The Alberta Pension Advantage?

A Quantitative Analysis of a Separate Provincial Plan

Trevor Tombe (University of Calgary) October 2023

Seminar, University of Alberta

Rising interest an Alberta Pension Plan

- Long history (explicitly since 1982; speculation in 1965)
- CPP reforms in late-1990s increased interest
- Budget 2000 featured some analysis; ultimately abandoned
- Rising tensions with Ottawa post-2015 revived interest

pension plan for Alberta?

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How closely. If at all, have you been following news and information about the Alberta government's plan to withdraw Alberta from the Cacada Pension Plan and establish a separate public

• Rising tensions with Ottawa post-2015 revived interest



WITHDRAW FROM CANADA PENSION PLAN – GOOD OR BAD IDEA? BY AGE GROUP IN ALBERTA

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Fair Deal Panel (May 2020), Recommendation 13: Withdraw from CPP

Government of Alberta Study by LifeWorks

- a. Sustainable contribution rate: 5.9 percent
- b. Total employee+employer savings: \$5 billion per year
- c. Assets transferred from CPP in 2027: \$334 billion
- d. Increased CPP contribution rate: 10.5 percent

Core Intuition of Pension Sustainability Analysis





Source: 31st Actuarial Report of the CPP, Chart 15

This Paper

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Key Insights:

- a. Clarifying the nature of pension sustainability analysis
 - Simple and (to my knowledge) novel algebra
- b. Transfer of CPP assets is highly uncertain
 - The paper provides the most detailed interpretation to date
- c. Modest potential benefits of a separate plan (1.3% lower rate)
 - Equivalent to 0.4-0.5% higher implied return on contributions
- d. Quantitatively important risks of a separate plan
 - New investment risk results relevant for smaller plans like APP

Canada/Québec Pension Plan: OSFI (2021), Retraite Québec (2021) Alberta Pension Plan:

- Emery and McKenzie (2000) APP contribution rate of 8.15%
- Robson (2000) APP contribution rate of 7.8-9.11%
- Brown (2000); Vaillancourt (2000)
- Alberta (2000): "potential advantage of an APP would have to be weighed against a number of complex and difficult issues"

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Recent work that has revived interest:

- Clemens et al. (2019) APP contribution rate of 5.9%
- "Fair Deal Panel" relies heavily on this paper
- LifeWorks (2023) APP contribution rate of 5.9%

The Canada Pension Plan: A Primer

The Evolution of Canada's Pension Systems



A long and difficult road for policy makers. But CPP today is a secure and sustainable public pension system.

Basic features of the plan are fairly simple:

- Two parts: "base" and "additional" CPP. I focus on base.
 - Base is partially funded; additional is fully funded
- Base contribution rate: 9.9%
- Pensionable earnings: \$3,500 to \$66,600 (in 2023)
- Benefits indexed to inflation (annually)
- · Supplementary benefits: survivors, children, death, disability

Benefits: (One-quarter of average maximum pensionable amount over five years prior to retirement) \times (earnings relative to maximum over ~85% of working life)

• New benefit value (2023): \$1,300 per month max; \$700 average

		Billions of Dollars (\$)					
Year	Rate (%)	Contri- butions	Expen- ditures	Net Flow	Assets (Dec 31)	Invest. Income	A/E
1970	3.6	0.8	0.1	0.7	3.6	0.2	24.1
1990	4.4	7.9	10.4	-2.5	40.7	4.4	3.5
2000	7.8	20.0	19.7	0.3	47.5	4.4	2.3
2010	9.9	35.9	32.0	3.9	142.5	11.8	4.2
2020	9.9	52.8	51.3	1.5	474.9	51.3	9.0
2025 *	9.9	70.3	69.3	1.0	600.2	33.8	8.2
2040	9.9	124.2	134.4	-10.3	1,326.7	76.4	9.5
2050	9.9	176.7	197.2	-20.5	2,198.7	126.6	10.7
2100	9.9	928.5	1,246.8	-318.2	17,024.5	982.4	13.2

CPP Sustainability Improving Over Time





Source: Chief Actuary of Canada, various CPP actuarial reports.

Spatial Redistribution in the CPP?





Source: LifeWorks (2023)

Spatial Redistribution in the CPP?

Figure 4: Net CPP Contributions, Raw and Adjusted (2018)



Note: Displays the net per capita CPP contributions for each included province, both unadjusted and controlling for selected individual characteristics, as well as the 95 percent confidence intervals for the adjusted estimates.

Source: Author's calculations using SPSD/M version 30.0 microdata.

Simple Algebra of Pension Sustainability

Relationship to Public Debt Sustainability Analysis?

In the context of public debt sustainability, "fiscal adjustments" are

Maintaining a stable debt/GDP ratio

$$\boldsymbol{f} = \boldsymbol{d}_{\mathrm{O}} \times \left(\frac{\boldsymbol{r} - \boldsymbol{g}}{1 + \boldsymbol{g}}\right) - \overline{\boldsymbol{p}}$$

where \overline{p} is the average primary balance and g is GDP growth

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In a **pension plan** context, the **minimum contribution rate** would be

Maintaining a stable asset/earnings ratio

$$\mathbf{c} = \overline{b} - a_{\mathrm{O}} \times \left(\frac{r-g}{1+g}\right)$$

where \overline{b} is the average pay-as-you-go rate and g is earnings growth

Static world: Total contributions $(c \times W)$ equal total benefits (B)

 $\Rightarrow c^* = B/W$

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With demographics: Employment rate *e*, wages *w*, retiree share *s*, and average benefits *b*.

$$\Rightarrow c^* = (b \times s)/(w \times e)$$
$$= \left(\frac{b}{w}\right) \times \left(\frac{s}{e}\right)$$

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Add dynamics: Discount rate $\varphi_t = \prod_{i=1}^{t} (1 + r_i)$

$$c^* = \frac{\sum_{t=1}^T \varphi_t^{-1} B_t}{\sum_{t=1}^T \varphi_t^{-1} W_t} = \frac{P V_T^B}{P V_T^W}$$

Plan asset levels evolve over time

$$A_t = A_{t-1}(1+r_t) + cW_t - B_t$$

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$$\begin{aligned} A_t &= A_{t-1}(1+r_t) + cW_t - B_t \\ \Rightarrow A_T &= A_0 \times \varphi_T + \varphi_T \left(\sum_{t=1}^T \varphi_t^{-1} cW_t - \varphi_t^{-1} B_t \right) \end{aligned}$$

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$$\Rightarrow c \times PV_T^W = PV_T^B - (A_0 - A_T / \varphi_T)$$

Intuition: Some assets $(A_0 - A_T / \varphi_T)$ can cover expenditures; then contributions $(c \times PV_T^W)$ make up the rest.

• How much depends on your desired future A_T

Minimum contribution rate: Assets relative to expenditures at *T* (A_T/B_T) will be the same as some initial year (A_0/B_0)

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Very long-run: $c^* \rightarrow \frac{PV_T^B}{PV_T^W} \left(1 - \frac{A_0}{PV_T^B}\right)$ if interest rates are high enough

Canada Pension Plan, 2025-2084:

- PV earnings: \$23.8 trillion
- PV expenditures: \$2.7 trillion
- Relative expenditure growth: 31.1%
- Assets: \$600 billion

$$\Rightarrow \text{Minimum contribution rate: } \frac{2.7}{23.8} \left(1 - \frac{0.6 \times (1 - 0.311)}{2.7} \right) = 0.095$$

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Clemens et al. (2019): AB was 16.5% of earnings and 10.6% of CPP expenditures, so an APP minimum contribution rate is:

$$0.095 \times \frac{0.106}{0.165} = 0.061$$
 (w/ some adj. for assets, leading to 5.9%)

In the model to come, I find:

- PV earnings in Alberta is 18.4 percent of CPP
- PV expenditures in Alberta is 15.8 percent of CPP

An APP and a CPP-ex-AB depend on a comparison of these PVs

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What happens if Alberta leaves CPP? (Abstracting from asset split)

$$\frac{c_{CPP,New}^*}{c_{CPP,Old}^*} = \frac{1 - 0.158}{1 - 0.184} = 1.032 \implies c_{CPP,New}^* = 0.098$$

$$\frac{c_{APP}^*}{c_{CPP,Old}^*} = \frac{0.158}{0.184} = 0.86 \implies c_{APP}^* = 0.082$$

Definition: An asset split is neutral if

$$\left(1 - \frac{A_{\mathsf{O}}(1 - \varphi_{\mathsf{T}}^{\mathsf{B}}/\varphi_{\mathsf{T}})}{\mathsf{PV}_{\mathsf{T}}^{\mathsf{B}}}\right)$$

is the same in both APP and CPP-ex-AB systems.

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is the same in both APP and CPP-ex-AB systems.

This implies,

$$\left(\frac{A_{\rm o}^{\rm AB}}{A_{\rm o}^{\rm RoC}}\right) = \left(\frac{PV_{\rm T}^{\rm AB,B}/(\varphi_{\rm T}-\varphi_{\rm T}^{\rm AB,B})}{PV_{\rm T}^{\rm RoC,B}/(\varphi_{\rm T}-\varphi_{\rm T}^{\rm RoC,B})}\right),$$

which (it turns out) implies 19.7 percent of CPP assets for APP

Model
Demographic Projections

A population transition matrix A and migration vector M

- Two-sex Leslie model with age-specific fertility rates
- Sex- and age-specific survival and migration probabilities
- · Mortality improvements over time

 $\mathbf{P}' = \mathbf{A} \cdot \mathbf{P} + \mathbf{M}$

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A population transition matrix A and migration vector M

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	Population	Persons 18-64	Male Life	Female Life
Year	(Millions)	per person 65+	Expectancy	Expectancy
2030	5.1	3.4	81.6	85.5
2050	6.8	2.8	83.3	86.9
2070	8.7	2.7	84.8	88.1
2090	11.2	2.6	86.2	89.2

 $\mathbf{P}' = \mathbf{A} \cdot \mathbf{P} + \mathbf{M}$

Intial parameters:

- Number of APP contributors: 16% of CPP in 2025
- Number of APP beneficiaries: 13% of CPP in 2025
- Alberta new benefit levels: 5% higher than CPP in 2025

Baseline assumptions:

- Inflation: 2%
- Labour productivity growth: 0.9%
- Earnings-distribution: stable
- Non-retirement benefits: 1.7% of earnings
- Operating expenditures: 0.1% of earnings
- Mortality improvement rate: 0.8%
- Real investment returns: 4%
- Fertility rate: 1.75
- Net migration rate: 1.0%

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- Operating expenditures: 0.1% of earnings
- Mortality improvement rate: 0.8%
- Real investment returns: 4% (LifeWorks: 3.7%)
- Fertility rate: 1.75 (LifeWorks: 1.5)
- Net migration rate: 1.0% (LifeWorks: 0.7%)

Base CPP assets in 2025 projected to be approximately \$600 billion

The *Canada Pension Plan Act* governs the assets that are transferred to a separating province with a comparable plan

... but it is unclear 🛛 😀

For Alberta today, this is a roughly \$200 billion problem!

Section 113(2) of the CPP Act: A Four-Step Procedure

- ... shall be calculated by the Minister of Finance as the amount obtained by adding
 - (a) the total amount of all contributions credited to the Canada Pension Plan Account and the Additional Canada Pension Plan Account, to the day on which the regulation referred to in subsection (1) became effective, in respect of employment in that province or in respect of self-employed earnings of persons resident in that province, and
 - (b) the part of the net investment return of the Investment Board and all interest credited to or accrued to the credit of the Canada Pension Plan Account and the Additional Canada Pension Plan Account, to the day on which the regulation referred to in subsection (1) became effective, that is derived from the contributions referred to in paragraph (a),

and subtracting from the total so obtained

- (c) such part of all amounts paid as or on account of benefits under this Act as would not have been payable under this Act if that province had been a province described in paragraph (a) of the definition province providing a comprehensive pension plan in subsection 3(1), and
- (d) the part of the costs of administration of this Act, to the day on which the regulation referred to in subsection (1) became effective, that is equal to the proportion of those costs that the total amount of the contributions referred to in paragraph (a) is of the total amount of all contributions credited to the Canada Pension Plan Account and the Additional Canada Pension Plan Account to that day.

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Section 113(2), Paragraph (a)

... the total amount of all contributions credited to the Canada Pension Plan Account and the Additional Canada Pension Plan Account, to the day on which the regulation referred to in subsection (1) became effective, in respect of employment in that province or in respect of self-employed earnings of persons resident in that province

Practical challenge: public data based on residence

• Alberta, 1966-2025: \$203 billion

Section 113(2), Paragraph (b)

... the part of the net investment return of the Investment Board and all interest credited to or accrued to the credit of the Canada Pension Plan Account and the Additional Canada Pension Plan Account, to the day on which the regulation referred to in subsection (1) became effective, that is derived from the contributions referred to in paragraph (a)

Practical challenge: publicly available contribution data based on residence (same problem as paragraph (a))

Conceptual challenge: What does "derived from" mean?

Section 113(2), Paragraph (b)

... the part of <u>THE NET INVESTMENT RETURN</u> of the Investment Board and all interest <u>CREDITED TO</u> or accrued to the credit of the Canada Pension Plan Account and the Additional Canada Pension Plan Account, to the day on which the regulation referred to in subsection (1) became effective, that is derived from the contributions referred to in paragraph (a)

Practical challenge: publicly available contribution data based on residence (same problem as paragraph (a))

Conceptual challenge: What does "derived from" mean?

The original CPP was very different

- Excess contributions over revenues loaned to provinces
- Total bonds purchased from each province was equal to their contribution shares
- Ten-year rolling average

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The "part of all interest credited to the CPP Account ... that is derived from contributions" was therefore equal to that province's (10-year rolling average) contribution share

- Alberta, 1966-2021: 15.5-16% \rightarrow \$85 billion

Hon. Mr. MCCUTCHEON: It hardly is an administrative difficulty that sets the formula for investment; in other words, you are going to keep nine sets of books. Mr. BRYCE: Buried away in the computer will be all these records. Stored in the memory of the computer will be sufficient information to constitute these accounts if necessary, but we would not propose to keep these accounts in our regular books.

Source: Joint Committees, 26th Parliament, 2nd Session : Special Joint Committee on Canada Pension Plan, vol. 1, 401-402. Hon. Mr. MCCUTCHEON: I take it you are going to charge your administration on a general pro rata basis?

Mr. BRYCE: Yes. Now, to complete my answer to your question, there may be some difficulties where we have different rates of interest owing to the fact that we have to allow the interest payable on the operating balance, so to speak, and things of this sort, but I assume we can resolve this with reasonable equity.

Hon. Mr. MCCUTCHEON: By and large the interest will be charged on what I might call the net balance and payments in and payments out, like administration charges.

Mr. BRYCE: Yes.

Mr. CHATTERTON: But the amount that is to be paid to the provincial government, except in so far as interest is concerned, does not depend on the payments out.

Mr. BAYCE: Mr. Thorson is coming to that.

Source: Joint Committees, 26th Parliament, 2nd Session : Special Joint Committee on Canada Pension Plan, vol. 1, 401-402.

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... alas, he never did

Mr. THORSON: From the total of the two amounts described in paragraphs (a) and (b) there would be subtracted, in arriving at the amount to be transformed, two separate amounts described in paragraphs (c) and (d)

Paragraph (c) describes the amount of the benefits that have been paid but that would not have been paid if the province in question had been a province having its own pension plan from the inception of the federal plan.

Paragraph (d) describes part of the cost of administration of the act up to the time when the regulation became effective, computed according to the proportion—such costs of administration up to that time that the total of the contributions referred to in paragraph (a)—that is to say, the contributions that derive from employment or self-employed earnings in that province —is of the total amount of all contributions credited to the account up until the same day.

Source: Joint Committees, 26th Parliament, 2nd Session : Special Joint Committee on Canada Pension Plan, vol. 1, 401-402.

Section 113(2), Paragraph (c)

... such part of **all amounts paid as** as or on account of **benefits** under this Act as would not have been payable under this Act if that province had been a province described in paragraph (a) of the definition province providing a comprehensive pension plan in subsection 3(1) **[to recipients of the separating province]**

Practical challenge: publicly available expenditure data based on residence (bigger problem than paragraph (a))

• Alberta, 1966-2025: \$136 billion

Section 113(2), Paragraph (d)

the part of the costs of administration of this Act, to the day on which the regulation referred to in subsection (1) became effective, that is equal to the proportion of those costs that the total amount of the contributions referred to in paragraph (a) is of the total amount of all contributions credited to the Canada Pension Plan Account and the Additional Canada Pension Plan Account to that day.

Practical challenge: Same as paragraph (a). But conceptually easy.

• Alberta, 1966-2025: 16% \rightarrow \$2 billion

The amount of assets transferred to Alberta A_i is given by:

where C_i is total contributions by Albertans, B_i is total plan benefits to Albertans, *I* is the total net investment income credited to the CPP Account, and *O* is total operating costs of the CPP. The terms r_i and o_i are the share of total net investment income and operating costs The amount of assets transferred to Alberta A_i is given by:

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This is <u>VERY</u> different than analysis preferred by the Government of Alberta, which adopts a method that deviates from the text

Uncertainties in the Asset Split Estimate

Material uncertainty in two main components of formula

- Contributions only known by residence
- Benefits by province not tied to historical contributions by province of work

Some evidence that Alberta workers who retire elsewhere receive larger CPP benefits (roughly 5%) than non-Albertan workers who move to retire in Alberta

Some discretion to federal Minister of Finance

Baseline estimate assumes for 20%

• In line with stated intent of Pearson's government (asset split related to future obligations), although that is likely irrelevant

But What About John Robarts!?

Robarts wanted an option to leave and

... be placed in precisely the same financial position as if [Ontario] had operated an identical but separate plan from the outset... [this] was accepted and Bill C-136 allows such opting out with transfer of assets.

Result: \$300 billion in 2025

Intuitively correct originally. Is it correct anymore? Does it even matter?



Source: Legislative Assembly of Ontario

Quantitative Results

Projected APP Asset to Expenditure Ratio

Figure 5: Ratio of APP Assets to Expenditures, 2025 to 2100



Note: Displays the projected ratio of total APP assets to expenditures from 2025 to 2100 using the estimated minimum contribution rates for APP and CPP.

	Real Investment Returns				
Scenario	3%	3.5%	4.0%	4.5%	5%
Baseline	9.4	8.8	8.2	7.6	7.1
National average fertility rate	9.5	9.1	8.4	7.8	7.2
National average net migration rate	9.8	9.2	8.5	7.8	7.2
Zero net migration	10.5	9.7	9.0	8.2	7.5
No mortality improvements	8.5	8.0	7.5	6.9	6.4
Mortality improvement rate doubles	10.1	9.5	8.8	8.2	7.6
Five percent higher expenditures	9.8	9.2	8.6	8.1	7.5
Ten percent higher expenditures	10.3	9.7	9.1	8.5	7.9
Initial assets at \$90 billion	9.6	9.1	8.6	8.2	7.7
Initial assets at \$150 billion	9.3	8.5	7.8	7.1	6.4
Initial assets at \$300 billion	8.6	7.2	5.8	4.5	3.2
GoA Scenario	8.2	6.6	5.0	3.4	1.9

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Zero net migration	10.5	9.7	9.0	8.2	7.5
No mortality improvements	8.5	8.0	7.5	6.9	6.4
Mortality improvement rate doubles	10.1	9.5	8.8	8.2	7.6
Five percent higher expenditures	9.8	9.2	8.6	8.1	7.5
Ten percent higher expenditures	10.3	9.7	9.1	8.5	7.9
Initial assets at \$90 billion	9.6	9.1	8.6	8.2	7.7
Initial assets at \$150 billion	9.3	8.5	7.8	7.1	6.4
Initial assets at \$300 billion	8.6	7.2	5.8	4.5	3.2
GoA Scenario	8.2	6.6	5.0	3.4	1.9

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Zero net migration	10.5	9.7	9.0	8.2	7.5
No mortality improvements	8.5	8.0	7.5	6.9	6.4
Mortality improvement rate doubles	10.1	9.5	8.8	8.2	7.6
Five percent higher expenditures	9.8	9.2	8.6	8.1	7.5
Ten percent higher expenditures	10.3	9.7	9.1	8.5	7.9
Initial assets at \$90 billion	9.6	9.1	8.6	8.2	7.7
Initial assets at \$150 billion	9.3	8.5	7.8	7.1	6.4
Initial assets at \$300 billion	8.6	7.2	5.8	4.5	3.2
GoA Scenario	8.2	6.6	5.0	3.4	1.9

	Real Investment Returns				5
Scenario	3%	3.5%	4.0%	4.5%	5%
Baseline	9.4	8.8	8.2	7.6	7.1
National average fertility rate	9.5	9.1	8.4	7.8	7.2
National average net migration rate	9.8	9.2	8.5	7.8	7.2
Zero net migration	10.5	9.7	9.0	8.2	7.5
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- Especially relevant if APP funds used for local investments

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Volatility is critical for long-run projections

Portfolio composed of 70/30 equity/debt

- One-year standard deviation in returns of 10.7%
- Large variation relative to expected returns of 6%

Less well known: positive skew in long-run compound returns

At 7% return, will take ~ 10 years to double [ln(2)/ln(1.07)]

Things are different with stochastic returns. Consider an iid log-normal distribution of returns

- With 17% annual volatility (U.S. equity): 50% probability of doubling in 13 years, 30% prob. in 20 years
- With 30% annual volatility (emerg. mkt.): 50% probability of doubling in 22 years, 30% prob. in 59 years

Bessembinder (2018), Farago and Hjalmarsson (2023)

- Example: returns either -20% or 20% with equal prob.
- Two-period mean is 0%; but two-period median is -4%

APP Investment Risks Are Large

Figure 6: Distribution of Minimum Contribution Rates



Note: Displays the projected minimum contribution rates for a separate APP under a range of investment returns calibrated to reflect historical experiences. Based on one million simulations of normally distributed annual returns with a six percent nominal return and 10.7 percent standard deviation.

Simulate **one million draws from normally distributed one-year returns**, mean 6% and standard deviation of 10.7% (as in CPP)

• Median annual compound rate of return: 5.5%

Critical risk metrics for an Alberta Pension Plan:

- Probability minimum contribution rate exceeds 8.2%: 67%
- Median minimum contribution rate by 2084: 8.9%
- Median minimum contribution rate for infinite horizon: 9.6%
Nominal Internal Rates of Return, CPP vs APP

Implied rate of return to contributor depends on future benefits relative to contributions

For someone with maximum pensionable earnings:

Age at Death	Canada Pension Plan	Alberta Pension Plan
70	-3.5%	-2.6%
75	0.7	1.4
80	2.5	3.0
85	3.5	4.0
90	4.1	4.5
95	4.5	4.9
100	4.8	5.2

Another Way to Quantify the Benefits

At an 8.2% minimum contribution rate, room for:

- Boost benefit spending by 5 percent,
- Lower business contribution rate by 0.5 points, and
- Lower worker contribution rate by 0.5 points.

Maximum monthly savings per worker: \$26

- Can be viewed as the cost of insurance against interprovincial migration risk and elevated demographic/investment risks
- Present value over lifetime: \$12,000

Conclusion

The paper provides an updated analysis on the financial viability of an **Alberta Pension Plan**

- While feasible, **benefits are modest**, and increasing benefits while reducing contributions may be difficult
- Division of assets from the Canada Pension Plan is problematic due to the vagueness of the Act
- An APP is more sensitive to underlying migration, mortality, and investment risks than CPP
- An APP minimum contribution rate is 8.2%, but with investment risks there is a **1/3 probability the MCR exceeds 9.5%**

Potential benefits of an APP must be weighed against the risks