
FINANCES OF THE NATION

PROVINCIAL DEBT SUSTAINABILITY IN CANADA: DEMOGRAPHICS, FEDERAL TRANSFERS, AND COVID-19

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For almost 60 years, the Canadian Tax Foundation published an annual monograph, Finances of the Nation, and its predecessor, The National Finances. In a change of format, the 2014 Canadian Tax Journal introduced a new “Finances of the Nation” feature, which presents annual surveys of provincial and territorial budgets and topical articles on taxation and public expenditures in Canada.

The underlying data for the Finances of the Nation monographs and for the articles in this journal will be published online in the near future.

In this article, Trevor Tombe examines the sustainability of Canada’s public debt in the face of steadily rising provincial debt, a severe economic shock from COVID-19, and mounting health-care costs associated with an aging population. He finds that while the federal debt is solidly sustainable, despite a large increase owing to COVID-19, the debt burden of most provincial governments is not. He discusses some of the policy options available to improve fiscal outlooks, focusing in particular on reform of federal transfers.

KEYWORDS: PUBLIC DEBT ■ FEDERAL-PROVINCIAL ■ DEMOGRAPHY ■ TRANSFER PAYMENTS ■ FISCAL POLICY

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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 introduced in 2020 in response to the COVID-19 pandemic will add more to the federal debt than has occurred in any other single fiscal year since the Second World War. Given the extent and magnitude of the crisis, the government's response was appropriate. But this short-term fiscal shock is dwarfed by a slower-moving and significantly larger challenge from aging populations. Provincial governments face mounting health-care costs, including but by no means limited to the added burden of managing the pandemic, and all governments face potentially slower rates of economic growth. This article outlines a simple but powerful approach to quantifying 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 that provincial government finances are strained, while federal finances remain strong, despite recent deficits. Options abound for most governments to improve their capacity to meet present and future challenges. The analysis 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 gross domestic product (GDP) in 2020—a historically high level exceeded only during the Great Depression and the Second World War. To put this in context, I display Canada's overall public debt levels since 1870 in figure 1(a). Only once before in Canada's post-war 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 60 years. Overall, provincial debt has roughly tripled as a share of GDP since 1960, rising by nearly 40 percentage points. Meanwhile, the federal debt 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. Not only do provincial governments account for a larger share of the public debt today, but 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 aged 65 and over may

increase from 18 percent today to nearly 24 percent by 2040, and the share aged 75 and over may double from 7 percent today to 14 percent over the same time.¹ With provinces responsible for health-care delivery, incremental costs from this aging will be disproportionately borne by them. Recent debt increases and the coming demographic challenge mean that the future of government debt sustainability in Canada will be determined by the fiscal health of the provinces.

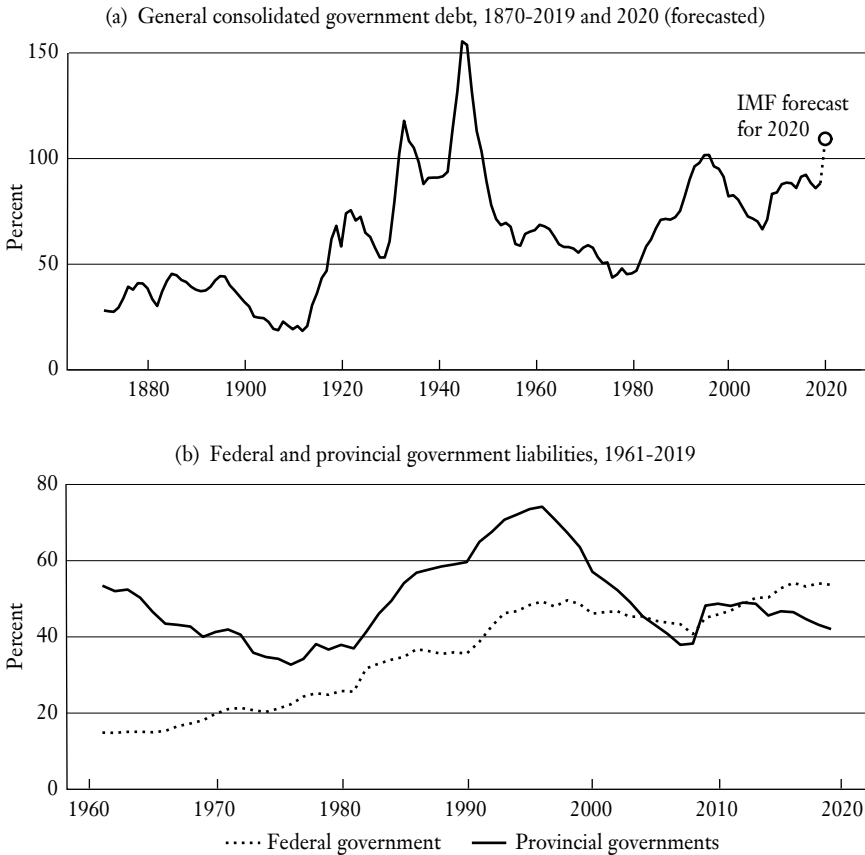
Before providing details, it is worth appreciating intuitively what “sustainable” fiscal policy means. Today’s debt is potentially a burden on the future, and additional borrowing to cover budget deficits adds to that burden. Public finances are sustainable if the future burden is manageable under current 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, future revenues must exceed program spending by enough to repay current debt. If interest rates are less than growth rates, governments can sustainably borrow to cover program spending above revenues—but assuming a reasonable time horizon, the extent of such borrowing is limited.

To clarify these issues, I provide a detailed framework that makes it possible to project future government revenues and expenditures, and to quantify any gap between current fiscal policy and an alternative sustainable policy. If current fiscal policy is not sustainable, increases in revenues or decreases in program spending are required. The magnitude of the required fiscal adjustment is commonly known as “the fiscal gap.”² Although there are many complexities and uncertainties to consider, in a world where interest rates are roughly equal to economic growth

1 Author’s calculation from Statistics Canada tables 17-10-0005-01 (formerly CANSIM table 051-0001), “Population Estimates on July 1st, by Age and Sex”; and 17-10-0057-01 (formerly CANSIM table 052-0005), “Projected Population, by Projection Scenario, Age and Sex, as of July 1 (x 1,000).” These are projections around a range of potential outcomes. For perspective, the share of the population aged 65 and over ranges from slightly more than 21 percent in the slow-aging scenario to nearly 26 percent in the fast-aging scenario. Historically, such projections have proved to be useful guides. In the mid-1980s, for example, the Canada Pension Plan “case” projection for 2020 was for a population of nearly 35 million and an age 65+ share of 16.2 percent, both not too far off the actual numbers. 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: Department of Supply and Services, 1985), 52-60, tables 7-31 to 7-35.

2 The term was originally put forward by Alan J. Auerbach, “The U.S. Fiscal Problem: Where We Are, How We Got Here and Where We’re Going,” in Stanley Fischer and Julio J. Rotemberg, eds., *NBER Macroeconomics Annual 1994* (Cambridge, MA: MIT Press, 1997), 141-86, at 174. Assessing government policy by reference to the fiscal gap is now a well-established approach to fiscal policy analysis.

FIGURE 1 Government Debt-to-GDP Ratios in Canada



(Figure 1 is concluded on the next page.)

rates, a government’s fiscal gap will be roughly equal to 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.

To construct these projections, I compile detailed provincial data on 12 revenue and 6 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 (EI), defence 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-care expenditure data from the Canadian Institute for Health Information (CIHI), population projections from the Office of

FIGURE 1 Concluded

GDP = gross domestic product; IMF = International Monetary Fund.

Note: This figure 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 subnational debt. Federal and provincial governments are separated for the period 1961–2019.

Sources: Debt-to-GDP ratio for 1870 to 2016 is from Óscar Jordà, Moritz Schularick, and Alan M. Taylor, “Macrofinancial History and the New Business Cycle Facts,” in Martin Eichenbaum, Erik Hurst, and Jonathan A. Parker, eds., *NBER Macroeconomics Annual 2016* (Chicago: University of Chicago Press, 2017), 213–63. The debt ratio is updated from 2017 to 2019 using the change in general government debt from Statistics Canada table 36-10-0580-01 (formerly CANSIM 378-0121), “National Balance Sheet Accounts (x 1,000,000)”; nominal GDP growth rates for 2017 and 2018 are from Statistics Canada table 36-10-0222-01 (formerly CANSIM 384-0038), “Gross Domestic Product, Expenditure–Based, Provincial and Territorial, Annual (x 1,000,000).” Forecast for 2019 is from Canada, Department of Finance, *Federal Economic and Fiscal Snapshot 2020* (Ottawa: Department of Finance, July 8, 2020); forecast for 2020 is from the International Monetary Fund, *World Economic Outlook Update* (Washington, DC: IMF, June 2020). Separate provincial and federal liabilities (book value) are from Statistics Canada tables 36-10-0535-01 (formerly CANSIM 378-0076) (Archived), “National Balance Sheet, Provincial Governments, Annual, 1961–2011 (x 1,000,000)”; 36-10-0533-01 (formerly CANSIM 378-0074) (Archived), “National Balance Sheet, Federal Government, Annual, 1961–2011 (x 1,000,000),” for 1961 to 1989; and 36-10-0580-01 (formerly CANSIM 378-0121), “National Balance Sheet Accounts (x 1,000,000)” for 1990 to 2019. GDP data are as shown in graph (a), supplemented with Statistics Canada table 36-10-0325-01 (formerly CANSIM 384-0015) (Archived), “Provincial Gross Domestic Product (GDP), Expenditure–Based, Provincial Economic Accounts, Annual, 1961–1980 (x 1,000,000),” for 1961 to 1980.

the Parliamentary Budget Officer (PBO), and numerous other sources. The result is a detailed interconnected model of Canadian government finances. Though in some cases necessarily abstract, the model 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 that provincial government finances are not sustainable, with the notable exception of Quebec. Across 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 that debt levels at the end of the projection period are no higher than the levels 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, with 40 percent being attributable to slowing economic growth and 60 percent to rising health-care costs.

There is, however, significant variation across provinces. Quebec's fiscal situation is sustainable, largely owing to that province's higher-than-average taxes. The situation in Alberta and Saskatchewan is not sustainable; both provinces are projected to experience relatively large fiscal gaps, at 4.8 percent and 3.4 percent of GDP respectively. These gaps are accounted for by far lower-than-average taxes rather than projected health-care expenditures, which are lower in these provinces than in any other. The Atlantic provinces also face unsustainable finances, although the Maritimes are significantly aided by equalization to an extent that Newfoundland and Labrador is not. The latter 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 underlie the significant challenge faced by Newfoundland and Labrador.

Finally, while the long-run challenges are large, there is significant concern around the abrupt increase in government debt resulting from 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 (CHT) 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 an understanding of long-term provincial sustainability.

Before proceeding further, some important caveats are in order. All projections in this article 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 revenues 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-care-specific inflation of 1 percentage point above the economy-wide inflation rate of 2 percent per year. But if health-care-specific inflation falls to just 0.5 percentage points above average, for example, the provincial fiscal gap falls from 2.7 percent to 1.3 percent of GDP. Similarly, I find that provincial revenues grow more slowly than the economy overall. But if instead own-source revenues grow in line with GDP, the aggregate fiscal gap declines to 1.5 percent. This analysis therefore demonstrates that gradual health-care 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 across 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-care costs. I find that both of the proposed measures have meaningful effects on fiscal gaps and may

therefore be potentially important reforms to consider. 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 article 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 PBO's *Fiscal Sustainability Report 2020*.³ The PBO's analysis is a timely, thorough, and important examination of all subnational finances; however, it aggregates provincial and municipal finances. This article complements the PBO's work by focusing on provincial governments only, by enriching the level of detail behind government budget projections, and by including capital spending. By separately modelling a dozen different revenue categories, this article finds a notably larger fiscal gap than that forecasted by the PBO, since I find that 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 municipal budgets. 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 also 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? To be clear, what is specifically meant by "unmanageable" is 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-third of the province's GDP. Today, most provinces have debt levels at or above that level

3 Office of the Parliamentary Budget Officer, *Fiscal Sustainability Report 2020* (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*, International Monetary Fund Technical Notes and Manuals no. 10/02 (Washington, DC: IMF, Fiscal Affairs Department, January 2010).

with no reasonable risk of default. Internationally, Japan's debt level is on track to approach 270 percent of its GDP in 2020,⁵ which is roughly double the level that led Greece into a debt crisis nearly a decade ago. Various factors—interest rates, economic growth rates, domestic versus international holdings, the currency that public debt is denominated in, volatility, and more—all matter. But for Canada's provinces we must also consider the role of the federal government and fiscal transfers. And 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.⁶ This is summarized by the government's budget constraint, expressed as

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

where G_t is program expenditures, r_t is the rate of interest on debt D_{t-1} in the last period, R_t is government revenue (from all sources), and $\Delta D_t = D_t - D_{t-1}$, the change in public debt (that is, the deficit). If spending (the left-hand side of the equation) exceeds revenue (R_t), 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 the level of debt affects interest costs and therefore future spending. There is therefore a risk that debt may snowball and grow 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 principal ever being paid off, D_0 today becomes $D_0(1 + r)$ next year, and $D_0(1 + r)^2$ in the year after, and so on. This exponential growth implies that debt will eventually grow beyond the public's ability to service it. But with a growing economy, the ability to service debt is itself increasing. In this case, if debt is rolled over indefinitely, the *burden* of debt D_0 today becomes $D_0(1 + r)/(1 + g)$ next year (where g is the rate of growth in the economy), $D_0(1 + r)^2/(1 + g)^2$ in the year after, and so on. If these values are declining over time—say, because economic growth g exceeds the interest rate r —the debt ratio is mechanically sustainable in perpetuity. Looking at debt ratios (that is, debt to GDP) rather than levels not only allows for easy comparison of debt burdens over time and across jurisdictions, but is also the relevant measure for long-run sustainability analysis.

5 International Monetary Fund, *World Economic Outlook Update* (Washington, DC: IMF, June 2020).

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

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

$$d_t = \left(\frac{1 + r_t}{1 + g_t} \right) \times d_{t-1} - p_t, \quad (2)$$

where d_t is total debt as a share of GDP and p_t is the government's primary budget balance (revenue R_t minus program spending G_t) as a share of GDP. If the primary budget is balanced, revenues cover all program spending, and the debt ratio in the next period will evolve over time according to $(1 + r_t)/(1 + g_t)$. If interest rates exceed growth rates, this ratio will be larger than 1, and the debt burden will rise. If interest rates equal growth rates, the debt ratio will remain stable. And if interest rates are lower than growth rates, the debt ratio will gradually decline to zero over time.

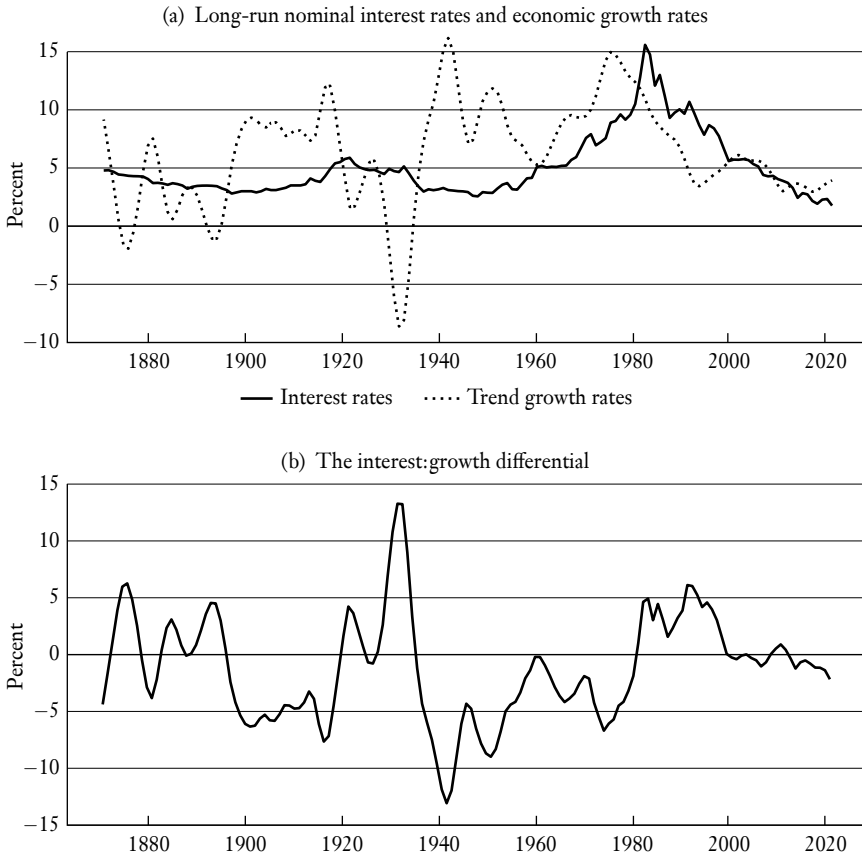
The expression in equation 2 also allows one to appreciate what factors matter for long-run sustainability. In the next section, I will unpack this in more detail, but if the debt ratio, interest rates, and growth rates are each stable, so too is the burden of debt. This is sustainable. To achieve this, equation 2 reveals that to achieve $d_t = d_{t-1}$, the government must run a primary balance equal to

$$p^* = \left(\frac{r - g}{1 + g} \right) \times d. \quad (3)$$

If interest rates exceed growth rates, the government must run a primary surplus to compensate and maintain the debt ratio at d . If the primary balance falls short, a fiscal gap exists. In this case, increases in revenues or decreases in program spending may be required. And if debt levels increase—say, owing to a short-term shock—and if $r > g$, the government will require a larger primary surplus to ensure sustainability. In this sense, $(r - g)$ captures the fiscal cost of public debt. But if interest rates are less than growth rates, larger debt may create a fiscal benefit by allowing the government 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 to reveal 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 has averaged over 6.2 percent. Meanwhile, nominal long-term borrowing rates averaged just over 5 percent, meaning that the average interest:growth differential was -1.2 percent. But, as is evident in figure 2(b), there is significant variation around this average. In the years between 1945 and 1979, the differential averaged over -4 percent, while between 1980 and 2000 it averaged over 3 percent. Since 2000, the average differential has been modestly negative at -0.5 percent. This phenomenon is not unique to Canada. Recent research suggests that interest rates fall below

FIGURE 2 Comparison of Borrowing Costs and Growth Rates in Canada, 1870-2019



Note: This figure displays the long-run nominal interest rates and the trend annual nominal economic growth rates in Canada from 1870 to 2019. The cyclical component of gross domestic product growth is removed using a Hodrick-Prescott filter.

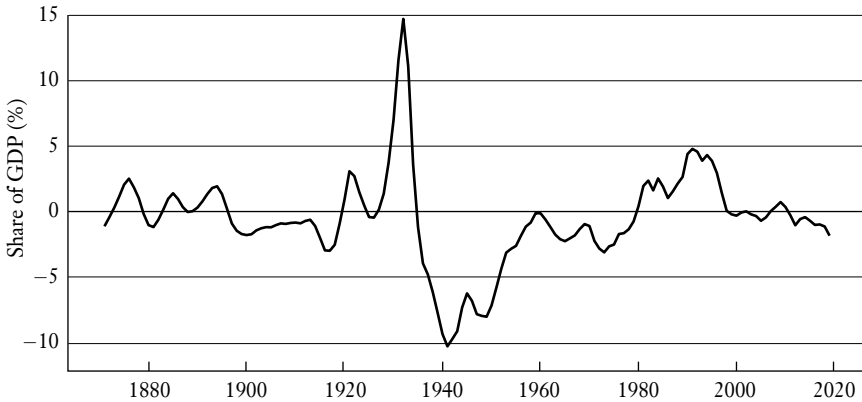
Sources: Long-run nominal interest rates for 1870 to 1975 and GDP growth for 1870 to 1981 are from Óscar Jordà, Katharina Knoll, Dmitry Kuvshinov, Moritz Schularick, and Alan M. Taylor, “The Rate of Return on Everything, 1870-2015” (2019) 134:3 *Quarterly Journal of Economics* 1225-98 (<https://doi.org/10.1093/qje/qjz012>); and Óscar Jordà, Moritz Schularick, and Alan M. Taylor, “Macrofinancial History and the New Business Cycle Facts,” in Martin Eichenbaum, Erik Hurst, and Jonathan A. Parker, eds., *NBER Macroeconomics Annual 2016* (Chicago: University of Chicago Press, 2017), 213-63. Interest rates for 1976 to 2019 are from Statistics Canada table 10-10-0122-01 (formerly CANSIM 176-0043), “Financial Market Statistics, Last Wednesday Unless Otherwise Stated, Bank of Canada,” vector v122544. Growth rates for 1982 to 2018 are from Statistics Canada table 36-10-0222-01 (formerly CANSIM 384-0038), “Gross Domestic Product, Expenditure-Based, Provincial and Territorial, Annual (x 1,000,000),” vector v62787312, updated to 2019 using Canada, Department of Finance, *Federal Economic and Fiscal Snapshot 2020* (Ottawa: Department of Finance, July 8, 2020).

economic growth rates more frequently than the reverse, often for long stretches.⁷ These interest:growth differentials also imply that the fiscal cost of public debt can fluctuate and potentially be negative (that is, become a fiscal benefit). I plot this in figure 3.

Looking forward, both growth rates 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 saving behaviour over the lifecycle of individuals.⁸ In Canada, recent evidence suggests that the natural real rate of interest may have been consistently falling over time, as in many other countries.⁹ 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 1 percentage point higher is a reasonable rule of thumb that I will use in this article. Current forward rates for government borrowing costs are notably less than this. As for growth rates, if we presume labour productivity growth of 1 percent per year, 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.

Does this mean that any level of debt is sustainable? If governments can perpetually roll over debt incurred today, both current and future generations benefit. This is known as “the deficit gamble”—and it may pay off under certain conditions.¹⁰ But it comes with risk: If governments fail to roll over debt owing to, say, a large adverse shock, costly fiscal adjustment will be required. It may be prudent to avoid this risk.

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- 7 See, for example, Paolo Mauro and Jing Zhou, *r-g < 0: Can We Sleep More Soundly?* IMF Working Paper no. WP/20/52 (Washington, DC: International Monetary Fund, Fiscal Affairs Department, 2020).
- 8 For informative research, see Douglas W. Elmendorf and Louise M. Sheiner, “Federal Budget Policy with an Aging Population and Persistently Low Interest Rates” (2017) 31:3 *Journal of Economic Perspectives* 175-94; Kurt G. Lunsford and Kenneth D. West, *Some Evidence on Secular Drivers of US Safe Real Rates*, Federal Reserve Bank of Cleveland Working Paper no. 17-23 (Cleveland, OH: Federal Reserve Bank of Cleveland, December 2017); Gabriele Fiorentini, Alessandro Galesi, Gabriel Pérez-Quirós, and Enrique Sentana, *The Rise and Fall of the Natural Interest Rate*, CEPR Discussion Paper no. 13042 (London, UK: Centre for Economic Policy Research, July 2018); and Carlos Carvalho, Andrea Ferrero, and Fernanda Nechio, “Demographics and Real Interest Rates: Inspecting the Mechanism” (2016) 88 *European Economic Review* 208-26 (<https://doi.org/10.1016/j.eurocorev.2016.04.002>).
- 9 Kathryn Holston, Thomas Laubach, and John C. Williams, “Measuring the Natural Rate of Interest: International Trends and Determinants” (2017) 108, supplement 1 *Journal of International Economics* S59-75 (<https://doi.org/10.1016/j.jinteco.2017.01.004>).
- 10 Laurence Ball, Douglas W. Elmendorf, and N. Gregory Mankiw, “The Deficit Gamble” (1998) 30:4 *Journal of Money, Credit and Banking* 699-720.

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

GDP = gross domestic product.

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

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

High debt levels may also lower the probability and duration of periods with favourable interest: growth differentials.¹¹ 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 article. 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 a dollar 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, I define the effective discount rate φ_t as

$$\varphi_t = \prod_{s=1}^t \left(\frac{1 + r_s}{1 + g_s} \right) \quad (4)$$

11 For recent evidence on these considerations, see Weicheng Lian, Andrea F. Presbitero, and Ursula Wiriadinata, *Public Debt and $r - g$ at Risk*, IMF Working Paper no. WP/20/137 (Washington, DC: International Monetary Fund, Research Department, 2020).

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. The effective discount rate 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

$$\sigma_T = \frac{1}{\bar{\varphi}_T} \left(\sum_{t=1}^T \varphi_t^{-1} \right)^{-1} \equiv \frac{\bar{\varphi}_T}{T\bar{\varphi}_T}, \quad (5)$$

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 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 composed of 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

$$d_T = \varphi_T \times d_0 - \varphi_T \times \left(\sum_{t=1}^T \varphi_t^{-1} p_t \right). \quad (6)$$

Though the full derivation is omitted, this result is intuitive. The first term following the equals sign 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 those projections in hand, equation 6 allows us to estimate whether future debt levels d_T will exceed current levels d_0 , and if so, by how much. If those debt levels do differ, a fiscal gap will exist, and changes in revenues or expenditures may be warranted.

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

$$d_T^* = \varphi_T \times d_0 - \varphi_T \times \left(\sum_{t=1}^T \varphi_t^{-1} (p_t + f) \right). \quad (7)$$

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

$$f = (d_T - d_0) \times \sigma_T, \quad (8)$$

which will be our measure of a government’s fiscal gap. Notice that the result 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 that there is scope for sustainable tax cuts or spending increases. The opposite is true for a government 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

$$f = d_0 \times \left(\frac{r-g}{1+g} \right) - \bar{p}, \quad (9)$$

where \bar{p} is the average primary balance from now until time T .¹² 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. Equation 9 also clarifies the way in which changes in interest rates matter. In general, changes in interest rates affect discount rates and therefore potentially affect \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 depends only on current debt. To illustrate, if debt is 50 percent of GDP and the interest:growth differential rises by 1 percentage point, 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 to repay it? To achieve $d_T = 0$, we require a larger fiscal adjustment to accumulate d_0 by year T . Specifically,

$$f_0 = f + d_0 \sigma_T. \quad (10)$$

To be clear, neither of the above fiscal gap measures represents optimal policy. These measures are almost certainly not optimal. Any sequence of annual adjustments (f_t) can achieve the same result as a single uniform adjustment so long as, on average, the adjustments are equal and therefore $\bar{f} = f$. Governments will need to balance many important tradeoffs when implementing any fiscal policy adjustments. These measures of fiscal gaps are nevertheless useful as digestible metrics by which to quantify the scale of future challenges.

THE EFFECT OF A TEMPORARY FISCAL SHOCK

Fiscal adjustment to repay debt is a particularly useful measure for analyzing temporary shocks such as COVID-19. If we (for now) suppose that there are no permanent structural changes in revenues or program spending, we can focus only on changes in debt. Though much remains uncertain, suppose that the pandemic

12 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 (as is the case 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.

response increases the public 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 International Monetary Fund's projection for Canada in its June 2020 *World Economic Outlook Update*.¹³

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, changes in long-run sustainability depend on changes in debt and the interest:growth differential. Specifically,

$$\Delta f = \Delta d_0 \times \left(\frac{r-g}{1+g} \right). \quad (11)$$

An interest:growth differential of, say, 0.01 implies that 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 a relatively minor change, but not trivial. For perspective, it is roughly 0.5 goods and services tax (GST) points in perpetuity. But the result is highly sensitive to the interest:growth differential. If interest rates equal growth, there will be no ongoing fiscal costs from the shock. If interest rates fall below growth (as we have seen is possible for the federal government), there will be fiscal benefits from the higher debt, in the sense that there will be room to lower revenues or increase program expenditures and maintain a stable (though now higher) debt-to-GDP ratio.

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 governments want to bring debt ratios down. If their time frame is a period of T years, the required adjustment is

$$\Delta f = \Delta d_0 \times \varphi_T \times \sigma_T. \quad (12)$$

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

$$\Delta f = \Delta d_0 \times \left(\frac{r-g}{1+g} \right) \times \left(1 - \left(\frac{1+r}{1+g} \right)^{-T} \right)^{-1} \approx \frac{\Delta d_0}{T}. \quad (13)$$

The first term following the equals sign is the COVID-19 debt shock. The second term is the carrying cost of the incremental debt. The third term reflects how much higher than the carrying cost that payments must be to repay the debt over T years. If interest rates and growth rates are equal, however, $\bar{\varphi}_T = 1$ and therefore $\Delta f = \Delta d_0/T$. Retiring COVID-19-related debt equivalent to 20 percent of GDP would therefore require increasing revenues or decreasing spending by 2 percent of GDP for 10 years, or by 1 percent for 20 years. This is a convenient rule of thumb.

13 Supra note 5.

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

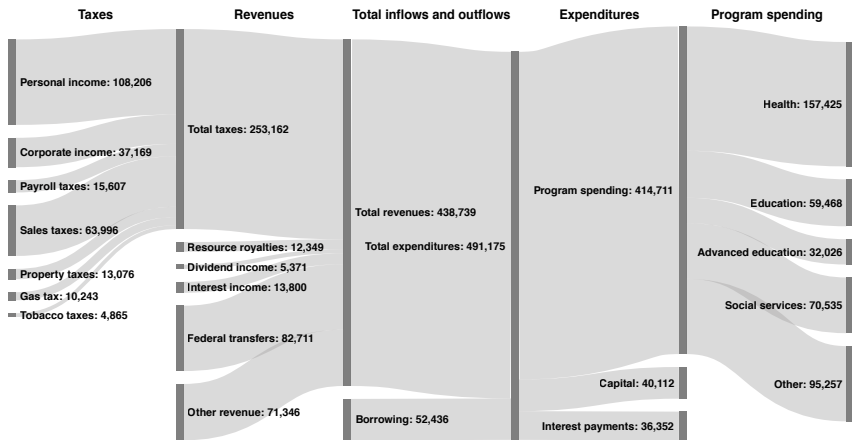
PROJECTING GOVERNMENT FINANCES OVER THE LONG RUN

THE PROJECTION MODEL

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 that I use to project their future values.

On the revenue side, I model 12 separate sources. Most revenues grow with the overall economy. Personal income taxes, corporate income taxes, payroll taxes, and 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, 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's, set property tax growth to maintain the real cost per household. I assume that revenue from this source will therefore roughly keep pace with changes in the population and in inflation. Tobacco 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 as a result of technological change. I assume that tobacco taxes grow with inflation and gasoline taxes grow with real GDP. Regarding own-source revenues in the “other revenue” category, I assume that they will grow with rising inflation and population growth. Finally, federal transfers follow an explicit formula.

I separately model four distinct components of federal transfers. First, the CHT (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. Second, the Canada social transfer (CST) is simpler and grows at a fixed rate of 3 percent per year. Both transfer programs are distributed across provinces according to population. Third, equalization payments 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 in 2016 to 2018 and over time according to a three-year moving average of provincial nominal GDP. This is a very good approximation of each province's true fiscal capacity. Fourth, and finally, I assume that provincial revenues from all other transfer programs will increase with population and inflation.

FIGURE 4 Provincial Government Financial Flows, 2018 (Millions of Dollars)

Note: This figure displays the aggregate 2018 fiscal inflows to provincial governments on the left and the fiscal outflows on the right.

Sources: Author's calculations from Statistics Canada tables 10-10-0017-01 (formerly CANSIM 385-0034), "Canadian Government Finance Statistics for the Provincial and Territorial Governments (x 1,000,000)"; and 10-10-0024-01 (formerly CANSIM 385-0040), "Canadian Classification of Functions of Government, by General Government Component (x 1,000,000)." Additional federal budget data, though not displayed, are from Statistics Canada table 10-10-0016-01 (formerly CANSIM 385-0033), "Canadian Government Finance Statistics for the Federal Government (x 1,000,000)."

On the expenditure side, the three largest provincial ministries account for over 60 percent of total program spending. I model each separately. Health care, 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 and inflation, plus a real increase of 0.5 percent per year in the per-student spending. This increment roughly accounts for real wage increases among workers in education that keep 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-student increase. I assume that all other program spending grows in line with population plus inflation (a very conservative assumption), and capital spending grows with the provincial economy.¹⁴ Provincial primary balances are then calculated as total revenue from all sources minus total program and capital spending.

¹⁴ Provincial governments do not normally include infrastructure spending in their calculation of budget deficits since such expenditures are gradually amortized over time. Because the focus of this article is on public debt dynamics, a cash basis for the deficit is more appropriate, so all capital spending is included.

The federal government is also an important component of the analysis to come. Its revenue sources are simpler and grow faster than those of provincial governments, since federal revenues from income and consumption taxes constitute a significantly larger share of the total. Tax revenues that grow with the economy account for nearly 90 percent of federal revenues. Federal revenues from other sources, such as government business enterprises, are also likely to grow with overall GDP. Meanwhile, EI premiums are tied to EI benefit payments. On the spending side, the federal government makes significant transfers to individuals through the payment of benefits to seniors, families with children, and the unemployed. I assume that these transfers will grow with the relevant demographic group plus inflation, and EI benefits will also grow with GDP per worker. I assume that defence spending will grow with the overall economy, consistent with stated goals and North Atlantic Treaty Organization (NATO) guidelines. Transfers to provinces have been discussed above. Other program spending is assumed to grow with population plus inflation.

Finally, there are several important macroeconomic variables that drive these budget projections. As discussed earlier, I assume federal borrowing rates of 3 percent and provincial borrowing rates of 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 assume that interest rates themselves will respond to overall debt levels; rather, I assume that Canadian governments will have access to a large global capital market that does not charge a risk premium if debt levels grow large. Finally, for each province's overall economy, real GDP is expressed as

$$Y_{it} = A_{it}w_{it}P_{it}, \quad (14)$$

where A_{it} is labour productivity, w_{it} is the working-age share of the population, and P_{it} is the total population. I assume that labour productivity growth is 1 percent per year; the working-age share is from the Statistics Canada population projections cited above. Total GDP across all provinces is then equal to Canada's total GDP.¹⁵

PROJECTING FUTURE HEALTH-CARE EXPENDITURES

Health care 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 that the share of Canada's population aged 65 and over may rise from 18 percent today to nearly 24 percent by 2040, while the share aged 75 and over may double

15 This method of calculation excludes economic activity in the three northern territories, which is not quantitatively important for the purposes of the analysis.

from 7 percent today to 14 percent.¹⁶ Changes in population shares map into health-care expenditures using data on average spending by age and gender cohorts. Specifically, average per-capita spending for a province, i , in year t is

$$b_{it} = \sum_c b_{it}^c p_{it}^c, \quad (15)$$

where b_{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. Using data compiled by the CIHI, I illustrate the full distribution of age-specific health-care spending in figure 5, with the range across all provinces illustrated as “whiskers” around the overall Canadian average.

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 its medium-growth (M2) scenario as the baseline case, but report how sensitive the results are to alternative growth assumptions.¹⁷ Beyond 2068, I assume that population shares are constant. In any case, holding all other factors constant, health-care costs increase according to a weighted average of cohort-specific population change, expressed as

$$\hat{b}_{it} = \sum_c \omega_{i0}^c \hat{p}_{it}^c, \quad (16)$$

where $\omega_{i0}^c \propto b_{i0}^c p_{i0}^c$ is the initial share of total health-care spending accounted for by spending on individuals within cohort c and hats denote relative changes. I find that \hat{b}_{it} is nearly 1.28 for British Columbia by 2050, implying that demographics and aging alone will increase health-care spending in that province by 28 percent. Across provinces, this projection 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-care spending. To estimate health-care-specific cost inflation over and above the economy-wide 2 percent per year, I use the same weight ω_{i0}^c to construct

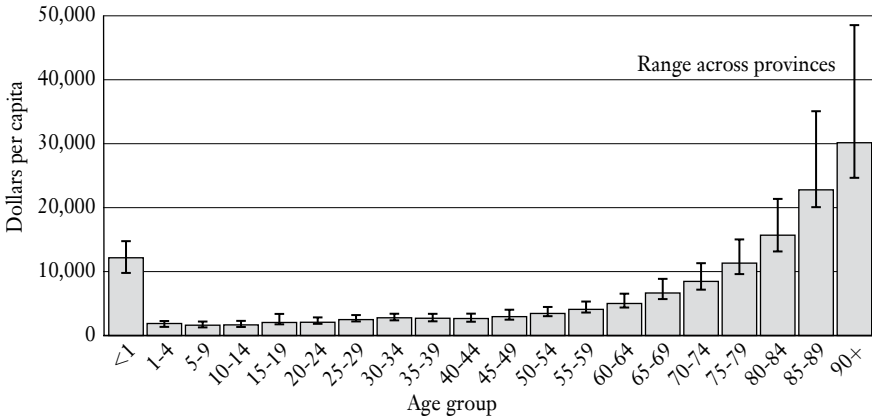
$$\hat{b}_{it} = \sum_c \omega_{i0}^c \hat{b}_{it}^c. \quad (17)$$

I estimate that since 1998 health-care-specific cost inflation grew at roughly 1.3 percent per year, though there is significant variation over time and across provinces. From 1998 to 2010, for example, the average was 2.3 percent across Canada, falling 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. Looking ahead, I assume 1 percent health-care-specific inflation

16 Statistics Canada table 17-10-0057-01 (formerly CANSIM 052-0005), “Projected Population, by Projection Scenario, Age and Sex, as of July 1 (x 1,000).”

17 Ibid.

FIGURE 5 Per-Capita Health-Care Spending in Canada by Age Group, 2017



Note: This figure displays the average level of health-care spending in Canada per capita across different age groups. The range across provinces represents the gap between the provinces with the lowest average spending and those with the highest average spending.

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

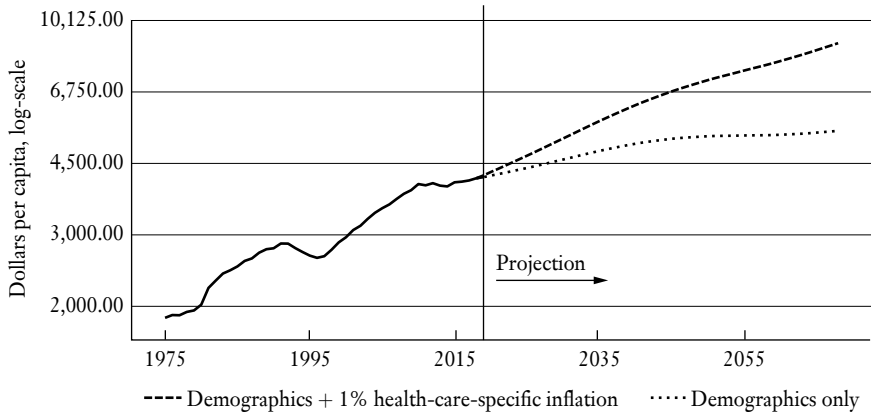
as the baseline case, but report results across a range of values. This measure assumes the same rate of health-care-specific inflation across all age and gender cohorts.¹⁸

Combining both demographic change and health-care-specific inflation, I project forward overall per-capita health-care 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 using demographics alone rises to over \$5,000 (in 2018 dollars per capita) by 2040 and nearly \$5,300 by 2050. Including health-care-specific inflation, these estimates rise to over \$6,200 by 2040 and \$7,200 by 2050. Over the next 30 years, this increase represents an average annual growth rate of 1.8 percent per year for health-care costs attributable to demographics alone and incremental health-care-specific inflation of 1 percent per year. This analysis suggests that provincial health-care 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. Health-care spending plateaus at roughly this level for the remaining years. This 3 percentage point increase in provincial health-care spending is reasonable, though it is somewhat larger than the projection in the latest PBO fiscal sustainability report.¹⁹ To be clear, there are several sources of uncertainty. Technological developments in health-care delivery may

18 The magnitude of future price changes is unlikely to be uniform, and historically the relative cost increases for older age cohorts have been smaller than for younger cohorts; however, 1 percent is a reasonable approximation.

19 See supra note 3.

FIGURE 6 Per-Capita Health-Care Spending by Provincial Governments, Actual and Projected, 1975-2055 Onward



Note: This figure displays the average level of health-care spending by provincial governments per capita historically between 1975 and 2019 and the author's baseline projection from 2018 onward. The projection separately reports health-care costs with and without a 1 percentage point increase in the rate of inflation specific to those costs.

Source: Author's calculations from the Canadian Institute for Health Information, *National Health Expenditure Trends, 1975 to 2019* (Ottawa: CIHI, 2019) for the period 1975-2019. The projection incorporates several data sources and methods. See the text for details.

increase or decrease costs. Immigration patterns may dampen the pace at which Canada's population ages. And health-care spending is endogenous to other government policies, such as supports for low-income individuals, housing, promotion of health and wellness, and so on. Nevertheless, I suggest that the projections presented here are a conservative illustration of a potential future.

THE 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 across the 75-year forecast horizon. The ratio of federal revenue to GDP is therefore stable, since this is also the growth rate of the national economy. Provinces, however, will see more modest revenue growth ranging between 3.3 percent and 3.4 percent; therefore, the revenue-to-GDP ratio declines from the current level of 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 thereafter. Provincial governments may see much more rapid growth, with program expenditures rising by an

average of 3.8 percent to 2040 and roughly 3.5 percent thereafter. Health-care 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 that those deficits create in table 1. Specifically, these values correspond to $-\bar{p}$ and $-\sum_{t=1}^T \varphi_t^{-1} p_t$, respectively.

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 an average annual primary deficit of no less than 1.1 percent, and Newfoundland and Labrador has an average deficit of 7.7 percent. In present-value terms, the projected provincial primary imbalances from 2018 to 2050 are collectively equivalent to two-thirds of GDP today. For the period 2018-2090, I estimate that 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. Projected future imbalances are therefore significantly larger than the current debt-to-GDP ratio and dwarf the short-term debt increases attributable to COVID-19. In contrast, the federal government is expected to record long-run primary surpluses averaging 1 percent of GDP between 2018 and 2050. In subsequent years, the projected federal surplus is even larger. Between 2018 and 2090, the average federal primary surplus is 2.5 percent of GDP—the equivalent of roughly 8 GST points today. The present value of such surpluses approaches 230 percent of GDP.

Projected provincial debt levels are not merely large but also unsustainable. 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-year 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 that 14 percent of Alberta's entire economy be directed toward debt service payments. Given the revenue instruments available to the government in this projection, interest costs would amount to 125 percent of revenue. Something would have to give long before this situation materialized. One measure of long-run sustainability is the fiscal adjustment required, starting immediately, to stabilize debt as a percentage of GDP. This adjustment is equivalent to the average primary imbalances reported in table 1 plus a measure of the burden of current debt. The projected 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 as well as large differences between provinces. I report gaps for each province in table 2.

TABLE 1 Long-Run Fiscal Projections for Canada's Governments, 2018-2090 (Percent of GDP)

Province	Current debt				Average annual primary deficit for the period 2018 to . . .				Accumulated primary deficits for the period 2018 to . . .			
	2030	2050	2070	2090	2030	2050	2070	2090	2030	2050	2070	2090
British Columbia	22.0	1.5	1.9	2.1	0.6	1.5	1.9	2.1	7.0	44.0	89.0	131.0
Alberta	25.0	4.6	4.9	4.9	4.2	4.6	4.9	4.9	52.0	163.0	289.0	418.0
Saskatchewan	29.0	3.1	3.3	3.4	2.7	3.1	3.3	3.4	32.0	101.0	173.0	240.0
Manitoba	74.0	1.1	1.5	1.6	0.2	1.1	1.5	1.6	3.0	35.0	74.0	107.0
Ontario	47.0	2.7	2.9	3.0	2.1	2.7	2.9	3.0	24.0	82.0	139.0	188.0
Quebec	52.0	-1.3	-0.9	-0.9	-2.2	-1.3	-0.9	-0.9	-25.0	-35.0	-40.0	-49.0
New Brunswick	70.0	1.7	2.5	2.6	1.7	2.5	2.7	2.6	18.0	64.0	98.0	120.0
Nova Scotia	43.0	0.8	2.0	2.4	0.8	2.0	2.3	2.4	9.0	51.0	88.0	114.0
Prince Edward Island	38.0	1.7	3.2	3.9	1.7	3.2	3.8	3.9	20.0	97.0	180.0	248.0
Newfoundland and Labrador	46.0	5.8	8.3	8.4	5.8	7.7	8.3	8.4	60.0	173.0	253.0	306.0
Provinces	42.0	1.4	2.5	2.6	1.4	2.2	2.5	2.6	16.0	66.0	120.0	167.0
Federal	35.0	-0.4	-1.7	-2.5	-0.4	-1.0	-1.7	-2.5	-5.0	-34.0	-104.0	-229.0

GDP = gross domestic product.

Note: This table 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, $-\sum_{t=1}^T \varphi_t^{-1} \bar{p}_t$.

Sources: Current debt is from Statistics Canada table 10-10-0017-01 (formerly CANSIM 385-0034), "Canadian Government Finance Statistics for the Provincial and Territorial Governments (x 1,000,000)." Other values are the author's calculations. See the text for details.

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
British Columbia	22.5	14.4	2.5	2.3	2.2
Alberta	25.5	8.0	5.2	5.1	4.8
Saskatchewan	29.4	14.7	3.8	3.6	3.4
Manitoba	74.4	34.4	2.6	2.2	1.7
Ontario	47.8	39.5	3.7	3.2	3.1
Quebec	51.7	39.3	0.0	-0.4	-0.6
New Brunswick	69.7	37.8	4.1	3.7	3.5
Nova Scotia	43.4	33.8	3.3	3.0	3.0
Prince Edward Island	38.5	30.4	4.5	4.1	4.0
Newfoundland and Labrador . . .	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

GDP = gross domestic product.

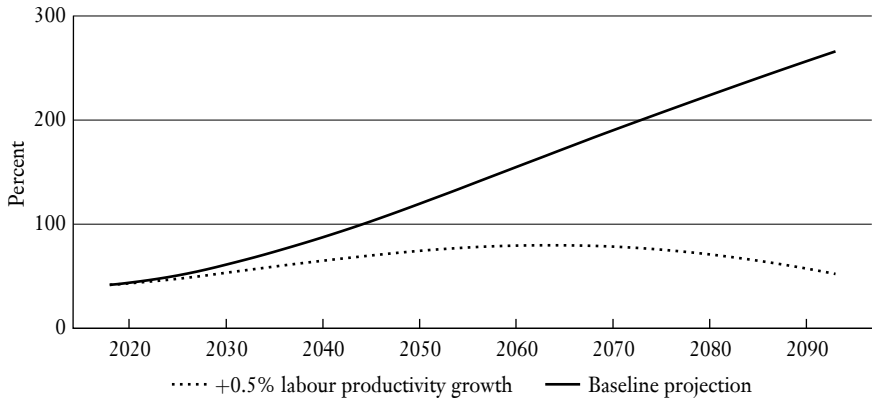
Note: This table displays the initial debt and net debt as a share of GDP in 2018 and three measures of the 75-year horizon fiscal gap. Zero debt reports the permanent fiscal adjustment necessary to achieve zero debt at the end of the 75-year forecast horizon. Same gross and net debt report the adjustment 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 10 provinces and the federal government, respectively.

Sources: Current debt is from Statistics Canada table 10-10-0017-01 (formerly CANSIM 385-0034), "Canadian Government Finance Statistics for the Provincial and Territorial Governments (x 1,000,000)"; net debt is from Canada, Department of Finance, *Fiscal Reference Tables 2019* (Ottawa: Department of Finance, September 2019), tables 18 through 27. Other values are the author's calculations. See the 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 percent and 5 percent, and provincial rates between 3 percent and 6 percent, fiscal gaps range from -3.4 percent to -1.5 percent federally and 2.6 percent to 3.4 percent provincially. For a range of labour productivity growth rates from 0.5 percent to 1.5 percent per year, fiscal gaps range from -4.5 percent to -1.5 percent federally and 0.3 percent to 5.7 percent provincially. To reinforce this point, I illustrate in figure 7 the projected debt-to-GDP ratios for provincial governments given an annual rate of growth in labour productivity that is 0.5 percentage points higher than the baseline rate of 1 percent. Sustained increases in productivity growth, though difficult for governments to influence directly, are crucial for long-run sustainability. Alternative demographic assumptions also matter, but only slightly. Using Statistics Canada's slow-aging scenario, I

FIGURE 7 Projected Provincial Debt-to-GDP Ratios with Higher Productivity Growth, 2020-2090



GDP = gross domestic product.

Note: This figure 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.

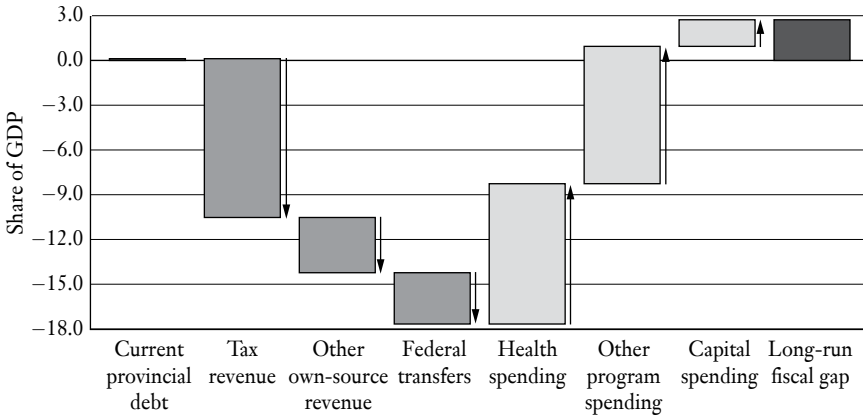
Source: Author's calculations. See the text for details.

estimate an average provincial fiscal gap of 2.0 percent and a federal gap of -3.2 percent. Using the fast-aging scenario, these estimates become 3.4 percent and -2.5 percent, respectively.

Our framework also allows for a simple additive decomposition of the average annual provincial balance \bar{p} and therefore a decomposition of the long-run provincial fiscal gap 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 of those components for ease of presentation in figure 8. Each represents the additive contribution to primary balances and therefore the fiscal gap. Overall, provincial revenues equivalent to nearly 18 percent of GDP are more than offset by expenditures of 21 percent of GDP, nearly half of which is for health care. This visual puts magnitudes in proper perspective. Own-source revenues average 14.3 percent across 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-care spending.

Not only do fiscal gaps differ widely across provinces, but so too do the underlying drivers. I report the magnitude of each component in table 3. Comparing each province with the 10-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

FIGURE 8 Decomposing the Long-Run Provincial Fiscal Gap



GDP = gross domestic product.

Note: This figure displays the relative contributions of various budget components to the aggregate provincial fiscal gap across a 75-year 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 values enlarge it. See the text for details.

Source: Author’s calculations. See the text for details.

national average, fully accounting for the province’s long-run fiscal gap. Other own-source revenues are larger than average and include resource revenues. These estimates suggest that if Alberta had average taxes, 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 revenues that are more than 4 percentage points of GDP higher than the average. But its expenditure levels, especially for health care, more than offset that advantage. Interestingly, other Atlantic provinces also have significantly higher health-care expenditures yet a far lower fiscal gap. On the revenue side, the maritime provinces benefit significantly more from federal transfers compared to Newfoundland and Labrador. We will soon see that this difference is entirely the result of Canada’s equalization program. Finally, Quebec is the only province with solidly sustainable finances over the projection period. Its position is not due to lower expenditure demands (which, on the contrary, are above average in all categories) but to significantly higher taxes than elsewhere—nearly a full 5 percentage points of GDP higher on average across the 75-year horizon.

So far, this analysis has been a mere accounting exercise. We can push further in understanding the long-term challenges faced by provinces by experimenting with alternative scenarios where provincial finances are resimulated under different assumptions. This can be a powerful means of identifying fundamental causes of fiscal challenges. For instance, by holding fixed the demographic composition of provinces at the observed 2018 levels, we can show that an aging population fully

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

Province	Revenues				Expenditures			
	Effect of current debt	Taxes	Other own-source	Federal transfers	Health	Non-health	Capital	Fiscal gap ^a
British Columbia	0.1	-10.9	-3.9	-2.9	9.7	8.4	1.8	2.2
Alberta	-0.1	-5.7	-4.9	-2.0	7.8	8.1	1.6	4.8
Saskatchewan	0.0	-8.4	-5.4	-2.7	7.9	10.0	2.0	3.4
Manitoba	0.1	-11.0	-3.1	-6.0	10.8	9.3	1.7	1.7
Ontario	0.2	-11.2	-1.9	-2.7	8.9	8.2	1.7	3.1
Quebec	0.3	-15.4	-5.9	-5.6	11.4	12.4	2.1	-0.6
New Brunswick	0.9	-12.1	-4.2	-11.0	12.7	13.9	3.3	3.5
Nova Scotia	0.5	-12.4	-3.6	-10.0	14.2	12.0	2.2	3.0
Prince Edward Island	0.1	-13.2	-3.1	-10.9	15.4	13.6	2.1	4.0
Newfoundland and Labrador	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

GDP = gross domestic product.

Note: This table displays the relative contributions of various budget components to the fiscal gap over a 75-year 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 numbers enlarge it. The final column may not exactly equal the sum of the other seven because of rounding. See the text for details.

a Fiscal gap measure based on gross debt ratios.

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

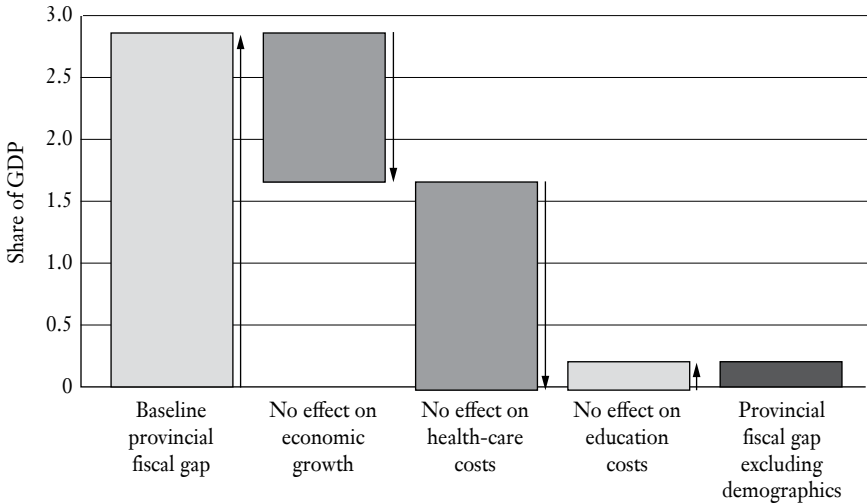
accounts for the long-run fiscal gaps facing provincial governments. Population growth is unaffected overall, but the fraction of the population in each age category is fixed through time. This has two effects. First, because the working-age share of the population is no longer declining, economic growth rates are higher, averaging 4 percent per year until 2040 and 3.8 percent thereafter. Second, health-care 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 of these factors matter for the long-run financial health of provinces.

Decomposing the effect of demographics on the long-run financial position of provinces, I find that over 40 percent of the fiscal gap is from slower economic growth, nearly 60 percent is from rising health-care costs, and lower education costs provide a modest offsetting effect.²⁰ In aggregate, without any demographic change, the measured fiscal gap declines to only 0.2 percent of GDP. 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, these reflect the challenges that are particular to these provinces. All three of them have yet to address their overreliance on natural resource revenues. If this revenue source does not grow significantly faster than the province's overall economy, large structural deficits 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 that province also has a structural challenge. In Newfoundland and Labrador's case, there may be scope for federal support since the scale of the challenge may exceed the provincial government's own capacity to achieve a healthier fiscal balance. The potential role of the federal government in improving the sustainability of provincial finances will be a theme in much of the analysis to come.

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 8 GST points or decreasing spending by nearly 15 percent, may appear daunting. The gap is certainly not small. But it can be reduced through less abrupt action—that is, through gradual and sustained changes to revenue and spending policies. In the discussion that follows, I will present examples of a few such options. These examples will also serve to illustrate the sensitivity of fiscal gap estimates to the underlying projection assumptions.

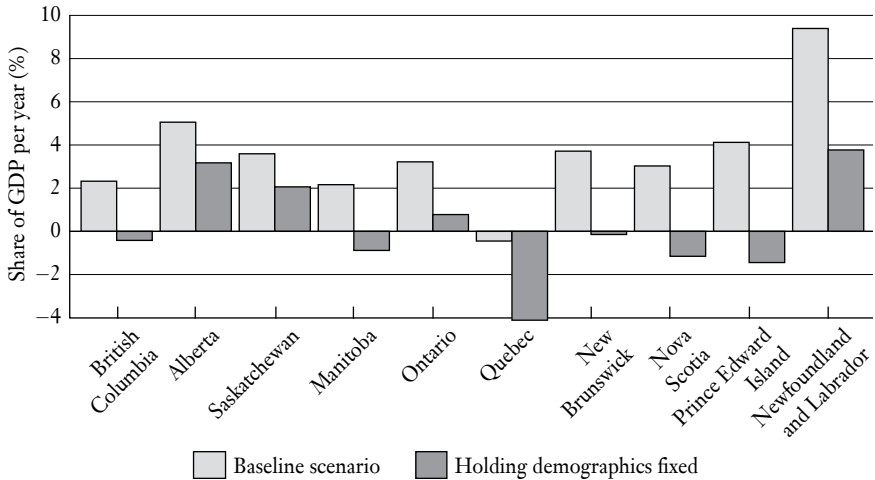
20 The effects are not strictly additive. The change in provincial fiscal gaps owing to demographic-related education or health-care costs, for example, is different when economic growth is also affected. This follows from the underlying effective discount factor φ_t being different across scenarios. I report here the average marginal contribution of each factor across all 12 possible orderings of the three factors.

FIGURE 9 Decomposing the Effect of Demographics on Provincial Fiscal Gaps

GDP = gross domestic product.

Note: This figure 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: Author's calculations. See the text for details.

FIGURE 10 The Effect of an Aging Population on Provincial Fiscal Gaps

GDP = gross domestic product.

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

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

If provinces could lower the health-care-specific inflation rate from 1 percent to, say, 0.5 percent per year, the aggregate provincial fiscal gap would decline to 1.3 percent—less than half of the baseline estimate presented above. This approach would mark a material departure from the past, but it may not be infeasible. It would imply that health-care spending would rise to a peak of 8.4 percent of GDP by the mid-2040s and fall 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 that is roughly 0.3 percentage points lower than GDP growth. If gradual reforms over time, such as small changes in tax rates, fee schedules, and so on, kept provincial own-source revenue growth in line with GDP, the aggregate fiscal gap would decline to 1.5 percent. If provincial governments could achieve both modestly lower health-care spending growth and modestly higher own-source revenue growth, the entire fiscal gap might be closed. Cutting health-care-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, achieving sustainability within 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-care-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 over, 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. While this scenario achieves sustainability within the 75-year horizon, unfortunately the transition path may not be feasible. Debt will accumulate substantially in the meantime and will exceed 100 percent by the mid-2030s. There may be no avoiding a more aggressive approach to fiscal consolidation in Newfoundland and Labrador. The province's average program expenditures as a share of GDP are fully 5 percentage points higher than the national average. It will be necessary to bring spending in line with that of other provinces, and perhaps to modestly increase Newfoundland and Labrador's own-source revenues (which are already above average), in combination with other gradual and ongoing fiscal reforms. Federal transfers will also be important. I turn to this area of the fiscal landscape next and explore it in depth.

FEDERAL TRANSFERS AND PROVINCIAL FINANCIAL SUSTAINABILITY

Federal transfers play an essential role in ensuring that provincial governments have the fiscal capacity necessary to deliver key public services. Programs like the CHT

and the 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 less capacity to raise revenue. Over time, the economic prospects of some provinces are also stronger than the prospects of others. For example, the populations of the Atlantic provinces are aging more quickly, and this trend may dampen the economic growth rates in those provinces. In the baseline scenario explored in this article, I estimate average real GDP growth rates of 0.8 percent per year in New Brunswick and Nova Scotia, and near zero in Newfoundland and Labrador. Meanwhile, Ontario averages growth of 1.6 percent per year, and Alberta averages 2.4 percent. These growth differentials will, over time, affect the relative revenue-raising capabilities of provincial governments. Equalization will therefore help to fill that gap.

To estimate the effect of equalization on provincial debt sustainability, I estimate fiscal gaps under a scenario where equalization is replaced with an equal per-capita transfer. That is, equalization is eliminated and the proceeds are 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 would be cut in half and the proceeds redirected toward equal per-capita allocations.²¹ In any case, there are large implications of this change for lower-income regions. I estimate that the fiscal gap in New Brunswick would increase to 9.5 percent of GDP from its baseline level of 3.7 percent. Nova Scotia and Prince Edward Island would also see significant increases. Quebec and Manitoba—the other large equalization recipients—would each see their fiscal gap increase by more than 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 would decline from 5.1 percent to 4.4 percent; Saskatchewan's, from 3.6 percent to 2.9 percent; British Columbia's, from 2.3 percent to 1.4 percent; and Ontario's, from 3.2 percent 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 assuming that all federal transfers were set at zero in the third column of table 4. Without transfers, the aggregate 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 in such a situation. But over the 75-year period examined here, federal transfers contribute the equivalent of 3.4 percent of GDP to provincial revenues.

21 Government of Saskatchewan, "Premier Scott Moe Calls for Changes to Equalization Program," press release, June 20, 2018 (<https://www.saskatchewan.ca/government/news-and-media/2018/june/20/equalization-program>).

TABLE 4 The Effect of Federal Transfers on the Long-Run Sustainability of Provincial Governments (Percent of GDP)

Province	Effect of transfers			Increase transfers		
	Baseline fiscal gap	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
British Columbia	2.3	1.4	5.2	2.0	1.6	0.4
Alberta	5.1	4.4	7.1	4.9	4.6	3.1
Saskatchewan	3.6	2.9	6.3	3.3	2.9	1.7
Manitoba	2.2	2.3	8.2	1.6	6.6	0.2
Ontario	3.2	1.8	5.9	2.9	2.5	1.3
Quebec	-0.4	1.8	5.1	-1.0	-1.8	-2.4
New Brunswick	3.7	9.5	14.7	2.6	1.0	1.8
Nova Scotia	3.0	7.5	13.1	2.0	0.5	1.1
Prince Edward Island	4.1	9.5	15.1	3.0	1.4	2.2
Newfoundland and Labrador	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

CHT = Canada health transfer; CST = Canada social transfer; GDP = gross domestic product; GST = goods and services tax.

Note: This table displays the fiscal gap estimate corresponding to stable net debt-to-GDP ratios over a 75-year time horizon.

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

Reforms that potentially increase this contribution may be important to address provincial fiscal gaps in future years.

Increasing federal transfers is feasible, given the relatively large fiscal space available to the federal government. As shown in table 4, if the size of cash transfers were increased by 10 percent (over \$8 billion in 2020-21, for perspective), the aggregate provincial fiscal gap would be reduced to 2.5 percent of GDP. Increasing transfers by 25 percent would decrease the provincial fiscal gap to just under 2 percent. The federal government can also transfer tax points instead of cash to the provincial governments. Table 4 illustrates the effect if the federal government vacated the entire sales tax field, leaving it to the provinces: the provincial fiscal gap would shrink 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.²² The increases imagined in the foregoing scenarios are undeniably large—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 that province’s precarious fiscal position. I estimate that without the federal government’s stream of payments to Newfoundland and Labrador, totalling \$2.5 billion under the 2019 Atlantic accord, the province’s fiscal gap would be roughly 0.2 percentage points higher. Most important, however, is the lack of equalization payments to Newfoundland and Labrador, compared to the other Atlantic provinces. If natural resource revenues were excluded, Newfoundland and Labrador would qualify for equalization. The province’s average income is higher than that in the other Atlantic provinces, so it would not receive as much, but I find that its fiscal gap would decline to 8 percent.

Given that demographics and health-care costs are such an important driver of provincial fiscal challenges, specific changes in federal support for health-care expenditures may be warranted. In the 2019 federal election campaign, the Bloc Québécois (BQ) put forward a proposal to allocate the CHT on the basis of the provincial population aged 65 and over, rather than the current per-capita allocation.²³ 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 effects of a change in the allocation and a change in the pace of growth. A sustained increase of 2 percentage points per year in CHT transfers would shrink the aggregate provincial fiscal gap to 0.7 percent and consume almost all of the

22 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,” *Finances of the Nation* feature (2018) 66:4 *Canadian Tax Journal* 871-917.

23 Bloc Québécois, *Le Québec, c’est nous : Plateforme politique du Bloc Québécois* (Quebec: BQ, 2019) (www.blocquebecois.org/wp-content/uploads/2019/09/Plateforme_Bloc2019_web.pdf).

TABLE 5 Fiscal Gap Estimates for Various Health-Care Financing Reforms (Percent of GDP)

Province	Baseline fiscal gap	Faster CHT growth			Deeper reforms	
		Allocate CHT on basis of 65+ population	Increase of 1 percent per year	Increase of 2 percent per year	Increment to CHT growth	Cover all costs related to an aging population
British Columbia	2.3	2.1	1.5	0.1	1.8	0.9
Alberta	5.1	5.3	4.4	3.3	4.8	4.3
Saskatchewan	3.6	3.9	2.9	1.7	3.4	3.1
Manitoba	2.2	2.5	1.2	-0.3	1.9	1.3
Ontario	3.2	3.2	2.4	1.0	2.8	2.1
Quebec	-0.4	-0.6	-1.4	-2.9	-0.9	-1.8
New Brunswick	3.7	3.1	2.8	1.2	3.1	1.5
Nova Scotia	3.0	2.5	2.0	0.4	2.4	1.1
Prince Edward Island	4.1	3.8	3.0	1.3	3.5	2.4
Newfoundland and Labrador	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

CHT = Canada health transfer; GDP = gross domestic product.

Note: This table displays the fiscal gap estimate corresponding to stable net debt-to-GDP ratios over a 75-year time horizon.

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

long-run fiscal space available to the federal government. This would be a significant increase that, over time, would increase the federal share of health-care 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 the spending decisions of any specific provincial government. Such policies would have the effect of subsidizing provincial spending increases and potentially lead to greater inefficiencies in the delivery of important public services.

Index CHT Growth to Demographics

Currently, the CHT grows at the same rate for all provinces, but different provinces have different rates of population growth for different age cohorts. Population trends are, to some extent, beyond the provincial government's control. However, health-care spending by age category is a policy choice and depends on related decisions concerning public-sector compensation, hospital capacity and location, and so on. So, instead of assuming uniform CHT growth, we could measure cost pressures using a nationally representative measure of health-care spending and provincial demographic changes. For Canada as a whole, an aging population adds to health-care costs when the population shifts toward higher-spending cohorts, as illustrated in figure 5. The rate of increase in national health-care expenditures is $\sum_c b_0^\epsilon p_i^\epsilon$, where b_0^ϵ is the initial period of health-care spending on cohort c and p_i^ϵ is the population share accounted for by that cohort. A national average health-care spending measure applied to each province's population shares could be a way to grow health-care spending in a relatively exogenous manner. Specifically,

$$\text{CHT growth increment} = \frac{\sum_c b_0^\epsilon p_i^\epsilon}{\sum_c b_0^\epsilon p_i^\epsilon} \equiv \sum_c \omega_0^\epsilon \hat{p}_i^\epsilon. \quad (18)$$

This expression mirrors the province-specific measure of demographic cost pressures \hat{b}_i defined earlier, but uses national average health-care spending per capita by cohort instead. This increment would see CHT transfers grow faster for all provinces, but at different rates. By 2040, the increase in CHT transfers would range from 11 percent more than the baseline projection for Saskatchewan to 40 percent more for Newfoundland and Labrador. The federal share of health-care spending would decline gradually in the coming years, to less than 23 percent by 2040. Therefore, this option is a relatively modest approach to indexing 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 the CHT To Cover All Demographic Costs

Real per-capita spending on health care is projected to rise in response to changing demographics and health-care-specific inflation over and above the general rate of 2 percent per year. 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 through the current system of funding health-care costs generally. Many elderly individuals move into other provinces in their retirement years, and to the extent that they do, the case for federal support to provinces to which those individuals relocate is potentially strong. One option is for the federal government to fund health-care costs related to aging but not other provincial health-care spending decisions. This approach takes the CHT increment proposed above and shifts incremental aging costs entirely to the federal government. Specifically,

$$\text{CHT supplement to fully cover aging costs} = \bar{b}_0 \times (\sum_c \omega_0^c \hat{p}_t^c - 1), \quad (19)$$

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

The grant under this formula would gradually increase to nearly 1.5 percent of GDP by 2050 and decline thereafter. This level of support is less than the total projected health-care expenditure increase since it does not compensate for health-care-specific inflation, but only for aging-related cost increases. But the contribution is still large. The federal government's share of total health-care spending would increase from the current level of one-quarter to a peak of one-third by the mid-2040s. Without such a transfer, the CHT is on track to grow at a slower rate than health-care spending, and therefore its share of the total will decline to roughly 18 percent by 2050. Expressed another way, the provincial share of health-care spending will rise from the current level of 5.5 percent of GDP to 6.5 percent by 2050 and 7 percent by 2070. In the baseline projection without the age-related supplement, this share rises to 8 percent by 2050 and nearly 8.5 percent by 2070. This option could result in a significant improvement in provincial debt sustainability. I estimate that the aggregate provincial fiscal gap would decline to 1.7 percent of GDP from the baseline 2.9 percent. If, along with this new transfer, provincial governments ensured that their own-source revenues kept pace with economic growth, or if health-care-specific inflation were limited to 0.5 percent, the aggregate provincial fiscal gap would be reduced to almost zero.

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 proved to be—transfers may encourage provincial governments to increase their spending in order to gain a short-term political advantage. Federal transfer arrangements that are impervious to such abuse are difficult to design. Canada has grappled with this challenge since Confederation, and it is a core challenge of fiscal federalism generally.²⁴

24 For a comprehensive review of this issue, see Jonathan A. Rodden, *Hamilton's Paradox: The Promise and Peril of Fiscal Federalism* (Cambridge, UK: Cambridge University Press, 2005).

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 has caused 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 that governments are incurring in 2020, 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 is unknown. Canada's *Federal Fiscal and Economic Snapshot 2020*²⁵ provides rich detail, but substantial uncertainty remains. In this section, I propose a first attempt to quantify the effect of a large-scale economic shock on provincial (and federal) debt sustainability. This exercise should be interpreted as illustrative in nature, and therefore distinct from the main analysis. It has value nonetheless. I show that even a shock as large as COVID-19, which has led to the largest deficits since the Second World War and economic disruptions rivalled only by those seen during the Great Depression, may not have as great an impact on 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.

I will begin by describing some of the details behind the fiscal scenario. I model two components of the COVID-19 shock. First, all provinces have experienced 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.²⁶ From 2022 onward, I assume a gradual recovery to the pre-COVID-19 baseline trajectory of nominal GDP by assuming that one-third of the remaining gap in each period is closed through above-normal growth. While prospects are potentially optimistic, the economic shock of the pandemic will continue to be felt until 2029, the earliest estimated date for the return of all provinces to GDP within 1 percent of their pre-COVID-19 path. Second, I assume a large federal spending response, amounting to \$300 billion, that both supports individuals and businesses, and (importantly for our purposes here) cushions provinces against incremental expenditure pressures from the pandemic. The underlying presumption is that the federal government intends to provide funding for the recovery far beyond the \$19 billion safe restart agreement already committed to. This exercise serves to illustrate potential

25 Canada, Department of Finance, *Federal Economic and Fiscal Snapshot 2020* (Ottawa: Department of Finance, July 8, 2020).

26 Robert Hogue, "Reopening of Provincial Economies: Different Speed, Scale and Outcomes," *Royal Bank of Canada Economics*, June 10, 2020 (<https://thoughtleadership.rbc.com/reopening-of-provincial-economies-different-speed-scale-and-outcomes>).

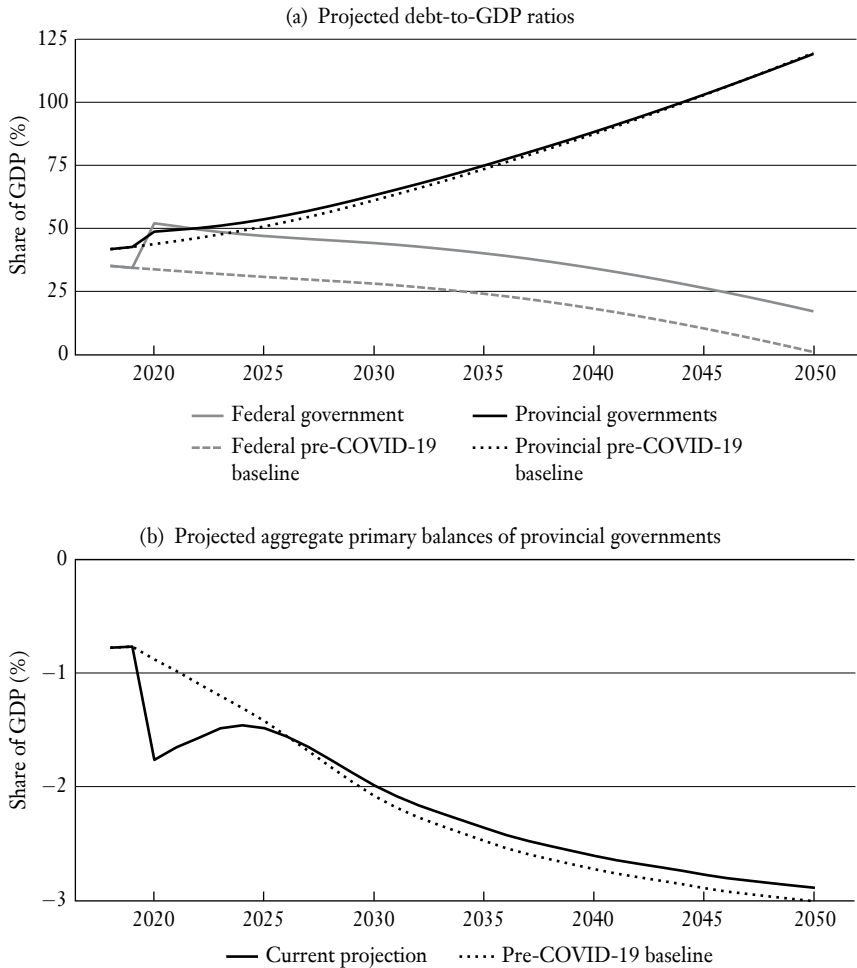
magnitudes and is a reasonable approximation of the true fiscal and economic shock based on current information.

Accordingly, this scenario anticipates 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. Looking ahead, I estimate that federal primary balances do not return to surplus until 2023 but remain permanently below the pre-COVID-19 baseline. By 2030, the federal primary balance is roughly 0.15 percentage points of GDP below the pre-COVID-19 trajectory and remains roughly 0.12 percentage points below across the entire forecast horizon. Meanwhile, the provinces see worsened primary balances until the late 2020s but afterward have a smaller primary deficit than previously projected. In terms of the 75-year horizon fiscal gaps, under this scenario, the federal position declines to -2.5 percent from the baseline -2.8 percent while the provinces' aggregate fiscal gap decreases by 0.1 percentage points. I illustrate these results in figure 11.

An important aspect of this scenario is the interaction between large economic shocks and federal transfers—specifically, the benefit that provinces derive 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 that experienced 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. In order to return to the pre-COVID-19 baseline path of economic activity, 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 an increase of roughly 1 percentage point 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 that provincial governments incur because of COVID-19.

CONCLUSION

This article develops a comprehensive model of provincial and federal finances, and projects future debt ratios over a wide variety of scenarios. I find that most provinces, with the notable exception of Quebec, face significant long-run challenges owing to an aging population, falling rates of economic growth, and rising health-care costs. Meanwhile, the federal government faces an excess of fiscal capacity and enjoys

FIGURE 11 Post-COVID-19 Debt Sustainability in Canada, 2018-2050 (Forecasted)

GDP = gross domestic product.

Note: This figure displays the projected debt-to-GDP ratio for Canada's governments in the baseline scenario (dashed line) compared to the post-COVID-19 scenario. Debt to GDP for 2018 is from actual data; values for 2019 onward are fiscal projections. The COVID-19 shock occurs in 2020. Negative primary balances are deficits.

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

a sustainable financial position 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 the provinces, and to Ottawa, to overcome the fiscal challenge presented by an aging population.

The scenarios set out in this article are but a small sample of the potential fiscal futures that might unfold. But however the fiscal reality evolves, it is important to consider carefully the potential implications of current policy choices for future fiscal outcomes. 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 article. 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.