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# Canada Pension Plan: actuarial and investment considerations

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Canada Pension Plan Investments

## Canada Pension Plan (CPP)

- Contributory retirement social insurance program covering all working Canadians outside of the province of Quebec
- Two components of the CPP: base and additional
- CPP is financed through employee and employer contributions and investment earnings
- Assets of the CPP are invested by [Canada Pension Plan Investments](#) (CPPIB)

## Sustainability of base and additional CPP

- **The financial state of the CPP is reviewed every three years by the federal Minister of Finance and the provincial ministers**
  - The review is based on the results of the [actuarial valuation](#) which determines minimum contribution rates needed to sustain the plan over long-term
- **The Plan is considered sustainable if the legislated contribution rates are in line with minimum contribution rates**

## Self-adjustment mechanisms

- **Should legislated rates be considered insufficient to sustain the Plan or outside of specified ranges, ministers must agree on course of actions**
- **Insufficient rates provision articulate default adjustments to the Plan in case no agreement is reached between ministers**

## Roles and responsibilities of the OCA and CPPIB

- The role of each stakeholder is defined by legislation
- The OCA prepares an actuarial report on the financial state of the Plan every three years identifying the minimum contribution rates needed to sustain the Plan
- CPPIB invests CPP assets in line with its mandate

**CPPIB and OCA maintain constant dialogue and exchange information**

## CPPIB's mandate requires consideration of both asset and liability factors

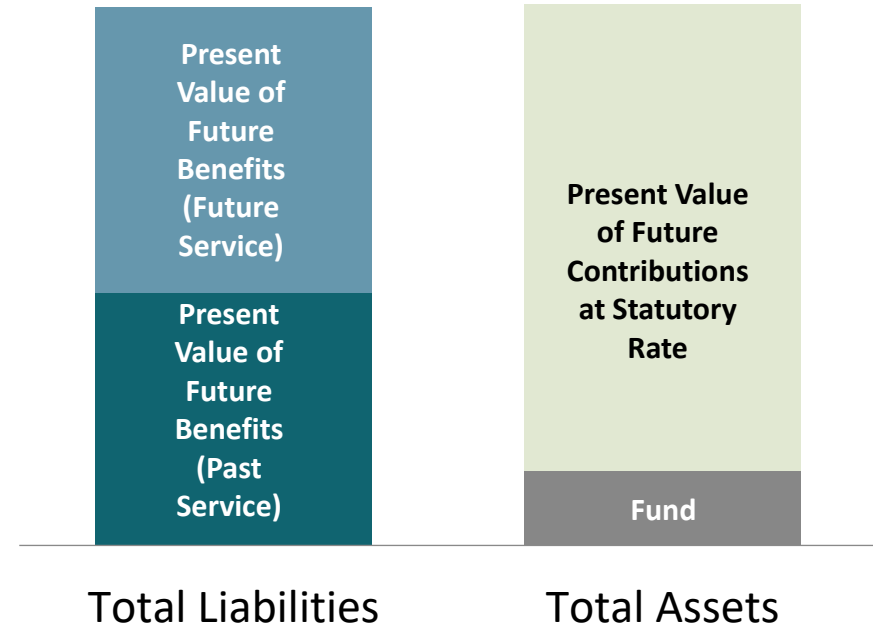


- **Asset-liability management balances Plan outcome risk and reward in setting the target risk of the Base and Additional CPP through Reference Portfolios**
- ***Investment Guideline 6: Taking into account social security liabilities and funding policy in the determination of investment policy***

## CPPIB Step 1: Stochastic modelling of the Open Group balance sheet

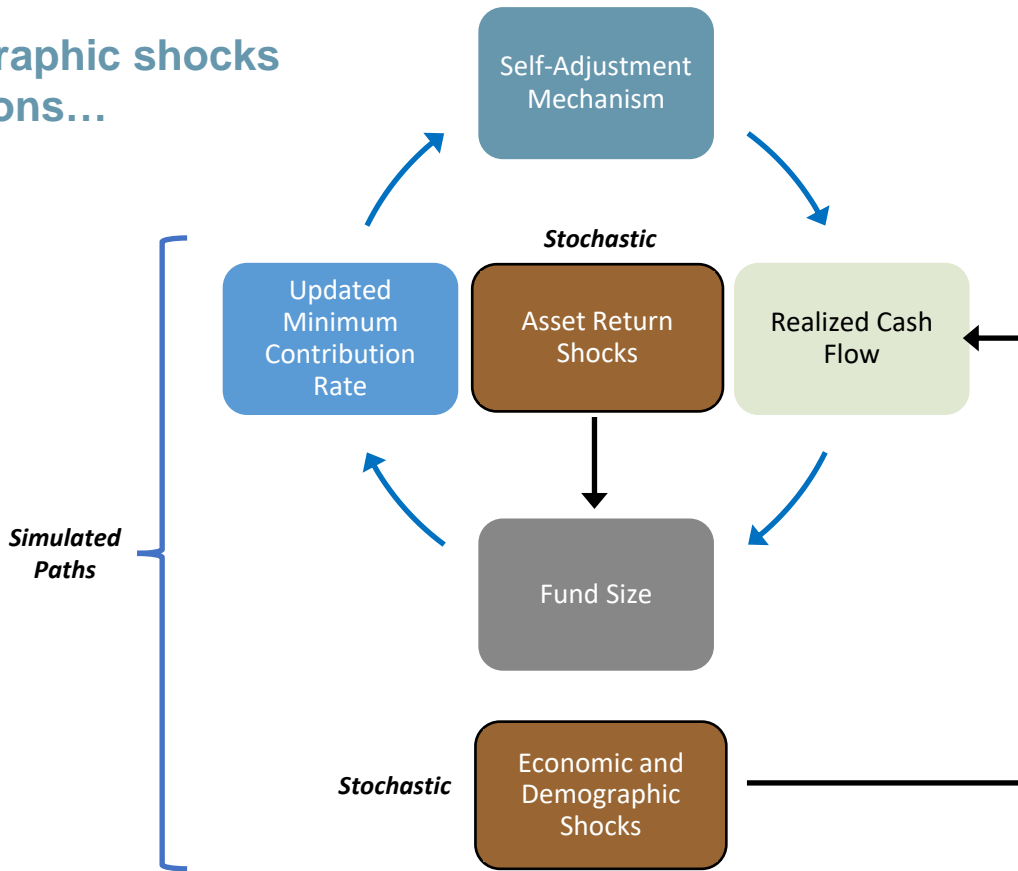
- **Open Group balance approximates the statutory sustainability test**
- **Stochastic modelling of components generates stochastic Minimum Contribution Rate (MCR)**
- **Deterministic baseline benchmarked to last Actuarial Review**

Base CPP Open Group  
Balance Sheet – Dec 31, 2018  
(OCA Discount Rates)



## Investment, economic and demographic shocks affect fund and cash flow realizations...

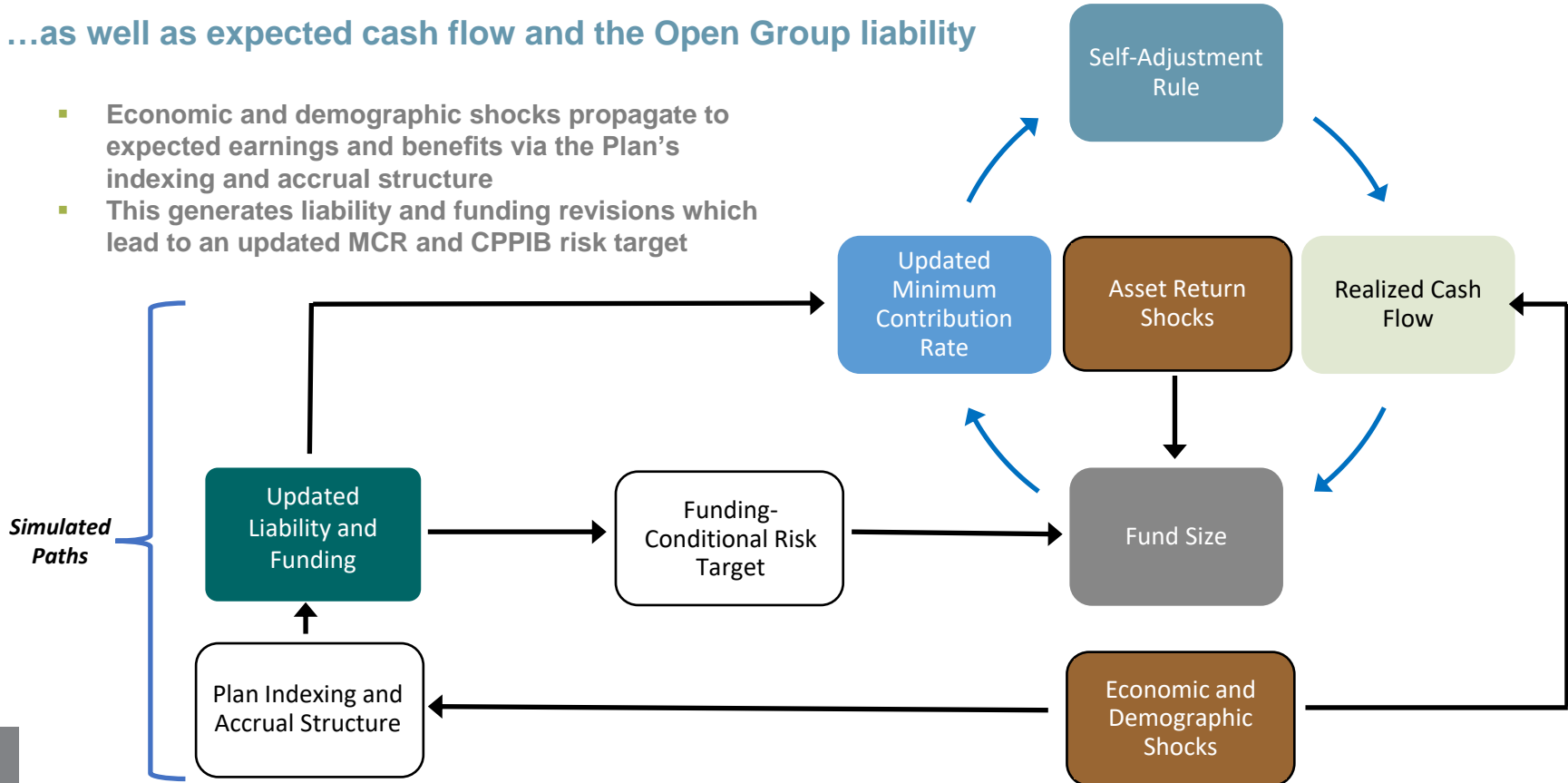
- Asset return shocks directly affect fund realizations
- Economic and demographic shocks directly affect cash flow realizations
- Shocks occur within a modelled repeating 3-year Actuarial Review cycle over the full 75-year Actuarial horizon





## ...as well as expected cash flow and the Open Group liability

- Economic and demographic shocks propagate to expected earnings and benefits via the Plan's indexing and accrual structure
- This generates liability and funding revisions which lead to an updated MCR and CPPIB risk target

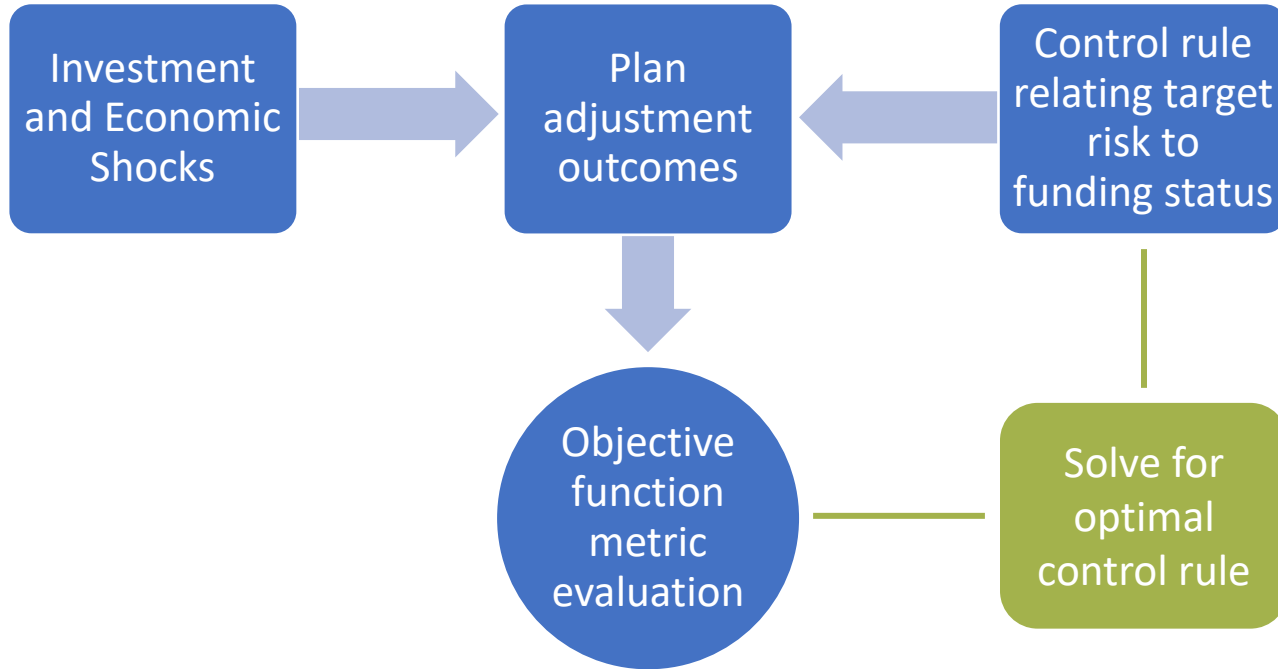


## CPPIB Step 2: An explicit objective function expresses a view of Plan outcomes over various dimensions

Objective Function	Plan Value Metric (B)	Loss Function (A)	Time Steps; Horizon (C)
Minimize discounted expected loss function (A) defined over a Plan Value metric (B) over specified time steps and horizon (C)	Plan adjustments: change in contribution rate minus full cost rate (captures benefit adjustments)	Credit favourable adjustments less than unfavourable adjustments	<ul style="list-style-type: none"> <li>• 3-year actuarial review periods</li> <li>• 75-year horizon;</li> <li>• 2% rate of time preference</li> </ul>
Multi-period objective aligned with Open Group nature of Plan	Requires a detailed understanding of the actuarial review process and drivers	Expression of risk aversion explicable to the CPPIB Board and key stakeholders (including OCA)	Aligns with open group nature of Plan and Actuarial Review cycle

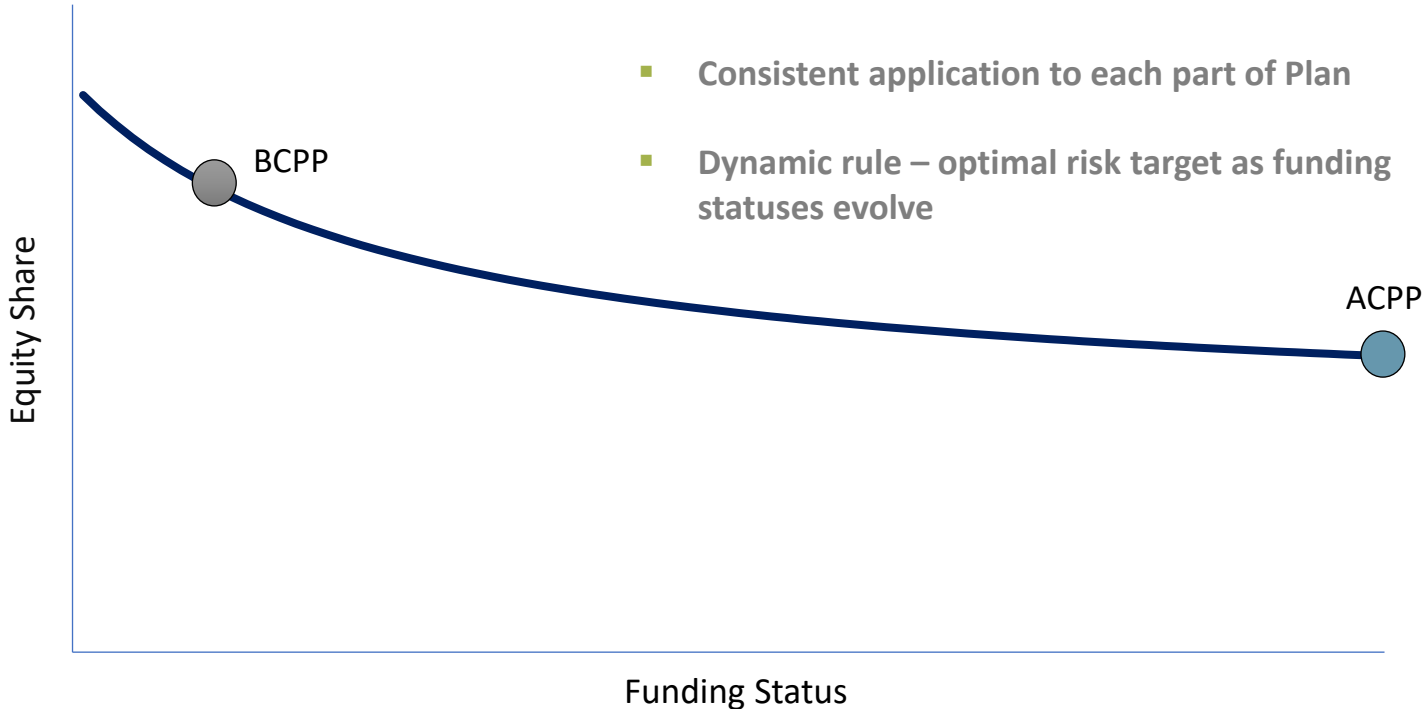
Related to OCA processes and facilitated by information exchange

## CPPIB Step 3: Solve for the optimal control rule that meets the objective



## CPPIB Step 3: Optimal control rule solution

### Optimal Funding-Conditional Equity-Debt Risk Schedule



## The CPPIB process requires key inputs that originate from the actuarial review cycle as well as actuarial and Plan structure insights

CPPIB Stochastic Asset Projection Drivers	CPPIB Stochastic Liability Projection Drivers
Expected asset class returns	Best-estimate projected contributory earnings and benefits
Expected asset class risk structure	Best-estimate demographic and economic projections
Optimal funding-conditional target risk rule	Best-estimate projected fund return
	Liability relationship to economic factors
	Economic risk and relationship to returns

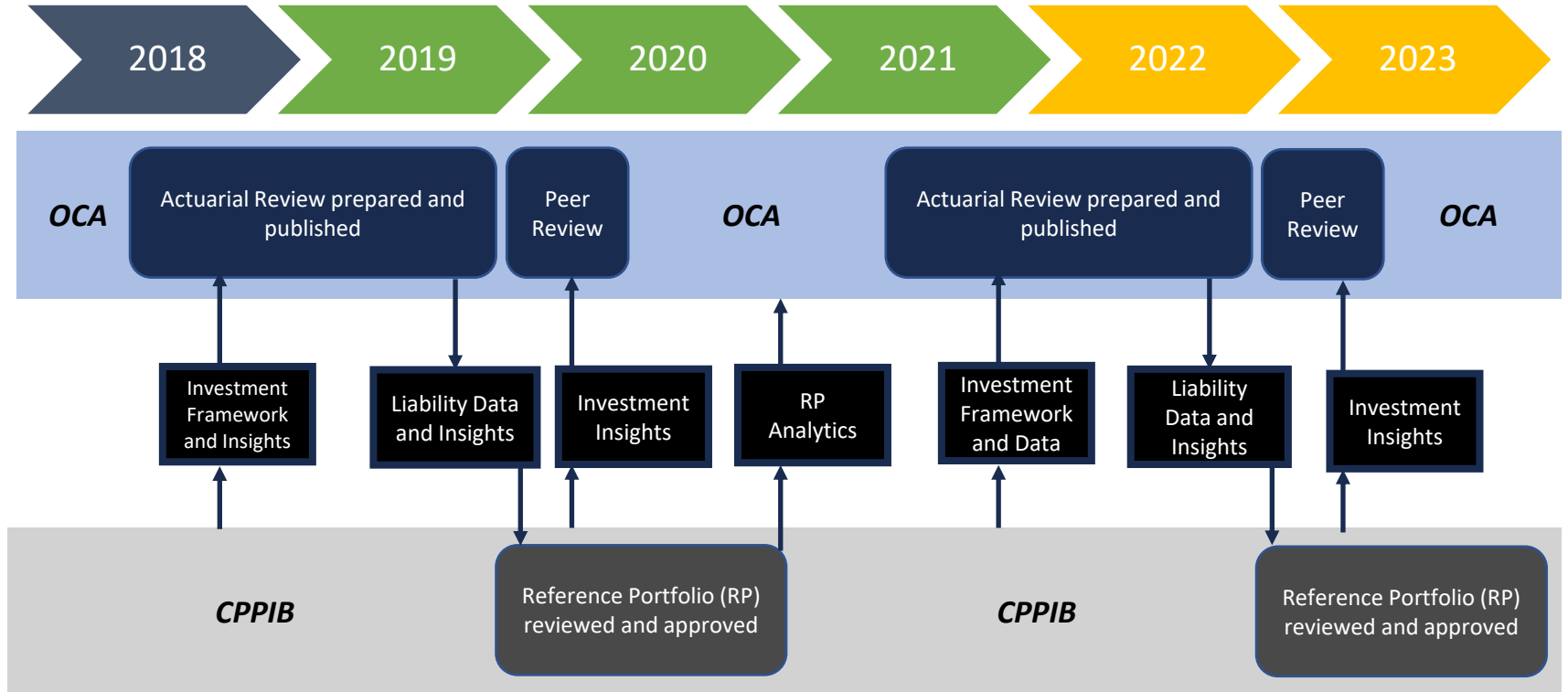
### *Origination:*

CPPIB

OCA

Plan Structure:  
OCA a key source of insights

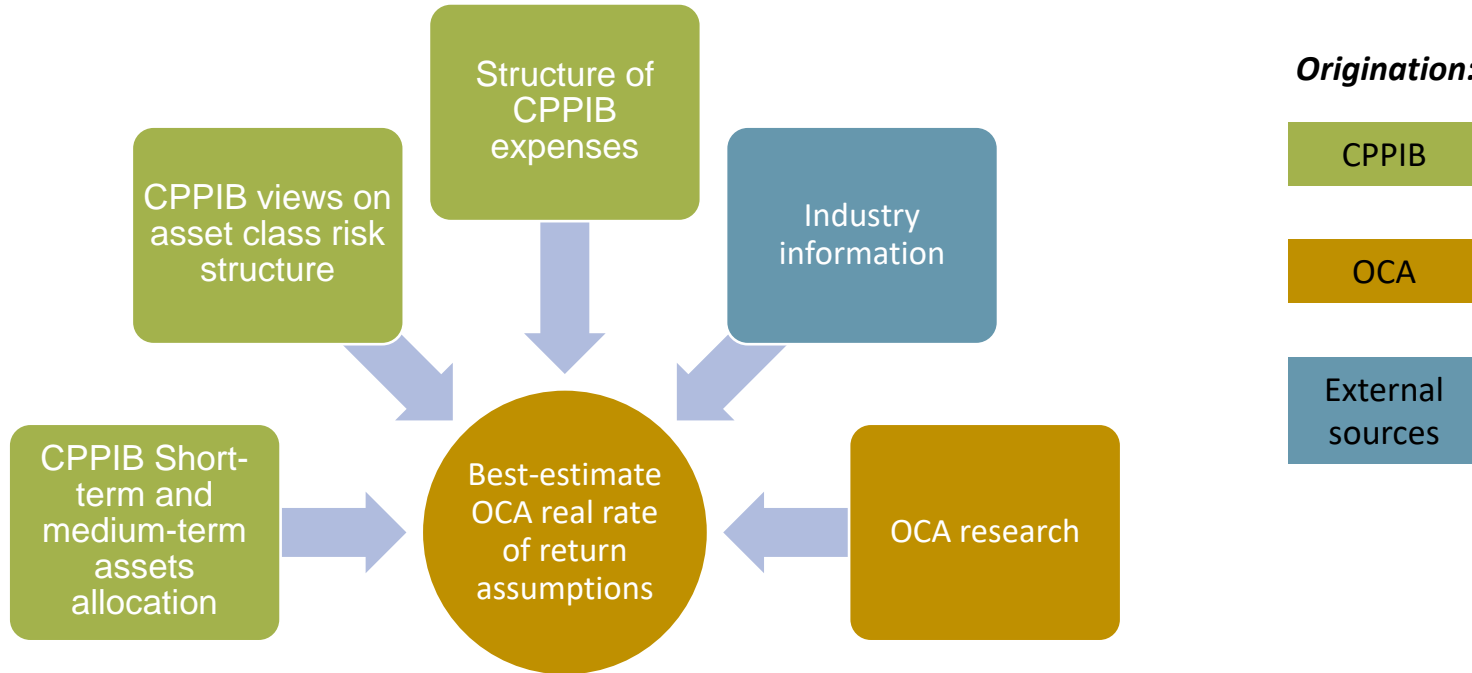
## Alignment of the Reference Portfolio and actuarial review cycles facilitates two-way data and information sharing between the two processes



## OCA projections cover very long time period – at least 75 years

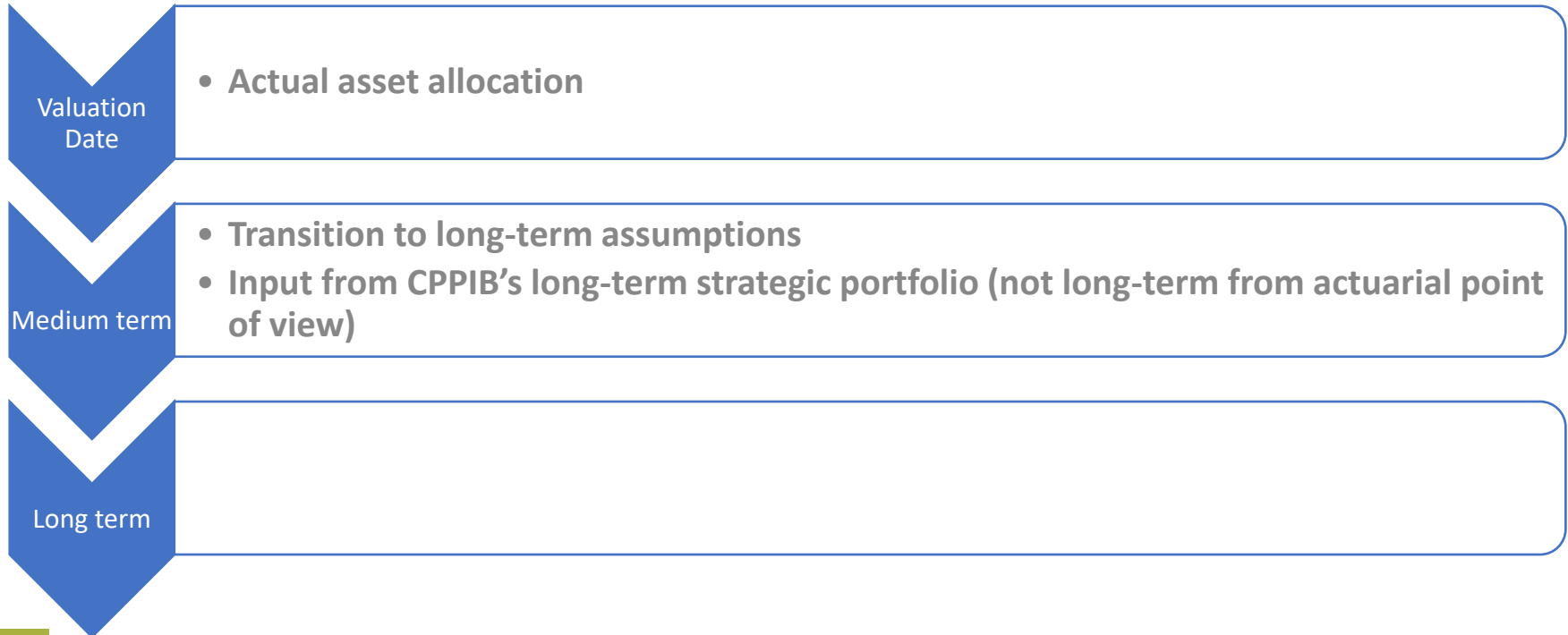
- **Real rate of return on assets projections is OCA best-estimate assumption**
  - Risk-return structure of assets classes
  - Asset allocation
- **Deterministic best-estimate assumptions are complemented by an extensive stochastic stress-testing**

## In the process of preparing the CPP actuarial valuations the OCA needs input from the CPPIB





# OCA dynamic asset allocation approach – projections over long time horizon



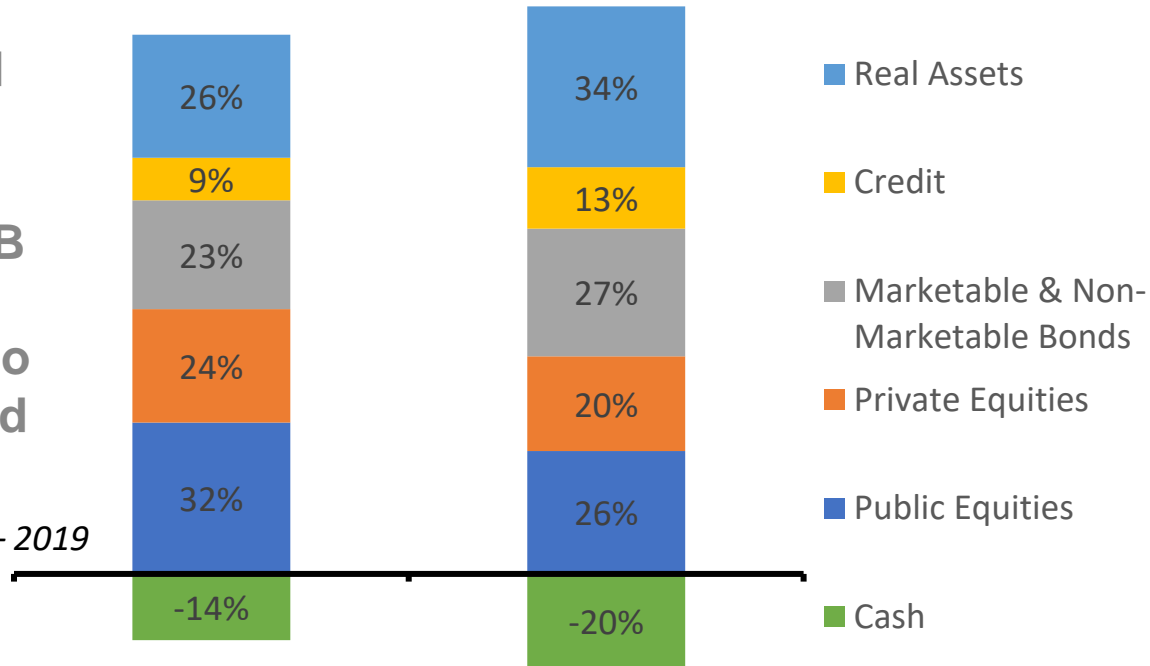
# CPPIB Actual and Strategic Portfolios (Base CPP) for CPP30

**Actual Portfolio – Dec. 2018**

**CPPIB Strategic Portfolio (2025+)**

Asset classes and allocations as at valuation date are aligned with CPPIB (level of risk of Reference Portfolio 85 equities/15 fixed income)

Source: CPP Investments – 2019 Annual Report



# OCA dynamic asset allocation approach – projections over long time horizon

Valuation  
Date

- Actual asset allocation

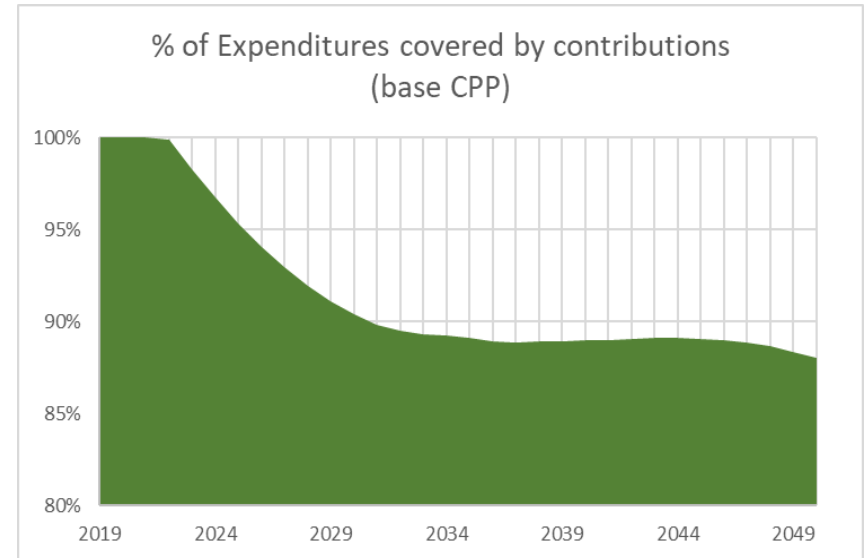
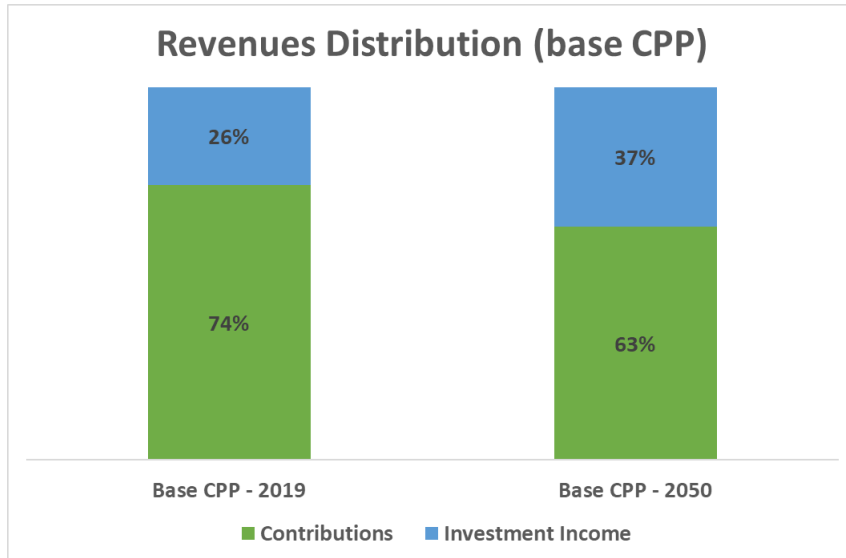
Medium term

- Transition to long-term assumptions
- Input from CPPIB's long-term strategic portfolio (not long-term from actuarial point of view)

Long term

- Recognize financing objectives of the Plan
- Assume that assets are invested with the view to support the stability and the sufficiency of contribution rates (level of risk)

# By the design of the base CPP financing, investment income increases in importance as a source of revenues



Source: 30<sup>th</sup> CPP Actuarial Report

# Long-term risk/return trade-off

## ■ Stability

- Higher reliance on investment income for financing the Plan suggests higher impact of market volatility on the stability of contribution rate

## ■ Sufficiency

- In order for the legislated contribution rate to be sufficient, a certain level of investment income is required

## ■ Gradual decrease in equity allocation is assumed

- Consistent with CPPIB's optimal control rule solution (slide 12)

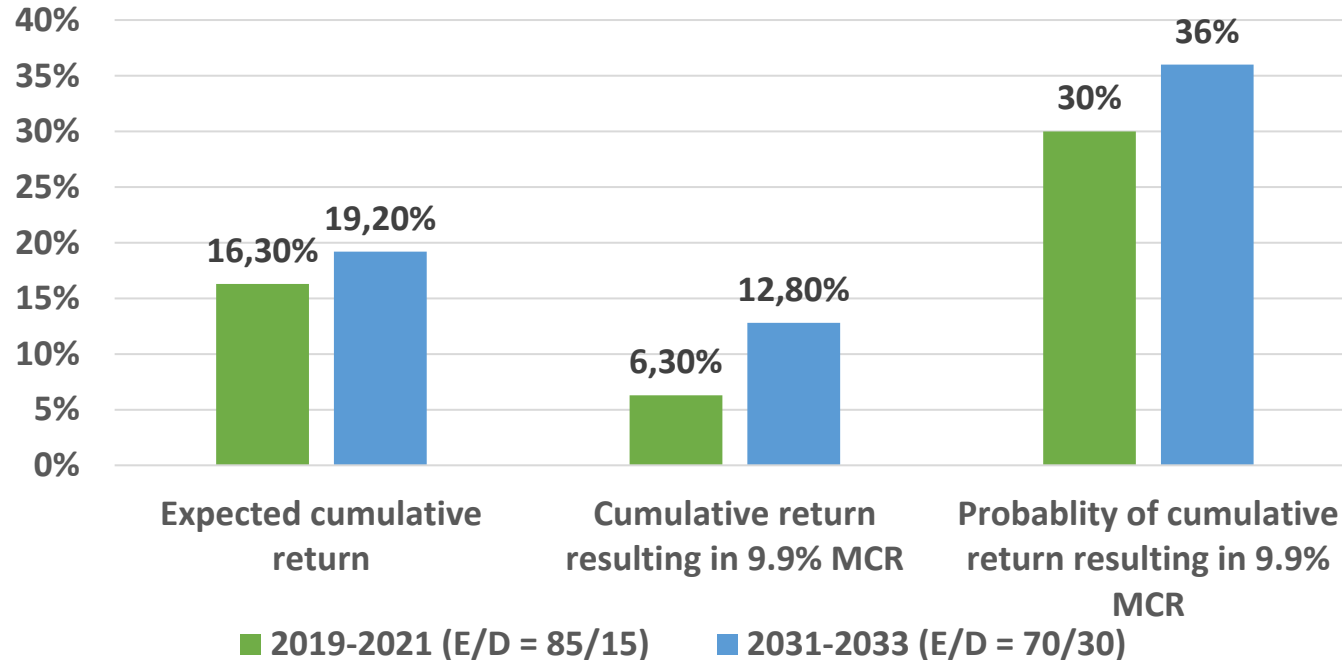
### Base CPP risk/return trade-off (percentages)

Hypothetical Reference Portfolio		Expected One-Year Standard Deviation	Minimum Contribution Rate
Equity	Debt		
85	15	14.0	9.41
70	30	10.7	9.72
50	50	6.6	10.29

*Current base CPP legislated rate: 9.9%*

*Source: 30<sup>th</sup> CPP Actuarial Report*

# Risk of MCR Reaching Legislated Rate (Base CPP)

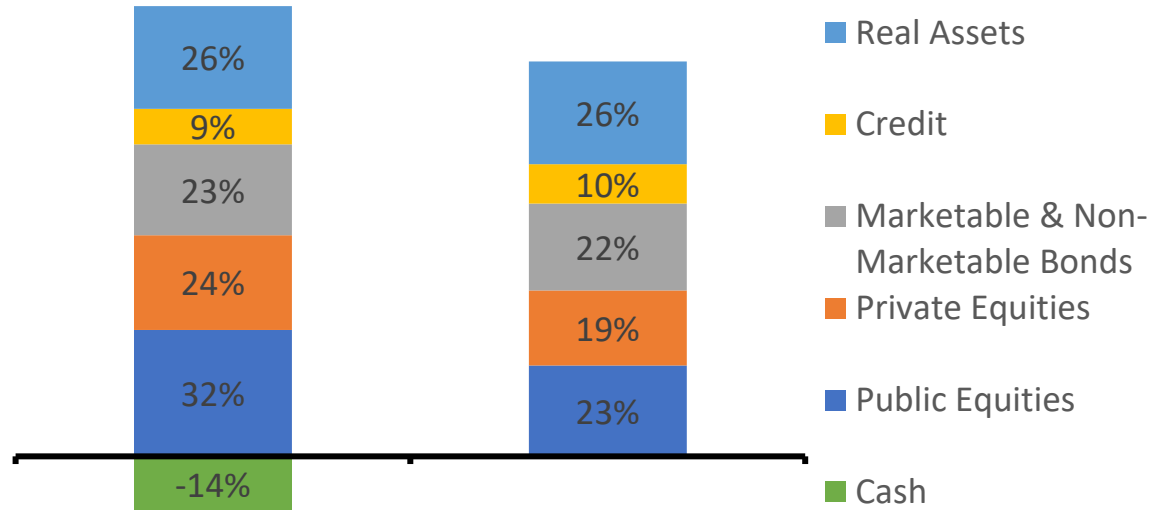


Source: 30<sup>th</sup> CPP Actuarial Report

# OCA asset allocation assumption –CPP30 (base CPP)

**Actual Portfolio – Dec. 2018**

**Ultimate asset allocation - OCA**



## Conclusion

- **CPP legislation clearly defines distinct roles for the actuarial and investment functions**
- **Mutual communication of data and underlying processes facilitates the ability of the OCA and CPPIB to meet their respective mandates in the service of the CPP**
- **Specific features (e.g., long investment horizon, target risk, Open Group balance) are reflective of the long-term and social insurance nature of CPP and its funding**





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# Questions and Answers

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