Provincial Debt Sustainability in Canada: Demographics, Federal Transfers, and COVID-19

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Abstract

As one of the most decentralized federations in the world, the sustainability of Canada's public debt depends on the fiscal health of its provinces. Years of steadily rising provincial debt, a severe economic shock from COVID-19, and mounting healthcare costs from aging populations all create pressures. This paper explores how large these long-term fiscal challenges are, what they depend on, and how provinces differ. It also proposes policy options available to both provincial and federal governments, with a focus on reforms to federal transfers. To accomplish this, it describes a simple yet powerful approach to quantify long-run fiscal gaps that builds on the literature but clarifies and simplifies some common results. It combines this flexible and easily computable model with readily available and regularly updated data to construct a projection of government finances. I find that while the federal government is solidly sustainable, despite a large debt increase due to COVID-19, most provincial governments are not. Modest reductions in health spending growth combined with increases in revenue growth, however, are sufficient to overcome this challenge in all but the oil-producing provinces. Of course, our public finances will be buffeted by currently unknowable future developments, both positive and negative, so the path of future debt cannot be known with certainty. This analysis is nonetheless valuable. It shows we have the data and the tools to measure and manage our long-term fiscal challenges today.

Keywords: Debt sustainability; provincial finances; federal-provincial transfers; aging population

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Introduction

Rising debt in the past, unprecedented fiscal and economic disruptions in the present, and aging populations in the future all raise questions around the long-term viability of Canada's public debt. Federally, emergency spending measures in response to COVID-19 will add more to the federal debt than any other single fiscal year has outside of World War 2. Given the crisis, this was appropriate. But this short-term shock is dwarfed by a slower moving yet significantly larger challenge from aging populations. Provincial governments face mounting health costs, and all governments face potentially slower rates of economic growth. Ensuring governments are well positioned to overcome this challenge, without having to resort to large and abrupt changes in revenue or spending, and to rebuild their fiscal capacity to respond to future crises is important. This paper outlines a simple though powerful approach to quantify long-run fiscal challenges in Canada and pays particularly close attention to provincial governments. Building on readily available data from Statistics Canada, I develop a rich model of future public finances and explore a wide variety of scenarios. I find provincial government finances are strained. Federal finances, on the other hand, remain strong despite recent deficits. Options abound for most governments to overcome these challenges. The analysis also highlights the importance of federal-provincial transfers for provincial debt sustainability and proposes several reforms to help mitigate fiscal pressures.

Examining in detail the future trajectory of Canada's public debt is important, especially now. Following the largest economic and fiscal shock in generations, overall debt levels are set to approach 110 percent of GDP this year — an historically high level not seen outside of the Great Depression and World War 2. To appreciate this, I display Canada's overall public debt levels since 1870 in Figure 1 (a). Only once in Canada's postwar experience has debt exceeded 100 percent of GDP, and this moment in the mid-1990s ushered in a period of substantial fiscal consolidation. Going into the COVID-19 crisis, though, Canada's two orders of government face very different fiscal situations. Separating federal and provincial debt in

Figure 1 (b), we see that Canada's provincial governments have been continuously and systematically increasing their debt levels over the past sixty years. Overall, provincial debt has roughly tripled as a share of GDP since 1960, rising by nearly 40 percentage points. The federal debt, meanwhile, rises and falls with fiscal developments but is lower today than in 1960 and even the COVID-19 shock is unlikely to bring debt to levels seen in the 1990s. And not only do provincial governments account for more public debt today than the federal government does, the coming years will see substantial fiscal pressures from an aging population that will only add to this burden. The share of Canada's population over age 65 may increase from 17 percent today to nearly one-quarter by 2040, and the share over age 75 may double from 7 percent today to 14 percent over that same time.[1] With provinces responsible for healthcare delivery, incremental costs from this aging will be disproportionately borne by them. Recent debt increases and the coming demographic challenge means the future of government debt sustainability in Canada will be determined by the fiscal health of its provinces.

Before providing details, it is worth appreciating intuitively what "sustainable" fiscal policy means. Today's debt is potentially a burden on the future; and additional borrowing to cover budget deficits adds to this burden. Public finances are sustainable if those future burdens are manageable under current fiscal policy. In a growing economy, where the ability to carry and service debt is rising over time, the burden of debt is captured by interest costs as a share of total income. So continuously increasing the stock of debt faster than the pace of economic growth cannot continue indefinitely. At some point, abrupt changes in fiscal policy — either increasing revenues or decreasing program spending — would be required to avoid default. A stable debt-to-GDP ratio is therefore a common and useful metric of sustainable public finances. Interest rates and growth rates are also important determinants of sustainability. If interest rates exceed growth rates, then future revenues must exceed program spending by enough to repay current debt. If interest rates are less than growth rates, then governments can sustainably borrow to cover program spending above revenues — but over reasonable time horizons this is limited.

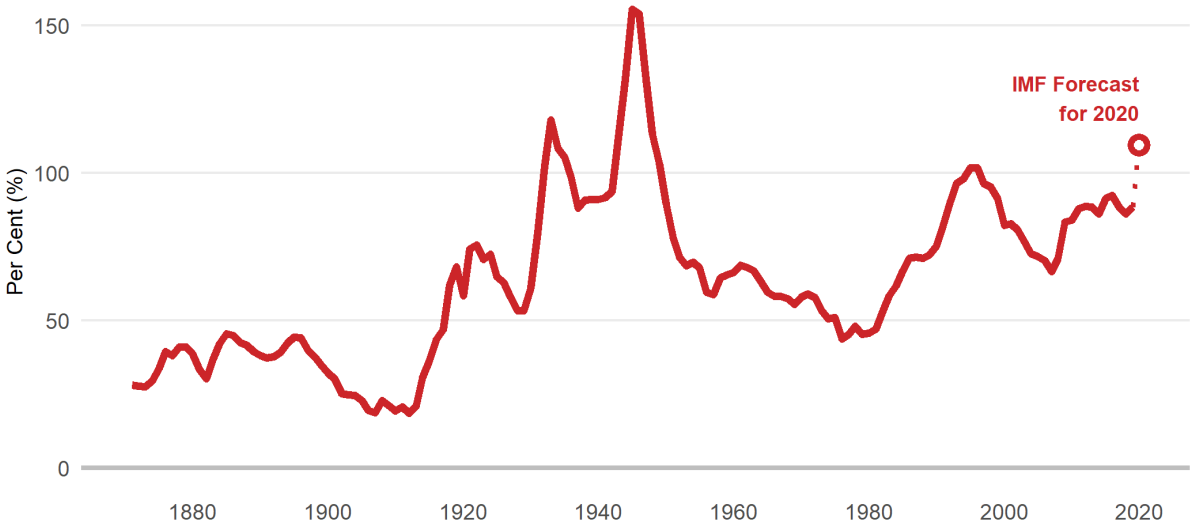
To clarify these issues, I provide a detailed framework to project future government revenues and expenditures and to quantify any gap between current fiscal policy and an alternative sustainable one. If current fiscal policy is not sustainable, then increases in revenue or decreases in program spending is required. The magnitude of the required fiscal adjustment is commonly known as the "fiscal gap".[2] Though there are many complexities and uncertainties to consider, in a world where interest rates roughly equal economic growth rates, a government's fiscal gap will roughly equal its average projected annual primary deficit (the deficit net of interest payments). Projecting revenues and program expenditures is therefore central to the exercise. Governments with projected future deficits face a positive fiscal gap and unsustainable fiscal policy unless revenues increase or spending decreases. The reverse is true for governments with projected future surpluses, as we will see is the case for Canada's federal government.

[1] Source: Author's calculation from Statistics Canada table 17-10-0057-01, "Projected population, by projection scenario, age and sex, as of July 1." These are projections around a range of potential outcomes. For perspective, the share aged 65 and over ranges from just over 21 percent in the slow-aging scenario to nearly 26 percent in the fast-aging scenario. Historically, such projections have proven to be useful guides. In the mid-1980s, for example, the CPP 'case' projection for 2020 was for a population of nearly 35 million and a 65+ share of 16.2, both not too far off the actuals. For this and many other projections, see Canada, *Report of the Royal Commission on the Economic Union and Development Prospects for Canada*, vol. 2 (Ottawa: Supply and Services Canada, 1985), 52-60, tables 7-31 to 7-35.

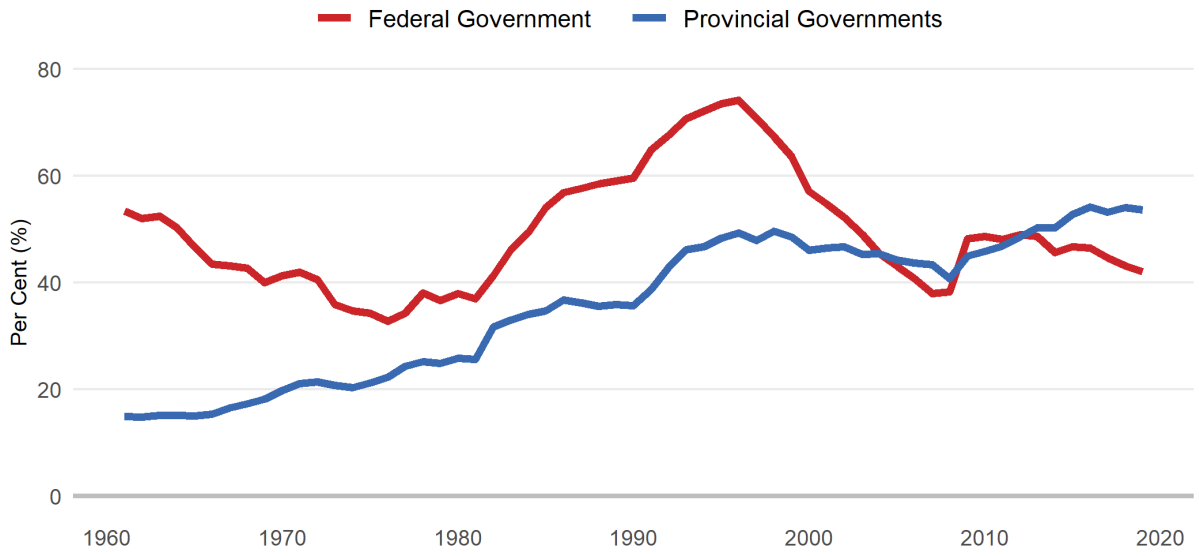
[2] The term was originally put forward by Alan Auerbach, "The U.S. Fiscal Problem: Where We Are, How We Got Here and Where We're Going" (1994) 9 *NBER Macroeconomics Annual* 141-186. It is now a well-established approach to fiscal policy analysis.

Figure 1: Government Debt to GDP Ratios in Canada

(a) General Consolidated Government Debt, 1870-2019 and 2020(F)



(b) Federal and Provincial Government Liabilities, 1961-2019



Note: Displays data on general government debt in Canada as a share of gross domestic product from 1870 to 2019 and a forecast for 2020. This includes both federal and sub-national debt. Federal and provincial governments are separated for the period 1961 to 2019.

Source: Debt to GDP ratio for 1870 to 2016 is from Òscar Jordà, Moritz Schularick, and Alan M. Taylor, "Macrofinancial History and the New Business Cycle Facts" (2016) 31 *NBER Macroeconomics Annual* 213 - 263. The debt ratio is updated from 2017 to 2019 using the change in general government debt from Statistics Canada table 36-10-0580-01, "National Balance Sheet Accounts", nominal GDP growth rates for 2017 and 2018 from Statistics Canada table 36-10-0222-01, "Gross domestic product, expenditure-based, provincial and territorial, annual," and the *Federal Economic and Fiscal Snapshot 2020* forecast for 2019. Forecast for 2020 is from the IMF World Economic Outlook Update, June 2020. Separate provincial and federal liabilities (book value) are from Statistics Canada tables 36-10-0535-01, "National balance sheet, provincial governments, annual, 1961-2011" and 36-10-0533-01, "National balance sheet, federal government, annual, 1961 – 2011" for 1961 to 1989 and 36-10-0580-01, "National Balance Sheet Accounts" for 1990 to 2019. GDP data is as in panel (a), supplemented with Statistics Canada table 36-10-0325-01, "Archived - Provincial gross domestic product (GDP), expenditure-based, provincial economic accounts, annual, 1961 – 1980" for 1961 to 1980.

To construct these projections, I compile detailed data on twelve provincial revenue and six expenditure components. I also model federal finances, with additional detail for unique federal areas of expenditure, such as provincial transfers, old age security, child and family benefits, employment insurance, defense spending, and so on. Each budget component is then projected forward by forecasting growth rates of underlying tax bases, revenue sources, and cost pressures using demographic projections from Statistics Canada, health expenditure data from the Canadian Institute for Health Information, population projections from the Office of the Parliamentary Budget Officer, and numerous other sources. The result is a detailed interconnected model of Canadian government finances. Though in some cases necessarily abstract, it incorporates sufficient complexity to reveal novel interactions between orders of government, program designs, and economic and fiscal shocks, all within several informative scenarios.

The analysis reveals provincial government finances are not sustainable, with the notable exception of Quebec. Over a projected 75-year time horizon, provincial revenues average nearly 18 percent of GDP versus program and capital spending of nearly 21 percent. These imbalances, appropriately discounted to present value terms, are equivalent to roughly 170 percent of GDP in debt obligations today. To ensure debt levels at the end of the projection period are no higher than today, revenues must increase or expenditures must decrease by an immediate and permanent amount equivalent to 2.7 percent of GDP per year. This positive fiscal gap for provincial governments, however, is more than fully offset by a negative fiscal gap of 2.8 percent of GDP for the federal government. Thus, the general fiscal situation in Canada is sustainable, though there is an imbalance between the two orders of government. The analysis also reveals that the aging population fully accounts for the provincial challenge: 40 percent due to slowing economic growth and 60 percent due to rising healthcare costs.

There is significant variation across provinces, however. Quebec's fiscal situation is sustainable, owing largely to their higher than average taxes. Alberta and Saskatchewan are not sustainable, with relatively large fiscal gaps of 4.8 and 3.4 percent of GDP, respectively. Both are accounted for by far lower than average taxes, as projected health expenditures are lower in these provinces than any other. Atlantic provinces also face unsustainable finances, though the Maritimes are significantly aided by equalization to an extent that Newfoundland and Labrador is not. That province faces the largest fiscal gap, by far, at 9.4 percent of GDP. Above-average spending, a rapidly aging population, and the slowest projected economic growth in Canada underly their significant challenge.

Finally, while these long-run challenges are large, there is significant concern around the abrupt increase in government debt due to COVID-19, especially at the federal level. I find that federal finances remain strongly sustainable despite the shock, and provincial finances are actually improved in the long run as a result. Behind this seemingly counterintuitive result is the way the Canada Health Transfer formula operates in the face of a large short-term shock. I will explain in the main text, but this underscores why federal-provincial transfer arrangements are central to understand long-term provincial sustainability.

Before proceeding further, some important caveats are in order. All projections in this paper are subject to uncertainty and are not themselves predictions. Nor do these results guide what governments should or should not do to adjust the path of future finances. Instead, they illustrate a potential path that current policy is on and quantify the size of long-term gaps between revenue and program spending. Understanding this is necessary to guide tax and expenditure decisions today. This exercise also reveals how sensitive long-run finances are to changes in underlying assumptions. Indeed, exploring a variety of scenarios is potentially this exercise's most valuable contribution. Consider a few examples. First, in line

with historical experience, the baseline projections incorporate health-specific inflation of 1 percentage point above the economy-wide inflation rate of 2 percent per year. But if health-specific inflation falls to just 0.5 percentage points above average, for example, the provincial fiscal gap falls from 2.7 to 1.3 percent of GDP. Similarly, I find provincial revenues grow more slowly than the economy overall. But if instead own-source revenue grows in line with GDP then the aggregate fiscal gap declines to 1.5 percent. This analysis therefore demonstrates that gradual health spending restraint combined with modestly higher revenue growth can fully address the long-term challenges of provincial governments.

The analysis also reveals an important role for federal transfers. Current fiscal arrangements contribute an average of 3.4 percent of GDP to provincial finances over the 75-year horizon, and programs like equalization are particularly important for the sustainability of lower income provinces. I propose two potential reforms to federal transfers to help cover aging-related health costs. I find both have meaningful effects on fiscal gaps are may therefore be potentially important reforms to consider. And finally, certain provinces face particularly large fiscal challenges that modest reforms cannot overcome. Alberta, Saskatchewan, and Newfoundland and Labrador face fiscal gaps that persist across nearly all scenarios examined here. These provinces should therefore consider revenue and expenditure changes to address this. Delaying action will merely increase the scale of adjustment required.

To be clear, this paper is not the first to examine the long-run fiscal future of Canada's provincial governments. The most important contribution to this area of research is the Office of the Parliamentary Budget Officer's *Fiscal Sustainability Report*.[3] This analysis is a timely, thorough, and important examination of all subnational finances, but aggregates provincial and municipal finances. This paper complements their work by focusing on provincial governments only, by enriching the level of detail behind government budget projections, and by including capital spending. By separately modeling a dozen different revenue categories, this paper finds a notably larger fiscal gap than the PBO since I find provincial own-source revenues will grow more slowly. There is also an important place for analysis that excludes municipalities, since in normal circumstances their long-term finances are sustainable by construction. Local governments do not generally set tax rates and fee levels separately from expenditure decisions. Standard practice is for expenditures to be determined by local councils and then property tax rates are endogenously determined to mechanically balance their budget. In that sense, primary balances are zero by construction and therefore fiscal gaps are also zero. Finally, the budget model developed here and the wide varieties of scenarios it explores, will not only form the basis of the current analysis but it, and regular updates to it, will be made available to facilitate future research.

Before turning to this detailed model of provincial finances, I begin with a primer on public debt dynamics. Much of this will build on, and contribute to, well-established practices in the literature.[4]

A Primer on Public Debt Dynamics

At its core, long-run debt sustainability analysis asks two simple questions: Will public debt grow to unmanageable levels? If so, what policy changes are required? What is specifically meant by "unmanageable" is, to be clear, a moving target and varies both across jurisdictions and over time. In the Canadian context, Alberta defaulted on its debt in the mid-1930s with a debt level that was roughly one-

[3] Canada, Office of the Parliamentary Budget Officer, *Fiscal Sustainability Report* (Ottawa: Office of the Parliamentary Budget Officer, 2020).

[4] A useful guide to debt sustainability analysis is Julio Escolano, "A Practical Guide to Public Debt Dynamics, Fiscal Sustainability, and Cyclical Adjustment of Budgetary Aggregates" (2010) 2010:02 *IMF Technical Notes and Manuals*.

third of its GDP. Today, most provinces have debt levels at or above that level with no reasonable risk of default. And internationally, Japan's debt level is on track to approach 270 percent of its GDP in 2020 — which is roughly double the level that lead Greece into a debt crisis nearly a decade ago. Various factors from interest rates, economic growth rates, domestic versus international holdings, the currency public debt is denominated in, volatility, and more, all matter. For Canada's provinces, these factors matter but we must also consider the role of the federal government and fiscal transfers. But behind all such complexities is some basic arithmetic.

Simple Debt Sustainability Arithmetic

Public debt rises if spending exceeds revenue. Dollars out, after all, must be balanced by dollars in from either revenues or new borrowing.[5] This is summarized by the government's budget constraint,

$$G_t + r_t \times D_{t-1} = R_t + \Delta D_t,$$

where G_t is program expenditures, r_t is the rate of interest on debt D_{t-1} last period, R_t is government revenue (from all sources), and finally $\Delta D_t = D_t - D_{t-1}$ is the change in public debt (i.e., the deficit). If spending (the left-hand side of the equation) exceeds revenue R_t then borrowing increases debt as $\Delta D_t > 0$. The reverse holds if revenue exceeds spending. Importantly, changes in debt in one period affect the government's future budget because it affects interest costs and therefore future spending. There is therefore a risk that debt snowballs and grows beyond a government's ability to service it.

How much debt can sustainably increase over time depends on economic growth. Without economic growth, public debt cannot indefinitely grow more quickly than the interest rate. If current public debt is rolled over, without ever paying off principle, then D_0 today becomes $D_o(1 + r)$ next year and $D_0(1 + r)^2$ the year after, and so on. This exponential growth implies debt will eventually grow beyond the public's ability to service it. But with a growing economy, that ability to service debt is itself increasing. In this case, if debt is rolled over indefinitely, the *burden* of debt D_0 today becomes $D_0(1 + r)/(1 + g)$ tomorrow, where g is the rate of growth in the economy, and $D_0(1 + r)^2/(1 + g)^2$ the year after, and so on. If these values are declining over time, say due to economic growth g exceeding interest rates r, then this is mechanically sustainable in perpetuity. This also motivates looking at debt ratios (that is, debt to GDP) rather than levels. It not only allows for easy comparison of debt burdens over time and across jurisdictions but is the relevant measure for long-run sustainability analysis.

Dividing through the government's budget constraint by nominal GDP and rearranging somewhat yields an expression that governs how debt ratios evolve,

$$d_t = \left(\frac{1 + r_t}{1 + g_t}\right) \times d_{t-1} - p_t,$$

where p_t is the governments primary budget balance (revenue R_t minus program spending G_t) as a share of GDP and d_t is total debt as a share of GDP. If the primary budget is balanced, then revenues cover all program spending and the debt ratio next period will evolve over time according to $(1 + r_t)/(1 + g_t)$. If interest rates exceed growth rates, then this ratio is larger than one and debt burdens will rise. If interest

[5] Another option is printing money. This comes with a risk of rising inflation if not used in moderation, so most advanced economies shy away from this option and central banks operate (largely) independently of fiscal authorities. And since money printing is unavailable for provincial governments (the focus of this paper), I do not consider it in the analysis.

rates equal growth rates, then the debt ratio remains stable. And if interest rates are lower than growth rates, then the debt ratio gradually declines to zero over time.

This expression also allows one to appreciate what factors matter for long-run sustainability. In the next section, I will unpack this in more detail, but if the debt ratio, interest rates, and growth rates are each stable then so too is the burden of debt. This is sustainable. To achieve this, the above expression reveals that to achieve $d_t = d_{t-1}$ the government must run a primary balance equal to

$$p^* = \left(\frac{r-g}{1+g}\right) \times d.$$

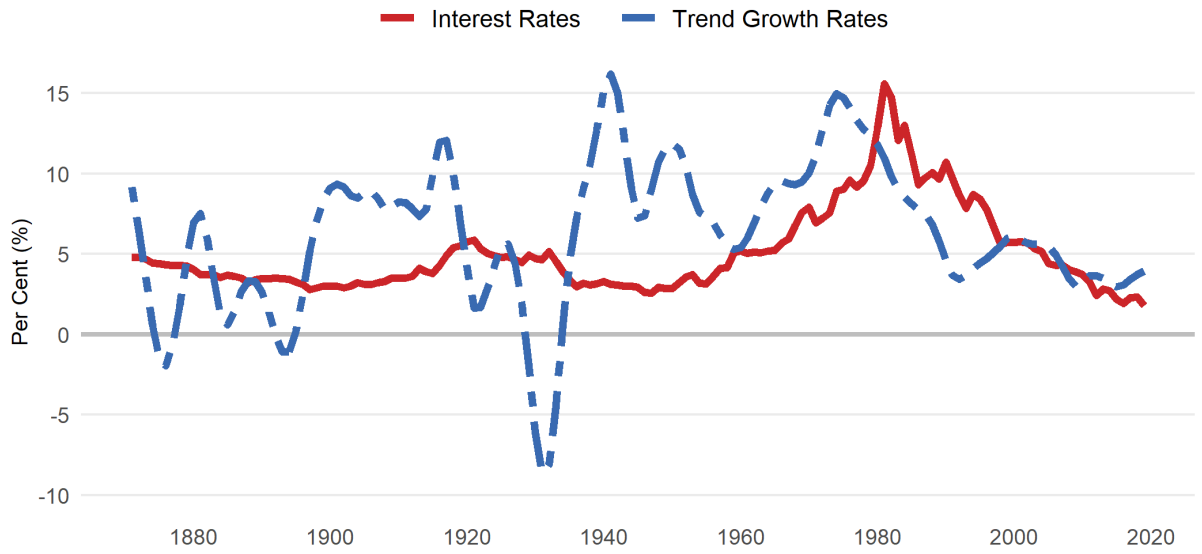
If interest rates exceed growth rates, then government must run a primary surplus to compensate and maintain the debt ratio at d. If primary balances fall short, then a "fiscal gap" exists. In this case, increases in revenues or decreases in program spending may be required. And if debt levels increase, say from a short-term shock, then government would require a larger primary surplus to ensure sustainability if $r > g$. In this sense, $(r-g)$ captures the fiscal cost of public debt. But if interest rates are less than growth rates then larger debt may create a fiscal benefit by allowing governments to sustainably run larger primary deficits. I will return to this point shortly, but much therefore depends on the interest-growth differential $(r-g)$. Historical experience provides insight around what this differential normally is.

Gathering data from a variety of sources, I display the full history of Canada's long-term interest rates and economic growth rates in Figure 2 (a). I abstract from the periodic ups and downs over the business cycle by displaying the underlying trend rate of growth. Growth is typically more volatile than long-term interest rates, but robust growth that exceeds interest rates is not uncommon – in fact, it is the norm. The trend rate of annual nominal GDP growth since confederation averaged over 6.2 percent. Meanwhile, nominal long-term borrowing rates averaged just over 5 percent meaning the average interest-growth differential was -1.2 percent. But, as evident in Figure 2 (b), there is significant variation around this average. In the years between 1945 to 1979, the differential averaged over -4 percent while between 1980 and 2000 it averaged over +3 percent. Since 2000, the average differential was modestly negative at -0.5 percent. This phenomenon is not unique to Canada. Recent research suggests interest rates falling below economic growth rates occurs more frequently than the reverse, often for long stretches.[6] These interest-growth differentials also imply the fiscal cost of public debt can fluctuate and potentially be negative (that is, a fiscal benefit). I plot this in Figure 3.

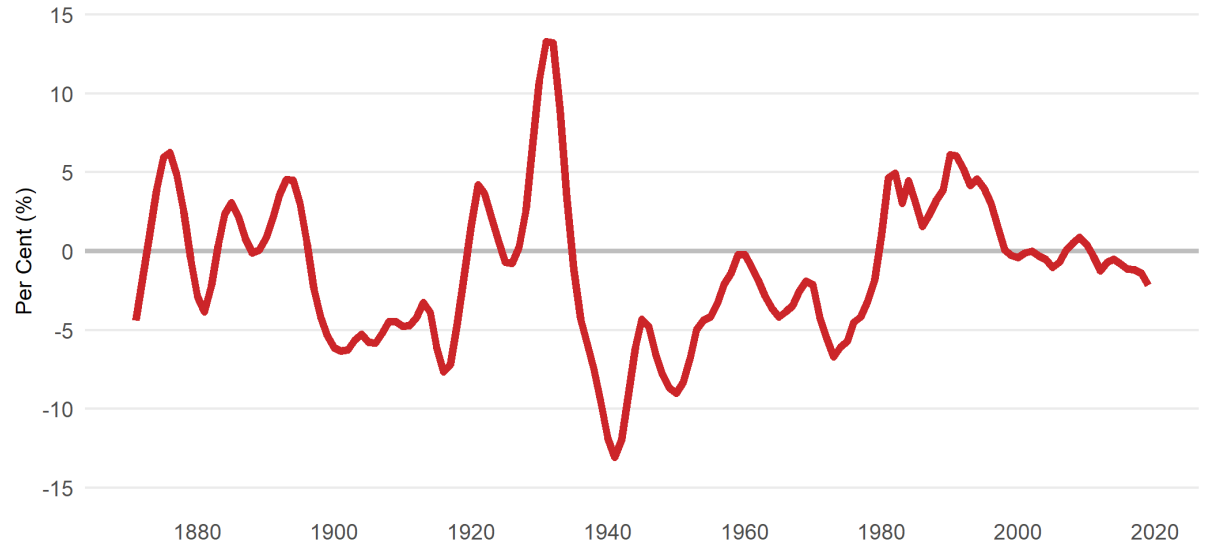
[6] See, for example, Paolo Mauro and Jing Zhou, "r-g<0: Can We Sleep More Soundly?" (2020) 20:52 *IMF Working Paper*.

Figure 2: Comparing Borrowing Costs and Growth Rates in Canada, 1870-2019

(a) Long-Run Nominal Interest Rates and Economic Growth Rates



(b) The Interest-Growth Differential

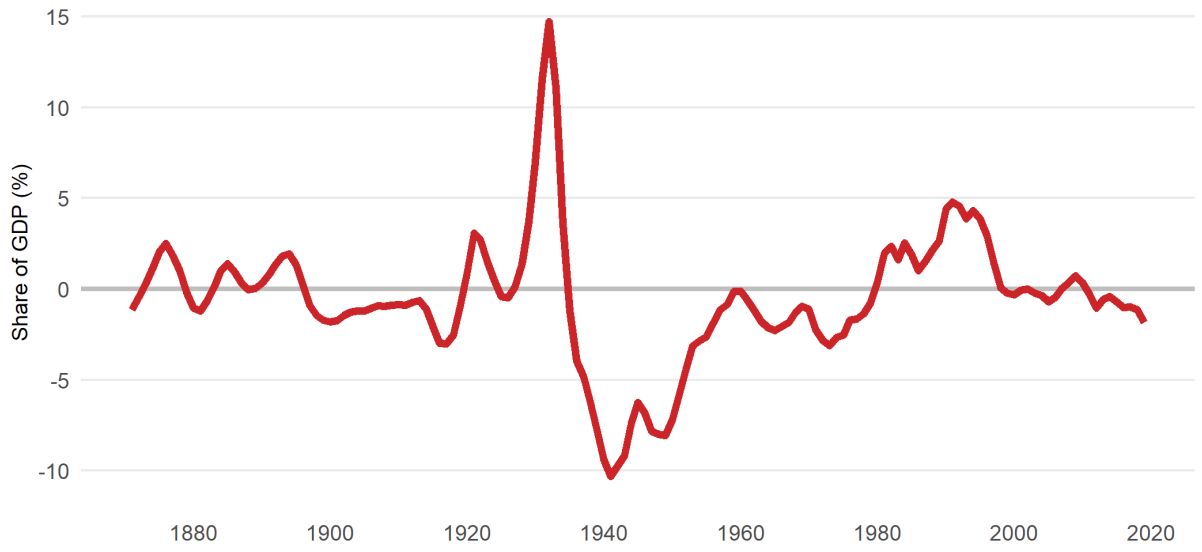


Note: Displays the long-term nominal interest rates and the trend annual nominal economic growth rates in Canada from 1870 to 2019. The cyclical component of GDP growth is removed using a Hodrick–Prescott filter.

Source: Long-term nominal interest rates for 1870 to 1975 and GDP growth for 1870 to 1981 is from Òscar Jordà, Katharina Knoll, Dmitry Kuvshinov, Moritz Schularick, and Alan M. Taylor, "The Rate of Return on Everything, 1870–2015" (2019) 134:3 *Quarterly Journal of Economics* 1225-1298 and Òscar Jordà, Moritz Schularick, and Alan M. Taylor, "Macrofinancial History and the New Business Cycle Facts" (2016) 31 *NBER Macroeconomics Annual* 213 – 263. Interest rates for 1976 to 2019 is from Statistics Canada table 10-10-0122-01, "Financial market statistics, last Wednesday unless otherwise stated, Bank of Canada", vector v122544. Growth rates for 1982 to 2018 is from Statistics Canada table 36-10-0222-01, "Gross domestic product, expenditure-based, provincial and territorial, annual", vector v62787312, updated to 2019 using the *Federal Economic and Fiscal Snapshot 2020*.

Looking forward, both growth and interest rates may continue recent trends. Indeed, they share one particularly important driver: an aging population, which will be the focus of much of the analysis to come. There are a variety of mechanisms at play, but on balance an aging population may lower an economy's potential rate of growth by decreasing the share of its population employed and may also lower interest rates through changes in savings behaviour over one's lifecycle.[7] In Canada, recent evidence suggests the natural real rate of interest may have been consistently falling over time, as in many countries.[8] Observed rates fluctuate from year to year, to be sure, but a real federal interest rate of 1 percent (3 percent nominal) with provincial borrowing rates roughly one percentage point higher is a reasonable rule-of-thumb that I will use in this paper. Current forward rates for government borrowing costs are notably less than this. As for growth rates, if one presumes labour productivity growth of 1 percent per year then the analysis to come points to real GDP growth averaging 1.7 percent (3.7 percent nominal). This is consistent with estimates of trend real growth in the literature and among many forecasters. It also implies that future economic growth may very well exceed long-term federal borrowing rates.

Figure 3: The Fiscal Cost of General Government Debt in Canada, 1870-2019



Note: Displays the fiscal cost of debt as a share of GDP in Canada, based on $d_0(r-g)/(1+g)$. See text for details.

Source: Author's calculations from the data in Figure 1 and Figure 2.

Does this mean any level of debt is sustainable? If we can perpetually roll over debt incurred today, then both current and future generations benefit. This is known as the "deficit gamble" — and it may payoff under certain conditions.[9] But it comes with risk: if we fail to roll over debt due to, say, a large adverse

[7] For informative research, see Douglas Elmendorf and Louise Sheiner, "Federal Budget Policy with an Aging Population and Persistently Low Interest Rates" (2017) 31:3 *Journal of Economic Perspectives* 175-194; Kurt Lunsford and Kenneth West, "Some evidence on secular drivers of US safe real rates" (2017) 17:23 *Federal Reserve Bank of Cleveland Working Paper*; Gabriele Fiorentini, Alessandro Galesi, Gabriel Pérez-Quirós, and Enrique Sentana, "The rise and fall of the natural interest rate" (2018) 13042 *CEPR Discussion Paper*; and Carlos Carvalho, Andrea Ferrero, and Fernanda Nechio, "Demographics and real interest rates: Inspecting the mechanism" (2016) 88 *European Economic Review* 208-226.

[8] Kathryn Holston, Thomas Laubach, and John C. Williams, "Measuring the natural rate of interest: international trends and determinants" (2017) 108:S1 *Journal of International Economics* 59-75.

[9] Laurence Ball, Douglas Elmendorf, and N. Gregory Mankiw, "The Deficit Gamble" (1998) 30:4 *Journal of Money, Credit and Banking* 699-720.

shock then costly fiscal adjustment will then be required. It may be prudent to avoid this risk. High debt levels may also lower the probability and duration of periods with favorable interest-growth differentials.[10] But regardless, rising debt levels may not be optimal even if there are mechanical fiscal benefits. Taxes necessary to pay interest, for example, may come with additional distortionary effects on the economy and government bonds may crowd out private investment. These are topics explored by a large (and recently growing) research literature but will not be examined in this paper. In any case, with this foundational knowledge and intuition in hand, some additional detail is necessary to quantify the long-run fiscal challenges facing Canada's governments.

A General Framework for Debt Sustainability Analysis

Over long horizons, it is helpful to express future values in present value terms. A dollar next year, after all, is worth less than one today. Similarly, 1 percent of GDP next year is different than 1 percent today. Given interest rates and growth rates that may change through time, define the effective discount rate φ_t as

$$\varphi_t = \prod_{s=1}^{t} \left(\frac{1 + r_s}{1 + g_s} \right).$$

Intuitively, this represents the accumulated interest rates and growth between today and some future year t. Debt of d_0 today, for example, will have a future value of $\varphi_t d_0$ in t years. And the present value of some future primary surplus p_t is p_t/φ_t today. This object is also useful to determine how annual flows accumulate. Specifically, the "sinking fund factor" — the annual amount necessary to accumulate a value equal to 1 percent of GDP by the end of T years — is

$$\sigma_T = \frac{1}{\varphi_T} \left(\sum_{t=1}^{T} \varphi_t^{-1} \right)^{-1} \equiv \frac{\bar{\varphi}_T}{T \varphi_T},$$

where $\bar{\varphi}_T$ is the (harmonic) mean of the effective discount rates φ_t over T years. To accumulate an amount equal to 10 percent of GDP, for example, one must raise $10 \times \sigma_T$ percent of GDP each year for the next T years. Both objects φ_t and σ_T are useful for analyzing public debt dynamics. The former converts between future and present values while the latter converts between stocks and flows.

As discussed, public debt evolves according to the government's budget constraint. Future debt is the accumulated changes derived through repeated substitution of one period's budget constraint $d_t = [(1 + r_t)/(1 + g_t)] \times d_{t-1} - p_t$ into the next. After appropriately rearranging, we have

$$d_T = \varphi_T \times d_0 - \varphi_T \times \left(\sum_{t=1}^{T} \varphi_t^{-1} p_t \right).$$

Though the full derivation is omitted, this result is intuitive. The first term is future debt caused by current debt d_0. The second term is future debt caused by imbalances between revenue and program spending, summarized in parentheses by the present value of all future primary balances p_t. Projecting those future primary balances will occupy the bulk of the analysis to come. With them in hand, this expression allows

[10] For recent evidence on these considerations, see Weicheng Lian, Andrea Presbitero, and Ursula Wiriadinata, "Public Debt and r-g at Risk" (2020) 20:137 *IMF Working Paper*.

us to see if future debt levels d_T will exceed current levels d_0, and by how much. If they do differ, then a fiscal gap exists and changes in revenues or expenditures may be warranted.

Consider an immediate and permanent change in revenues or program spending to ensure $d_T^* = d_0$, where d_T^* is the future debt level with fiscal adjustment. That is, define a fiscal adjustment f such that

$$d_0 = \varphi_T \times d_0 - \varphi_T \times \left(\sum_{t=1}^{T} \varphi_t^{-1}(p_t + f) \right),$$

This effectively determines the annual contribution f required to accumulate $(d_T - d_0)$ by year T. Using the sinking fund factor, this is simply

$$f = (d_T - d_0) \times \sigma_T,$$

which will be our measure of a government's fiscal gap. Notice, it can be either positive or negative. If a government is projected to run large primary surpluses in the future, and therefore future debt levels will be lower than today's, then $f < 0$. This means there is scope for sustainable tax cuts or spending increases. The opposite is true for governments facing projected primary deficits.

Some additional intuition may solidify this point. In a special case where interest rates and growth rates are constant over time, the fiscal gap becomes

$$f = d_0 \times \left(\frac{r - g}{1 + g} \right) - \bar{p},$$

where $\bar{p}$ is the average primary balance from now until time T.[11] The intuition here is identical to the simple arithmetic explored earlier. To maintain a stable debt ratio, fiscal policy must adjust to offset primary deficits and any change in the burden of current debt over time. This expression also clarifies the way in which changes in interest rates matter. In general, they affect discount rates and therefore potentially $\bar{p}$. But if revenues and expenditures both grow at the same rate as the economy (and therefore p_t is constant) they have no effect on $\bar{p}$. The effect of interest rates on the fiscal gap therefore only depends on current debt. To illustrate, if debt is 50 percent of GDP and the interest-growth differential rises by one percentage point then the fiscal gap increases by 0.5 percent of GDP. This reveals how higher debt today increases risk exposure to future changes in interest-growth differentials.

Given this risk, what if we do not want to simply maintain debt but instead repay it? To achieve $d_T = 0$, we require a larger fiscal adjustment to accumulate d_0 by year T. Specifically,

$$f_0 = f + d_0 \sigma_T.$$

To be clear, neither fiscal gap measure represents optimal policy. They are almost surely not optimal. Any sequence of annual adjustments f_t can achieve the same result as a single uniform adjustment so long as, on average, they are equal and therefore $\bar{f} = f$. Government will need to balance many important trade-

[11] In general, $\bar{p} = \sum_{t=1}^{T} \omega_t p_t$ where the weights are $\omega_t = (1/\varphi_t)/(\sum_{t=1}^{T} 1/\varphi_t)$. The general solution is $f = d_0(\varphi_T - 1)\omega_T - \bar{p}$ to achieve $d_T = d_0$. Alternatively, to achieve zero debt by period T the gap is $f_0 = d_0 \varphi_T \omega_T - \bar{p} = f + d_0 \times \omega_T$. Finally, when governments have meaningful levels of financial assets (such as in Alberta), achieving the same net debt level at time T requires $f_n = [d_0(\varphi_T - 1) - \Delta a]\omega_T - \bar{p} = f - \Delta a \times \omega_T$, where Δa is the change in financial assets as a share of GDP. The two measures are identical if financial assets grow with GDP.

offs when implementing any fiscal policy adjustments. These measures of fiscal gaps are nevertheless useful as digestible metrics to quantify the scale of future challenges.

The Effect of a Temporary Fiscal Shock

Fiscal adjustment to repay debt is particularly useful for analyzing temporary shocks such as COVID-19. If we (for now) suppose that there are no permanent structural changes in revenue or program spending, then we can focus only on changes in debt. Though much remains uncertain, suppose the pandemic increases debt by $100 billion (over 4 percent of GDP) provincially and $360 billion (nearly 16 percent of GDP) federally. The combined effect is an increase in general government debt of 20 percent of GDP. While merely illustrative, this matches the IMF's projection for Canada in their July 2020 World Economic Outlook.

What effect does a 20 percentage point increase in the government debt ratio have for long-run finances? If anticipated interest rates and growth rates are unaffected, then changes in long-run sustainability depends on the change in debt and the interest-growth differential. Specifically,

$$\Delta f = \Delta d_0 \times \left(\frac{r-g}{1+g}\right).$$

An interest-growth differential of, say, 0.01, implies a 20 percentage point increase in the public debt would increase the fiscal gap by 0.2 percent of GDP — 0.16 percent federally and the rest provincially. This is relatively minor, but not trivial. For perspective, it is roughly 0.5 GST points in perpetuity. But this is highly sensitive to the interest-growth differential. If interest rates equal growth, then there are no ongoing fiscal costs from the shock. And if interest rates fall below growth (as we have seen is possible for the federal government) then there are fiscal *benefits* from the higher debt in the sense that there would be room to lower revenue or increase program expenditures and maintain a stabile (though now higher) debt/GDP.

Simply maintaining the debt ratio in the face of a large current shock, however, may be imprudent. Governments may therefore wish to bring down their debt ratios to pre-crisis levels. How large a fiscal adjustment is required depends on how quickly one wants to bring debt ratios down. If we wish to do so over T years, then the required adjustment is

$$\Delta f = \Delta d_0 \times \varphi_T \times \sigma_{\mathrm{T}}.$$

More intuitively, if interest rates and growth rates are constant then

$$\Delta f = \underbrace{\Delta d_0}_{\substack{The\\ Debt\\ Shock}} \times \underbrace{\left(\frac{r-g}{1+g}\right)}_{\substack{Carrying\\ Costs}} \times \underbrace{\left(1-\left(\frac{1+r}{1+g}\right)^{-T}\right)^{-1}}_{\substack{To\ Repay\ Debt\\ Over\ T\ Years}} \approx \frac{\Delta d_0}{T}.$$

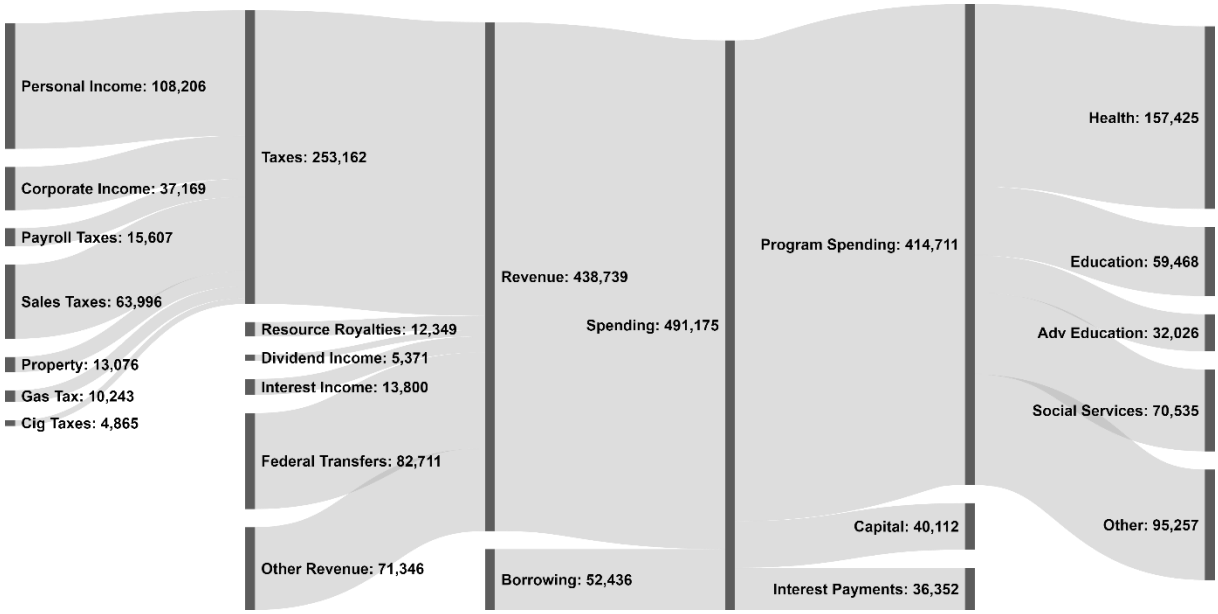
The second term is the carrying cost of the incremental debt. The third term reflects how much more than carrying costs payments must be to repay the debt over T years. If interest rates and growth rates are equal, however, then $\bar{\varphi}_T = 1$ and therefore $\Delta f = \Delta d_0/T$. Retiring COVID-related debt equivalent to 20 percent of GDP would therefore require increasing revenue or decreasing spending by 2 percent of GDP for ten years, or 1 percent for twenty. This is a convenient rule-of-thumb.

With this robust framework for modeling public debt dynamics in hand, we may proceed to a detailed examination of federal and provincial finances in Canada.

Projecting Government Finances over the Long-Run

To project future primary balances, I disaggregate revenues and expenditures into separate components and project forward their underlying bases or cost drivers. This exercise will be grounded in an initial year that maps directly to data on government finances from Statistics Canada. I summarize the relevant provincial budget components and data sources in Figure 4 and in what follows I (briefly) describe the assumptions I use to project their future values.

Figure 4: Provincial Government Financial Flows (2018)



Note: Displays the aggregate 2018 fiscal inflows to provincial government on the left and the fiscal outflows on the right. All values are in millions of dollars.

Source: Author's calculations from Statistics Canada tables 10-10-0017-01, "Canadian government finance statistics for the provincial and territorial governments," and 10-10-0024-01, "Canadian classification of functions of government, by general government component." Additional federal budget data, though not displayed, is from Statistics Canada table 10-10-0016-01, "Canadian government finance statistics for the federal government."

On the revenue side, I model twelve separate sources. Most revenues grow with the overall economy. Personal income taxes, corporate income taxes, payroll taxes, consumption and excise taxes are mechanically related to total income and total spending. To the extent that economic growth is shared proportionally across the income distribution, then aggregate rates of economic growth are sufficient proxies for rates of growth in these revenue sources. Certain other revenue sources also keep pace with overall economic growth, such as business income and (potentially) natural resource revenues. But many revenue sources grow more slowly. Some provincial governments, such as British Columbia, for example, set property tax growth to maintain the real cost per household. I presume revenue from this source will therefore roughly keep pace with population plus inflation. Cigarette and gasoline taxes are also likely to grow more slowly. The former as the share of the smoking population declines and the latter as fuel use

declines from technological change. I presume cigarette taxes grow with inflation and gasoline taxes grow with real GDP. Regarding own-source revenues in the "Other Revenue" category, I presume they grow with inflation and population. Finally, federal transfers follow explicit formula.

I separately model four distinct components of federal transfers. First, the Canada Health Transfer (the largest major transfer) grows with a moving average of national nominal GDP growth, with a minimum floor growth rate of 3 percent per year. The Canada Social Transfer is simpler and grows at a fixed rate of 3 percent per year. Both transfer programs are distributed across provinces according to population. Equalization payments, meanwhile, are not equal and instead are distributed according to provincial revenue-raising capabilities. The total size of equalization grows with a moving average of national nominal GDP, with no floor growth rate. I model provincial fiscal capacity as evolving from the observed average across fiscal years starting 2016 to 2018 and over-time according to a three-year moving average of provincial nominal GDP. This is a very good approximation each province's true fiscal capacity. Fourth, and finally, I presume all other transfer programs grow with population and inflation.

On the expenditure side, the three largest provincial ministries account for over 60 percent of total program spending. I model each separately. Healthcare, given its size and its importance for long-run provincial finances, will be discussed in depth shortly. Primary and secondary education spending will grow along with the K-12 population plus inflation plus a 0.5 percent per year real increase in the per-pupil spending. This increment roughly accounts for real wage increases among workers in education keeping pace with the rest of the economy. Similarly, post-secondary education spending will grow along with the relevant population, which I consider to be those aged 20 to 24, plus inflation and a 0.5 percent real per-pupil increase. I presume all other program spending grows in line with population plus inflation (a very conservative assumption) and capital spending grows with the overall economy.[12] Provincial primary balances are then total revenue from all sources minus total program and capital spending.

The federal government is also an important component of the analysis to come. Their revenue sources are simpler and grow faster than provincial governments since income and consumption tax revenues are a significantly larger share of the total. Tax revenues that grow with the economy are nearly 90 percent of federal revenues. Other sources of revenue, such as from government business enterprises, are also likely to grow with overall GDP. EI premiums, meanwhile, are tied to EI benefit payments. On the spending side, the federal government makes significant transfers to individuals through old age benefits, families with children, and the unemployed. I presume each grows with the relevant demographic group plus inflation and EI benefits grows with GDP per worker. I presume defense spending to grow with the overall economy, as this is consistent with stated goals and NATO guidelines. Transfers to provinces was already discussed, leaving other program spending that grows with population plus inflation.

Finally, there are several important macroeconomic variables that drive these budget projections. As discussed earlier, I presume federal borrowing rates of 3 percent and provincial borrowing rates are 4 percent. Actual rates may come in lower or higher, and I explore how sensitive the main results are to alternative assumptions. Total interest costs are endogenous and are determined by the model: public debt of d_t implies interest costs of $r \times d_t$. To err on the conservative side, I do not presume that interest rates themselves respond to overall debt levels. This presumes Canadian governments have access to a large global capital market that does not charge a risk premium if debt levels grow large. Finally, for each

[12] Provincial budgets do not normally consider infrastructure spending within their budget deficits since they are gradually amortized over time. As the focus of this paper is on public debt dynamics, a cash basis for the deficit is more appropriate so all capital spending is included.

province's overall economy, I presume real GDP is $Y_{it} = A_{it}w_{it}P_{it}$, where A_{it} is labour productivity, w_{it} is the working-age share of the population, and P_{it} is total population. I assume labour productivity growth is 1 percent per year and the working-age share is from the same Statistics Canada population projections. Total GDP across all provinces is then Canada's total GDP.[13]

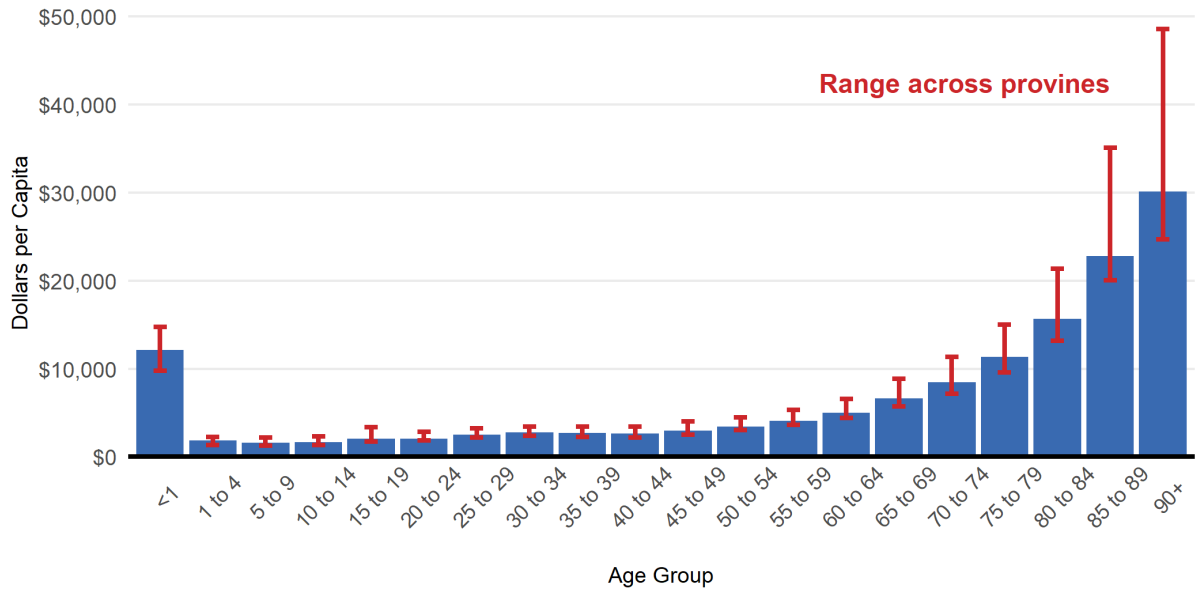
Projecting Future Healthcare Expenditures

Healthcare is the most significant public service delivered by provincial governments. It accounts for nearly 40 percent of overall program spending and as populations age this will only grow. Statistics Canada's latest projection suggests the share of Canada's population aged 65 and over may rise from 18 percent today to over one-quarter by 2060 while the share aged 75 and over may double from over 7 percent today to over 14 percent. Changes in population shares map into healthcare spending using data on average spending by age and gender cohorts. Specifically, average per capita spending for a province i in year t is,

$$h_{it} = \sum_{c} h_{it}^{c} p_{it}^{c},$$

where h_{it}^{c} is the per capita spending for cohort c (say, men aged 20 to 24 or women aged 65 to 69) and p_{it}^{c} is the share of the province's population accounted for by this cohort. The Canadian Institute for Health Information compiles this and I illustrate the full distribution of age-specific healthcare spending in Figure 5, with the range across all provinces illustrated as whiskers around the overall Canadian average.

Figure 5: Per Capita Health Spending in Canada by Age Group (2017)



Note: Displays the average level of health spending in Canada per person across different age groups. The range across provinces resents the gap between the lowest average spending and the highest average spending provinces.

Source: Author's calculations from the Canadian Institute for Health Information, *National Health Expenditure Trends: 1975 to 2019* (Ottawa, Ontario: CIHI, 2019).

[13] This abstracts from economic activity in the three northern territories. This is not quantitatively important for the analysis.

Demographics will affect average spending levels as population shares change. In this analysis, I use Statistics Canada's population projections for 2018 to 2068, taking their medium growth (M2) scenario as the baseline case but report how sensitive the results are to alternative growth assumptions.[14] Beyond 2068, I presume population shares are constant. In any case, holding all else constant, health costs increase according to a weighted-average of cohort-specific population change,

$$\hat{h}_{it} = \sum_{c} \omega_{i0}^{c} \hat{p}_{it}^{c},$$

where $\omega_{i0}^{c} \propto h_{i0}^{c} p_{i0}^{c}$ is the initial share of total health spending accounted for by spending on individuals within cohort c and hats denote relative changes. I find that $\hat{h}_{it}$ is nearly 1.28 for British Columbia by 2050, implying that demographics and aging alone will increase the health spending by 28 percent. This ranges from a high of 1.53 in Newfoundland and Labrador to a low of 1.14 in Saskatchewan.

Beyond demographics, other factors contribute to health spending. To estimate health-specific cost inflation over and above the economy-wide 2 percent per year, use the same weights ω_{i0}^{c} to construct

$$\hat{h}_{it} = \sum_{c} \omega_{i0}^{c} \hat{h}_{it}^{c}.$$

Since 1998, I estimate this grew at roughly 1.3 percent per year. Though there is significant variation over time and across provinces. From 1998 to 2010, for example, this averaged 2.3 percent across Canada and fell to roughly zero in the years following. Over the whole period since 1998, this measure was lowest in Quebec, at 0.85 percent per year, and highest in Alberta, at 2.3 percent. Going forward, I presume 1 percent health-specific inflation as the baseline case, but report results across a range of values. Note that this presumes the same rate of health-specific inflation across all age and gender cohorts.[15]

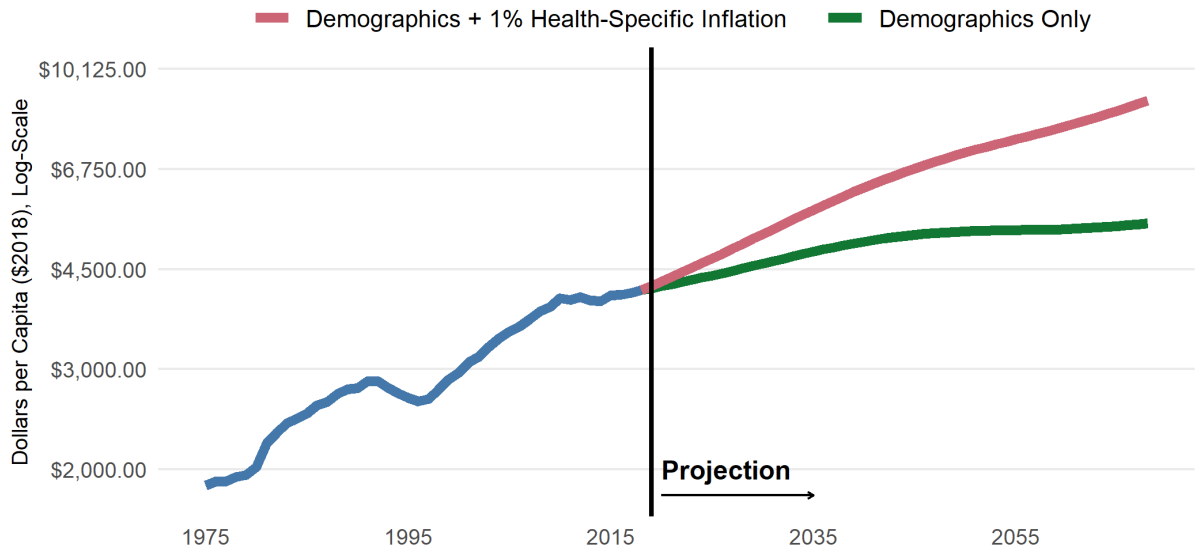
Combining both demographic change and health-specific inflation, I project forward overall per capita healthcare costs for each province. While I do not display all individual provincial projections here, I report the average per capita spending levels in Figure 6. From an overall level of roughly $4,500 per capita in 2018, the projection with only demographics rises to over $5,000 (2018$/capita) by 2040 and nearly $5,300 by 2050. Health-specific inflation adds to this, combining to over $6,200 by 2040 and $$7,200 by 2050. Over the next 30 years, this represents an average annual growth of 1.8 percent per year to health costs due only to demographics and incremental health-specific inflation of 1 percent per year. This analysis suggests provincial healthcare spending in Canada will rise from just over 7 percent of GDP today to nearly 9 percent by 2040 and to 10 percent by 2050. It plateaus at roughly this level for remaining years. This three percentage point increase in provincial health spending is reasonable, though it is somewhat larger than the latest PBO Fiscal Sustainability Report projection. To be clear, there are several sources of uncertainty. Technological developments in health deliver may increase or decrease costs. Immigration patterns may dampen the pace at which Canada's population ages. And healthcare spending is also endogenous to other government policies, such as supports for low-income individuals, housing,

[14] Statistics Canada, Table 17-10-0057-01, "Projected population, by projection scenario, age and sex, as of July 1".

[15] The size of future price changes is unlikely to be uniform, and historically the relative costs increases for older age cohorts has been smaller than for younger cohorts, but this is a reasonable approximation.

promotion of health and wellness, and so on. It is nevertheless a conservative illustration of a potential future.

Figure 6: Per Capita Health Spending by Provincial Governments, Actual and Projected



Note: Displays the average level of health spending by provincial government per capita historically between 1975 and 2019 and my baseline projection from 2018 onwards. The projection separately reports healthcare costs with and without a 1 percentage point higher rate of price inflation in healthcare.

Source: Own calculations from the Canadian Institute for Health Information, *National Health Expenditure Trends: 1975 to 2019* (Ottawa, Ontario: CIHI, 2019) for the period 1975 to 2019. Displays the population-weighted average per capita spending across all provinces. The projection incorporates several data sources and methods. See text for details.

Long-Run Fiscal Sustainability of Canada's Provinces

Combining all revenue and expenditure projections described in the previous section, we may proceed to estimating the long-run fiscal future of Canada's various governments. Overall, the federal government is in a much stronger position than provincial governments. Federal revenue growth averages roughly 3.7 percent per year consistently throughout the 75-year forecast horizon. The ratio of federal revenue to GDP is therefore stable, as this is also the growth rate of the national economy. Provinces, however, will see more modest revenue growth of between 3.3 and 3.4 percent, and therefore the revenue to GDP ratio declines from its current 20 percent to 17.4 percent by 2040 and 16 percent by 2060. In terms of program expenditures, the federal government may see growth averaging 3.4 percent per year to 2040, declining somewhat afterwards. Provincial governments may see much more rapid growth of 3.8 percent to 2040 overall, and roughly 3.5 percent afterwards. Health spending is a core driver, with growth at nearly 5 percent per year over the next two decades and a more modest 4 percent thereafter. With provincial revenues failing to keep pace with expenditures, deficits will rise and debt will mount. The federal government will see the opposite. Using the debt dynamics expressions derived earlier, I summarize the average annual primary deficits and the accumulated debt those deficits create in Table 1. Specifically, these values correspond to $-\bar{p}$ and $-\sum_{t=1}^{T} \varphi_t^{-1} p_t$, respectively.

Table 1: Long-Run Fiscal Projections for Canada's Governments (Percent of GDP)

Province	Current Debt	Average Annual Primary Deficit for the Period from 2018 Until…				Accumulated Primary Deficits for the Period from 2018 Until…			
		2030	2050	2070	2090	2030	2050	2070	2090
BC	22	0.6	1.5	1.9	2.1	7	44	89	131
AB	25	4.2	4.6	4.9	4.9	52	163	289	418
SK	29	2.7	3.1	3.3	3.4	32	101	173	240
MB	74	0.2	1.1	1.5	1.6	3	35	74	107
ON	47	2.1	2.7	2.9	3.0	24	82	139	188
QC	52	-2.2	-1.3	-0.9	-0.9	-25	-35	-40	-49
NB	70	1.7	2.5	2.7	2.6	18	64	98	120
NS	43	0.8	2.0	2.3	2.4	9	51	88	114
PE	38	1.7	3.2	3.8	3.9	20	97	180	248
NL	46	5.8	7.7	8.3	8.4	60	173	253	306
Provinces	42	1.4	2.2	2.5	2.6	16	66	120	167
Federal	35	-0.4	-1.0	-1.7	-2.5	-5	-34	-104	-229

Note: Reports the current gross debt ratio for 2018, the average primary budget deficits $-\bar{p}$ over various time horizons, and the accumulated present value of those deficits, $-\sum_{t=1}^{T} \varphi_t^{-1} p_t$. All values are shares of GDP.

Sources: Current debt is from Statistics Canada tables 10-10-0017-01, "Canadian government finance statistics for the provincial and territorial governments." Other values are the authors' calculations. See text for details.

Most provincial governments face large and persistent gaps between their projected revenues and program expenditures. Quebec is the notable exception. Between 2018 and 2050, for example, Quebec's average annual primary surplus is 1.3 percent of GDP. By comparison, all other provincial governments have average annual primary deficits of no less than 1.1 percent and Newfoundland and Labrador have average deficits of 7.7 percent. In present-value terms, these provincial primary imbalances are collectively equivalent to two-thirds of GDP today for projected imbalances from 2018 to 2050. For imbalances from 2018 to 2090, I estimate these imbalances are equivalent to 168 percent of GDP today. For comparison, the total stock of current provincial gross debt is 42 percent of GDP. Future imbalances are therefore significantly larger than current debt and dwarf the short-term debt increases due to COVID-19. The federal government, meanwhile, faces long-run primary surpluses that average 1 percent of GDP between 2018 and 2050. And over time these grow even larger. Between 2018 and 2090, average federal primary surpluses are 2.5 percent GDP – the equivalent of roughly 8 GST points today. The present-value of such surpluses approach 230 percent of GDP.

Projected provincial debt levels are not merely large, they are unsustainable. And for some provinces, they would not likely be possible and a fiscal crisis would occur before the end of the forecast horizon. By the end of the 75 period, for example, I project a debt to GDP ratio of nearly 350 percent of GDP for Alberta. At 4 percent interest, this would require 14 percent of Alberta's entire economy be directed towards debt service payments. But given the revenue instruments available to the government in this projection, interest costs are 125 percent of revenue. Something would have to give long before this materializes. One measure of long-run sustainability is the fiscal adjustment required, starting immediately, to stabilize debt as a percent of GDP. This is equivalent to the average primary imbalances reported in Table 1 plus a measure of the burden of current debt. This fiscal gap is 2.7 percent of GDP for

provincial governments collectively and -2.8 percent for the federal government. Importantly, the combined federal and provincial finances are sustainable in the long run, but there exists a persistent imbalance between the two orders of government and large differences between provinces. I report gaps for each province in Table 2.

Table 2: Long-Run Fiscal Gaps for Canada's Provinces (Percent of GDP)

Province	Gross Debt in 2018	Net Debt in 2018	Fiscal Adjustment to Meet Different Debt Targets over a 75-Year Horizon		
			Zero Debt	Same Net Debt	Same Gross Debt
BC	22.5	14.4	2.5	2.3	2.2
AB	25.5	8.0	5.2	5.1	4.8
SK	29.4	14.7	3.8	3.6	3.4
MB	74.4	34.4	2.6	2.2	1.7
ON	47.8	39.5	3.7	3.2	3.1
QC	51.7	39.3	0.0	-0.4	-0.6
NB	69.7	37.8	4.1	3.7	3.5
NS	43.4	33.8	3.3	3.0	3.0
PE	38.5	30.4	4.5	4.1	4.0
NL	46.1	46.1	9.7	9.4	9.4
Provinces	41.7	30.0	3.2	2.9	2.7
Federal	35.1	32.6	-2.2	-2.8	-2.8

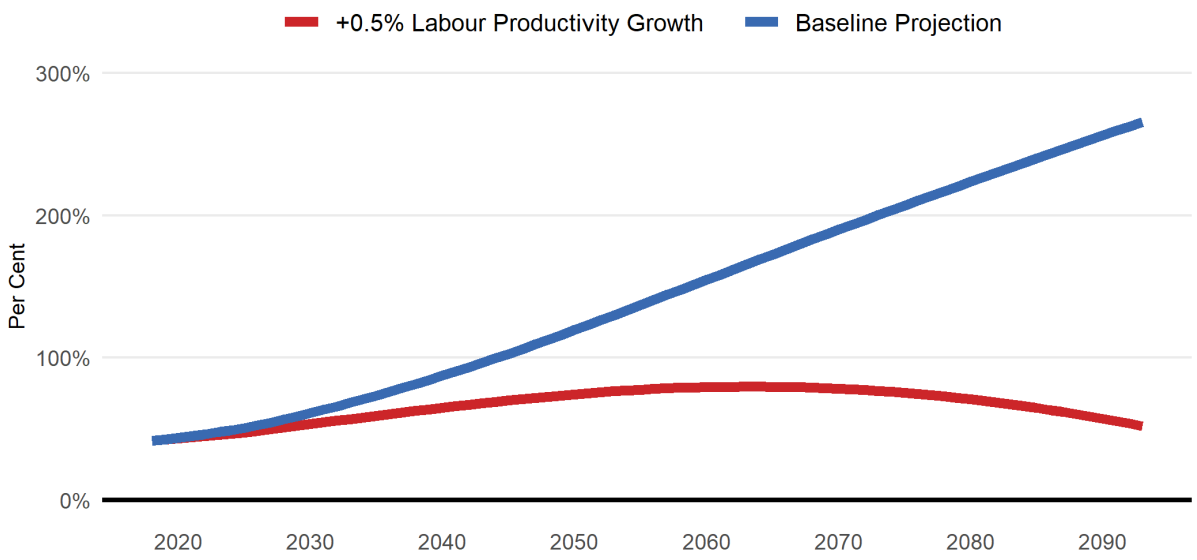
Note: Displays the initial debt and net debt as a share of GDP in 2018 and three measures of the 75-year horizon fiscal gap. Zero debt reports the permanent fiscal adjustment necessary to achieve zero debt at the end of the 75-year forecast horizon. Same gross and net debt report the adjustment necessary to achieve either the same gross or the same net debt as in 2018. The bottom two rows report the estimates for the aggregate of all ten provinces and the federal government, respectively.

Sources: Current debt is from Statistics Canada tables 10-10-0017-01, "Canadian government finance statistics for the provincial and territorial governments" and net debt is from Canada, Department of Finance, *Fiscal Reference Tables* (Ottawa: Department of Finance, September 2019), Tables 18 to 27. Other values are the authors' calculations. See text for details.

What Affects Provincial Fiscal Gaps?

It is instructive to investigate the drivers of provincial primary balances in the long run. First consider macroeconomic developments. Interest rates and economic growth rates both matter but the latter more than the former. For a range of federal borrowing rates between 2 and 5 percent, with provincial rates between 3 and 6 percent, fiscal gaps range from -3.4 to -1.5 percent federally and 2.6 to 3.4 percent provincially. For a range of labour productivity growth rates from 0.5 to 1.5 percent per year, fiscal gaps range from -4.5 to -1.5 percent federally and 0.3 to 5.7 percent provincially. To reinforce this point, I illustrate in Figure 7 the projected debt ratio for provincial governments with 0.5 percentage point higher annual labour productivity growth. Sustained increases in productivity growth, though difficult for governments to influence directly, is crucial for long run sustainability. Alternative demographic assumptions also matter, but only slightly. Using Statistics Canada's slow-aging scenario, I estimate overall provincial fiscal gaps of 2.0 percent provincially and -3.2 percent federally. Using the fast-aging scenario, these become 3.4 percent and -2.5 percent, respectively.

Figure 7: Provincial Debt Ratios with Higher Productivity Growth

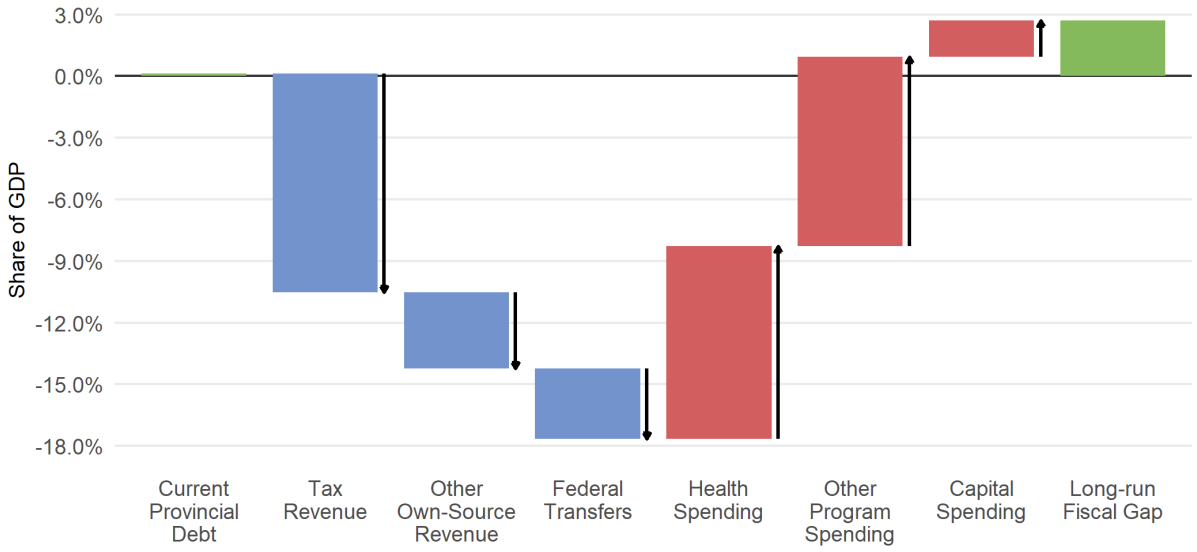


Note: Displays the projected level of aggregate provincial debt as a share of GDP with 0.5 percentage points higher annual labour productivity growth than in the baseline projection of 1 percent per year.

Source: Authors' calculations. See text for details.

Our framework also allows for a simple additive decomposition of the average annual balance $\bar{p}$ and therefore a decomposition of the long-run fiscal gaps f. While we can investigate the contribution from each of the individual revenue and expenditure components contained in the analysis (see Figure 4), I combine some for ease of presentation in Figure 8. Each represents the additive contribution to primary balances and therefore the fiscal gap. Overall, nearly 18 percent of GDP in revenues are more than offset by expenditures of 21 percent of GDP, nearly half of which is in health. This visual puts magnitudes in proper perspective. Own-source revenues average 14.3 percent over the 75-year horizon, so the fiscal gap is equivalent to nearly one-fifth of those revenues. This would be the increase in revenues necessary to eliminate the fiscal gap. And on the spending side, the long-run gap is equivalent to roughly one-seventh of current program expenditures or one-quarter of non-health spending.

Figure 8: Decomposing the Long-Run Provincial Fiscal Gap



Note: Displays the relative contributions of various budget components to the aggregate provincial fiscal gap over a 75-year time horizon. The size of each bar corresponds to the average annual amount represented by each component as a share of GDP. Negative values shrink the fiscal gap while positive ones enlarge it. See text for details.

Source: Authors' calculations. See text for details.

Not only do fiscal gaps differ widely across provinces, so too do the underlying drivers. I report the magnitude of each component in Table 3. Comparing each province to the ten-province average reveals some of the important underlying causes of provincial fiscal gaps. Alberta's 4.8 percent gap, the second largest of all provinces, is not due to above-average levels of expenditures over the projection period. Instead, total tax revenues are roughly 5 percentage points of GDP below the national average – fully accounting for its long-run fiscal gap. Other own-source revenues are larger than average and include resource revenues for example. This suggest that if Alberta had average taxes then its finances would be sustainable in the long run. Newfoundland and Labrador, the province with the largest long-run challenge by a wide margin is different. This province is projected to have more than 4 percentage points of GDP higher revenues than average. But its expenditure levels, especially in health, more than offset this. Interestingly, other Atlantic provinces also have significantly higher health expenditures yet far lower fiscal gaps. On the revenue side, the Maritimes benefit significantly more from federal transfers than Newfoundland and. We will soon see this is entirely due to Canada's equalization program. Finally, Quebec is the only province with solidly sustainable finances over this projection period. This is not due to lower expenditure demands, which are above average in all categories, but to significantly higher taxes than elsewhere – nearly a full five percentage points of GDP higher on average over the 75-year horizon.

Table 3: Decomposing the Long-Run Fiscal Gap for Individual Provinces (Percent of GDP)

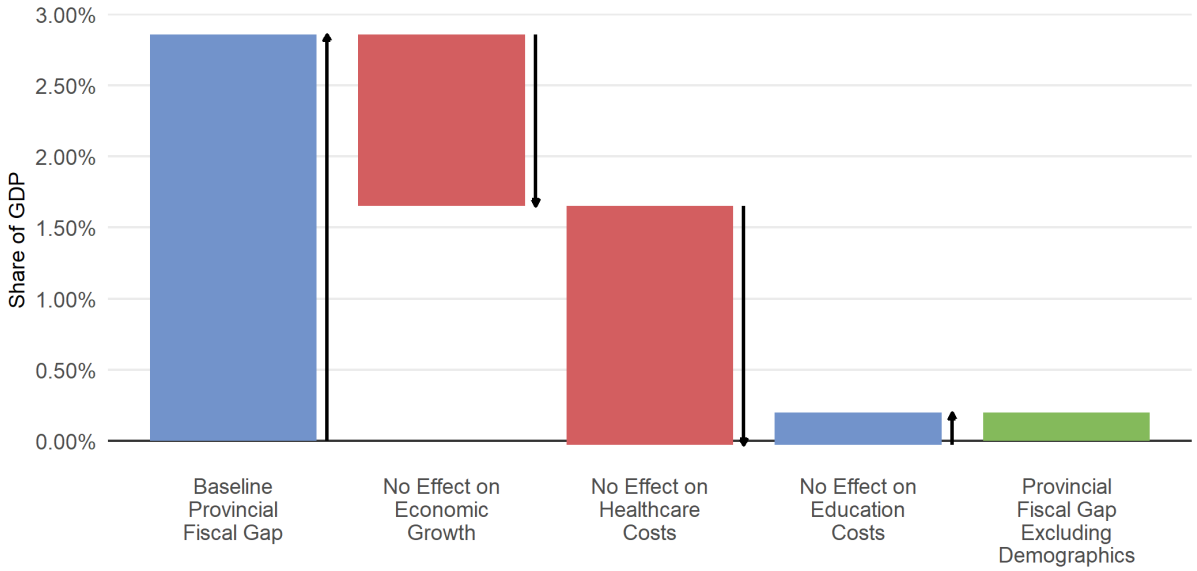
Province	Effect of Current Debt	Revenues			Expenditures			Fiscal Gap*
		Taxes	Other Own-Source	Federal Transfers	Health	Non-Health	Capital	
BC	0.1	-10.9	-3.9	-2.9	9.7	8.4	1.8	2.2
AB	-0.1	-5.7	-4.9	-2.0	7.8	8.1	1.6	4.8
SK	0.0	-8.4	-5.4	-2.7	7.9	10.0	2.0	3.4
MB	0.1	-11.0	-3.1	-6.0	10.8	9.3	1.7	1.7
ON	0.2	-11.2	-1.9	-2.7	8.9	8.2	1.7	3.1
QC	0.3	-15.4	-5.9	-5.6	11.4	12.4	2.1	-0.6
NB	0.9	-12.1	-4.2	-11.0	12.7	13.9	3.3	3.5
NS	0.5	-12.4	-3.6	-10.0	14.2	12.0	2.2	3.0
PE	0.1	-13.2	-3.1	-10.9	15.4	13.6	2.1	4.0
NL	1.0	-11.1	-5.9	-4.9	15.4	12.8	2.1	9.4
All	0.1	-10.6	-3.7	-3.4	9.4	9.2	1.8	2.7

Note: Displays the relative contributions of various budget components to fiscal gaps over a 75-year time horizon for each province. Each number corresponds to the average annual magnitude of each revenue and expenditure category as a share of GDP. Negative numbers shrink the fiscal gap while positive ones enlarge it. The final column may not exactly equal the sum of the other seven due to rounding. See text for details. * Fiscal gap measure based on gross debt ratios.

Source: Authors' calculations. See text for details.

This has, so far, been a mere accounting exercise. We can push further in understanding the long-term challenges provinces face by experimenting with alternative scenarios where provincial finances are re-simulated under alternative assumptions. This can be a powerful means of identifying fundamental causes of fiscal challenges. For instance, we can show that an aging population fully accounts for the long-run fiscal gaps facing provincial governments by holding fixed the demographic composition of provinces at the observed 2018 levels. Population growth is unaffected overall, but the fraction of the population in each age category is fixed through time. This has two effects. First, as the working age share of the population is no longer declining, economic growth rates are higher — averaging 4 percent per year until 2040 and 3.8 percent thereafter. Second, healthcare expenditures grow more slowly — roughly maintaining a level just over 7 percent of GDP, instead of gradually increasing to 10 percent in the baseline estimates. Both matter for the long-run financial health of provinces.

Figure 9: Decomposing the Effect of Demographics on Provincial Fiscal Gaps



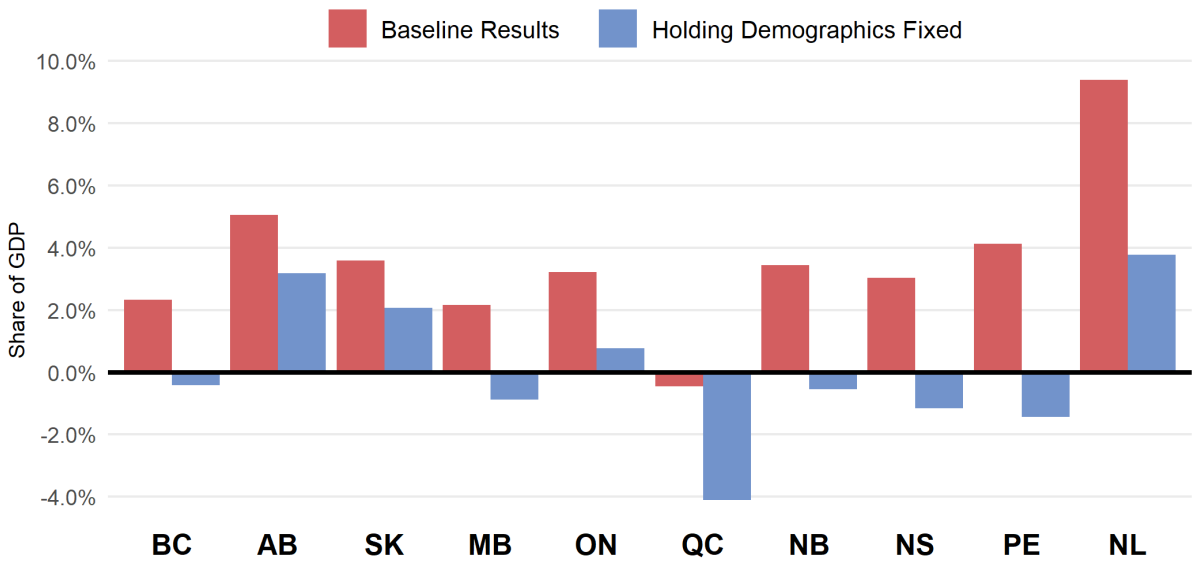
Note: Displays the relative contributions of three ways in which demographic change affects long-run provincial finances. This illustrates the fiscal adjustment required over a 75-year horizon.

Source: Authors' calculations. See text for details.

Decomposing the effect of demographics on the long-run financial position of provinces, I find over 40 percent of the fiscal gap is from slower economic growth, nearly 60 percent is from rising healthcare costs, and lower education costs provide a modest offsetting effect.[16] In aggregate, the measured fiscal gap declines to only 0.2 percent of GDP without any demographic change. I display these changes in Figure 9. While an aging population is the central driver of provincial long-run fiscal challenges overall, this is not true for all provinces. In Figure 10, I report the fiscal gap estimates for each province with and without demographic changes. It is evident that the oil producing regions of Alberta, Saskatchewan, and Newfoundland and Labrador face unique challenges. In part, this reflects unique challenges that each of the three provinces faces. Alberta has yet to address its over-reliance on natural resource revenues. If this revenue source does not growth significantly faster than the overall economy, then its large structural deficit will persist. For Newfoundland and Labrador, slow underlying rates of economic growth reflect demographics — as seen in the large change between the baseline results and the scenario holding demographics fixed — but it too has a structural challenge. Policy makers in those provinces have a unique challenge to confront, although in Newfoundland and Labrador's case there may be scope for federal support as the scale of the challenge may exceed the provincial government's own capacity to overcome. This will be a theme in much of the analysis to come.

[16] The effects are not strictly additive. The change in provincial fiscal gaps due to demographic-related education or healthcare costs, for example, is different when economic growth is also affected. This follows from the underlying effective discount factor φ_t being different across scenarios. I report here the average marginal contribution of each factor across all twelve possible orderings of the three factors.

Figure 10: The Effect of an Aging Population on Provincial Fiscal Gaps



Note: Displays the estimate of the long-run fiscal gap for each province, with and without an aging population. This displays the fiscal gap estimate corresponding to a 75-year time horizon.

Source: Authors' calculations. See text for details.

Policy Options to Improve Fiscal Outlooks

An aggregate fiscal gap of 2.9 percent, which implies immediately and permanently raising revenues by the equivalent of nearly eight GST points or decreasing spending by nearly 15 percent, may appear daunting. It is certainly not small. But gradual and sustained changes to revenue and spending can overcome this fiscal gap with less abrupt action. I will illustrate a few such options. This also serves to illustrate how fiscal gap estimates are sensitive to the underlying projection assumptions.

If provinces can lower the health-specific inflation rate from 1 to 0.5 percent per year, for example, then their aggregate fiscal gap declines to 1.3 percent — less than half the baseline estimate presented above. This would mark a material departure from the past but may not be infeasible. It would imply healthcare spending rise to a peak of 8.4 percent of GDP by the mid-2040s and falling thereafter. On the revenue side, as we have seen, there are many revenue sources that will not keep pace with overall economic growth. Over the entire projection period, total revenue grows at a rate roughly 0.3 percentage points lower than GDP growth. If gradual reforms over time, such as through small changes in tax rates, fee schedules, and so on, kept provincial own-source revenue growth in line with GDP then the aggregate fiscal gap would decline to 1.5 percent. If provincial government could achieve both modestly lower healthcare spending growth and modestly higher own-source revenue growth, then the entire fiscal gap may be closed. Cutting the health-specific inflation to 0.5 percent and growing revenues in line with GDP would lead the aggregate fiscal gap to decline to -0.1 percent — that is, sustainable over the 75-year horizon.

While the overall picture in this scenario is hopeful, Alberta and Newfoundland and Labrador remain in an unsustainable position. And to a lesser extent, so too does Ontario. To be clear, Alberta and Ontario

have more options at their disposal to close this remaining gap. But Newfoundland and Labrador does not appear to have many easy options available. To illustrate one potential scenario, consider (1) lowering health-specific inflation to 0.5 percent, (2) growing provincial own-source revenues with GDP, (3) allocating CHT payments on the basis of the population aged 65 and above, and (4) removing resource revenues from the equalization program. Under this scenario, aggregate provincial finances are fully sustainable and so too are Newfoundland and Labrador's. The first two components of this package are for the province to implement, while the latter two require federal reforms. Unfortunately, while this scenario achieves sustainability over a 75-year horizon, the transition path may not be feasible. Debt accumulates substantially in the meantime and exceeds 100 percent by the mid-2030s. There may be no avoiding a more aggressive approach to fiscal consolidation in Newfoundland and Labrador. Average program expenditures as a share of GDP are fully five percentage points more than the national average. Bringing spending in line with other provinces, and potentially modestly increasing its already above-average own-source revenues, combined with gradual and ongoing reforms are necessary. But given the importance of federal transfers, I turn to this next and explore it in depth.

Federal Transfers and Provincial Financial Sustainability

Federal transfers play an important role ensuring provincial governments have the fiscal capacity necessary to deliver key public services. Programs like the Canada Health Transfer (CHT) and the Canada Social Transfer (CST) are allocated across provinces on an equal per capita basis while Fiscal Equalization Payments top up provinces with below-average ability to raise their own revenues. Provinces with weak economies tend to have smaller tax bases, and therefore a lower ability to raise revenue. Over time, the economic prospects of some provinces are also stronger than others. Atlantic provinces, for example, are aging more quickly and this may dampen their economic growth rates. In the baseline scenario explored in this paper, I find average real GDP growth rates of 0.8 percent per year in New Brunswick and Nova Scotia, near zero in Newfoundland and Labrador. Meanwhile, Ontario averages 1.6 percent per year and Alberta averages 2.4. These growth differentials will, over time, affect the relative revenue raising capabilities of provincial governments. Equalization will therefore help fill that gap.

To estimate the effect of equalization on provincial debt sustainability, I estimate fiscal gaps under a scenario where equalization is eliminated and replaced with an equal per capita transfer. That is, equalization is eliminated, and the proceeds used to proportionally increase the CHT and CST. This is not a proposal under serious consideration by any federal political party, but proposals along these lines are regularly advanced. Saskatchewan Premier Scott Moe, for example, recently pitched a 50/50 plan whereby equalization was cut in half and the proceeds redirected towards equal per capita allocations. In any case, there are large implications of this change for lower-income regions. I estimate that the fiscal gap in New Brunswick increases to 9.5 percent of GDP from its baseline level of 3.7 percent. Nova Scotia and PEI also see significant increases. Quebec and Manitoba — the other large equalization recipients — see their fiscal gaps both increase by over 2 percentage points. Higher income regions that typically do not receive equalization would benefit since the per capita grants would increase. Alberta's fiscal gap declines from 5.1 to 4.4 percent, Saskatchewan's from 3.6 to 2.9 percent, British Columbia's from 2.3 to 1.4 percent, and Ontario's from 3.2 to 1.8 percent. I report these results, along with other scenarios for federal transfers in Table 4.

More generally, the contribution of current fiscal arrangements to long-run provincial sustainability may also be quantified. I estimate fiscal gaps if all federal transfers were set to zero in the third column of Table

4. Without transfers, the overall provincial fiscal gap would be 6.3 percent — more than double the baseline estimate. This suggests that as of 2018, federal transfers cover nearly 60 percent of provincial fiscal gaps that would exist in the absence of transfers. To be sure, provincial governments would have made very different tax and expenditure decisions under such a situation. But over the 75-year horizon examined here, federal transfers are equivalent to a 3.4 percent of GDP contribution to provincial revenues. Reforms that potentially increase this contribution may be important to address provincial fiscal gaps going forward.

Table 4: The Effect of Federal Transfers on Long-Run Sustainability of Provincial Governments

Province	Baseline Fiscal Gap	Effect of Transfers		Increase Transfers		
		Replace Equalization with Larger CHT and CST	Eliminate All Federal Transfers	Boost Cash Transfers by 10 Percent	Boost Cash Transfers by 25 Percent	Transfer GST to Provinces
BC	2.3	1.4	5.2	2.0	1.6	0.4
AB	5.1	4.4	7.1	4.9	4.6	3.1
SK	3.6	2.9	6.3	3.3	2.9	1.7
MB	2.2	2.3	8.2	1.6	6.6	0.2
ON	3.2	1.8	5.9	2.9	2.5	1.3
QC	-0.4	1.8	5.1	-1.0	-1.8	-2.4
NB	3.7	9.5	14.7	2.6	1.0	1.8
NS	3.0	7.5	13.1	2.0	0.5	1.1
PE	4.1	9.5	15.1	3.0	1.4	2.2
NL	9.4	9.6	14.3	8.9	8.2	7.5
Provinces	2.9	2.9	6.3	2.5	2.0	0.9
Federal	-2.8	-2.8	-6.2	-2.5	-2.0	-0.9

Note: Displays the fiscal gap estimate corresponding to stable net debt to GDP ratios over a 75-year time horizon. All values are expressed as shares of GDP.

Source: Authors' calculations. See text for details.

Increasing federal transfers is feasible, given the relatively large fiscal space available to the federal government. Consider increasing the size of cash transfers by 10 percent (over $8 billion in 2020/21, for perspective). This would lower provincial fiscal gaps to 2.5 percent of GDP. And increasing transfers by 25 percent would decrease provincial fiscal gaps to just under 2 percent. The federal government can also transfer tax points instead of cash to the provincial governments. To illustrate, imagine the federal government vacates the entire sale tax field and leaves it to provinces. This would shrink the provincial fiscal gap from 2.9 percent to 0.9 percent. Historically, tax point transfers were central to fiscal arrangements in Canada, although we have moved away from this approach in recent years.[17] These are undeniably large increases in transfers — larger than is realistically on offer — but provide an important sense of scale. Finally, some targeted measures to support Newfoundland and Labrador may be necessary given the province's precarious fiscal position. I include the 2019 Atlantic Accord to Newfoundland and Labrador, baseline in the analysis, for example, and find that their fiscal gap would be roughly 0.2

[17] For a comprehensive review of the history of federal-provincial transfers, including tax point transfers, see Trevor Tombe, "Final and Unalterable – But Up for Negotiation: Federal-Provincial Transfers in Canada" (2018) 66:4 *Canadian Tax Journal* 871-917.

percentage points higher without it. Most importantly, however, is their lack of equalization payments compared to the other Atlantic provinces. If natural resource revenues were excluded, then Newfoundland and Labrador would qualify for equalization. This province's average income is higher than in the Maritimes, so it would not receive as much but I find their fiscal gap would decline to 8 percent.

Table 5: Fiscal Gap Estimates for Various Healthcare Financing Reforms

Province	Baseline Fiscal Gap	Allocate CHT Based on 65+ Population	Faster CHT Growth		Deeper Reforms	
			1 Percent Per Year Faster	2 Percent Per Year Faster	Increment to CHT Growth	Cover All Costs due to an Aging Population
BC	2.3	2.1	1.5	0.1	1.8	0.9
AB	5.1	5.3	4.4	3.3	4.8	4.3
SK	3.6	3.9	2.9	1.7	3.4	3.1
MB	2.2	2.5	1.2	-0.3	1.9	1.3
ON	3.2	3.2	2.4	1.0	2.8	2.1
QC	-0.4	-0.6	-1.4	-2.9	-0.9	-1.8
NB	3.7	3.1	2.8	1.2	3.1	1.5
NS	3.0	2.5	2.0	0.4	2.4	1.1
PE	4.1	3.8	3.0	1.3	3.5	2.4
NL	9.4	8.7	8.7	7.6	8.7	7.4
Provinces	2.9	2.9	2.0	0.7	2.5	1.7
Federal	-2.8	-2.8	-1.9	-0.3	-2.4	-1.6

Note: Displays the fiscal gap estimate corresponding to stable net debt to GDP ratios over a 75-year time horizon. All values are expressed as shares of GDP.

Source: Authors' calculations. See text for details.

As demographics and healthcare costs are such an important driver of provincial fiscal challenges, specific changes in federal support for health expenditures may be warranted. In the 2019 federal general election, the Bloc Québécois put forward a proposal to allocate the Canada Health Transfer based on the 65+ population, rather than its current equal per-capita allocation. This "needs based" approach to the CHT would benefit provinces with older populations, cost those with younger populations, and leave the aggregate provincial fiscal gap unaffected. To shrink the aggregate gap, faster growth is necessary. The BQ also proposed an increase in the CHT growth rate above current levels. In Table 5, I report the effect of a change in the allocation and a change in the pace of growth. A sustained increase of 2 percentage points more per year in CHT growth would shrink provincial fiscal gaps to 0.7 and consume nearly the entire long-run fiscal space available to the federal government. This would be a significant increase that, over time, increases the federal share of healthcare expenditures to 30 percent by 2040 and to 40 percent by 2060.

Beyond these simple options, more fundamental reforms are worth considering. In the two options that follow, I take care not to propose policies that directly expose the federal government to spending decisions of any specific provincial government. This would have the effect of subsidizing provincial spending increases and potentially lead to greater inefficiencies in important public services.

Index CHT Growth to Demographics — Currently, CHT grows at the same rate for all provinces. But different provinces have different rates of population growth for different age cohorts. This is (somewhat) beyond the provincial government's control. Health spending by age category, however, is a policy choice and depends on public sector compensation decisions, hospital capacity or location decisions, and so on. So, instead of uniform CHT growth, we could measure cost pressures using a nationally representative measure of health spending and provincial demographic changes. For Canada as a whole, an aging population adds to healthcare costs when the population shifts towards higher-spending cohorts as illustrated in Figure 5. The rate of increase national healthcare expenditures is $\sum_c h_0^c p_t^c$, where h_0^c is the initial period health spending on cohort c and p_t^c is the population share accounted for by that cohort. A national average health spending measure applied to each province's population shares could be a way to growth health spending in a relatively exogenous manner. Specifically,

$$CHT\ Growth\ Increment = \frac{\sum_c h_0^c p_{it'}^c}{\sum_c h_0^c p_{it}^c} \equiv \sum_c \omega_0^c \hat{p}_{it}^c.$$

This mirrors the province-specific measure of demographic cost pressures $\hat{h}_{it}$ defined earlier but uses national average health-spending per capita by cohort instead. This increment would see transfers grow faster for all provinces, but at different rates. By 2040, federal health transfers would range from 11 percent higher in Saskatchewan than the baseline projection and 40 percent higher in Newfoundland and Labrador than baseline. The federal share of health spending would decline modestly in the coming years — to below 23 percent by 2040 — and is therefore a relatively modest approach to index the pace of CHT growth to demographic factors. It would lower the aggregate fiscal gap for provinces by roughly 0.4 percent of GDP.

Supplement CHT to Cover All Demographic Costs — The real per capita spending on health rises due to demographics and to health-specific inflation over and above the general 2 percent per year rate. Since the latter is more a policy choice than the former, the federal government could cover more of the costs related to population aging than it does healthcare costs generally. As elderly individuals move across provinces for retirement, the case for federal support to provinces where those elderly individuals move is potentially strong. One option for the federal government to cover health costs related to aging, but not other provincial health spending decisions. In effect, this takes the CHT increment proposed above, but shifts incremental aging costs entirely to the federal government. Specifically,

$$CHT\ Supplement\ to\ Fully\ Cover\ Aging\ Costs = \bar{h}_0 \times \left(\sum_c \omega_0^c \hat{p}_{it}^c - 1\right),$$

where $\bar{h}_0$ is the national average real per capita initial level of health spending. This is a large increase in federal transfers but it allows federal support for an aging population without being susceptible to provincial decisions over actual health spending decisions as only population shares would change over time, and those result largely from decisions of individual Canadians.

This grant gradually increases to nearly 1.5 percent of GDP by 2050 and declining thereafter — smaller than the total projected health expenditure increase, since it does not compensate for health-specific inflation. It compensates for aging-related cost increases only. But it is large. The federal government share of total healthcare spending increases from its current level of one-quarter to a peak of one-third by the mid-2040s. Without this new transfer, the Canada Health Transfer is on track to grow slower than healthcare spending and therefore its share of the total will decline to roughly 18 percent by 2050.

Expressed another way, the provincial share of healthcare spending will rise from its current 5.5 percent of GDP to 6.5 percent by 2050 and 7 percent by 2070. In the baseline projection without the demogrant supplement, this share rises to 8 percent by 2050 and nearly 8.5 percent by 2070. The result is a significant improvement in provincial debt sustainability. I find the aggregate provincial fiscal gap declines to 1.7 percent of GDP from its initial 2.9 percent. Combined with either provincial governments ensuring own-source revenues keep pace with economic growth or lowering health-specific inflation to 0.5 percent would address nearly the entire provincial fiscal gap.

These exercises, it must be said, do not account for the important behavioural changes that increased federal transfers may induce among provincial governments. Easy money from Ottawa may be as open to abuse as natural resource revenues have proven to be, with provincial governments increasing spending with the transfers to gain short-term political advantage. Federal transfer arrangements that avoid incentivising profligate behaviour are difficult to design; Canada has grappled with this challenge since Confederation – and it is a core challenge of fiscal federalism generally.[18]

The Effect of COVID-19 and Other Macroeconomic Developments

No analysis of public debt sustainability today can ignore the effect of COVID-19. The pandemic was the largest disruption to economic activity, government finances, labour markets, business operations, and indeed daily life since the Second World War. The consequences of this shock will be felt for many years to come. And the large deficits governments are incurring this year, and potentially for many years to come, are reasonably raising concerns over the long-run sustainability of public debt. At the time of writing, much about the broader fiscal and economic disruptions associated with COVID-19 and the public health response to it are not known. The federal Fiscal and Economic Snapshot 2020 provides rich detail, but uncertainty remains large. In this section, I propose a first attempt to quantify the effect of a large-scale economic shock on provincial (and federal) debt sustainability. It should be interpreted as illustrative in nature, and therefore distinct from the main analysis. It has value nonetheless. I show even a shock as large as COVID — which has lead to the largest deficits since World War 2 and economic disruptions rivaled only by those seen in the Great Depression — may not have as large an implication for long-run sustainability as one might initially imagine. Perhaps counterintuitively, I demonstrate that COVID-19 may have improved the long-run position of provincial governments despite its short-run costs.

First, some details behind the fiscal scenario. I model two components of the COVID shock. First, a large and persistent reduction in the level of economic activity. Current projections for the effect of the pandemic on nominal GDP vary, but I use the June 10, 2020 projections for provincial GDP in 2020 and 2021 from the Royal Bank of Canada.[19] From 2022 onwards, I presume a gradual recovery to the pre-COVID baseline trajectory of nominal GDP by presuming one-third of the remaining gap each period is closed through above-normal growth. While potentially optimistic, this is a significant economic shock that takes until 2029 before all provinces return to within 1 percent of their pre-COVID path. Second, I presume a large $300 billion federal spending response that both supports individuals and business and, importantly for our purposes here, cushions provinces from incremental expenditure pressures from the pandemic. This implicitly presumes there will be more support forthcoming than the $19 billion "Safe

[18] For a comprehensive review of this issue, see Jonathan Rodden, *Hamilton's Paradox: The Promise and Peril of Fiscal Federalism* (Cambridge, United Kingdom: Cambridge University Press, 2005).

[19] Robert Hogue, "Reopening of Provincial Economies: Different Speed, Scale and Outcomes" (2020) *Provincial Outlook*. Accessed online on August 10, 2020. URL: https://thoughtleadership.rbc.com/reopening-of-provincial-economies-different-speed-scale-and-outcomes/

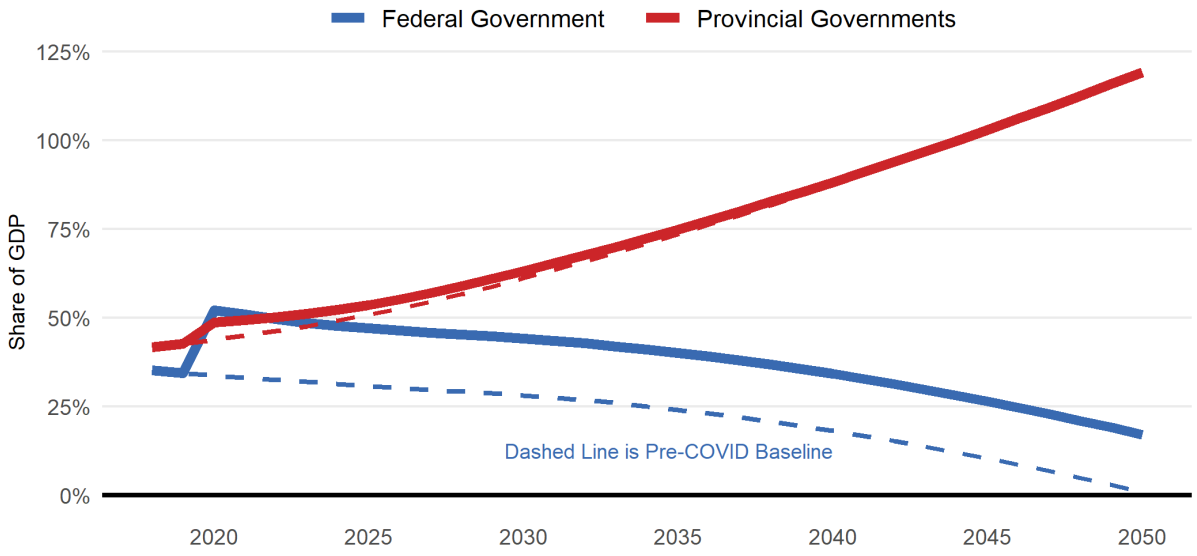
Restart Agreement" already committed to. This exercise serves to illustrate potential magnitudes and is a reasonable approximation to the true fiscal and economic shock based on current information.

This scenario is a significant negative shock with long-lasting effects. In the short-term, the federal debt ratio rises to 52 percent of GDP by 2021 and provincial debt rises to nearly 49 percent. The combined effect is a 24 percentage point increase in government debt to GDP ratios — a modestly larger effect than the latest projections from the IMF. Going forward, I project federal primary balance do not return to surplus until 2023 but remains below its pre-COVID baseline permanently. By 2030, the federal primary balance is roughly 0.15 percentage points of GDP below its pre-COVID trajectory and remains roughly 0.12 percentage points below over the entire forecast horizon. Provinces, meanwhile, see worsened primary balances until the late 2020s but afterwards have a smaller primary deficit than previously projected. In terms of our 75-year horizon fiscal gaps, this COVID scenario sees the federal position decline to -2.5 percent from the baseline -2.8 percent while provinces see a decrease by 0.1 percentage points. I illustrate these results in Figure 11.

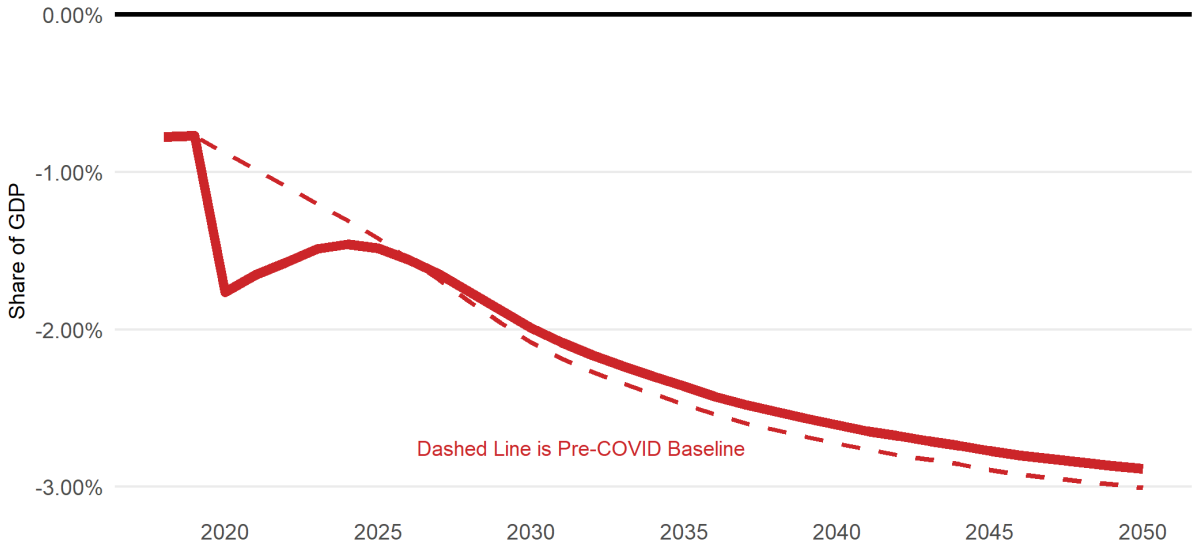
This reveals an important way in which large economic shocks and federal transfers interact: provinces benefit from health transfers that automatically grow larger. The CHT grows with a three-year moving average of nominal GDP growth but, importantly, has a minimum growth of 3 percent per year. During particularly severe periods of economic contraction, such as in 2020, the moving average growth in GDP will decline below the 3 percent minimum threshold. It may remain bound by this growth floor until 2023, when the sharp 2020 contraction will be dropped from the moving average. At that point, average growth should exceed the previous baseline growth because Canada will continue to be recovering to its potential level of output. If we ever return to the pre-COVID baseline path of economic activity, then some above-normal growth is necessary. This will then result in larger growth in the CHT than would have been the case from 2023 until recovery is complete and normal growth returns. In this scenario, I find that by 2030 the total CHT is nearly 5 percent larger than it would have been absent the COVID-19 shock. This is meaningful and represents roughly a one percentage point increase in the share of total health spending covered by the federal government. By dropping large contractions but counting recovery growth rates, the CHT is set to ratchet permanently up to a modestly higher level. In time, this more than offsets the short-term debt provincial governments incur because of COVID-19.

Figure 11: Post-COVID Debt Sustainability in Canada

(a) Debt to GDP Ratios, 2018-2050(F)



(b) Aggregate Primary Balances of Provincial Governments, 2018-2050(F)



Note: Displays the projected debt to GDP ratio for Canada's governments in the baseline scenario (dashed line) compared to the post-COVID scenario. Debt to GDP for 2018 is data, values for 2019 onward are fiscal projections. The COVID shock occurs in 2020. Negative primary balances are deficits.

Source: Authors' calculations. See text for details.

Conclusion

This paper develops a comprehensive model of provincial and federal finances and projects future debt ratios over a wide variety of scenarios. I find most provinces, with the notable exception of Quebec, face significant long-run challenges due to an aging population, falling rates of economic growth, and rising healthcare costs. The federal government, meanwhile, faces an excess of fiscal capacity and enjoys a sustainable financial position even despite the massive debt accumulated in response to COVID-19. Combined, Canada's general government (federal plus provincial) is sustainable in the long run, making the challenge for provinces one that may involve changes in federal-provincial fiscal arrangements — ranging from increased and reformed cash transfers to tax point transfers. Current transfers have significantly contributed to provincial finances, and for relatively lower-income regions (the Maritimes in particular) equalization mitigates what would otherwise be potentially intractable financial challenges. While Newfoundland and Labrador may require a unique approach, there are a wide variety of gradual policy options available to provincial provinces, and to Ottawa, to overcome the fiscal challenge an aging population presents.

The scenarios in this paper are but a small sample of the potential fiscal futures that might unfold. But however the fiscal reality evolves, carefully considering the potential implications of current policy choices for future fiscal outcomes is important. Policy makers today can take gradual and sustained action to avoid more dramatic changes later. And such action should be guided by the kind of analysis put forward in this paper. Whether rebuilding fiscal capacity following a short-term shock or preparing for predictable long-term pressures, governments have both the tools and the data to respond today to the fiscal challenges of tomorrow.