



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 Reports on the Canada Pension Plan as at 31 December 2015

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

8 February 2017



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# *Presentation*

- Purpose of the 27<sup>th</sup> CPP Actuarial Report
- Demographic Assumptions
- Economic (other than investment) Assumptions
- Investment Assumptions
- Main Findings
- Additional CPP – the 28<sup>th</sup> CPP Actuarial Report



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# *Purpose of the Triennial CPP Report*

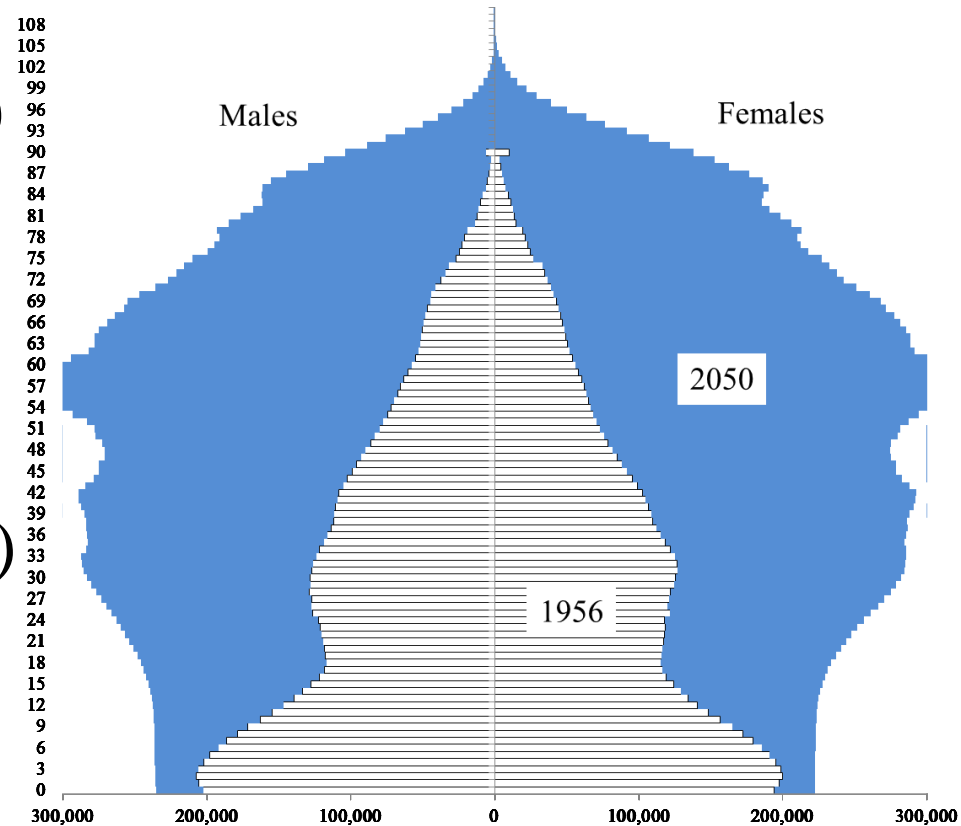
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- Inform contributors and beneficiaries of the current and projected future financial status of the Canada Pension Plan
- Calculate the minimum contribution rate
- Actuarial report is based on “best-estimate” assumptions over a long period of time (75 years)
- Although secondary, recent trends are also taken into account.



# Demographic Assumptions

Age Profile of Canada Population, 1956 to 2050

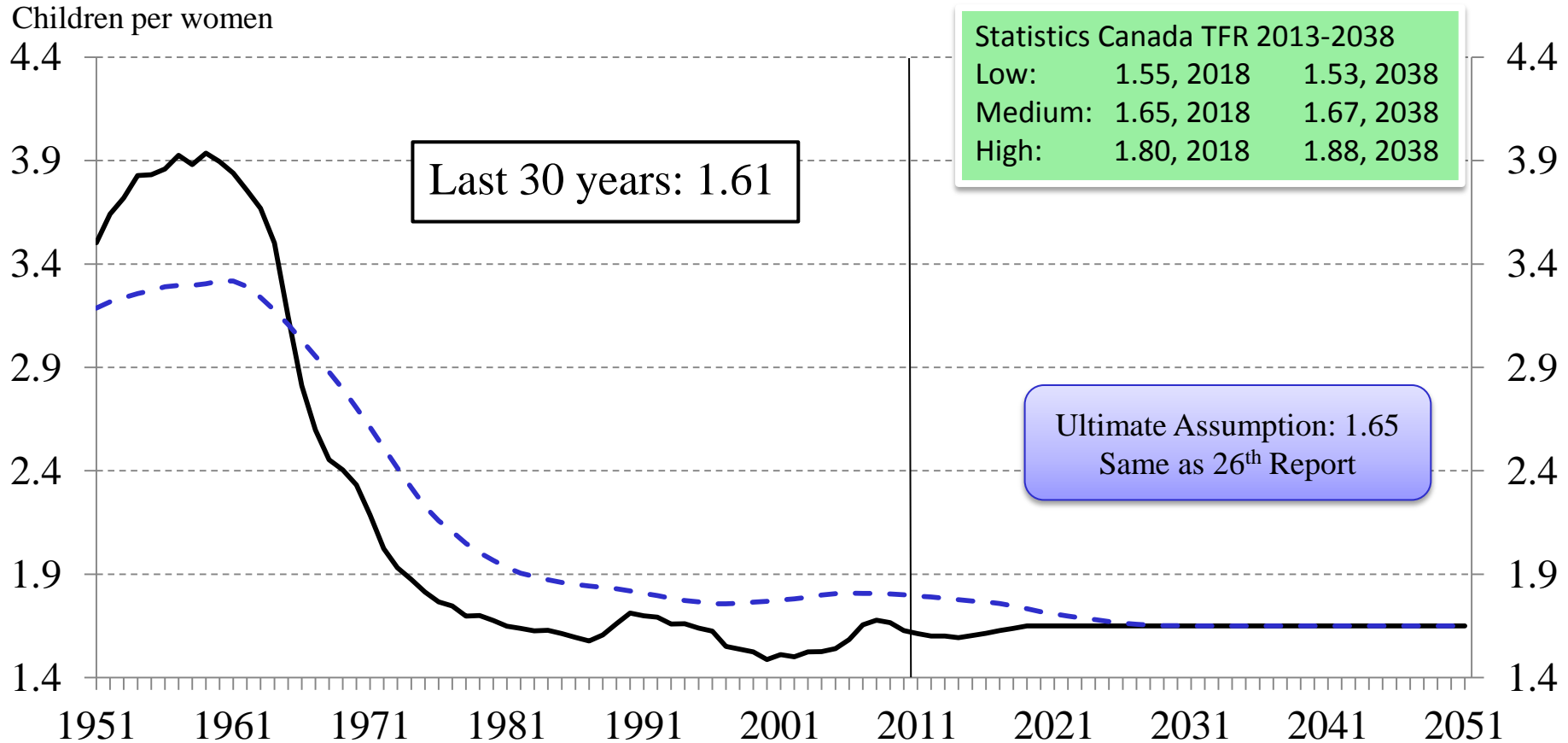


- Fertility (Number of births)
- Migration
- Mortality (Life expectancy)

Sources: Statistics Canada, CPP/QPP Seminars, Human Mortality Database, World Population Reference Bureau



# Total Fertility Rate for Canada

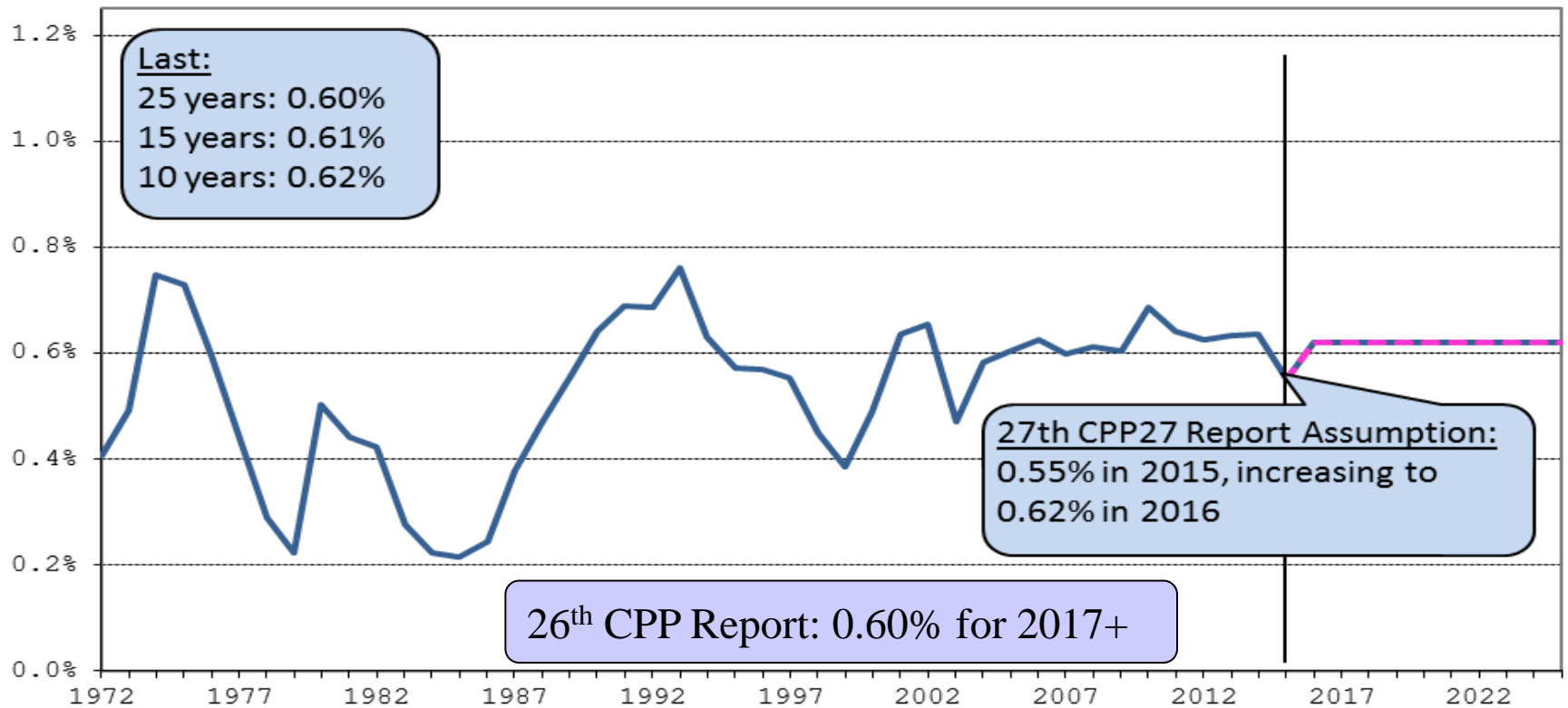


— Total Fertility Rate    - - Cohort Fertility Rate (women age 30 in calendar year)



# Net Migration Rate (Canada)

(Rate as a percentage of population)



Statistics Canada 2014-15

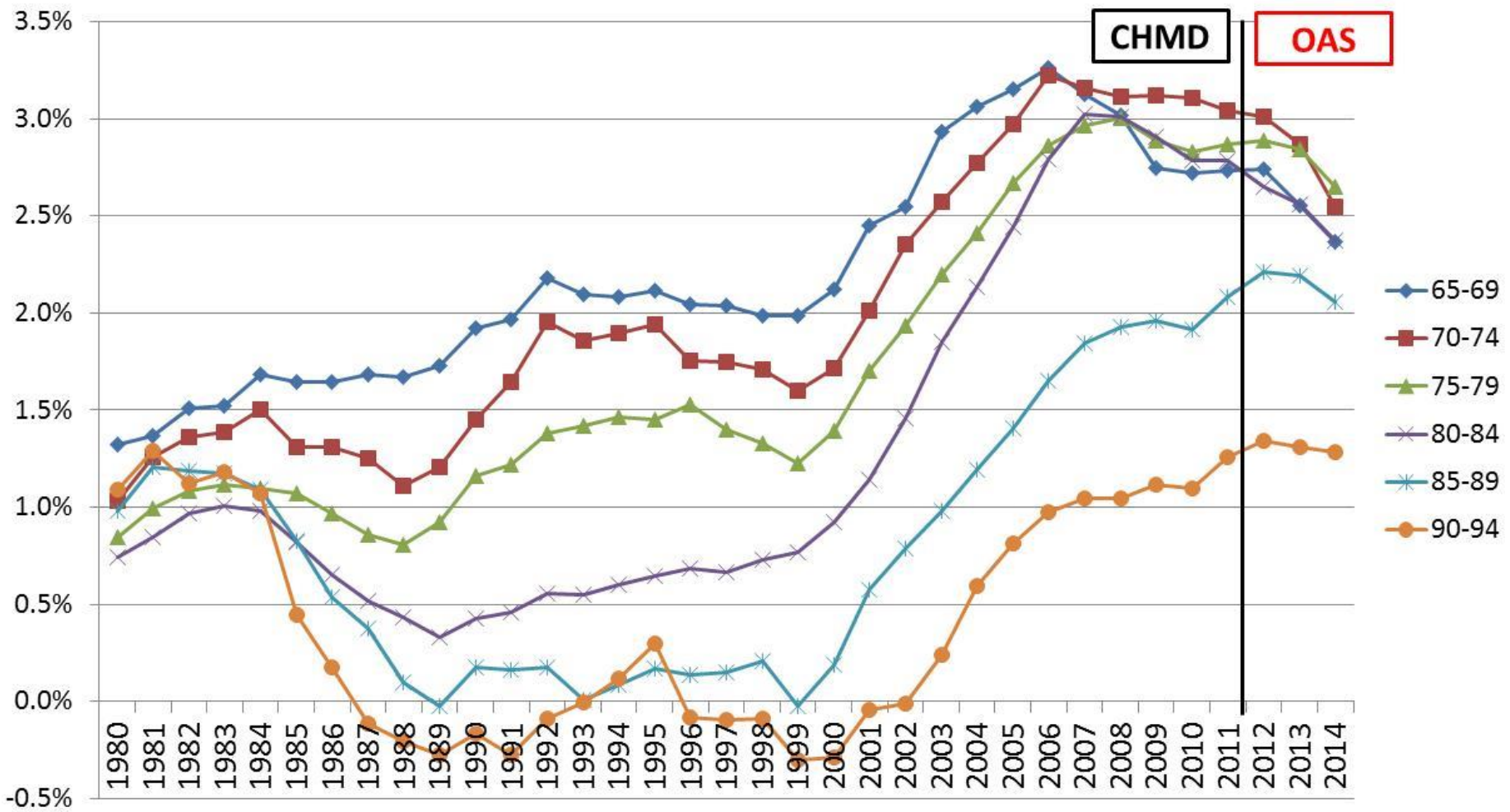
{ Low: 0.46%  
 Medium: 0.63% (Average 2013-2038: 0.59%)  
 High: 0.73%

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# *Slowdown in mortality improvements in recent years: a blip or a new trend?*

**Males Mortality Improvement Rates 10-year Average**  
(Based on HMD Qx until 2011, blend of HMD and OAS Qx from 2012 to 2014)



# *Average MIR for 2015-2031 are generally higher compared with CPP26*

Age Group	Males		Females	
	CPP26 (%)	CPP27 (%)	CPP26 (%)	CPP27 (%)
45-64	1.2	1.2	1.0	1.0
65-74	1.4	1.6	1.1	1.3
75-84	1.4	1.6	1.1	1.3
85-89	1.1	1.3	0.9	1.2
90+	0.5	0.5	0.4	0.5

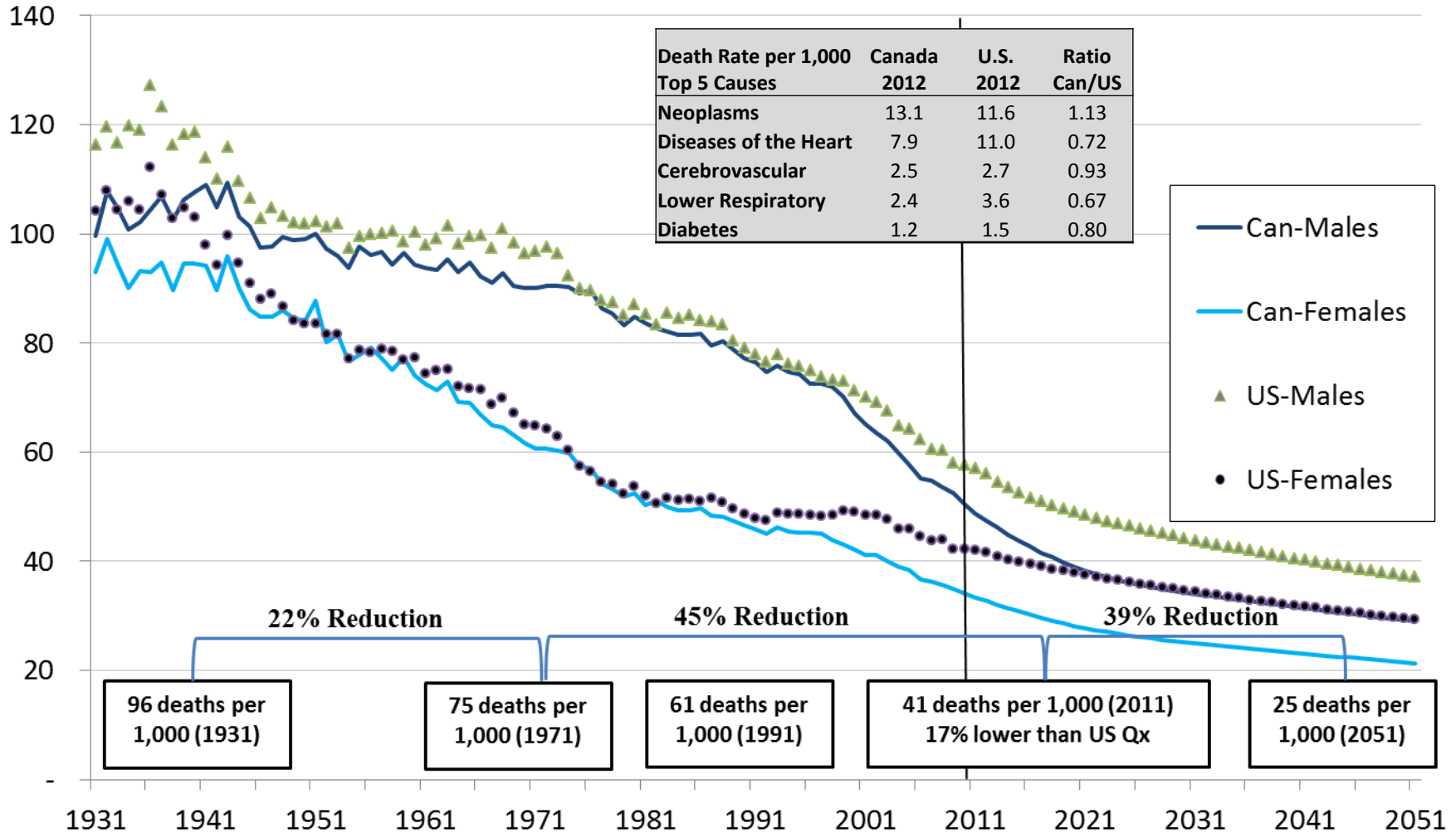
<i>ULTIMATE</i>	<i>CPP26 (2030)</i>	<i>CPP27 (2032)</i>
<b>0-84</b>	0.8%	0.8%
<b>85-89</b>	0.6%	0.8%





# *Mortality Rates have decreased over the last 80 years, more so over the last 40 years*

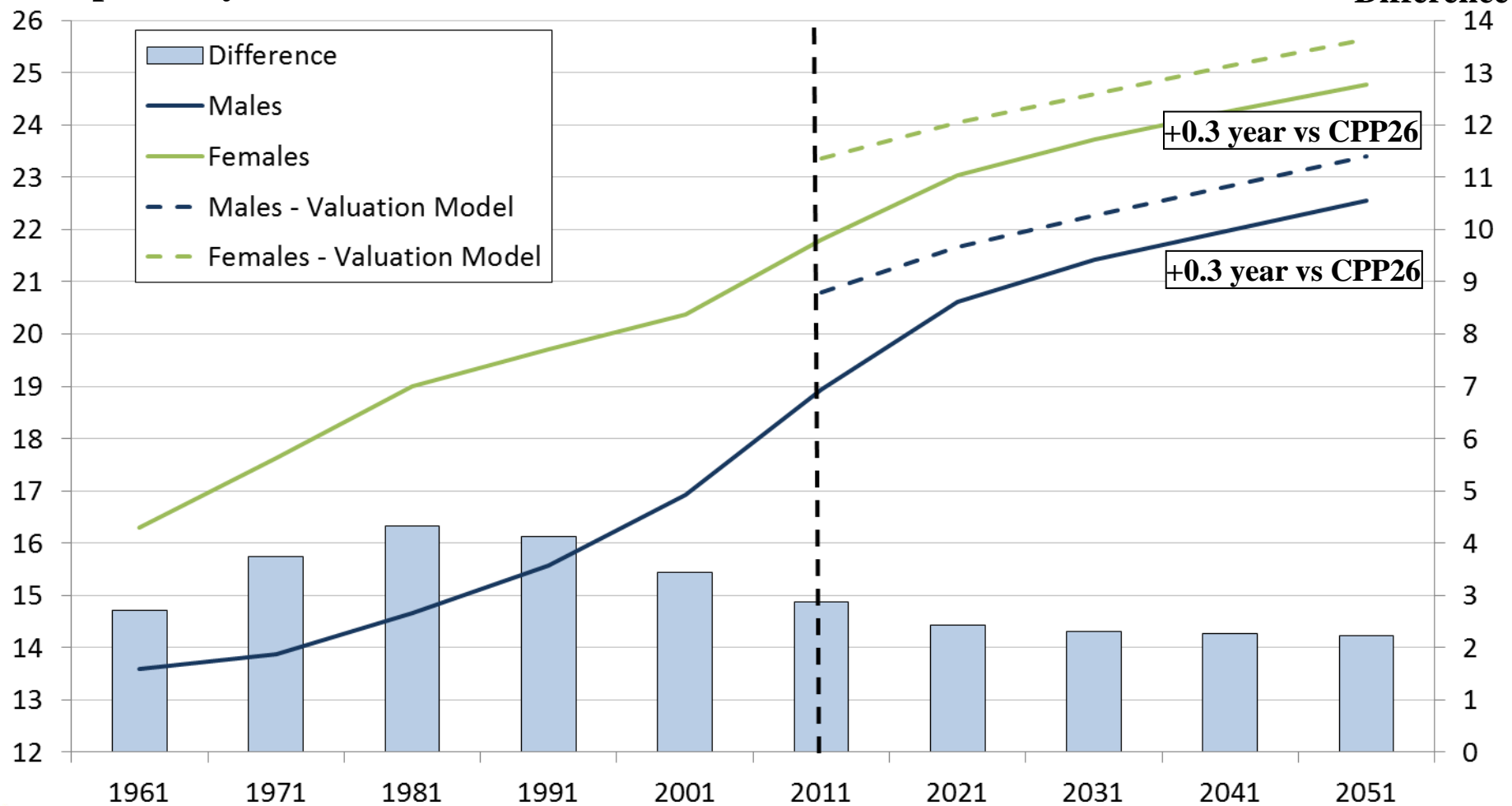
## Ages 75-84



Source: office of the chief Actuary, 27th CPP Actuarial Report and 2015 OASDI Trustees Report

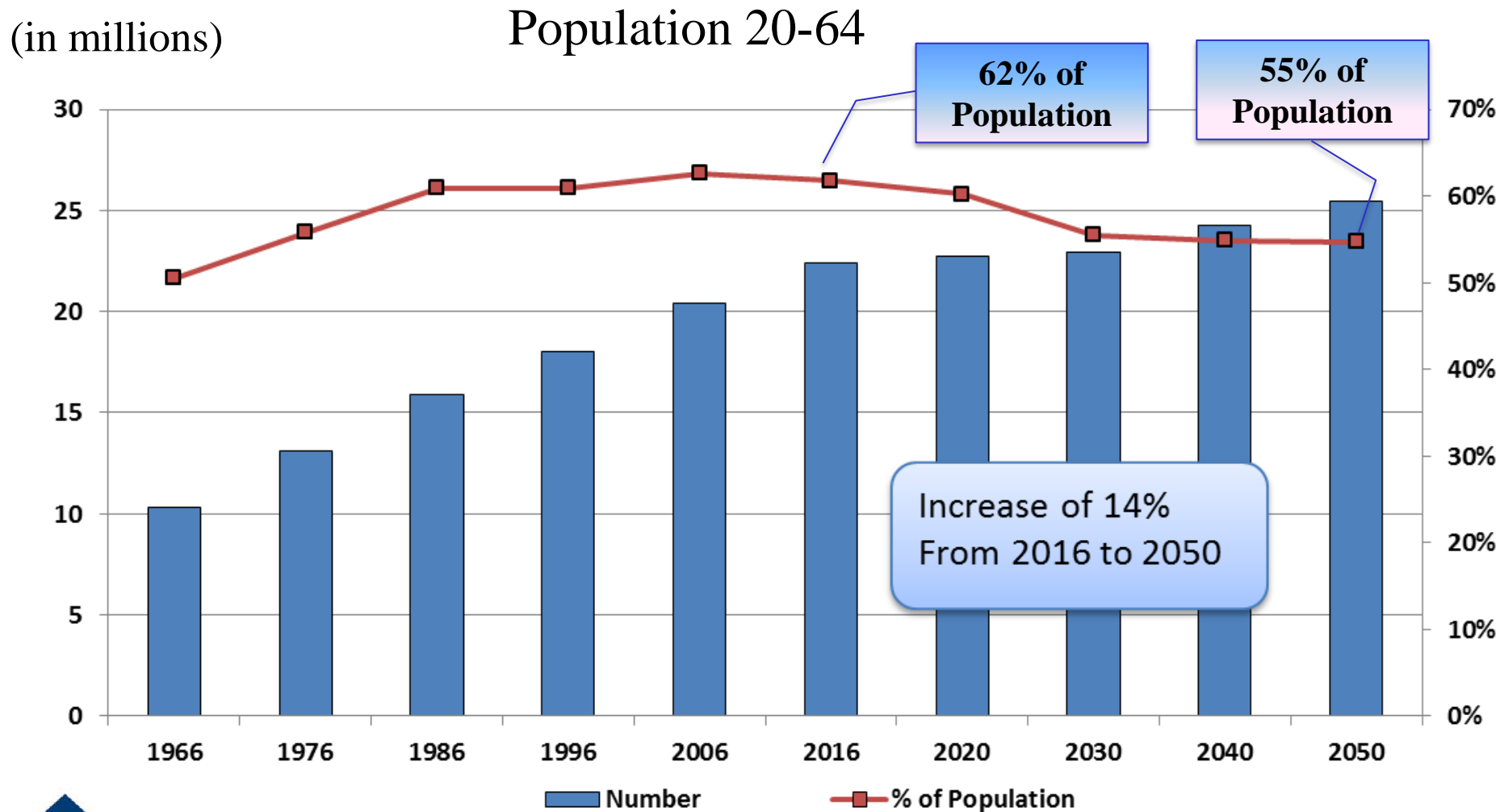
# Increase in Life Expectancy at 65

Life expectancy at 65



*More contributors are expected to reach the retirement age of 65 (93% for someone age 18 in 2015).  
Retirement beneficiaries are expected to receive their benefits for a longer period.*

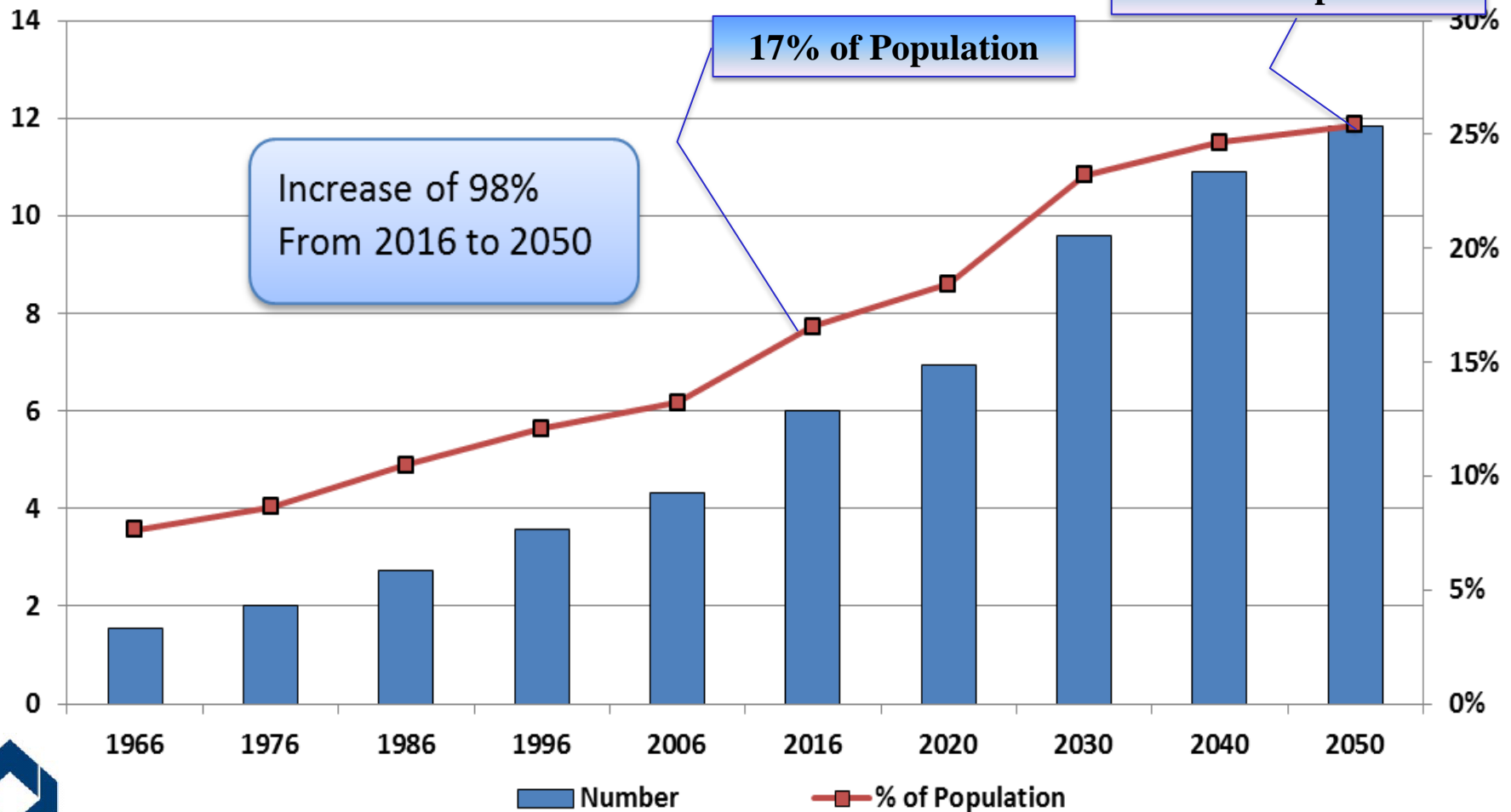
# The working-age population is projected to slightly increase



# The elderly population is projected to significantly increase

## Population 65+

(in millions)



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# *Economic (other than investment) Assumptions*

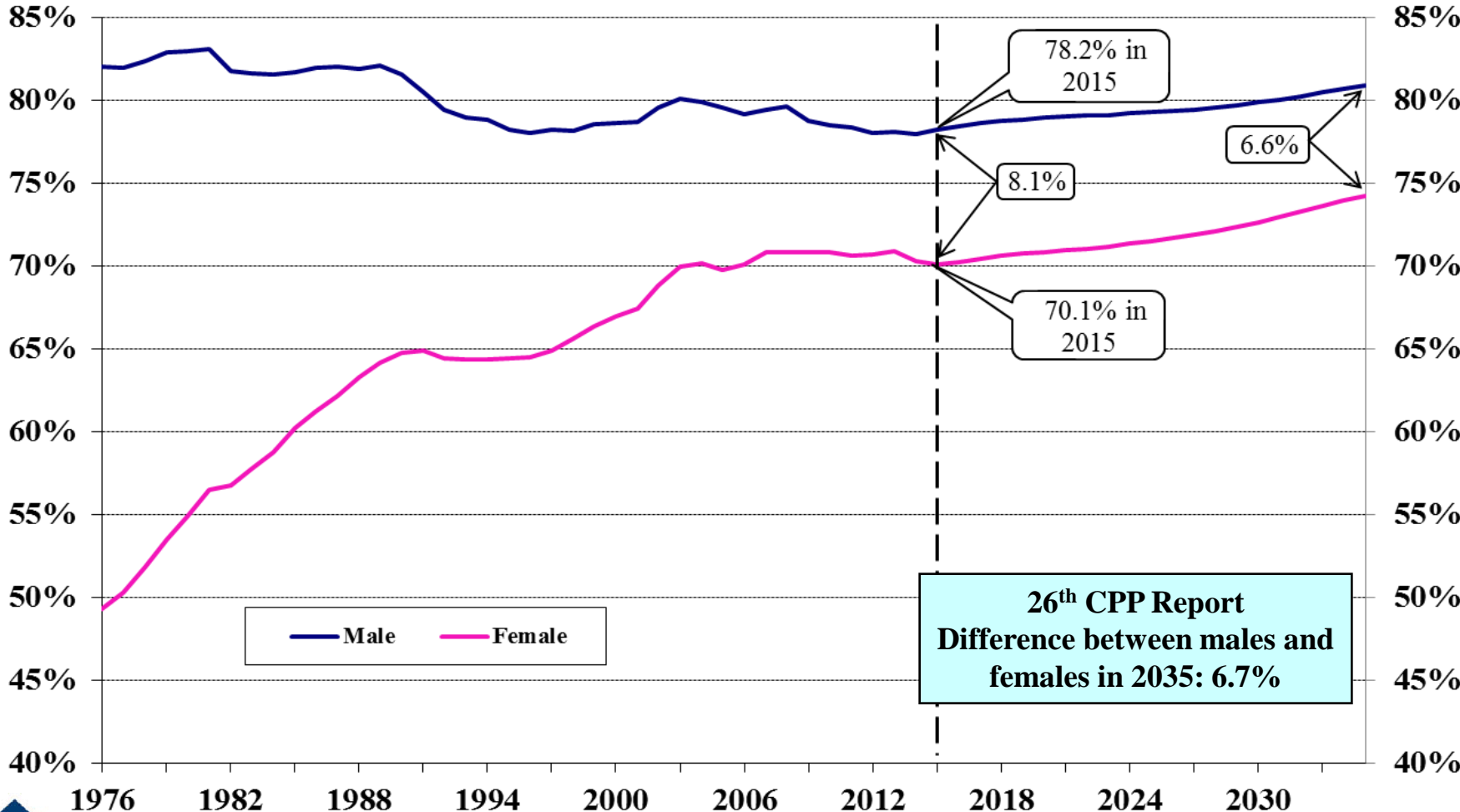
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- Participation rates
- Employment increase (Job creation rate)
- Unemployment rate
- Inflation rate
- Increase in average employment earnings

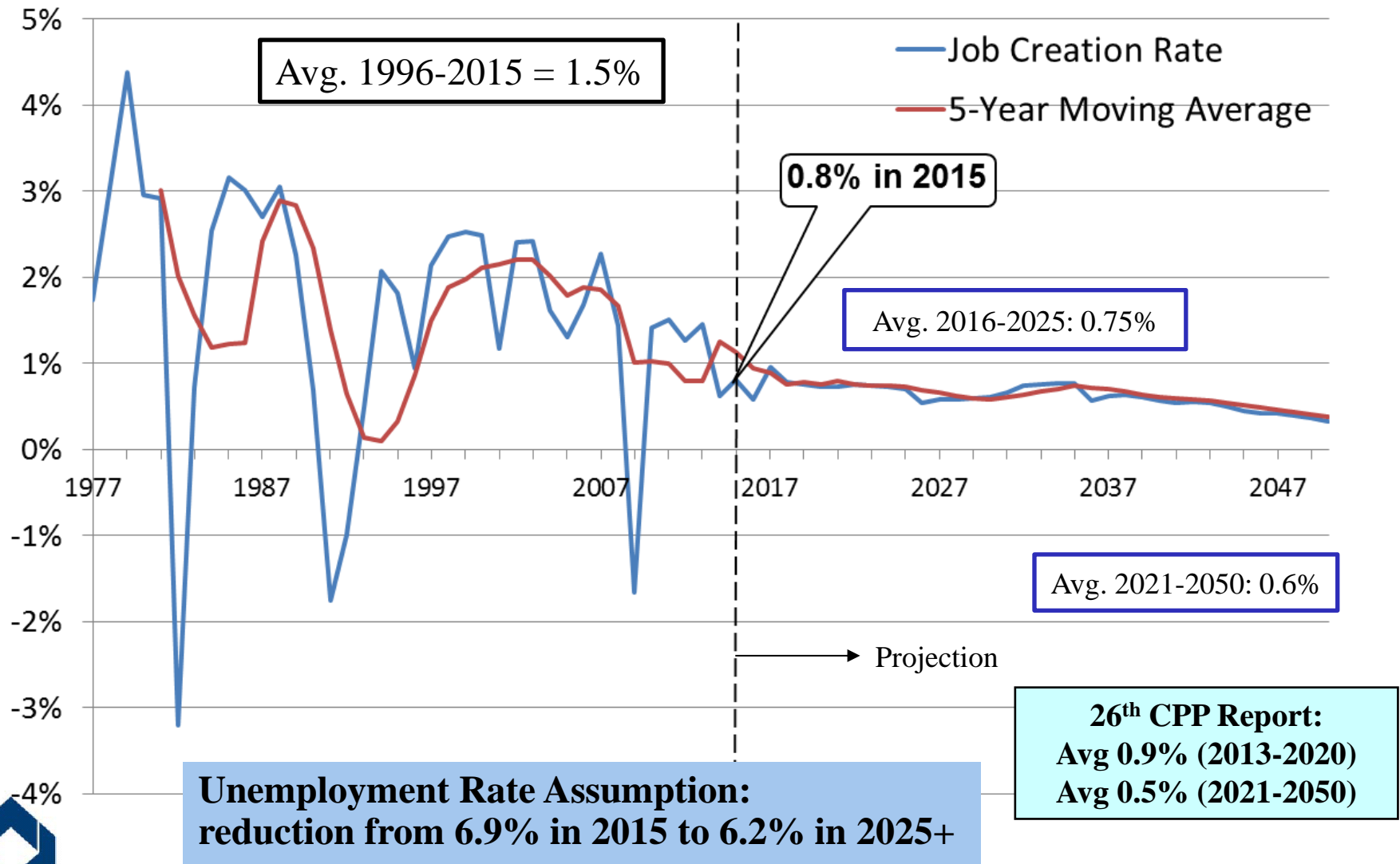
Sources: *Statistics Canada (Labour Force Survey 2015),*  
*OECD Economic Outlook (2015),*  
*Bank of Canada publications (2015)*  
*U of T Policy and Economic Analysis Program (Feb. 2016)*  
*CPP/QPP Seminars (Sept and Nov 2015)*



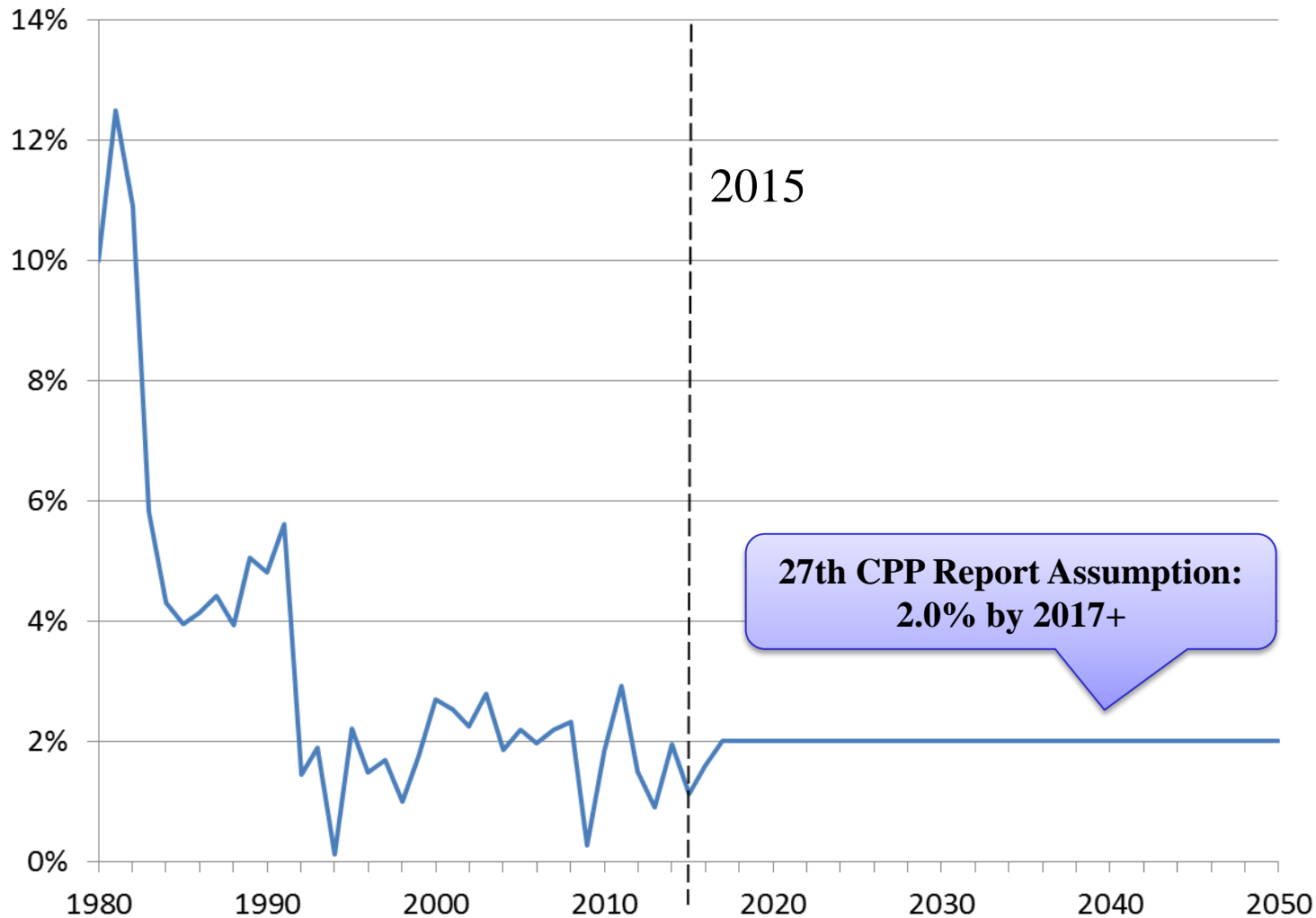
# Participation Rates (Canada, 15-69)



# Job Creation Rate (Canada, 15+)



# Annual Increase in Consumer Price Index



**26th CPP Report Assumption: 2.2% by 2021+**

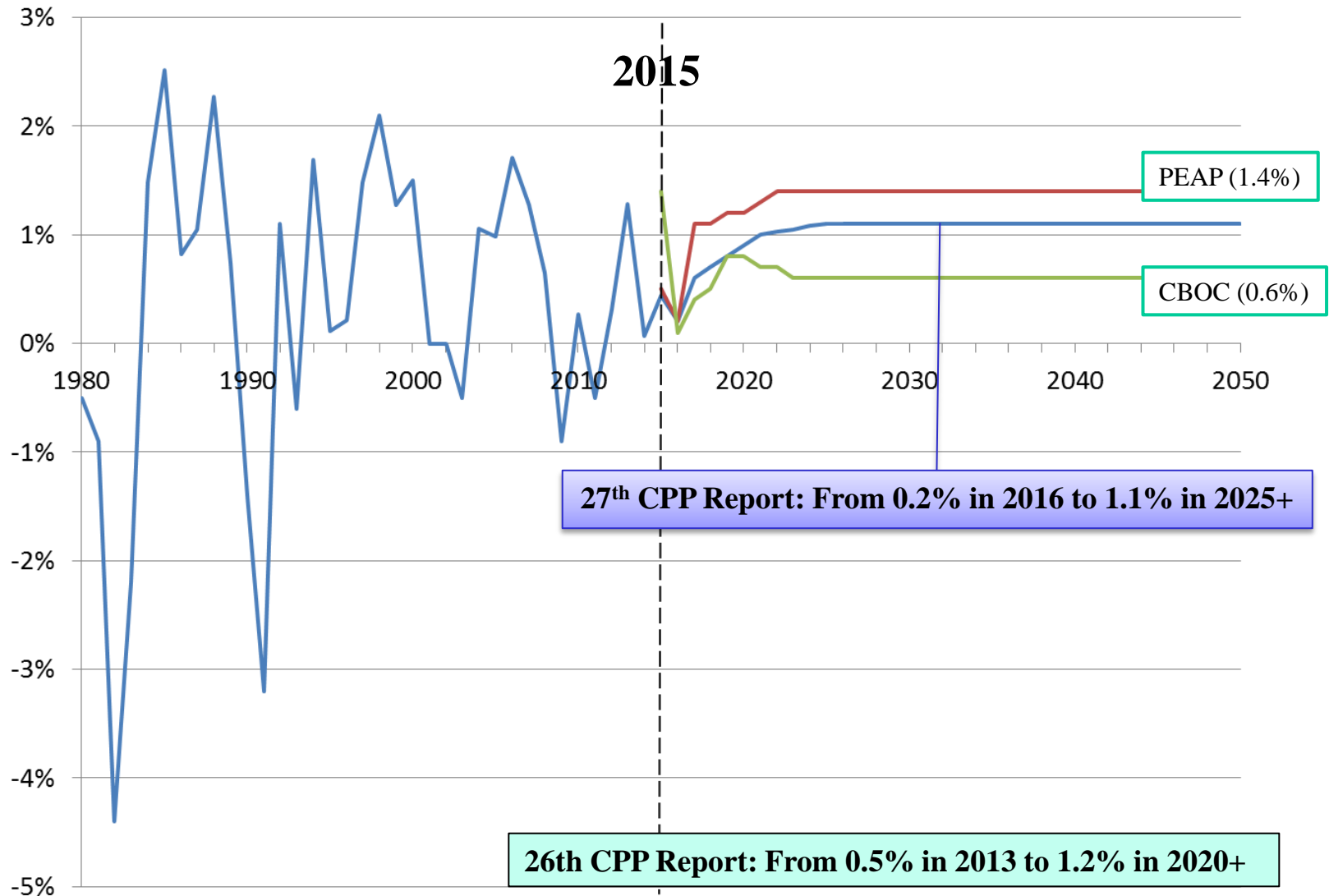


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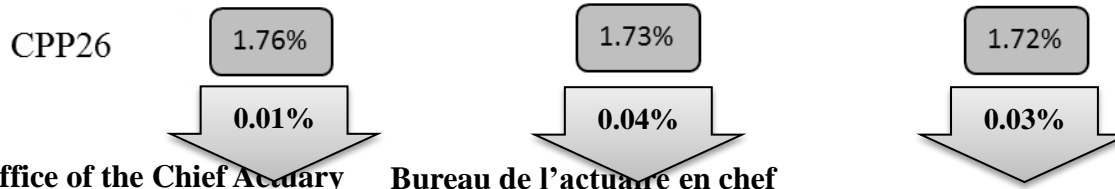
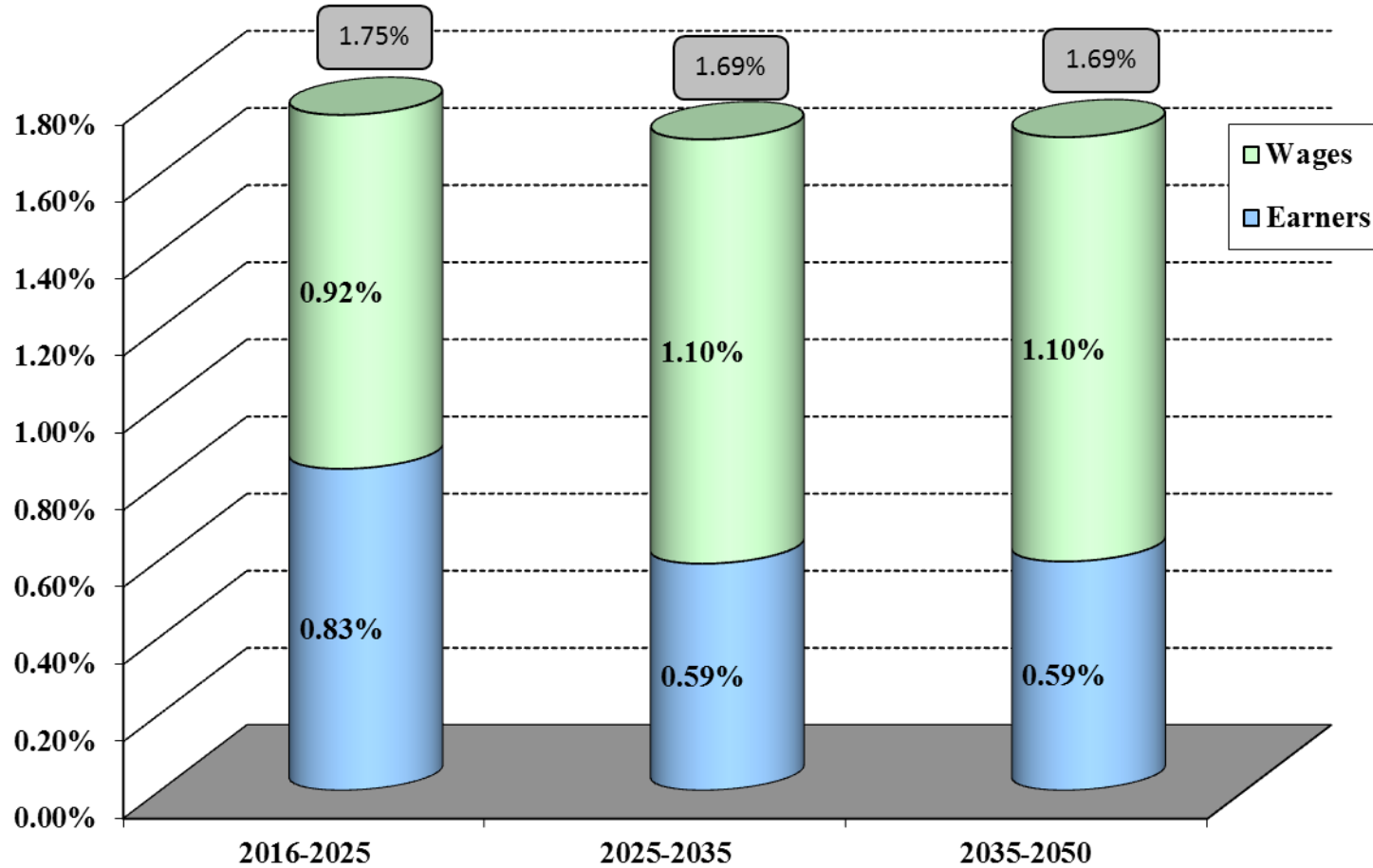
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# *Increases in Real Average Employment Earnings*



# Real Increase in Total Employment Earnings (18-69, Canada less Québec)



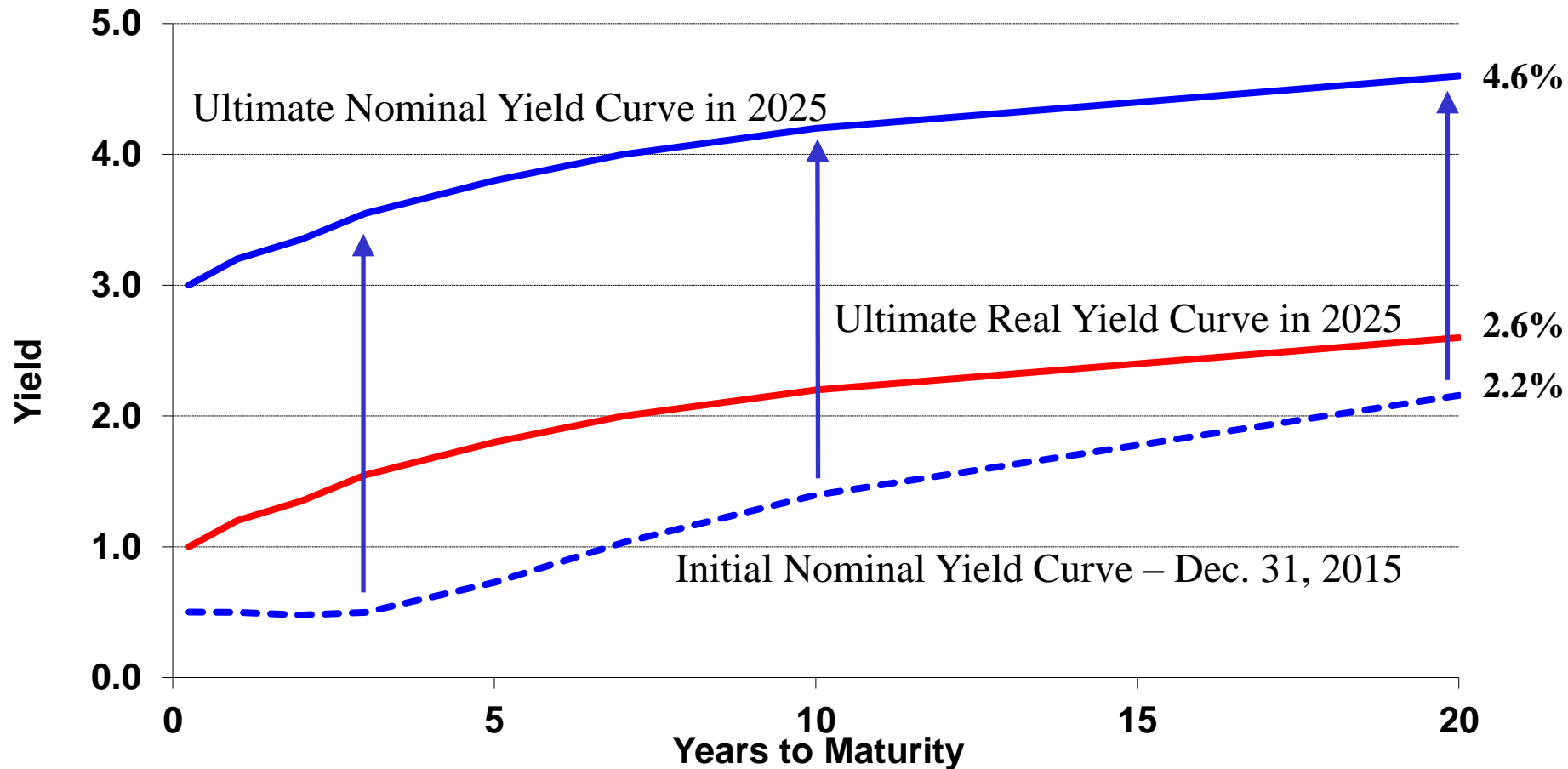
# *A building block methodology is used to determine the real rates of return*

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- Bonds:
  - Start with Long-term Federal bond yield (10+)
  - Add bond spread above long-term Federal bond yield
  - Convert bond yields to real bond returns
  - Add an allowance for rebalancing & diversification (R&D)
- Equities
  - Start with Long-term Federal bond real rates of return (10+)
  - Add ERP which includes an allowance for R&D
- Real Estate & Infrastructure
  - 1/2 Canadian equity return + 1/2 marketable bond return
- Investment Expenses
  - Applied as a reduction of expected real rates of return



# *Federal bond yield curve is expected to increase*



Ultimate federal long-term bond real yield is assumed to reach 2.6% (4.6% nominal) in 2025. This is lower than was assumed in the 26<sup>th</sup> CPP Report (2.8%) and the increase is spread over 9 years instead of 6 years.



# *CPP27 marketable bond portfolio is well aligned with the current CPPIB bond portfolio*

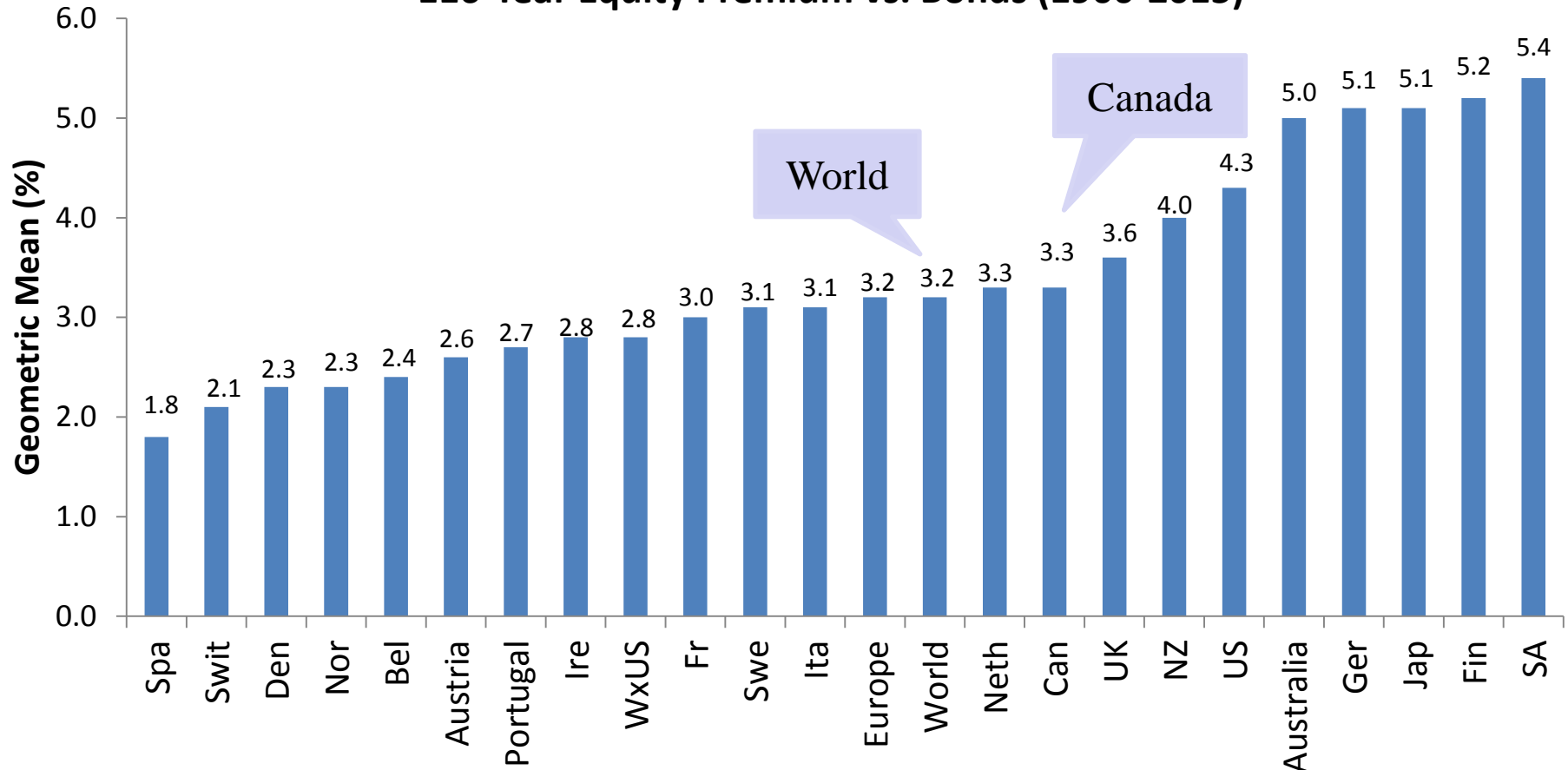
<b>CPP 27 (2025+)</b>				
	<b>Federal</b>	<b>Provincial</b>	<b>Corporate</b>	<b>Marketable Bond Portfolio*</b>
<b>Real rate of return</b>	2.0%	2.5%	3.4%	<b>Real Rate of Return: <u>2.7%</u> Maturity: 9.4 years</b>
<b>Asset mix</b>	40%	35%	25%	
<b>Maturity</b>	7.8	11.8	8.6	
<b>CPP 26 (ultimate)</b>				
	<b>Federal</b>	<b>Provincial</b>	<b>Corporate</b>	<b>Marketable Bond Portfolio*</b>
<b>Real rate of return</b>	2.2%	2.8%	3.3%	<b>Real Rate of Return: <u>2.9%</u> Maturity: 7.7 years</b>
<b>Asset mix</b>	35%	30%	35%	
<b>Maturity</b>	5.9	14.2	3.9	

\*The marketable bonds real return includes an allowance for R&D (+0.10% for CPP27 as well as for CPP26). Bond returns are shown before reduction for expenses.



# *The future ERP is expected to be lower than in the past (3.3% for Canada)*

**116-Year Equity Premium vs. Bonds (1900-2015)**



Source: Credit Suisse Global Investment Returns Yearbook 2016, Dimson, Marsh and Staunton

Equity risk premium is set at 2.1%, compared to 2.2% in the previous report.



# Portfolio Real Rates of Return

## Asset Allocation and Real Rates of Return by Asset Type (before investment expenses)

Year	Equity			Fixed Income Securities			Real Assets	Total
	Canadian	Foreign Developed Market	Emerging Markets	Marketable Bonds	Non-Marketable Bonds	Short Term		
	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
<b>Asset Allocation</b>								
<b>2040+</b>	8	41	6	19	0	1	25	100
<b>Real rate of return before investment expenses</b>								
<b>2016</b>	2.0	2.0	3.0	(3.6)	(1.6)	(3.8)	1.5	0.6
<b>2020</b>	4.7	4.7	5.7	(0.5)	(0.1)	(0.4)	4.2	3.6
<b>2025</b>	4.7	4.7	5.7	2.7	3.2	1.0	4.2	4.2
<b>CPP26-2025</b>	5.0	5.0	6.0	2.9	3.4	1.0	3.9	4.2

Total expected investment expenses of 1.0% are reduced by an additional rate of return due to active management of 0.8% for a net investment expenses assumption of 0.2% to reflect the expenses due to passive management.

## Portfolio Real Rate of Return Net of Investment and Operating Expenses (%)

	CPP27	CPP26
<b>First 5 years</b>	2.6	3.0
<b>First 75 years</b>	3.9	3.9
<b>Ultimate</b>	4.0	4.0



# *Real rate of return assumed by the OCA is in line with assumptions of peer*

## Ultimate asset mix and real rate of return assumptions

	Equities	Fixed Income	Alternative investments/RE&I	Real rate of return
<b>CPP</b>	55%	20%	25%	<b>4.00%</b>
<b>QPP</b>	59%	20%	21%	<b>4.70%</b>
<b>PSSA</b>	55%	20%	25%	<b>4.10%</b>
<b>RREGOP</b>	51%	33%	16%	<b>4.30%</b>
<b>ON PSPP</b>	42%	25%	33%	<b>3.85%</b>
<b>OTPP</b>	46%	13%	41%	<b>2.85%</b>
<b>OMERS</b>	48%	17%	35%	<b>4.25%</b>
<b>HOOPP</b>	34%	54%	13%	<b>3.65%</b>
<b>AB PSPP</b>	48%	29%	23%	<b>4.00%</b>

*Due to current low interest rate environment, the OCA assumes a real rate of return of 2.6% over the next five years.*





# Comparison with Previous Report

## Minimum Contribution Rate

26<sup>th</sup> CPP Actuarial Report  
as at 31 December 2012

9.84 (2016+)

<i>Experience Update (2013-15)</i>	<ul style="list-style-type: none"> <li>• Demographic</li> <li>• Economic</li> <li>• Benefits</li> <li>• Investments</li> </ul>	<ul style="list-style-type: none"> <li>+0.03</li> <li>-0.01</li> <li>-0.07</li> <li><b>-0.29</b></li> </ul>	<ul style="list-style-type: none"> <li>Lower births and migration than anticipated</li> <li>Earnings higher than anticipated</li> <li>Less pay outs than anticipated</li> <li>More investment income than anticipated</li> </ul>
<b>-0.34</b>			
<i>Demographic Assumptions</i>	<ul style="list-style-type: none"> <li>• Mortality</li> <li>• Migration</li> </ul>	<ul style="list-style-type: none"> <li>+0.09</li> <li>-0.04</li> </ul>	<ul style="list-style-type: none"> <li>Higher life expectancy</li> <li>0.62% vs. 0.60%</li> </ul>
<b>+0.05</b>			
<i>Economic Assumptions</i>	<ul style="list-style-type: none"> <li>• Labour Force</li> <li>• CPI</li> <li>• Real Wage</li> <li>• Others</li> </ul>	<ul style="list-style-type: none"> <li>-0.00</li> <li>+0.05</li> <li><b>+0.15</b></li> <li>-0.03</li> </ul>	<ul style="list-style-type: none"> <li>Higher participation at older ages</li> <li>2.0% vs. 2.2%</li> <li>1.1% vs. 1.2%</li> </ul>
<b>+0.16</b>			
<i>Benefit Assumptions</i>	<ul style="list-style-type: none"> <li>• Retirement</li> <li>• Disability</li> <li>• Methodology</li> </ul>	<ul style="list-style-type: none"> <li>+0.07</li> <li>-0.05</li> <li>-0.01</li> </ul>	<ul style="list-style-type: none"> <li>Take-up rates 61-64 and 66+</li> <li>Lower eligibility</li> <li>New PRB and working Ben algorithm</li> </ul>
<b>+0.00</b>			
<i>Investments Assumptions</i>	<ul style="list-style-type: none"> <li>• Rate of Return</li> </ul>	<ul style="list-style-type: none"> <li>+0.08</li> </ul>	<ul style="list-style-type: none"> <li>Lower net real rate of return</li> </ul>
<b>+0.08</b>			

27<sup>th</sup> CPP Actuarial Report  
as at 31 December 2015

9.79 (2019+)



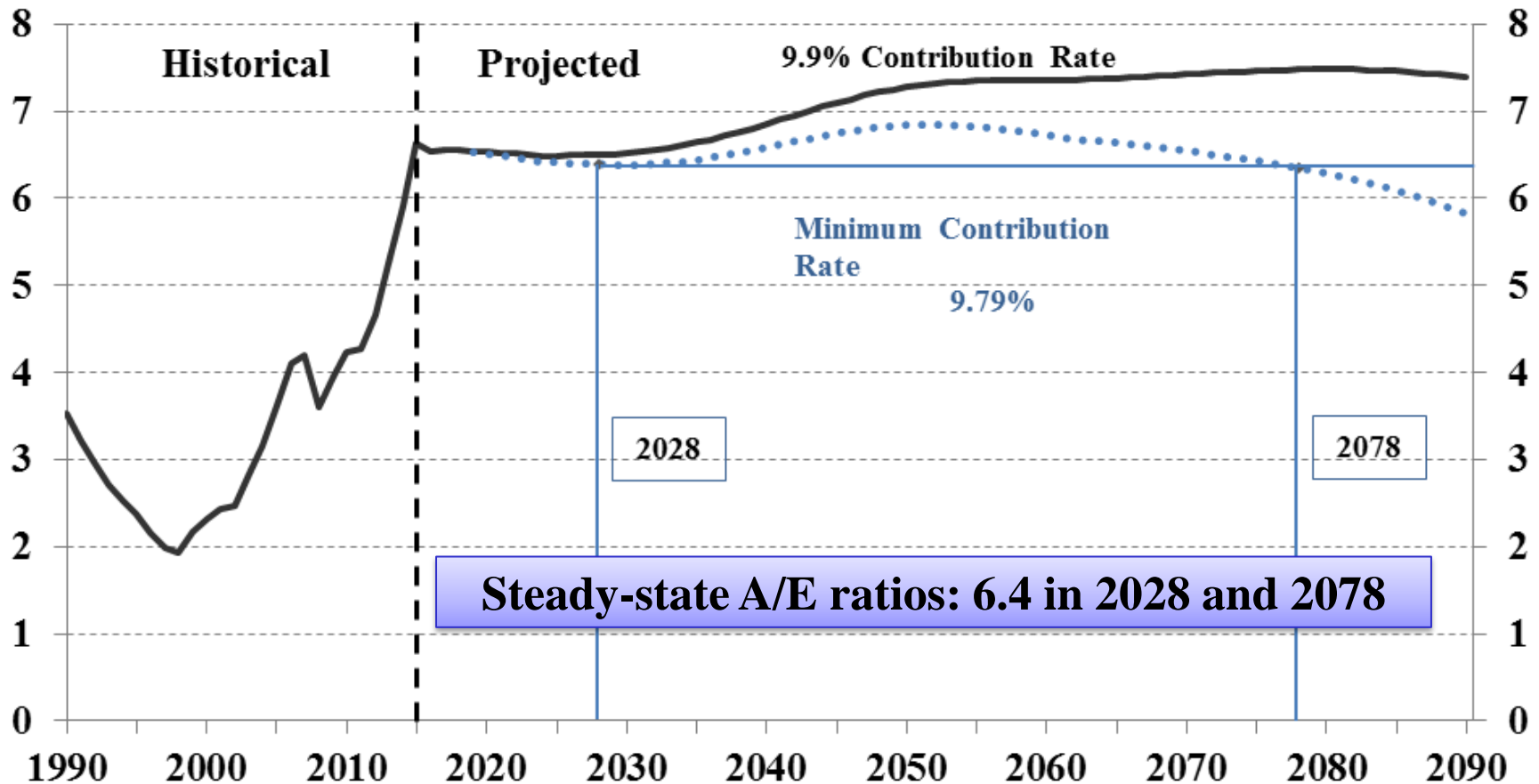
# *Uncertainty of Results: Variation of the MCR*

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- Different Asset Mix: between 9.5% to 11.0%
- BE Portfolio Tail Events: between 9.5% to 10.1%
- Individual Sensitivity Tests: between 8.5% to 11.1%
- High and Low Economic Growth: between 9.1% to 10.7%
- Younger and older Population: between 9.3% to 10.2%



# Evolution of A/E Ratio



**26<sup>th</sup> CPP Report : Steady-state A/E ratios: 5.3 in 2025 and 2075**



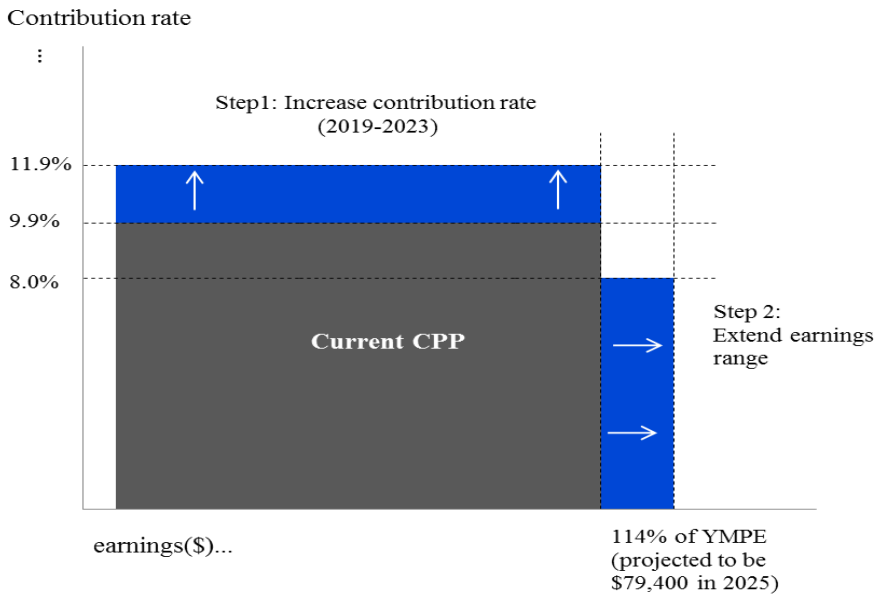
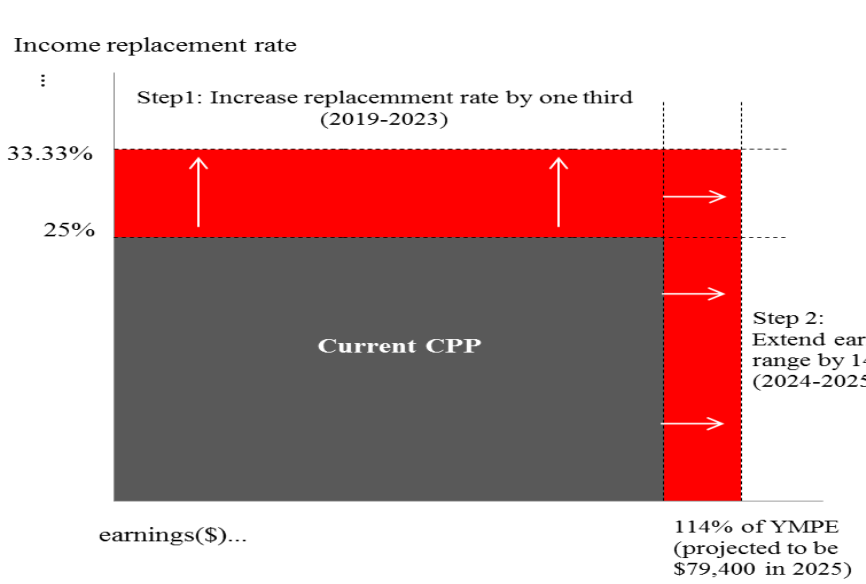
# *The legislated contribution rate of 9.9% is sufficient to finance the Plan over the projection period of 75 years*

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- With the legislated contribution rate of 9.9%, contributions are more than sufficient to cover expenditures until 2020 inclusive.
- Thereafter a proportion of investment income is required to pay the expenditures. In 2050, 26% of investment earnings is required to pay for benefits.
- Results contained in this report confirm that the 9.9% contribution rate is sufficient to finance the Plan and to accumulate assets of \$369 billion in 2020
- The minimum contribution rate to sustain the Plan is 9.79% of contributory earnings for the year 2019 and thereafter.



# Bill C-26 amends the Canada Pension Plan, the Canada Pension Plan Investment Board Act and the Income Tax Act



- Additional disability and survivor benefits:
  - Fully earnings-related and equal to a percentage of accrued additional retirement benefit
  - Eligibility requirements are harmonized with the base CPP: if a person is eligible to base benefits, he/she will be eligible to additional benefits.



# *Additional CPP strengthens link between contributions and benefits*

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- The financing objective of additional CPP:
  - To have constant contribution rates that result in projected contributions and investment income that are sufficient to fully pay the projected expenditures of the additional CPP over the long-term
- Each year of contributing to the enhanced CPP will allow workers to accrue partial additional benefits
  - Full additional CPP benefits will be available after 40 years of making contributions.
  - Partial benefits will be available sooner and will be based on years of contributions.

***No past service liability is created***



# *The 28<sup>th</sup> CPP Report was tabled in Parliament on 28 October 2016*

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- By legislation, the OCA prepares the CPP actuarial report whenever a Bill that materially affects the cost of the CPP is introduced in the Parliament
- The 28<sup>th</sup> Actuarial Report supplementing the Actuarial Report on the Canada Pension Plan as at 31 December 2015 contains financial estimates with respect to the Additional CPP
- CPP28 is based on the best-estimate assumptions of the CPP27 with some modifications
  - The most important modification is the assumed asset mix of the investment portfolio of the Additional CPP.



# *To ensure the stability of the additional contribution rates, stable returns on assets are desirable*

- At this time, there is no CPPIB investment strategy with respect to the additional CPP
- The real rate of return assumption was developed to reflect the financing objective of the additional Plan
- OCA assumption: additional assets will be invested in a portfolio that has a lower volatility than the assumed investment portfolio of the base CPP, and, thus, will generate lower returns
- To achieve this, asset mix of the base CPP portfolio was modified.

Asset Class	Allocation	
	Additional CPP	Base CPP
	(%)	(%)
Equity	37.5	55.0
Fixed Income Securities	37.5	20.0
Real Assets	25.0	25.0





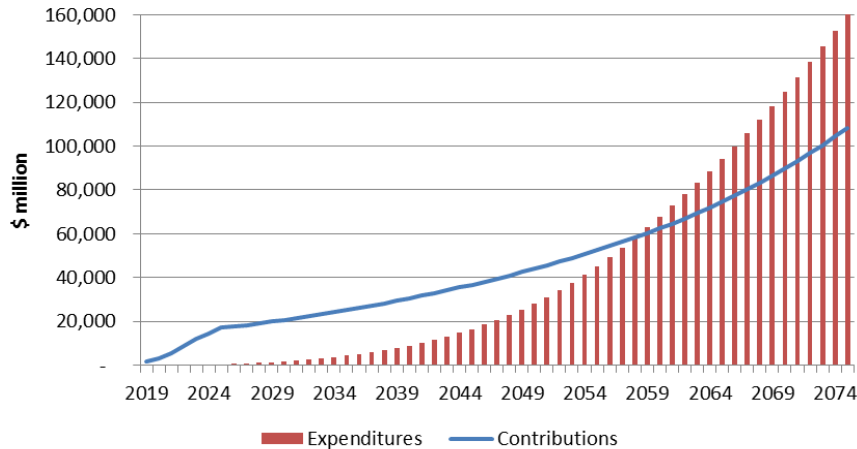
# *Assumed Annual Rates of Return on Additional CPP and Base CPP Assets (net of expenses)*

	<b>Additional CPP (CPP 28)</b>	<b>Base CPP (CPP 27)</b>
<b>Assets Allocation</b>	Fixed Income: 50% Equities: 50% <b>Volatility: 9.2%</b>	Fixed Income: 32.5% Equities: 67.5% <b>Volatility: 11.4%</b>
<b>2019</b>	2.12%	3.07%
<b>2020</b>	2.45%	3.38%
<b>2025+</b>	3.63%	4.03%
<b>Average real rate of return</b>		
<b>- 2019-2023</b>	2.51%	3.40%
<b>- 2019-2028</b>	3.03%	3.69%
<b>- 2019-2093</b>	3.55%	3.98%



# The additional assets are expected to surpass the base CPP assets by 2055

Projected Additional Contributions and Expenditures (2%/8% contribution rates)

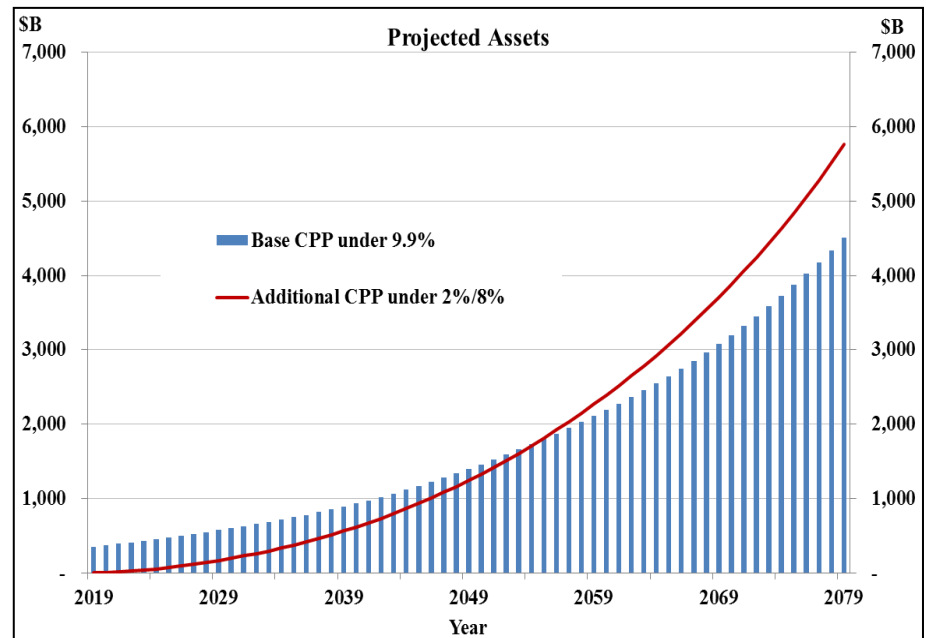


Under 2%/8% contribution rates:

- By 2050, additional contributions are projected to reach \$44.1 billion
- By 2050, additional expenditures are projected to reach \$28.2 billion
- Contributions will exceed benefits up to the year 2058.

Under 2%/8% contribution rates the additional assets are projected to grow rapidly:

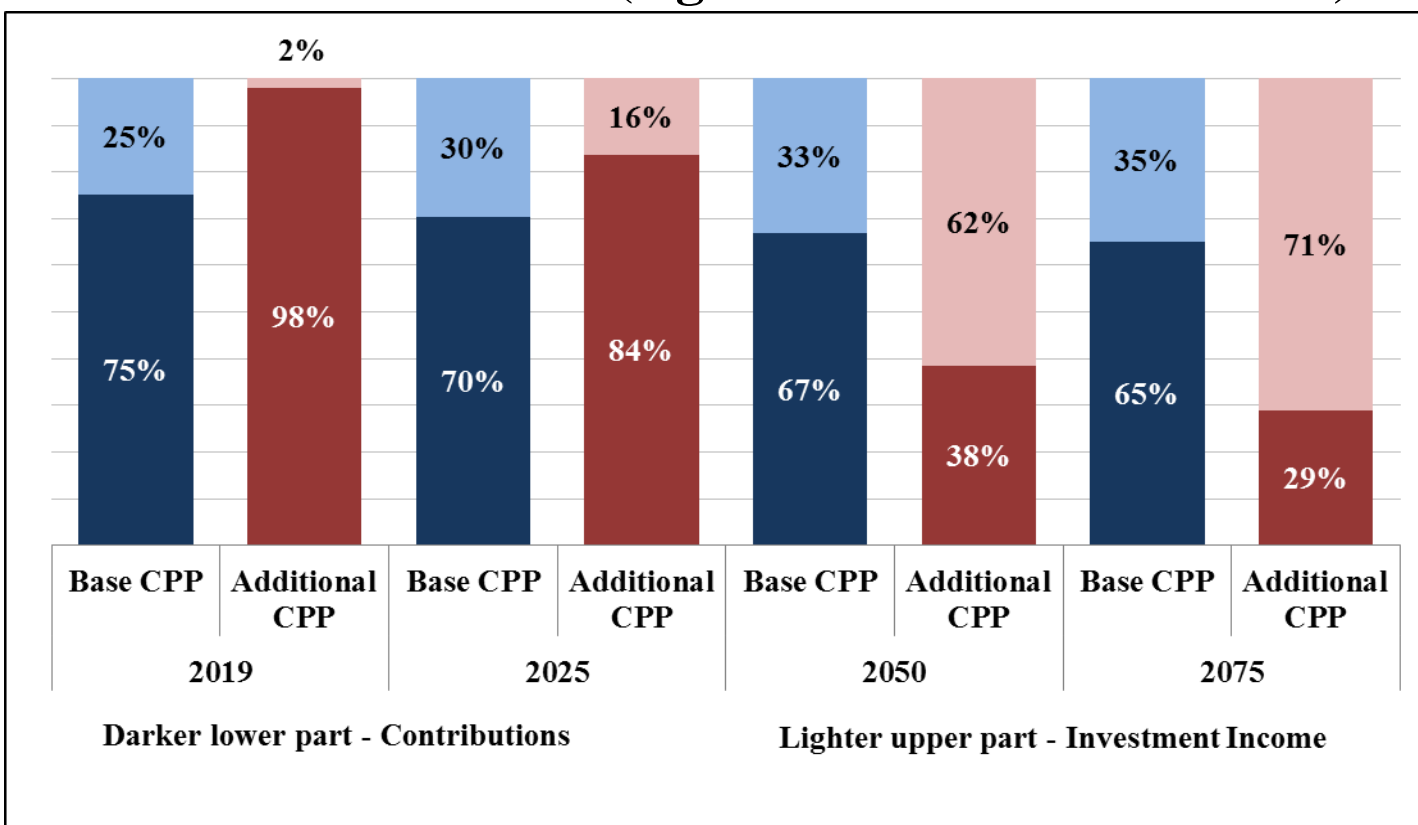
- from \$1.5 billion at the end of 2019
- to \$70 billion by 2025,
- \$196 billion by 2030,
- and \$1,330 billion by 2050.



# *For the additional CPP, investment income is the major source of revenues*

- The major source of financing:
  - contributions for the base CPP and investment income for the additional Plan.

## Sources of Revenues (legislated contribution rates)



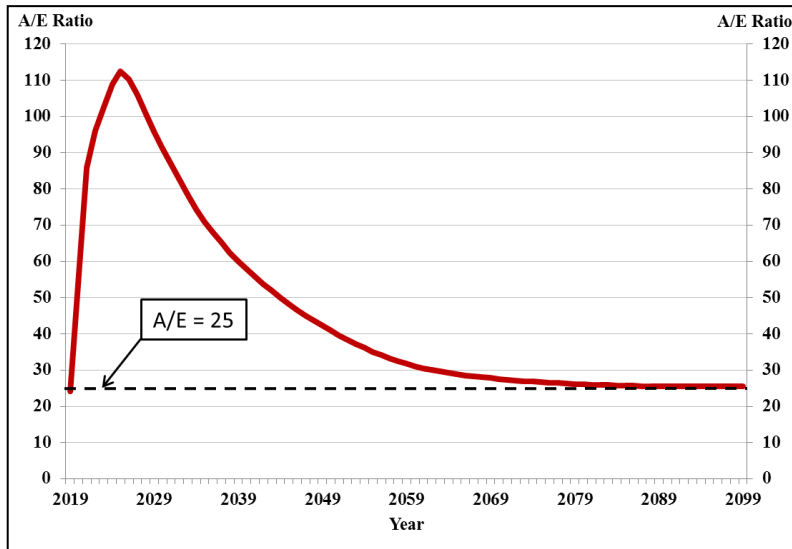
Darker lower part - Contributions

Lighter upper part - Investment Income



# *The minimum additional contribution rates are below the legislated contribution rates of 2%/8%*

- The constant minimum first and second additional contribution rates that result in projected contributions and investment income being sufficient to fully pay projected expenditures of the additional CPP are respectively **1.93%** for the year 2023 and thereafter, and **7.72%** for the year 2024 and thereafter.



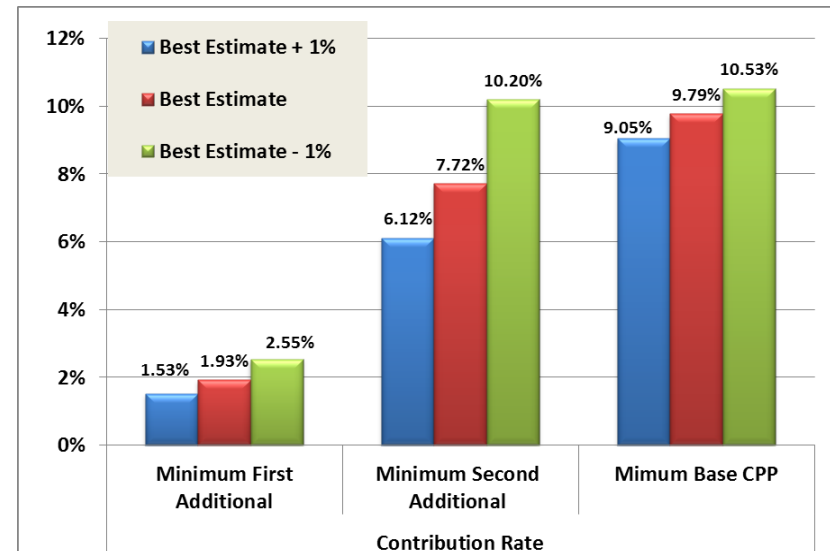
## Open Group Balance Sheet - Additional CPP January 1, 2019

	(\$billion)
<b>Assets</b>	
<b>Current Assets</b>	-
<b>Future Contributions</b>	674
<b>Total Assets (a)</b>	674
<b>Actuarial Liability (b)</b>	633
<b>Asset Excess (Shortfall) (a) – (b)</b>	40
<b>Assets as percentage of Liability (a)/(b)</b>	106.4%



# *Additional CPP will be sensitive to investment environments*

- The decrease in the best-estimate rate of return of 1% results in about 30% increase in the minimum additional contribution rates compared to about 8% increase in the minimum contribution rate for the base CPP
- Three possible investment scenarios such that the minimum additional contribution rates reach the legislated rates of 2%/8%:
  - Decrease real rate of return by 0.14% (75-year average of 3.41% vs 3.55%)
  - Nominal return of -9% in 2035
  - Nominal return of -4% in 2050.



# *Next steps – development of regulations*

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- Regulations describing the methodology to determine minimum additional contribution rates in accordance with financing objective of the additional CPP
- For the additional CPP, if additional contribution rates fall outside prescribed ranges:
  - As for the base CPP, the first priority is given to the recommendations of Ministers
  - Prescribed ranges and actions with respect to the benefits and contributions need to be defined in regulations.





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# Actuarial Report on the Canada Pension Plan as at 31 December 2015

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

Thank you

8 February 2017



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# Actuarial Reports on the Canada Pension Plan as at 31 December 2015

## Appendix



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# *Forecast Comparison for Canada, 2030*

	Conference Board (May 2016)	U of T PEAP (Feb 2016)	OCA CPP 27 <sup>th</sup>	Number of People in Labour Force (in thousands)	
				OCA	PEAP
Participation Rates (15+)	63.3%	63.8%	<b>63.1%</b>	<u>2030</u> <b>21,219</b>	<u>2030</u> 21,630
Labour Force Increases	0.6%	0.6%	<b>0.6%</b>	<u>2015-2030</u> <u>(average/year)</u> <b>129</b>	<u>2015-2030</u> <u>(average/year)</u> 157
Job Creation Rate	0.6%	0.6%	<b>0.6%</b>	<u>2015-2030</u> <u>(average/year)</u> <b>130</b>	<u>2015-2030</u> <u>(average/year)</u> 156
Unemployment Rate	5.6%	6.2%	<b>6.2%</b>		



# Change in real wage assumption has opposite impacts on the base and additional CPP

Canada	Low-Cost		Best-Estimate		High-Cost	
<b>Mortality (base and additional CPP):</b>						
Canadian life expectancy at age 65 in 2050 with future mortality improvements	Males	20.9	Males	23.3	Males	25.8
	Females	23.2	Females	25.6	Females	27.9
<b>Real wage increase</b>						
Base CPP	1.8%		1.1%		0.4%	
Additional CPP	0.4%		1.1%		1.8%	

