rate

(Children per woman)

1955-1979: 2.82

1980-2004: 1.60

23rd CPP Report: 1.60 for 2010+

Panel’s view: reasonable
Net Migration Rate

23rd CPP Report Assumption:
0.50% for 2007 to 2015
0.54% for 2020+
(same assumption as for CPP21)

Panel’s view: reasonable

Last 50: 0.50%
Last 30: 0.50%
Last 10: 0.56%
Increase in Life Expectancies at 65*

*Life expectancies shown are without assumed future mortality improvements.

More contributors are expected to reach the retirement age of 65.
Retirement beneficiaries are expected to receive their benefit for a longer period.

Panel’s view: reasonable
After 2025, almost all of the projected population increase will come from migration.
Working Age Population (ages 20-59)
(indexed 2005=100)

Economic Assumptions

- Participation rates
- Employment increase (Job creation rate)
- Unemployment rate
- Inflation rate
- Increase of average employment earnings
- Interest rate and rate of return by asset class

Gap between male and female participation rates will continue to decrease but at a slower pace

Participation Rates of 15-69 (Canada)

- Males in 2030 = 78.3%
- Females in 2030 = 68.5%

Panel’s view: reasonable

CPP21
Males in 2030 = 78.3%
Females in 2030 = 68.5%
Annual Increase in Consumer Price Index

- Average 76-85: 8.1%
- Average 66-75: 5.6%
- Average 86-95: 3.4%
- Average 96-05: 2.0%

CPP 23rd Report:
- 2.0% from 2007 to 2011 increasing to 2.5% in 2016+

CPP 21:
- 2.7% in 2015+

Panel’s view: assumption is within, but towards the high side of, the reasonable range.
Annual Increase in Real Wages

Avg 1982-2006: 0.2%
Avg 1957-2006: 1.1%

Assumption CPP 23rd Report: 1.3% (2015+)

CPP21: 1.2% in 2012+

Panel’s view: reasonable but somewhat low within the range of expert opinion.
Real Increase of Total Employment Earnings (18-69, Canada less Québec)
CPP reference portfolio consists of 65% equity and 35% debt

### Evolution of CPP Asset Mix

<table>
<thead>
<tr>
<th>Year</th>
<th>Fixed Income</th>
<th>Equity</th>
<th>Inflation-Sensitive</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>28%</td>
<td>65%</td>
<td>7%</td>
</tr>
<tr>
<td>2010</td>
<td>30%</td>
<td>60%</td>
<td>10%</td>
</tr>
<tr>
<td>2015</td>
<td>30%</td>
<td>60%</td>
<td>10%</td>
</tr>
<tr>
<td>2020</td>
<td>35%</td>
<td>55%</td>
<td>10%</td>
</tr>
<tr>
<td>2025</td>
<td>40%</td>
<td>50%</td>
<td>10%</td>
</tr>
</tbody>
</table>

Panel’s view: Ultimate asset mix is a little more heavily weighted to fixed income than they would have expected.
# Real Rate of Return by Asset Class

<table>
<thead>
<tr>
<th>(2007-2011)</th>
<th>CPP23 (2025+)</th>
<th>CPP21 (2033+)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate</td>
<td>Mix</td>
<td>Rate</td>
</tr>
<tr>
<td>Canadian Equities: (3.5%)</td>
<td>5.1% 15%</td>
<td>4.6% 15%</td>
</tr>
<tr>
<td>Foreign Equities: (3.5%)</td>
<td>5.1% 35%</td>
<td>5.0% 30%</td>
</tr>
<tr>
<td>RE &amp; Infrastructure: (2.9%)</td>
<td>3.95% 10%</td>
<td>4.0% 10%</td>
</tr>
<tr>
<td>Marketable Bonds: (2.7%)</td>
<td>3.2% 39.5%</td>
<td>3.4% 44.5%</td>
</tr>
<tr>
<td>Cash:</td>
<td>1.0% 0.5%</td>
<td>1.5% 0.5%</td>
</tr>
<tr>
<td>Total Real Return</td>
<td>4.22%</td>
<td>4.1%</td>
</tr>
</tbody>
</table>

**Average Real Rate of Return (2007-2016): 3.8%**

Panel’s view: long-term assumption is within, but towards the low side of, the reasonable range.
Presentation

• Purpose of the CPP Actuarial Report
• Demographic and Economic Assumptions
• CPP, a Partially Funded Pension Plan
• Uncertainty of Results
• Strengthening the Accountability and Peer Review
CPP, a Partially Funded Pension Plan

- **Steady-state funding**: replaces the original pay-as-you-go financing to build a reserve of assets equivalent over time to about five and a half years of benefit expenditures or about 25% of Plan liabilities.

- **Incremental full funding**: requires that changes to the CPP that increase benefits or add new benefits be fully funded (e.g., increase in eligibility for disability benefits for long-term contributors).
CPP, a Partially Funded Pension Plan

Sources of Income
- CPP follows the 70:30 Rule (Contributions:Investment Earnings).
- When the A/E ratio reaches approximately 5.5, 30% of revenues will come from investment earnings.
- Sources of income of fully-funded pension plans are the opposite (the 30:70 Rule).

How annual benefits are paid
- From 2007 to 2019, contributions exceed benefits.
- Once the A/E ratio reaches about 5.5, annual contributions will equal approximately 90% of annual benefits paid.
- In 2050, 31% of investment earnings is required to pay benefits.
CPP, a Partially Funded Pension Plan

Evolution of Asset/Expenditure Ratio

- **9.9% Legislated rate**
- **9.82% minimum contribution rate**
- **A/E ratios: 5.4 in 2019 and 2069**
In 2020, CPP/QPP assets are projected to be equal to 17% of the GDP.
Higher projected life expectancies have more than offset better-than-anticipated experience

<table>
<thead>
<tr>
<th>Description</th>
<th>Minimum Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actuarial Report as at 31 December 2003</td>
<td>9.77</td>
</tr>
<tr>
<td>Better investment experience (2004 to 2006)</td>
<td>(0.09)</td>
</tr>
<tr>
<td>Higher participation and job creation rates (2004 to 2006)</td>
<td>(0.04)</td>
</tr>
<tr>
<td>Contribution rate with no change in assumptions</td>
<td>9.64</td>
</tr>
<tr>
<td>Higher projected life expectancies</td>
<td>0.16</td>
</tr>
<tr>
<td>More people asking their retirement benefit at age 60</td>
<td>0.05</td>
</tr>
<tr>
<td>Others (including Bill C-36)</td>
<td>(0.03)</td>
</tr>
<tr>
<td>Report as at 31 December 2006</td>
<td>9.82</td>
</tr>
</tbody>
</table>
Over three-year periods, benefits and contributions are easier to project than investment earnings.

### Financial Status – 1998 to 2006

**Actual minus Expected**

(in billions of $)

<table>
<thead>
<tr>
<th>Period</th>
<th>Contributions</th>
<th>Earnings</th>
<th>Benefits</th>
<th>Assets</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998 to 2000</td>
<td>+1.2</td>
<td>+0.1</td>
<td>-0.1</td>
<td>+1.4</td>
<td>(+3%)</td>
</tr>
<tr>
<td>(T. 67, p. 121)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2001 to 2003</td>
<td>+1.7</td>
<td>-1.1</td>
<td>-0.1</td>
<td>+0.7</td>
<td>(+1%)</td>
</tr>
<tr>
<td>(T. 78, p. 122)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2004 to 2006</td>
<td>+0.1</td>
<td>+15.9</td>
<td>0.0</td>
<td>+16.0</td>
<td>(+16%)</td>
</tr>
<tr>
<td>(T. 16, p. 39)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1998 to 2006</td>
<td>+3.0</td>
<td>+14.9</td>
<td>-0.2</td>
<td>+18.1</td>
<td>(+19%)</td>
</tr>
</tbody>
</table>

The CPP assets of $36 billion at year-end 1997 were projected to reach $96 billion at year-end 2006. The actual value is $114 billion.
Presentation

• Purpose of the CPP Actuarial Report
• Demographic and Economic Assumptions
• CPP, a Partially Funded Pension Plan
• Uncertainty of Results
• Strengthening the Accountability and Peer Review
Uncertainty of Results

- Younger and Older populations → 9.1% and 10.7%.
- Equity shock -10% in both 2009 and 2010 → 9.82% to 9.98%. Assets reduced by $28 billion by end of 2010.
- Individual tests show that minimum rate could vary significantly from best-estimate if other than best-estimate assumptions are realized over projection period. Examples are:
  - Higher Life Expectancies at 65 → 9.82% to 10.2%
    - Males 25 vs. 22 years in 2050 (currently 19)
    - Female 28 vs. 24 years in 2050 (currently 22)
  - Higher retirement benefit uptake at age 60 → 9.82% to 10.0%
    - Males from 40% to 60%
    - Females from 45% to 65%
Historical Real Wage Increase

Geometric Mean (1943-2006) = 1.3%
σ = 2.1%
Using the experience of the last 64 years, ending in 2006, the projected average real wage increase will be in the range 0.5% to 1.9% with 95% probability.

\[ \mu = 1.3\% \]
\[ \sigma = 0.4\% \]

Minimum contribution rate between 10.4% and 9.3%
Historical Canadian Equity Real Return

Geometric Mean (1938-2006) = 6.6%

σ = 16.7%
Using the experience of the last 69 years, ending in 2006, the projected average real rate of return will be in the range 2.7% to 5.7% with 95% probability.

Historical mean portfolio return = 5.8%
(assuming 65% equity / 35% fixed income)

\[ \mu = 4.2\% \]
\[ \sigma = 0.75\% \]

Minimum contribution rate between 10.7% and 9.0%
Using the experience of the last 69 years, ending in 2006, the projected average real rate of return will be in the range 3.3% to 5.2% with 80% probability.

Minimum contribution rate between 10.3% and 9.3%
If the projection period is reduced to 10 years from 75 years, a wider confidence interval will result.
Changing to the CPPIB Reference Portfolio produces similar results.

Stochastic Analysis
Next 75 years
Real Rate of Return

CPPIB Reference Portfolio

95%

μ = 4.4%
σ = 0.75%
## Sustainability of the 9.9% Contribution Rate Under Extreme Conditions for the next 6 years (2007-2012)

<table>
<thead>
<tr>
<th>Asset Mix of CPP 23</th>
<th>Minimum Contribution Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Prob{\text{Real Return} \leq -0.3%} = 10%</td>
</tr>
<tr>
<td></td>
<td>-0.3%</td>
</tr>
<tr>
<td></td>
<td>Real Rate of Return</td>
</tr>
<tr>
<td></td>
<td>3.4 \rightarrow 4.2%</td>
</tr>
<tr>
<td></td>
<td>Prob{\text{Real Return} \geq 12.4%} = 10%</td>
</tr>
<tr>
<td></td>
<td>12.4%</td>
</tr>
</tbody>
</table>
Presentation

• Purpose of the CPP Actuarial Report
• Demographic and Economic Assumptions
• CPP, a Partially Funded Pension Plan
• Uncertainty of Results

• Strengthening the Accountability and Peer Review
Strengthening the Accountability in 1997

- Federal and provincial governments took meaningful steps to strengthen the transparency and accountability of actuarial reporting. They endorsed plans:
  - to review the CPP every three years, instead of every five years as before. Therefore, frequency of actuarial reporting was increased to three years with a further requirement to produce the report within one year of the valuation date.
  - to consult regularly with experts on assumptions to be used in actuarial reports;
  - to establish regular peer reviews of future actuarial reports on the CPP.
  - to supply actuarial information to Canadians in a timely manner.
CPP has been peer reviewed four times since 1998

- Role of the Auditor General and Selection Process
- Overseeing of the Peer Review by GAD
- Terms of Reference
  - Is the professional **experience** of the Chief Actuary and his staff adequate for carrying out the work required?
  - Does the work comply with professional **standards of practice** and statutory requirements?
  - Did the Chief Actuary have access to the **information** required?
  - Were the actuarial **methods and assumptions** used reasonable?
  - Does the actuarial report fairly **communicate** the results?
The Review Panel confirmed that...

- the staff is competent and qualified to carry out the work required;
- the work complies with all relevant professional standards of practice and statutory requirements;
- the Chief Actuary had access to the data and he completed relevant tests on the data as might be expected;
- actuarial methods and assumptions are reasonable;
- assumptions are, in the aggregate, reasonable, but towards the high-cost side of the reasonable range;
- the report fairly communicates the results;

• and made twelve recommendations on data, methodology, assumptions, communications of results and other actuarial issues.

March 2008
The panel found...

- That each of the major assumptions was within the reasonable range.
- In their view,
  - six of the nine major assumptions are near the centre of the reasonable range, and
  - three assumptions are within, but towards the high or low side of, the reasonable range.
23rd Actuarial Report on the Canada Pension Plan as at 31 December 2006 and its Peer Review Process

Appendix

Issues Looking Forward, the OECD Countries

16 June 2008
Provision of Retirement Income Security – What is Required?

• A retirement system built on the principles of:
  ➢ Intergenerational equity
  ➢ Solidarity: society protects all individuals and collectively ensures a basic level of assistance/standard of living for low-income retirees
  ➢ Responsibility: retirement income security is a shared responsibility between the government, society, employers and individuals

• Incentives to remain in the labour force
Between 2010 and 2030, the ratio of expenditures to GDP increases from 2.4% to 3.2%, driven largely by the retirement of the babyboomers.

$28 billion in 2004; $37 billion in 2010; $110 billion in 2030
Government Net Financial Liabilities as % of GDP (G7 Countries)

Source: OECD Economic Outlook No. 82 Database (Annex Table 33)

Office of the Chief Actuary    Bureau de l’actuaire en chef
# OECD Countries –
Increases in Normal Retirement Ages of State Pension Plans

<table>
<thead>
<tr>
<th>Country</th>
<th>From</th>
<th>To</th>
<th>Transition Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>60 (F)</td>
<td>65 (F)</td>
<td>2024-2033</td>
</tr>
<tr>
<td>Belgium</td>
<td>60 (F)</td>
<td>65 (F)</td>
<td>by 2009</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>57 (F)</td>
<td>65</td>
<td>by 2030 (proposed)</td>
</tr>
<tr>
<td></td>
<td>60 (M)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Denmark</td>
<td>65</td>
<td>67</td>
<td>2024-2027</td>
</tr>
<tr>
<td>Germany</td>
<td>65</td>
<td>67</td>
<td>2012-2029</td>
</tr>
<tr>
<td>Iceland</td>
<td>67 → 65 → 67</td>
<td></td>
<td>late 1980s – early 2000s</td>
</tr>
</tbody>
</table>
## OECD Countries –
Increases in Normal Retirement Ages of State Pension Plans

...*(cont’d)*

<table>
<thead>
<tr>
<th>Country</th>
<th>From</th>
<th>To</th>
<th>Transition Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ireland</td>
<td>Social insurance pensions: retirement pension paid from 65, old age contributory pension paid from 66</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Japan</td>
<td>60</td>
<td>65</td>
<td>2000-2025 (M) / 2030 (F)</td>
</tr>
<tr>
<td>Norway</td>
<td>70</td>
<td>67 (new ERA 62)</td>
<td>1973 (proposed as part of new pension system 2010)</td>
</tr>
<tr>
<td>South Korea</td>
<td>60</td>
<td>65</td>
<td>2013-2033</td>
</tr>
<tr>
<td>UK</td>
<td>60 (F)</td>
<td>65 (F)</td>
<td>2010-2020</td>
</tr>
<tr>
<td></td>
<td>65 (M, F)</td>
<td>68 (M, F)</td>
<td>2024-2046</td>
</tr>
<tr>
<td>U.S.</td>
<td>65</td>
<td>66</td>
<td>2002-2008 (year attained 65)</td>
</tr>
<tr>
<td></td>
<td>66</td>
<td>67</td>
<td>2020-2026 (year attained 66)</td>
</tr>
</tbody>
</table>
OECD Countries –
Life Expectancy at Average Exit Age from Labour Force*

Average exit age from LF

- France: 58.9
- Spain: 62
- Austria: 61
- Switzerland: 62.7
- Canada: 62.3
- Greece: 61.1
- Finland: 62.4
- Germany: 61.9
- Netherlands: 62.1
- Czech Republic: 60.4
- Sweden: 63.9
- Norway: 63.8
- Denmark: 61.9
- United Kingdom: 63.2
- Ireland: 64.1
- United States: 63.8

Life expectancy at average exit age from LF


Sources: Eurostat, OECD, OCA, U.S. National Center for Health Statistics.
OECD Countries –
Incidence of Low Income Among Seniors vs.
Old Age Income Security Program Expenditures, as % GDP

Sources: Luxembourg Income Study (LIS) Key Figures for incidence of low income among seniors using 40% of median
OECD Social Expenditures Database, 1980-2001 for government expenditures on old-age income security programs as % of GDP
Office of the Chief Actuary   Bureau de l’actuaire en chef
OECD Countries –
Net Replacement Rates at Different Earnings Levels (% of individual pre-retirement earnings)

Source: OECD pension models.
OECD Policy Brief: Solving the Pensions Puzzle, March 2005
Note: Chart reproduced by the OCA

Office of the Chief Actuary   Bureau de l’actuaire en chef
An Efficient Retirement System Provides:

- Diversification of sources of retirement income
- Diversification of funding approaches
- Reasonable economic cost of public pensions (% of GDP)
- Reduction of poverty among seniors
- Reduction of income inequalities
- Maintenance of standard of living at retirement