The Alberta Pension Advantage? A Quantitative Analysis of a Separate Provincial Plan

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Abstract

A separate Alberta Pension Plan (APP) has gained renewed attention. This paper assesses the long-run viability of such a plan, using both a detailed quantitative model and simple, intuitive approaches. I find only modest scope for changes in benefit levels and contribution rates relative to the Canada Pension Plan (CPP). Specifically, I estimate an APP minimum contribution rate of 8.2 percent, compared to the CPP's 9.5 percent. With the same 0.4 percentage point cushion as in the CPP, the APP legislated contribution rate would then be 8.6 percent. This is in sharp contrast to a recent government-commissioned report, which found a contribution rate of 5.9 percent (LifeWorks, 2023). I explain this disparity and show that much depends on how one interprets imprecise language in the CPP Act. I also explore several relevant risks. Alberta's positive net migration flows, for example, account for nearly two-thirds of its pension advantage. And, depending on the time horizon, investment risks may eliminate its entire advantage. Overall, this paper not only provides an updated foundation to evaluate the strengths and weaknesses of an APP but also to understand pension sustainability more broadly.

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1 Introduction

Long a policy advanced by those seeking greater provincial autonomy for Alberta within (or, for some, separate from) Canada, an Alberta Pension Plan (APP) has returned to the centre of provincial policy debates. "Determine whether a referendum should be held to establish an Alberta Pension Plan that will increase pension benefits for seniors [and] reduce premiums for workers," read the July 13, 2023 mandate letter to Alberta's Minister of Finance (Alberta, 2023b). To that end, Alberta launched a public consultation in late September, 2023, based on a favourable government-commissioned report (LifeWorks, 2023). This continues a decades-long debate. After candidates for the Western Canada Concept party first put it forward in the 1982 provincial election, the issue had grown in prominence by the turn of the century, following large-scale (and in certain quarters, unpopular) reforms to the Canada Pension Plan (CPP). To some, an APP is a critical component of the so-called "Alberta Agenda" (Harper et al., 2001). To others, it is a gamble that exposes Albertans to a risky and uncertain future. Given the significance of this policy decision, and its potentially irreversible nature,[1] careful examination and study is required. To that end, this paper offers a new financial assessment of a separate provincial plan for Alberta. Using a detailed model of a hypothetical APP starting in 2025,[2] I find arguably modest scope for material changes in benefit levels and contribution rates. In addition, I quantify several relevant risks that such a plan would pose, including investment returns, uncertainty around initial assets, changes in migration and fertility rates, and more. I also clarify many of the underlying issues using simple and transparent algebra.

Before proceeding, some background may be helpful. The CPP is a partially funded system that operates throughout Canada in all provinces except Québec, which has a comparable provincial program. Following reforms in the late 1990s, which I describe in Section 2, the plan's financial foundation is strong. To ensure this, the CPP contribution rate for employees and employers is evaluated against a best-effort assessment of the lowest constant rate consistent with the long-run sustainability of the plan. This has been implemented in practice by estimating the rate that ensures the projected ratio of assets to expenditures does not decline over some time horizon. Specifically, the rate that ensures the CPP asset to expenditure ratio is projected to be the same in 2084 as in 2034. This is known as the "minimum contribution rate" (MCR), which will be the primary focus of this paper's analysis of a separate Alberta plan. Today, the CPP's minimum contribution rate is 9.54 percent (OSFI, 2021).[3] This is lower than the current legislated contribution rate of 9.9 percent, and therefore the plan is deemed sustainable. Indeed, this implies projected plan assets will grow faster than expenditures, which provides a cushion against future adverse risks. As detailed later, this minimum rate depends crucially on a comparison of the present values of future plan benefits

[1] While opting out of the CPP is provided for in law, there are no provisions for a province to join it.

[2] This date is selected for illustrative purposes only. The start date of a separate provincial plan would be much later, especially in light of the Government of Alberta's commitment to hold a referendum prior to enacting any plan. The Canada Pension Plan Act also requires a three-year notice be given before introducing a comparable plan.

[3] This applies to Base CPP only, which is the main pension benefit that accounts for most of the current CPP. I provide more details behind the history and functioning of the CPP in Section 2.

and pensionable earnings. Demographics is particularly important, since a younger population will tend to have a relatively higher present value of earnings compared to benefits, all else being equal. Québec illustrates this issue well. The CPP and Québec Pension Plan (QPP) originally had the same contribution rate. But as Québec aged more quickly, the QPP's minimum contribution rate increased to approximately one percentage point higher than the CPP's today (Retraite Québec, 2021) and, following reforms adopted in 2011, its legislated rate is 0.9 percentage points higher.[4] For Alberta, its younger population (its median age is three years less than the rest of the country) means a lower contribution rate is possible.

To quantify this, I build a rich model of a separate APP. I clarify the underlying intuition behind the analysis using simple and transparent algebra, which I present in section 3. The results of the simple model align closely with those of the full model, although both require projections of provincial mortality, fertility, migration, earnings, investment returns, and more. To that end, I produce new demographic projections for Alberta using common methods and the latest data. These allow me to project far beyond what is normally available from either Statistics Canada or the Government of Alberta. Where possible, assumptions mirror those used to assess the sustainability of the Canada Pension Plan. This includes improvements in mortality rates over time, for example, and real long-run investment returns. The underlying demographic and economic projections for the province form the basis of the present value of APP benefit and expenditure calculations that drive much of the analysis. With this model and these projections, I estimate a minimum contribution rate for a separate APP of 8.2 percent. This is approximately 1.3 percentage points below the Canada Pension Plan's (OSFI, 2021). And with the same 0.4 percentage point cushion as exists in the CPP, the legislated APP contribution rate would be 8.6 percent compared to the CPP's 9.9 percent. This is substantially higher than the 5.9 percent contribution rate that the Government of Alberta suggests may be possible, based on analysis from LifeWorks (2023). My results suggest that the benefits of an APP are arguably modest. For a hypothetical young person earning the maximum pensionable amount, this lower contribution rate (split between employers and employees) increases the implied rate of return on APP contributions by approximately 0.5 percentage points relative to CPP contributions.

These potential gains also come with important tradeoffs,. I therefore quantitatively explore several risk factors. First, investment returns play a crucial role; for every percentage point decrease in real investment returns, the required contribution increases by approximately 1.2 percentage points. A 3.5 percent real return would require a minimum contribution of 8.8 percent. Demographic shocks, such as from migration and fertility rate changes, also have a substantial impact. If Alberta's net migration rate decreases to 0.6 percent, the minimum contribution rate rises to 8.5 percent; with a migration rate of 0.4 percent, it goes up to 8.6 percent. And if positive net migration ceases, then nearly two-thirds of Alberta's pension advantage is eliminated. These risks are important considerations, as the CPP more effectively pools demographic and economic

[4]For a rich comparative exploration of the QPP's place within Canadian federalism, including recent reforms to both QPP and CPP, see Béland and Weaver (2019).

risks than a smaller provincial plan can. Indeed, I find an APP is more sensitive to changes in investment returns and mortality rates than the CPP is. With common assumptions around the volatility of investment returns, I estimate an approximately 37 percent probability that an APP requires a minimum contribution rate above 9.5 percent.

Finally, I quantify the particularly important role of a separate plan's initial assets in its long-run sustainability. Based on an historically grounded interpretation of the CPP Act, along with allowances for limitations in the publicly available data, I use a baseline share of CPP assets given to a separate APP of 20 percent ($120 billion). But if a separate plan were endowed with 25 percent of projected CPP assets in 2025 (i.e., $150 billion), the minimum contribution rate would drop to 7.8 percent. If assets are only 15 percent of the CPP (i.e., $90 billion), the rate increases to 8.6 percent. The asset split is also a key determinant of whether a CPP without Alberta would see an increase in its contribution rates. The loss of a relatively young jurisdiction, combined with the loss of some of its asset holdings, could possibly increase the CPP's contribution rate. I show that this not need be the case. In the baseline scenario, for example, I find the CPP post-separation minimum rate remains below the 9.9 percent legislated rate. But if 22.5 percent or more of projected CPP assets are given to an APP, then I estimate the minimum contribution rate of a CPP without Alberta would exceed the current legislated rate.

Motivated by the importance of initial assets, this paper sheds new light on an underappreciated aspect of the CPP Act's language related to a province's separation from the plan. The section of the Act governing the division of CPP assets (Section 113) is particularly problematic. One key part of that section (paragraph b) states that, among other things, "the part of the net investment return of the Investment Board... that is derived from the contributions" of the withdrawing province are transferred to it. But "derived" is never explicitly defined and there are multiple potential options. Historical context may help. Originally, the CPP only bought provincial bonds in proportion to a rolling average of a province's total CPP contributions. One could therefore apportion net investment returns of the Investment Board based on a separating province's historical contribution shares. I adopt that interpretation, although there are other options.

Premier John Robarts of Ontario, for example, claimed credit for including this clause (Canada, 1964a) and interpreted it differently. The Premier decided to participate in a national pension plan, in part due to his strong support for national unity and stability and a desire to not "impair the principle of national portability of pensions." However, he also wanted an option to leave the CPP and "be placed in precisely the same financial position as if [Ontario] had operated an identical but separate plan from the outset." This, at least according to the Premier's interpretation of events, "was accepted and Bill C-136 [the Act creating the CPP] allows such opting out with transfer of assets."[5] As I discuss in more detail in Section 4.2, this is unlikely to be the actual result of the language in the Act. It may have been language suitable for a plan with minimal accumulated assets invested only in non-negotiable provincial bonds, as I argue, but it may lead to a different

[5]Bill C-75, tabled on March 17, 1964, was the original CPP legislation. It contained no provision for asset splits. Following negotiations with provinces, the government introduced new legislation in Bill C-136.

outcome within the modern CPP. Indeed, were both Alberta and Ontario to withdraw, I estimate this approach would result in more assets be paid than currently exists within the CPP. Despite this potentially absurd outcome, this is the interpretation of the Act adopted by LifeWorks (2023), which suggests 53 percent of the total CPP assets would be transferred to an APP. This large asset transfer is the primary reason for the difference between their 5.9 percent minimum contribution rate and my estimate of 8.2 percent. Perhaps no other single variable matters more for a separate provincial pension plan, so I pay close attention to this in Section 4.2.

This paper also contributes to a broader literature that explores a separate Alberta Pension Plan, although research here has remained relatively inactive for nearly a quarter century. As interest in the subject rose in Alberta in the late 1990s and early 2000s, several researchers explored the topic in detail (Boothe, 2000). Estimates vary on the minimum contribution rate for an APP. Emery and McKenzie (2000) find an 8.2 percent contribution rate could sustain a separate APP. Across a variety of studies, meanwhile, the Government of Alberta suggests a range of between 7.8 and 9.1 percent would be reasonable (Alberta, 2000). There have been considerable economic and fiscal developments since that time, and the rising interest in a separate plan makes an updated and independent assessment valuable. In addition, recent work has suggested that a minimum contribution rate considerably lower than these early estimates may be possible. Specifically, Clemens et al. (2019) estimate a 5.9 percent contribution rate, which was prominently cited by Alberta's Fair Deal Panel (Alberta, 2020). In Section 3, I identify the source of the difference between their estimate and mine.

Several caveats are necessary before turning to the analysis: this paper is not a substitute for more detailed actuarial assessments, which—to be clear—are not yet possible. The publicly available data on the distribution of CPP contributions and benefit expenditures does not provide the individual-level longitudinal data necessary for such an analysis. Instead, I use province-level projections to estimate future financial flows in a separate APP, an approach also necessarily adopted by others in the literature. In a sense, this makes most of the available analysis of an APP akin to treating it (and the CPP) as a tax-and-transfer scheme rather than a pension program. I do not pursue this point further, although I note in several places where the analysis may depend on this. The paper also abstracts from several plan details, such as Additional CPP benefits, and from certain complex risk assessments, such as changes in the shape of the earnings distribution. It nevertheless provides the most solid foundation to date from which one may evaluate the potential strengths and weaknesses of a separate provincial plan, as well as a robust comparison to other existing analyses of the subject. It not only presents the most detailed quantitative modelling of a separate APP available but also provides an intuitive and accessible foundation to understand that framework through some simple algebra. Before turning to that analysis, though, a fuller description of the Canada Pension Plan will help set the stage.

2 The Canada Pension Plan: A Primer

Canada's retirement income system has several pillars. In addition to private pensions and savings, there is a near-universal amount given to elderly individuals through Old Age Security payments. For lower-income individuals, there is also an additional amount through the Guaranteed Income Supplement. Finally, there is an earnings-based defined benefit pension scheme that covers almost all workers and self-employed individuals through the Canada (and Québec) Pension Plan.[6] These plans started in the late 1960s, following several rounds of negotiation between Ottawa and the provinces. Federal jurisdiction in much of this space stems from two constitutional amendments (both Section 94A), one in 1951 granting power to Parliament to pay old-age pensions and another in 1964 expanding this to include supplementary benefits (such as survivors' and disability benefits). Provincial powers to enact their own laws related to old-age pensions remain paramount, so any province can leave the CPP, and Québec opted never to join.

The broad strokes of the CPP are relatively straightforward. Payroll taxes levied on earnings above an initial exemption ($3,500) and below a maximum pensionable amount ($66,600 in 2023) help fund benefits. Contributions are split equally between employees and employers. Retirement benefits in both plans are a function of lifetime earnings. Intuitively, they are set to one-quarter of a retiree's average lifetime earnings, adjusted for changes in the maximum pensionable earnings over time and for allowances to drop certain low-earning periods. More precisely, they are one-quarter of the average maximum pensionable amount over the five years prior to retirement multiplied by the retiree's earnings relative to the maximum over approximately 85 percent of their working life. Benefits are indexed to inflation, so the purchasing power of retiree incomes remains constant. The plan also provides survivors', children's, disability, and death benefits, but we need not concern ourselves with those details here. Finally, beginning in 2019, an enhancement to the CPP gradually provides larger benefits to recipients. This is known as the Additional CPP and will eventually grow to replace one-third of earnings up to a higher maximum pensionable amount. As this enhancement is fully funded, I focus my analysis in this paper on the Base CPP only.

The CPP was initially conceived as a pay-as-you-go system, where contributions by current workers and employers would fund payments to current retirees. But following intensive negotiations, notably with Québec and Ontario, the federal government opted for a slightly higher than necessary contribution rate, with excess amounts loaned to provincial governments at favourable interest rates (Little, 2008). However, as Canada's population aged and the number of beneficiaries grew, even this higher contribution rate was insufficient. Starting at 3.6 percent, it started to gradually increase by 0.2 percentage points per year after 1987 (OSFI, 2021). Despite these increases, plan assets still did not keep up with growing expenditures, which exceeded contributions starting in the early 1980s. The CPP's fifteenth actuarial report, tabled in 1995, projected that the entire CPP fund would be exhausted by 2015 and that contribution rates above 14 percent would soon be necessary. This prompted federal Finance Minister Paul Martin, along with several of his provin-

[6] For a detailed discussion of Canada's retirement income systems, and how it compares to other OECD countries, see Hoffman and Dahlby (2001).

Table 1: Historical and Projected Financial Results of the CPP, Selected Years

Year	Contribution Rate (%)	Billions of Dollars ($)					Asset to Expenditure Ratio
		Contributions	Expenditures	Net Cash Flow	Assets (Dec 31)	Investment Income	
1970	3.6	0.8	0.1	0.7	3.6	0.2	24.1
1980	3.6	2.6	2.0	0.6	18.4	1.5	7.6
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
Projection							
2025 *	9.9	70.3	69.3	1.0	600.2	33.8	8.2
2030	9.9	85.6	89.5	-3.9	791.2	44.8	8.4
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

Note: Displays selected historical results and financial projections for the Canada Pension Plan.

* The year 2025 is selected as the point of departure for a separate APP.

Source: Actuarial Report, Canada Pension Plan as at 31 December 2021 (OSFI, 2021), Tables 10 and 11.

cial counterparts, most notably Alberta's Jim Dinning and Ontario's Ernie Eves, to push forward on fundamental reforms to put the CPP on a sustainable footing (Little, 2008).

Without going into significant detail, the reforms enacted in 1997 modestly decreased the value of benefits, significantly increased the contribution rate, and, most importantly, established the CPP Investment Board to manage plan assets. The board's legislated goal is simple: to achieve the "maximum rate of return, without undue risk of loss," subject to ensuring the CPP can meet its obligations on any given business day (Canada, 1997, s. 5). These changes have been an unqualified success in ensuring the CPP is sustainable for generations to come. I report the historical and projected financial results of the CPP for selected years in Table 1. By 1997, total assets in the CPP declined to the equivalent of only two years of expenditures. As discussed in the introduction, sustainability is evaluated by whether the ratio of assets to expenditures is stable over a long time horizon. Prior to the 1997 reforms, this was clearly not the case. Today, following just over two decades of contributions exceeding expenditures, total CPP assets are now projected to be $600 billion in 2025. And if real investment returns (net of costs) are four percent, they are projected to grow faster than expenditures. The resulting investment income these assets generate compensates for rising expenditures without requiring contribution rate increases.

Before describing methods to analyze pension sustainability, certain broader macroeconomic considerations are also relevant to any discussion of a separate provincial plan. First, labour mobility across jurisdictions is somewhat complicated by multiple plans. But experience with

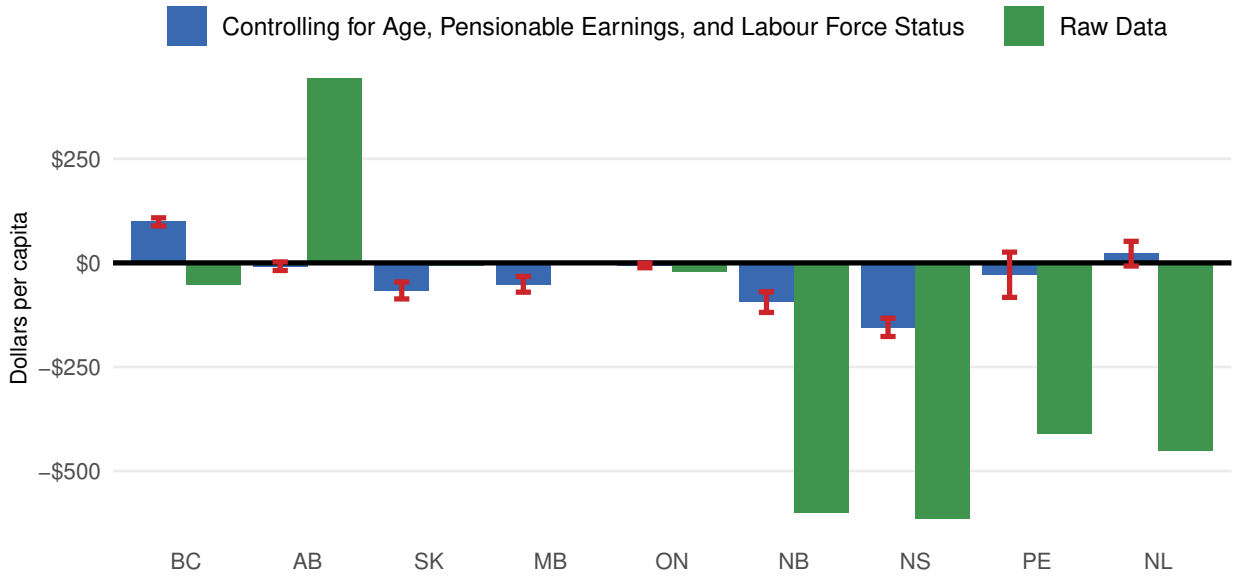
Québec's separate plan shows this is a potentially minor concern. The QPP and the CPP have sharing agreements that coordinate certain administrative aspects of the plans for workers who move in and out of Québec. Only a single payment is received, regardless of how many years one has worked in either jurisdiction. A retiree applies to whichever one they reside in at the time. The benefits are harmonized, so from an individual's perspective it matters little. And the two plans make financial adjustments between themselves to account for such moves. As mentioned in the introduction, however, the Québec plan has a higher contribution rate, so benefits received represent a lower return for workers in that province than elsewhere. I consider implied rates of return explicitly in the quantitative analysis to come.

Second, differences in where contributions are made and benefits received may create fiscal redistribution across provinces. This is a frequently raised issue among proponents of a separate APP. They point to large net financial outflows from Alberta on the order of nearly $4 billion annually in recent years through the CPP (Statistics Canada, 2022a). Importantly, however, even a separate provincial plan would feature some spatial redistribution. A working-age contributor who retires in another province, for example, would still receive APP-funded benefits.[7] And overall, the extent of true spatial redistribution within the CPP is limited. It is modestly redistributive across individuals with different earnings, due to the initial $3,500 basic exemption and certain other features of the plan. It also redistributes between people with different life expectancies since it provides partial insurance against exhausting personal savings. But for two individuals with identical earning profiles and personal characteristics, their places of residence during their working or retirement years (at least among CPP participating provinces) do not affect contributions made or benefits received.

To formally quantify this, I use the microdata from Statistics Canada's Social Policy Simulation Database and Model (SPSD/M, version 30.0). In 2018, the average per capita differential between CPP contributions (from both employees and employers) and benefits in Alberta was $442 above the national average (excluding Quebec). Controlling for age, pensionable earnings, and labour force status, I estimate that this differential falls to a statistically insignificant -$8. This demonstrates that while CPP financial flows differ, they do not do so because one lives in Alberta. I display all results from this simple exercise in Figure 1. The large surplus for the CPP in Alberta results primarily from its younger and higher-earning population. In the future, it will be balanced by correspondingly higher benefits paid to these individuals in their retirement years. While a separate APP would not meaningfully address aggregate spatial imbalances, the province's younger population would allow—at least initially—lower contribution rates to fund similar benefits. This paper explores only that issue in detail, starting in the next section.

[7]On balance, however, this is a potentially minor issue. The average annual net interprovincial migration flow among those age 65 and over was roughly balanced between 1971 and 2021, based on calculations using Statistics Canada data table 17-10-0015-01. In some years it is positive, while in others it is negative, but on average, there was a net annual inflow of just over 426 people per year. Although, to be clear, without individual-level longitudinal data it is not obvious how important, or not, such migration flows are.

Figure 1: 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. See text for details.

3 The Simple Algebra of Pension Plan Analysis

To fix ideas, I first explore a selection of simple models to illustrate the core intuition behind long-run pension sustainability assessments, starting with the simplest possible one. Let contributions in any given year be c (the contribution rate) times pensionable earnings W_t and benefits in any given year be B_t. If total earnings and benefits are constant in real terms, then the minimum contribution rate is simply $c^* = B/W$. That is, the minimum contribution rate reflects the ratio of plan benefits to earnings. This intuition carries forward into more flexible settings.

To see demographics, consider a region with an employment rate of e, average wages w, retirees as a share of the population s, and benefit payments per retiree b, each of which is constant. The minimum contribution rate is then $c^* = (b \times s)/(w \times e)$. If benefits are set to 25 percent of earnings, then in a region where 50 percent of the population are workers and 20 percent are retirees, the contribution rate would be 10 percent. But in a region where 52 percent are workers and 18 percent are retirees, the contribution rate would be only 8.7 percent. These values very roughly reflect Canada (excluding Quebec) and Alberta, respectively. They also demonstrate that even small changes in a population's composition can have large implications for pension sustainability.

Now consider a situation where benefits and earnings change over time. Given a discount factor,

$$\varphi_t = \prod_{i=1}^{t}(1 + r_i), \tag{1}$$

it is easy to determine the present values of earnings, contributions, and plan expenditures. As before, the minimum contribution rate is the value that equates the present value of contributions and benefits, and therefore

$$c^* = \frac{\sum_{t=1}^{T} \varphi_t^{-1} B_t}{\sum_{t=1}^{T} \varphi_t^{-1} W_t}. \tag{2}$$

That is, the minimum contribution rate is equal to the ratio of the present value of future benefits to the present value of future earnings. This differs from a pay-as-you-go pension arrangement where the contribution rate varies over time and equals the ratio of benefits to earnings in each period. If contribution rates are set to c^*, then excess contributions in some years are saved to offset deficiencies in other years. A pension plan at least partially funded by positive accumulated assets in all periods—as is the case for the Canada Pension Plan—adds some additional complexity.

3.1 A Partially Funded Pension Plan

Consider a pension plan with accumulated investment assets A_t. These assets evolve according to the difference between contributions and expenditures, plus any investment income. If all payments come at the end of the period, then

$$A_t = A_{t-1}(1 + r_t) + cW_t - B_t, \tag{3}$$

which is analogous to debt dynamics equations frequently used in public debt sustainability analysis. More generally, one can iterate this over time to show that assets at some end point T are

$$\begin{aligned} A_T &= A_0 \times \varphi_T + \varphi_T \left(\sum_{t=1}^{T} \varphi_t^{-1} cW_t - \varphi_t^{-1} B_t \right), \\ &= A_0 \times \varphi_T + c \times FV_T^W - FV_T^B, \end{aligned} \tag{4}$$

where FV_t^W and FV_T^B denote the future values of earnings and expenditures, respectively. More intuitively, dividing by φ_T reveals that the change in the present value of assets $(A_T/\varphi_T - A_0)$ equals the difference between the present values of contributions $c \times PV_T^W$ and expenditures PV_T^B.

In a sustainable plan, the contribution rate aims to achieve some future target level of assets. If the present value of assets is held constant, then the minimum contribution rate mirrors equation 2. In the CPP, however, this rate is selected such that the asset-to-expenditure ratio remains roughly constant over a certain time horizon. For simplicity, suppose we set a target for assets at time T to have the same ratio to expenditures as they had in the initial period. In present value terms, this requires $A_T^* = A_0 B_T / B_0 \equiv A_0 \times \varphi_T^B$, where φ_T^B is the cumulative growth of plan expenditures between period 0 and T. This is not exactly how the CPP is evaluated, but it simplifies the mathematical expressions and builds intuition. This results in a minimum contribution rate for

the plan of

$$\begin{aligned} c^* &= \frac{PV_T^B + A_T^*/\varphi_T - A_0}{PV_T^W}, \\ &= \frac{PV_T^B}{PV_T^W}\left(1 - \frac{A_0(1-\varphi_T^B/\varphi_T)}{PV_T^B}\right). \end{aligned} \tag{5}$$

For a sufficiently long time horizon, one can simplify the above—since $\varphi_T^B/\varphi_T \to 0$ if investment returns exceed the plan's expenditure growth—to yield

$$c^* = \frac{PV_T^B}{PV_T^W}\left(1 - \frac{A_0}{PV_T^B}\right). \tag{6}$$

In effect, initial assets shrink the required contribution rate by an amount that reflects the size of those assets relative to the present value of future obligations. Initial assets are therefore a particularly important variable to consider in pension sustainability analysis.

3.2 Simple Numerical Illustrations

To illustrate equation 5 for the Base CPP, consider the calculation of the minimum contribution rate for a 60-year horizon from 2025 to 2084. From the 31st CPP actuarial report, the implied value of φ_T^B/φ_T in 2084 is 0.311, using a six percent discount rate. The present value of contributory earnings and expenditures over this time horizon is approximately $23.8 trillion and $2.7 trillion, respectively. This is an expenditure-to-earnings ratio of 0.112. Finally, total initial assets are approximately $600 billion, which is roughly 0.224 of the present value of expenditures. All together, this implies the simple MCR is

$$c^* = 0.112 \times (1 - 0.224 \times (1 - 0.311)) = 0.095. \tag{7}$$

This compares well to the CPP's actual MCR, which differs only slightly due to subtleties that need not concern us here. This illustrates this simple expression's usefulness.

Without assets, the minimum contribution rate here would be 11.2 percent. But with assets, the contribution rate need only be 85 percent of this (from $(1 - 0.224 \times (1 - 0.311))$). These expressions also provide a simple estimate of the required contribution rates for provincial plans. If one splits assets such that the same 85 percent reduction occurs, then one need only compare the present values of future expenditures and earnings. For Alberta, the detailed projection model described later in this paper implies the ratio of the present value of benefits to earnings is 9.65 percent, which would be the no-asset contribution rate. For assets to have the same reducing effect on the contribution rate, they would also decrease this by 85 percent, resulting in a contribution rate of 8.2 percent. This is similar to the main estimate discussed later. Equivalently, since the model to come finds that the present value of Alberta earnings is 18.4 percent of the CPP's, while expenditures are

15.8 percent, the minimum contribution rate for a separate plan is simply 15.8/18.4 times the CPP rate. This also yields 8.2 percent. Interestingly, the inverse of this also reveals the potential scope for benefit increases to APP recipients. An APP with 16 percent higher present value of expenditures would have, for example, a minimum contribution rate equal to the CPP's (since that would raise the present value of APP expenditures to almost 18.4 percent of the CPP's). This abstracts from the offsetting effect of lowering the target future ratio of asset to expenditures—which can be seen in equation 5 increasing—but this is a minor issue. The quantitative analysis to come provides more detail. These simple numerical illustrations cleanly demonstrate the tradeoff between lower contribution rates and higher benefits.

These simple equations also help make sense of previous estimates that have provided very different results. The work cited by the Alberta Fair Deal Panel used a fixed share of future CPP contributions and expenditures to estimate the minimum contribution rate of a separate APP (Clemens et al., 2019). It specifically assumed the APP would, for all future years, capture the historical shares of 16.5 percent of CPP earnings and 10.6 percent of all expenditures. Abstracting from the effect of assets, this implies a minimum rate for an APP equivalent to $0.095 \times 0.106/0.165 = 6.1$ percent. This differs only slightly from their estimate of 5.9 percent. The quantitative analysis to come is based on a richer, more forward-looking projection of benefit expenditures and earnings that results in significantly different estimates.

As a final exercise, it is straightforward to determine the rest-of-Canada minimum contribution rate following the loss of Alberta from the CPP. One need only subtract Alberta's present values from both the numerator and denominator for Canada to estimate a new ratio of present values. I find this new ratio would be 0.116. Shrinking this in a manner consistent with a presumed 20 percent loss of assets to the APP, the minimum contribution rate proves to be 9.8 percent, or roughly a 0.3 point increase. Since this is below the current legislated contribution rate, a CPP without Alberta might well not require a higher contribution rate, although this would, of course, erode the CPP's current 0.4 percentage point cushion.

3.3 Neutral Asset Splits

Since initial assets play such an important role in determining the minimum contribution rates within a pension plan, and since the division of CPP funds in the event of a province separating is unclear, it is worth exploring a hypothetical rule for asset splits motivated by the above analysis.

An asset split is "neutral" if it affects minimum rates to the same extent in the separating region as it does elsewhere. Over a finite horizon, equation 5 implies only a slight adjustment to reflect differences in the future growth of expenditures. Specifically, where "RoC" denotes rest-of-Canada, excluding Québec, we have

$$\left(\frac{A_0^{AB}}{A_0^{RoC}}\right) = \left(\frac{PV_T^{AB,B}/(1-\varphi_T^{AB,B}/\varphi_T)}{PV_T^{RoC,B}/(1-\varphi_T^{RoC,B}/\varphi_T)}\right). \tag{8}$$

I estimate the present value of CPP expenditures from 2025 to 2100 is just under $3 trillion. For Alberta, I estimate the present value of projected expenditures over this same horizon is $490 billion, or just over 16.3 percent of the Canadian value and 19.5 percent of the rest-of-Canada value. Expenditures over this horizon grow by a factor of 18 for the CPP, 29 for an APP, and 16.2 for the CPP excluding Alberta. These values correspond to φ_T^B for each respective region, and compare to $\varphi_T = 79$ if interest rates are six percent. All together, the ratio of plan assets in the separate APP to the CPP excluding Alberta is then

$$\left(\frac{A_0^{AB}}{A_0^{RoC}}\right) = 0.195 \times 1.255 = 0.245, \tag{9}$$

which implies the share of initial CPP assets that go to Alberta is 19.7 percent.[8] Over an infinite horizon, equation 6 implies assets should be divided according only to the relative present values of future expenditures PV_T^B. If we presume the relative present values of projected expenditures that I estimate for 2025 to 2100 hold over this much longer horizon, then the share of CPP assets that would go to Alberta is 16.3 percent.

Dividing assets in this way ensures that the minimum contribution rate differs from the ratio of the present values of benefits to earnings by the same extent in both Alberta and the rest of Canada. It may also be appealing on principle, since accumulated assets are meant to partially cover future benefit expenditures. Dividing assets in a manner that reflects the anticipated future burden of such expenditures may therefore be appropriate. It is, however, not how assets would actually be divided. I detail both the legal language and the uncertainties in Section 4.2. And in the analysis to come, I presume a separate APP is initially endowed with 20 percent of projected CPP assets, which is close to the neutral share derived here although arrived at differently.

4 A Detailed Pension Model for Alberta

This section summarizes a rich yet tractable model of an Alberta Pension Plan. It is based on a detailed population projection for the province, along with various other assumptions. Given the main policy exercise is separating from the Canada Pension Plan, the point of departure is assumed to be 2025, based on the 31st Actuarial Report on the Canada Pension Plan. This detailed model also follows the CPP approach to evaluate sustainability, by finding the minimum contribution rate that equates the projected ratio of assets to expenditures in 2084 with this same projected ratio in 2034.

Several initial parameters are straightforward to set, although each is subject to uncertainty. I presume the initial number of APP contributors is 16 percent of the projected CPP contributors in 2025, which corresponds to Alberta's possible share of the Canadian (excluding Québec) working-age population that year. The initial number of beneficiaries is similarly set to 13 percent of the projected CPP total, reflecting the province's share of elderly individuals. Importantly, these shares

[8] This follows from 0.197=0.245/1.245.

do not imply a similar split of the total contributions or benefit expenditures, since earnings in Alberta differ from those elsewhere. I assume Alberta earnings and initial benefit levels in 2025 average five percent more than those for the CPP. These assumptions are not innocuous; they have direct implications for the present values of future benefit expenditures relative to contributory earnings. I believe these are, however, conservative assumptions. Indeed, the average amount paid for retirement benefits to Alberta recipients was 6.8 percent above the national average in July 2023, the most recent month available (ESDC, 2023).

From these initial conditions, contributions to the APP evolve in proportion to average nominal wages. Inflation is two percent per year, and labour productivity growth is 0.9 percent. The number of contributors increases with the projected working-age population in Alberta. I detail specific population and demographic projections in the next subsection. Benefit payments from the APP increase as new retirees claim their initial benefits, which grow in proportion to a rolling five-year average of earnings, and decrease as existing retirees die. All benefit payments are indexed to inflation. Non-retirement benefit payments are fixed at 1.7 percent of aggregate earnings, roughly in line with the latest projections for the CPP, and operating expenditures are fixed at 0.1 percent of earnings. Finally, assets yield an annual nominal rate of return of six percent.

4.1 Population Projections

Population and demographic projections are central to the analysis. Rather than simply rely on existing projections from Statistics Canada, which are limited in their time horizons, I use a two sex Leslie model to project population levels (Leslie, 1945; Caswell, 2001). I omit precise mathematical details, but the intuition behind this projection method is straightforward. A vector $\mathbf{P}$ collects the sex- and age-specific population levels at a given point in time. A transition matrix $\mathbf{A}$ then determines the corresponding sex- and age-specific populations the following year. This matrix includes sex- and age-specific fertility rates and survival probabilities. While this simple approach is deterministic, and abstracts from mating rules found within more complex two-sex models, it suffices for our purposes. I add migration flows as an adjustment term $\mathbf{M}$ to match observed sex- and age-specific net migration rates. All together, we have the following recursive equation:

$$\mathbf{P}' = \mathbf{A} \cdot \mathbf{P} + \mathbf{M}, \tag{10}$$

which projects population levels for all years over the desired time horizon.

I set elements of the transition matrix $\mathbf{A}$ and the net migration flows $\mathbf{M}$ to match recent information from Statistics Canada on mortality, fertility, and interprovincial and international migration flows. Specifically, the initial age- and sex-specific mortality rates for Alberta are from Statistics Canada's life tables for the three-year period 2017–2019. I assume these mortality rates improve over time. The ultimate average annual rate of decline in mortality rates equals 0.8 for most age groups (following the 31st CPP Actuarial Report), with lower improvement rates for those over age 90. As in the CPP analysis, the model includes a larger initial improvement rate

Table 2: Population and Demographic Projections for Alberta, Selected Years

Year	Population (Millions)	Persons 18–64 per person 65+	Male Life Expectancy	Female Life 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

Note: Displays selected statistics for Alberta's population in the baseline model for selected years of the projection.

Source: Author's calculations. See text for details.

that converges to the ultimate improvement rate by 2035. For fertility, I estimate age-specific fertility rates using a restricted spline from 5-year cohort rates from Statistics Canada for 2021. These are gradually re-scaled to align with an assumed long-run total fertility rate of 1.75 by 2030. Finally, the volume (as a share of the population) and age/sex distribution of net international and interprovincial migration flows match the 2002–2019 average using Statistics Canada data. The overall net migration rate is one percent of the population in the baseline scenario. This represents a somewhat conservative assumption, especially in light of significant increases in the pace of net migration since 2022. This is one potentially important weakness of the analysis, however. What matters for accumulating pension entitlements is not really the net-migration flow, but the total inflows to Alberta and the average length of contributions of those individuals. Given limitations in the publicly available data, I cannot explore this further but will highlight how the results may be sensitive to this later.

I summarize the results of this projection in Table 2. By 2050, the baseline population projection for Alberta is 6.8 million persons. This is approximately 14.3 percent of the projected national population for that year (OSFI, 2021, p. 104), up from nearly 12 percent today. For comparison, the Government of Alberta's most recent projection foresees a population of between 6.1 and 8.4 million persons by 2050 (Alberta, 2023a), depending on the scenario. The latest Statistics Canada (2022b) population projections, however, imply Alberta's population in 2043 will be between 5.8 and 7.2 million, depending on the scenario. Extrapolating to 2050 based on the 2033 to 2043 average annual growth rate results in a 2050 population of between 6.3 and 8.3 million. For context, increasing the net migration rate to 1.5 percent of the baseline one percent implies a 2050 Alberta population of 8 million in my model. In terms of demographics, I project that by 2050, there will be approximately 2.8 individuals between the ages of 18 and 64 years for each person above the age of 65 years. For comparison, the Government of Alberta's projection for this same ratio is between 2.7 and 3.3, depending on the scenario. Finally, falling mortality rates imply rising life expectancy at birth, averaging over 83 years for males and nearly 87 years for females.

4.2 Dividing the Canada Pension Plan Investment Funds

The final component of the APP model concerns the least understood piece of all: initial assets in 2025. There is no obvious way to determine the share of CPP assets that a hypothetical APP would be endowed with because the Canada Pension Plan Act is imprecise. The specific language found in Section 113 (2), which begins with a reference to subsection (1) that instructs the federal Minister of Finance to pay an amount to the province as calculated in subsection (2), as follows:

> **Amount to be paid to government of province**
>
> (2) For the purposes of subsection (1), the amount to be calculated as provided in this subsection in the case of any province 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.

This is somewhat vague and paragraph (b) is particularly problematic. The "part of the net investment return of the Investment Board ... credited to or accrued to the credit of the Canada Pension Plan Account ... that is derived from the contributions" could be interpreted in different ways and hinges on what "derived from" means in this context.

The original structure of the Canada Pension Plan adopted in legislation in 1965 may provide some guidance.[9] Before the late 1990s reforms, the CPP Investment Fund purchased only non-negotiable provincial government bonds, with some allowance for purchasing federal bonds as well. It funded those purchases out of excess amounts from the main CPP Account (that is,

[9] See Canada Pension Plan Act, 13-14 Elizabeth II, 26th Parliament, 2nd Session (1964-1965): 605-690.

amounts over and above what was expected to be required for three months' expenditures). The net investment income credited to the CPP Account was therefore only derived from interest earned on those bond holdings. Importantly, the share of bonds purchased from any given province in a month was set equal to the share of total CPP contributions made by that province's residents over a previous ten-year period. The total interest earned by the CPP Investment Fund from any given province was therefore mechanically a function of contributions. Abstracting from the fact that contribution shares, interest rates, and so on, change over time, a province that accounted for ten percent of total contributions would account for ten percent of the fund's bond holdings and therefore ten percent of interest income. And since interest earned by the fund came from provincial governments paying interest on bonds sold to the fund, paragraph (b) was effectively just returning to a separating province the amounts that it had paid in. Indeed, this was the understanding of key members of Pearson's government. The Minister of National Revenue, Mr. Benson, stated in the House of Commons during debates around the CPP legislation that if a comparable provincial plan were created then "at that point it would get the investments which it has in the Canada pension plan" (Canada, 1965). It is in this sense that Premier Robarts' understanding of this subsection, described in the introduction and in more detail shortly, may be correct. But today, the CPP fund is substantially larger, and returns are derived from a broad and highly diversified portfolio. Its returns are no longer paid by provincial governments, but the logic of using contributions to apportion actual net returns may still hold since the language in paragraph (b) is nearly identical to what was originally enacted in 1965. In my analysis, I therefore adopt this interpretation.

The entire procedure is then relatively straightforward, at least conceptually. Add total contributions from Albertans (paragraph (a)) to Alberta's share of investment returns (paragraph (b)) and subtract total benefit expenditures to Albertans (paragraph (c)). Operating costs are also apportioned on the basis of contributions (paragraph (d)). That is, the amount of assets transferred to Alberta A_i is given by

$$A_i = \underbrace{C_i}_{\text{Paragraph (a)}} + \underbrace{r_i \times I}_{\text{Paragraph (b)}} - \underbrace{B_i}_{\text{Paragraph (c)}} - \underbrace{o_i \times O}_{\text{Paragraph (d)}}, \tag{11}$$

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 that are apportioned to Alberta, respectively, which I set equal to historical contribution shares. With some extrapolations to 2025, I estimate cumulative contributions and benefit expenditures of $203 billion and $136 billion, respectively. I further estimate that since Alberta accounts for 16 percent of contributions over the 1966–2025 period, it receives that share of cumulative net investment returns, which is just under $85 billion.[10] Finally, Alberta's share of operating costs are just over $2 billion. All together,

[10]If the rolling ten-year sum of contributions were instead used to apportion net investment returns, as implied by the original CPP Act, then 15.5 percent, or $82.5 billion, of total net investment income would be attributed to Alberta.

the net transfer to a separate Alberta Pension Plan would then be $150 billion, or 25 percent of the projected CPP assets in 2025. This is an imperfect approximation. Publicly available data on province-specific CPP flows from Statistics Canada does not distinguish an individual who retires where they worked from one who retires elsewhere. That is, an Albertan who retires in Kelowna counts as the recipient of CPP benefits flowing to British Columbia. It similarly does not account for individuals who worked in another province but retired in Alberta. Without longitudinal administrative records, a more precise estimate is not feasible.

To be clear, this interpretation of the language in the Act is inconsistent with a modern application of Premier Robarts' view. That perspective requires a province be placed in a situation identical to what would have transpired had it opted not to join the Canada Pension Plan in the first place. This is no longer a reasonable interpretation of the text (especially in a practical sense) in light of reforms to the CPP adopted in the late 1990s. Placing a province in the same position it would have been had it never joined the CPP would require accumulating the difference between historical contributions and expenditures in a separate fund and earning a counterfactual stream of investment returns, compounded over time. Were this interpretation to hold, I estimate it would result in just under half of the projected $600 billion in Base CPP assets being given to the APP—approximately $300 billion. This is problematic for several reasons, not the least of which is that it is at odds with the language of the Act. Paragraph (b) says that "*the* net investment return of *the* Investment Board ... *credited to* ... *the* Canada Pension Plan Account" (emphasis added) is apportioned. That is, the calculation involves the net investment returns of the CPPIB that are actually credited to the CPP Account, not returns flowing from a hypothetical fund for Alberta from 1966 onwards. Expenditures are also not a factor in the calculation until after the actual net investment returns are apportioned. But expenditures would be required in any calculation that sought to implement the Robarts interpretation (as I will call it) of Section 113.

There are also practical problems to consider. If British Columbia, Alberta, and Ontario each withdrew from the CPP, for example, I estimate 128 percent of assets would need to be paid. And for several provinces, the result is a negative entitlement. It is therefore not an interpretation that results in a suitable allocation of CPP assets. Such an asset split may also materially increase the incentive for Ontario or British Columbia to leave the plan if Alberta does under these terms, which may destabilise the entire CPP. For both reasons, the Robarts interpretation leads to potentially absurd outcomes. The historically grounded interpretation that I adopt, however, where "derived from" implies using some measure of contribution shares to apportion actual net investment returns credited to the CPP Account, results in paying a positive share of CPP assets to any potential province that separates. It also does not result in the extreme "over-withdrawal" scenarios as the Robarts interpretation does. This may be relevant for any consequential legal analysis used to resolve the interpretation of the CPP Act.

As a final note on the matter, my estimate is subject to unavoidable legal and political uncertainty. For a separating province to receive one-quarter of total CPP assets may motivate the federal and other provincial governments to dispute any such calculation. A federal Finance Min-

ister, for example, could conclude that the proposed separate APP was not "comparable" to the CPP (especially if benefits are significantly different) and therefore the obligation to pay according to Section 113 would not apply. There is also a certain degree of flexibility over how the Minister may interpret the Act's language. They may potentially opt for an interpretation that results in paying a smaller share of assets. Ultimately, the Supreme Court may need to weigh in on the precise meaning of the Act and the reasonableness of the Minister's interpretation. Alternatively, the Act itself may be amended to provide clarity or to change the allocation entirely.

In any case, I assume for the baseline scenario that 20 percent of total CPP assets ($120 billion in 2025) go to a separate Alberta Pension Plan, although I also report results for a reasonable range of potential alternatives. This is primarily motivated by the data limitations previously described. But this assumption is also partially motivated by the government's original intent for Section 113. The federal government's white paper detailing the final CPP arrangements stated clearly that "in order that the province's right to establish its own plan may be effective, without the residents of the province losing the pension benefits they have already earned by their contributions, the federal plan would transfer to the province its fair share of the pension assets" (Canada, 1964c). That is, assets support future benefit payments. This interpretation was shared by a key official within the Department of Justice, who, in clause-by-clause testimony before the Special Joint Committee on Canada Pension Plan, said this section required that "there must be transferred to the province out of the Canada pension plan investment fund... all of the securities of that province that in effect stand behind those liabilities," referring to future pension obligations that the provincial plan assumes (Canada, 1964b). The neutral asset split approach of Section 3.3, whereby the separating province receives assets in proportion to the present value of projected future benefits, aligns relatively well with this perspective and yields just under 20 percent of CPP assets.

5 Quantitative Analysis of an Alberta Pension Plan

In this section, I report several quantitative assessments of a separate Alberta Pension Plan, beginning with the minimum contribution rate.

5.1 Minimum Contribution Rates

Ensuring pension plan assets are not depleted over long time horizons is at the core of pension sustainability assessments. The most recent Actuarial Report of the CPP estimates a contribution rate that ensures the ratio of assets to total plan expenditures will be no lower in 2084 than in 2034. I adopt this approach. For some of the analysis, however, I report the required contribution rates over longer time horizons.

I estimate the APP minimum contribution rate in the baseline scenario to be 8.2 percent, or 1.3 percentage points lower than the minimum rate in the CPP. The projected plan's ratio of assets to expenditures under both the estimated minimum contribution rate and the CPP minimum rate appear in Figure 2. At the minimum rate, assets are just over 12 times total expenditures over

Table 3: Selected Financial Projections for a Separate APP

	Billions of Dollars				Ratio of Assets
Year	Contributions	Expenditures	Balance	Assets	to Expenditures
2025	9.7	9.5	0.3	120	12.6
2030	12.1	12.9	-0.8	159	12.3
2040	18.4	20.8	-2.4	264	12.7
2050	27.2	33.1	-5.9	421	12.7
2060	40.7	51.3	-10.6	644	12.6
2070	61.7	77.6	-15.9	982	12.7
2080	92.3	118.8	-26.5	1,485	12.5
2090	139.5	179.4	-39.9	2,225	12.4
2100	210.9	273.6	-62.7	3,321	12.1

Note: Displays selected financial projections for the Alberta Pension Plan from 2025 to 2100, based on the minimum contribution rate of 8.2 percent. All values are nominal.

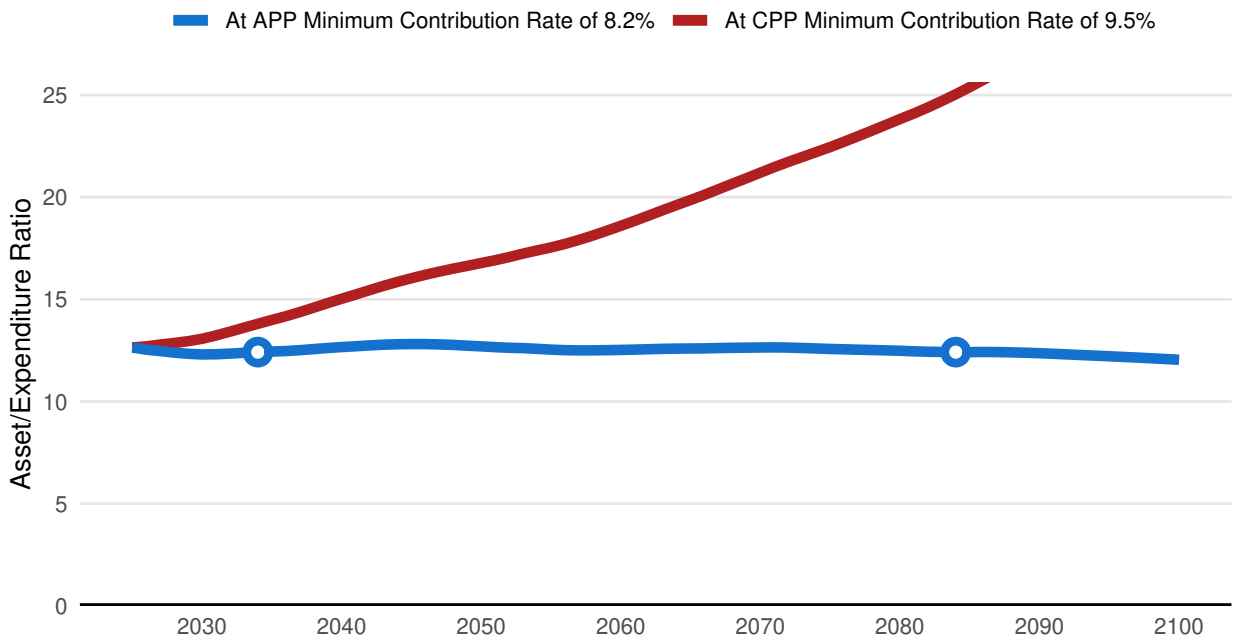
Source: Author's calculations. See text for details.

the relevant time horizon. For comparison, at the CPP minimum rate of 9.5 percent, I project an APP would see consistently rising asset levels, exceeding 25 times total expenditures by the mid-2080s. For additional context, I report selected financial variables, including total contributions and expenditures, along with total plan assets, in Table 3. As with the CPP, this projection finds APP expenditures exceed contributions in the near future—with a nearly $1 billion shortfall in 2030. Investment income offsets this and accounts for just under half of total APP revenues.

The minimum contribution is sensitive to several underlying parameters. I report a range of scenarios and their associated minimum contribution rates in Table 4. For clarity, as the CPP legislated rate of 9.9 percent exceeds its minimum contribution rate by about 0.4 percentage points, this amount should be added to the rates in this table to yield an APP legislated contribution rate with the same cushion. The table also abstracts from the several economic assumptions that are quantitatively unimportant for the results. The pace of real wage growth has a negligible effect. The difference in the minimum contribution rate required with a zero percent real wage growth versus a 1.5 percent growth rate is only 0.1 percentage points. Inflation similarly matters little. However, investment returns matter significantly, and therefore included for all reported scenarios. Each decrease of one percentage point in real investment returns, for example, increases the required contribution by approximately 1.2 percentage points. A 3.5 percent real return requires a minimum contribution of 8.8 percent, cutting the difference between that and the CPP minimum rate in half. This is modestly more sensitive to real interest rates than the CPP, reflecting a slightly larger asset-to-expenditure ratio. Higher initial assets increase this sensitivity further. For context, the CPP sensitivity is just over a one percentage point change in the MCR for each percentage point change in the long-run real rate of return.

As with investment returns, initial assets (not surprisingly) have a material effect on the estimated sustainability of a separate APP. If initial assets in the APP are equivalent to 25 percent of

Figure 2: 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 both the estimated minimum contribution rate and the Canada Pension Plan minimum rate of 9.5 percent. The two points represent the years 2034 and 2084 used to solve for the minimum contribution rate.

Source: Author's calculations. See text for details.

projected CPP assets in 2025 (that is, $150 billion), then the minimum rate for a separate APP falls to 7.8 percent. If initial assets are 15 percent of the CPP ($90 billion), then the minimum rate increases to 8.6 percent. If one thought the share of assets provided to an APP should approximate Alberta's share of total CPP contributors, then this scenario would capture that. Although that would be an incorrect reading of Section 113. And for completeness, I also report the effect of implementing the Robarts interpretation for asset splits, but do not view this as a credible scenario. I also report the scenario favoured by the Government of Alberta, based on LifeWorks (2023), which differs only slightly from the Robarts interpretation, and features different fertility and migration rates, and a different real return on investment, than my baseline assumptions. Roughly speaking, each $10 billion in initial assets is therefore equivalent to a 0.1 percentage point change in the APP's estimated minimum contribution rate. For the Canada Pension Plan, the share of assets provided to the APP matters for whether creating a separate plan would increase CPP contribution rates elsewhere. As mentioned previously, I estimate that in the baseline scenario the CPP's minimum contribution rate is 9.8 percent, which is below the legislated 9.9 percent rate. If the APP initial assets are at $90 billion, then the CPP minimum rate falls to 9.7. For $150 and $300 billion, however, the minimum rate increases to 10.0 and 10.5 percent, respectively, which exceeds the current legislated rate of 9.9 percent. I estimate that if 22.5 percent or more of the projected Base CPP assets

Table 4: Minimum Contribution Rates for an APP, Selected Scenarios

	Real Investment Returns				
Scenario	3%	3.5%	4.0%	4.5%	5%
Baseline Scenario	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 plan expenditures	9.8	9.2	8.6	8.1	7.5
Ten percent higher plan 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
Government of Alberta Scenario (Approx.) **	8.2	6.6	5.0	3.4	1.9

Note: Displays projected minimum contribution rates in a separate Alberta Pension Plan based on several demographic and economic scenarios. As the CPP legislated rate of 9.9 percent exceeds its minimum contribution rate by about 0.4 percentage points, this amount should be added to the rates in this table to yield an APP legislated rate with the same cushion. The baseline scenario uses a total fertility rate of 1.75, net migration rate of one percent, mortality improvement rate of 0.8 percent, and initial assets of $120 billion. The national average of the total fertility rate is 1.43. The national average net migration rate is 0.6 percent. All other scenarios are deviations from the baseline. The effect of changes in plan benefits are illustrated by a five or ten percent increase in the present value of plan expenditures.

* This corresponds to the Robarts interpretation of how assets would be split.

** This corresponds to an approximation of the "best estimate" scenario in Table C.4.4 of LifeWorks (2023, 68), based on a total fertility rate of 1.5, net migration rate of 0.7 percent, real investment return of 3.7 percent, and initial assets of $325 billion. All other assumptions are unchanged from the baseline scenario.

Source: Author's calculations. See text for details.

in 2025 are transferred to an APP, then the minimum contribution rate in a CPP without Alberta would exceed the legislated rate.

Demographic variables, especially migration, fertility, and mortality rates, are the next most important considerations. The baseline scenario features a net migration rate equal to one percent of Alberta's population. If that decreases to 0.6 percent, for example, which is close to Ontario's level and the national average, then the minimum contribution rises to 8.5 percent. With a net migration rate of 0.4 percent, which is roughly at Quebec's level, the minimum rate rises to 8.6 percent. And if net migration inflows were to cease entirely, the minimum rises to 9.0 percent. Turning to fertility, if Alberta's total fertility rate declines from the assumed baseline level of 1.75 to the national average of 1.4, then the minimum contribution rate rises to 8.4 percent. If both fertility and migration rates are equal to the respective national averages, then the contribution rate rises by 0.5 points to 8.7 percent. This results in the ratio of working-age to elderly individuals falling to 2.4 by 2050 and to 1.8 by 2090, which are similar to the national averages. Such a scenario also increases the financial risks of the plan, as evidenced by the greater sensitivity to changes in real investment returns. The pace of mortality rate improvements are also critical, as it is for the CPP. I find that if mortality rates do not improve, then total plan expenditures are lower and

the minimum contribution rate declines to 7.5 percent. If mortality rates improve at double the baseline rate, then benefit expenditures increase and the minimum contribution rate increases to 9.0 percent. Importantly, these results suggest the sensitivity of an APP to changes in mortality rates is roughly double that of the CPP. Regardless of which scenario unfolds, demographic uncertainty itself, which is less effectively pooled in a separate APP than in the CPP, may motivate a higher contribution rate (Armstrong et al., 2008).

This interaction between initial planned assets and demographic variables also reveals an interesting, and perhaps counter-intuitive, result: lower net migration rates do not *necessarily* represent a challenge for the long-run sustainability of a separate plan. Much depends on the size of the initial assets. The higher the initial asset value, the less migration rate decreases matter. And for sufficiently large initial assets, lower migration rates will decrease the minimum contribution rate. Higher net migration flows will tend to lower the effect of initial assets on the minimum rate because they increase the present value of future plan expenditures and therefore increase $(1 - A_0/PV_T^B)$. For Alberta, I estimate that $180 billion in initial assets will make the minimum contribution rate roughly independent of future net migration flows. I do not report this in Table 4, but it is important context to consider when evaluating the risks associated with a separate provincial plan. That being said, for reasonable initial asset values, a separate plan is subject to material demographic risks, especially in terms of future mortality rates, as demonstrated in the previous paragraph.

Beyond risks, it is also possible to quantify the scope to accommodate the policy preferences of Alberta's government. In particular, increasing pension benefits features prominently in arguments from proponents and is found within the mandate to the Minister of Finance. To explore this, I increase the present value of projected plan expenditures to approximate changes in benefits. While the details of how and when benefits are adjusted matters, this exercise illustrates the potential room available to the government. I estimate that there is only limited scope for benefit increases. Changes equivalent to a ten percent increase in the present value of plan expenditures, for example, would raise the minimum contribution rate to 9.1 percent. If expenditures instead increase by five percent, the minimum rate would be 8.6 percent. In the baseline scenario, worker and employer contributions could each be sustainably lowered by 0.5 percentage points and retirees could receive an increase in benefits equivalent to a five percent increase in the present value of plan expenditures. This would result in a 0.3 percentage point cushion between the legislated rate and the projected minimum contribution rate.

Finally, initial conditions are critical to these results. The model's baseline assumption is that 13 percent of the total CPP beneficiaries in 2025 will transition to a separate APP. But there is uncertainty around precisely how many current CPP beneficiaries will be absorbed by the APP, since a separate plan would need to assume all the obligations owed to those that had at any point in the past earned pensionable earnings in Alberta. If the initial number of beneficiaries rises to 14 percent of the CPP, then I estimate the minimum contribution rate would increase to 8.9 percent. This is a large change and a key source of uncertainty that relates to an issue discussed previously:

individual worker migration patterns are an important component of pension analysis, but data are unfortunately not readily available.

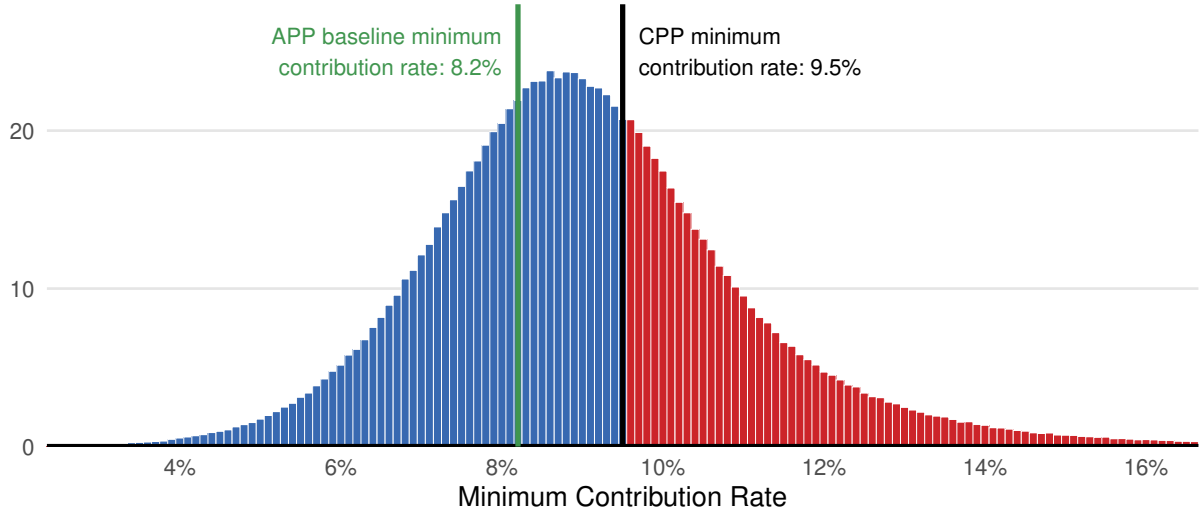
Depleting initial assets is an option to overcome some of the risks a separate plan would pose. A contribution rate of 7.85 percent, for example, would gradually decrease the projected ratio of assets to total plan expenditures to roughly 9 by 2084. But thereafter, contributions would have to eventually rise to stabilize the ratio. Expanding the time horizon shows by how much this would have to happen. In the very long run, the present value of future expenditures converges to just over $700 billion, which I also estimate to be 10.2 percent of the present value of future earnings. Initial assets of $120 billion is also roughly 17 percent of this. From equation 6, these values imply a very long-run minimum contribution rate for a separate APP is 8.5 percent.

5.2 Investment Risks

As demonstrated earlier, one of the significant factors that influence the financial sustainability of pension plans is the rate of return on their investments. Investment returns, however, are volatile. A separate provincial APP would also have weaker institutional protections of its investment board's mandate, since no single government can alter the CPPIB mandate, but Alberta alone could alter the APP's. It is therefore worth exploring and quantifying these risks more precisely. In this section, I quantify investment risk by simulating the distribution of 75-year average returns based on random annual draws from a normal distribution. I assume a nominal return of six percent, as in the baseline scenario, and a standard deviation in annual returns of 10.7 percent. This is lower than the current estimated one-year standard deviation of CPP portfolio returns and corresponds to its expected long-run volatility from 2033 onwards (OSFI, 2021, p. 139). It implicitly presumes a portfolio composed of 70 percent equity and 30 percent debt. The results of this simulation have significant implications for determining the contributions required to ensure the long-term sustainability of the plan. Greater volatility and lower average returns increase the likelihood of inadequate pension assets to meet future liabilities, thus necessitating higher contributions to bridge the shortfall. I display the distribution of minimum rates across one million draws in Figure 3.

I estimate an approximately 37 percent probability that a separate Alberta Pension Plan would require a minimum contribution rate above 9.5 percent. This presents a material degree of risk. I further find a 67 percent probability that the minimum contribution rate is above the 8.2 percent found in the baseline scenario described earlier. Despite simulating normally distributed annual returns, the resulting distribution of minimum contribution rates is asymmetric. This is due to an underappreciated feature of long-run compound returns, which display a positive skew that increases with single-period volatility and the investment time horizon (Bessembinder, 2018; Farago and Hjalmarsson, 2023). In these simulations, while the mean average annual compound rate of return is six percent, the median is less than 5.5 percent. This leads to more scenarios with a minimum contribution rate above 8.2 percent. To have more than a 50 percent probability of maintaining APP assets relative to expenditures by 2084, I estimate a contribution rate of at

Figure 3: Distribution of APP 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.

Source: Author's calculations. See text for details.

least 8.9 percent is required. Longer horizons increase this further, with the median minimum contribution rate converging to 9.6 percent in the very long run. These results suggest investment risks are equivalent to Alberta's entire pension advantage.

To be clear, the CPP also faces investment risks that, depending on the management of a separate APP investment fund, could correlate with future APP returns. The two plans, after all, could have similar portfolio structures and investment strategies. One should therefore not conclude that there is a 37 percent probability that a separate APP would have higher contribution rates than the current CPP. Even so, the effect of potentially lower or more volatile investment returns in an APP due to politically motivated capital allocations cannot be dismissed. Indeed, "giving Alberta control over the investment fund" was a stated rationale of the Alberta Agenda (Harper et al., 2001), and Premier Smith has also noted that the control of investment funds is a reason why Alberta is looking at a separate fund (Fawcett, 2019). Greater financial exposure to adverse climate change scenarios may be a particularly important future source of risk in a separate plan. And since the degree of positive skew in the long-run distribution of returns increases with short-term volatility, investment risks may matter more for the long-run sustainability of a separate APP than for the CPP.

5.3 Balance Sheet Analysis

The simplified model described in Section 3 primarily involved present-value comparisons. In the literature, this is normally referred to as Balance Sheet Analysis. The present values of future expenditures are a liability of the pension plan while the present values of future contributions are

Table 5: Open Group Balance Sheet Assessment of an APP

	Time Horizon Beyond 2025 (Years)							
	80	100	120	140	160	180	200	∞
Present Value of Contributions ($B)	421	462	491	512	527	538	546	567
Initial Assets ($B)	120	120	120	120	120	120	120	120
Present Value of Obligations ($B)	503	557	597	626	647	662	673	704
Asset excess/shortfall ($B)	38.2	24.8	14.5	6.6	0.6	-3.9	-7.4	-17.5
Assets as Share of Obligations (%)	107.6	104.5	102.4	101.1	100.1	99.4	98.9	97.5

Note: Displays the present values of future APP contributions and obligations, along with initial assets, over various time horizons beyond 2025. The contribution rate is set to the minimum contribution rate in the baseline scenario.

Source: Author's calculations. See text for details.

an asset, along with any positive investment balance. Comparing the magnitude of these assets and liabilities is one approach to assessing the financial sustainability of a pension plan. In this section, I adopt an "open group balance sheet," which includes future contributors to the plan.

For this analysis, I consider several time horizons that go beyond 2084. While the previous analysis is informative and covers a time scale relevant for most current retirees and plan contributors, a balance sheet analysis is typically longer. There will be contributions by new plan members in the future (say, someone who starts working in 2060 at age 20), and therefore a longer horizon is relevant to ensure the plan is sustainable for them. Over a 100-year horizon, I estimate the present values of APP expenditures will be approximately $557 billion and the present values of contributions will be $462 billion. Combined with initial assets of $120 billion, total assets are therefore 104.5 percent of obligations. The financial position of a separate Alberta Pension Plan funded at the estimated minimum contribution rate is therefore sound. Over a longer time horizon, however, the picture changes somewhat. Over a 200-year horizon, the ratio of total assets to obligations is 98.9 percent. A slightly higher contribution rate of 8.4 percent (instead of the 8.2 percent MCR) is required to ensure sustainability over the very long run. I display a selection of other horizons in Table 5. The infinite horizon estimates in the final column are particularly useful for equation 6, and imply a contribution rate of 8.5 percent is required for sustainability.

5.4 Implied Internal Rates of Return

Weighing risks and returns appropriately from an individual's perspective requires a different measure than the previous sustainability assessments. The implicit rate of return from an individual's pension contributions is one way to quantify the value from a fund. The return to an individual contributor is implicit and depends on the future benefits received relative to the contributions made during the individual's working life. Analyses often examine this by using the concept of the internal rate of return (IRR). The IRR, in the context of pension plans, can be understood as the average annual return an individual receives on their pension contributions, taking into account the timing of these contributions and the timing and amount of future benefits.

Table 6: Nominal Internal Rates of Return, CPP and APP (%)

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

Note: Displays the implied internal rate of return for an 18-year-old individual who consistently earns above the yearly maximum pensionable amounts. All values are percentages. Contributions are made at the minimum contribution rates.

Source: Author's calculations. See text for details.

Essentially, it is the discount rate at which the present value of future benefits equals the present value of contributions. A higher IRR suggests a more advantageous plan for the contributor.

I estimate the internal (nominal) rate of return from the perspective of an 18-year-old whose general dropout provisions apply to their first 8 years of employment and who remains in full time education until age 25. The individual contributes at the minimum contribution rates and at the maximum possible amounts. If this individual lives to age 85, I estimate an implied return on APP contributions of 4.0 percent, compared to a 3.5 percent return with the higher contribution rate in the CPP. I display a range of returns for various lifespans in Table 6. At a six percent discount rate, the present value of contributions for this individual is approximately $16,000 lower than under the CPP. Such returns will, to be clear, vary widely across individuals in different circumstances. I report this particular example for illustrative purposes, although they are not far off estimates previously reported in the 26th Actuarial Report of the CPP.

The estimated 0.5 percentage point higher return within a separate APP should be weighed against the risks of a separate plan. A separate APP may inherently carry higher levels of certain risks than the current CPP. The CPP's larger and more diversified participant base, in terms of both geography and industries, offers it some degree of protection against regional economic shocks or sector-specific downturns. The management and operational risks of establishing and running a new pension plan like the APP may also be higher. The risk-adjusted return of a separate APP relative to the current CPP is therefore lower than this analysis suggests.

6 Conclusion

This paper explored the financial sustainability of a separate Alberta Pension Plan and yielded several crucial insights. It provides a detailed and expanded update to previous studies to reflect recent economic and fiscal conditions. While a separate Alberta plan appears financially viable,

the benefits of such a plan are arguably relatively modest, and the goals of the Alberta government to increase benefits and reduce contribution rates may be challenging to fulfill. This paper also sheds new light on a previously unexplored issue: namely, that the division of assets in the event of provincial separation from the Canada Pension Plan is highly problematic. The Canada Pension Plan Act, which would govern any province's withdrawal from the plan, is vague and may not be interpreted as favourably to Alberta as has recently been suggested, including by the LifeWorks (2023) report to the Alberta government. Their analysis suggests Alberta would be entitled to over half the CPP assets. But an historically grounded interpretation of the CPP Act's language, which I argue for in this paper, yields an entitlement of between 20 to 25 percent. Moreover, if the LifeWorks (2023) approach were applied to both Alberta and Ontario, then it would result in more assets being paid out than actually exist within the CPP. Whatever the correct interpretation, overcoming this legal ambiguity would critically determine the potential features of a separate Alberta Plan and may strain Canada's federation.

With an eye towards informing ongoing—and potentially increasing—public policy debate in Alberta and elsewhere, I present several simplified approaches to evaluating pension sustainability. In addition, my detailed analysis based on a rich model of a separate plan illustrates a broader range of potential scenarios than has previously been explored. I estimate a minimum contribution rate of 8.2 percent, which would lead to a legislated contribution rate of 8.6 percent if a 0.4 percentage point cushion were included, as in the CPP. This result contrasts with the considerably lower rate cited by Alberta's Fair Deal Panel and the 5.9 percent rate favoured by the Government of Alberta. I further find that with an increase in benefits equivalent to a five percent increase in the present value of plan expenditures, the minimum rate of a separate Alberta Pension Plan would need to be 8.6 percent and a legislated contribution rate of 9.0 percent. In this scenario, both worker and employer contributions could each only be sustainably lowered by just under 0.5 percentage points compared to the Canada Pension Plan. These potential gains must be considered alongside the additional risks a separate Alberta pension plan would entail. If positive net migration into Alberta ceases, for example, then nearly two-thirds of Alberta's baseline pension advantage is eliminated. And combined with the greater sensitivity to investment and mortality risk that a separate Alberta plan could face, my estimates suggest there may be no advantage at all. Whether the possibility of modest decreases in contribution rates and increases in benefits is worth the cost of incurring these additional risks is a critical policy question facing Albertans today.

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