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ARC - Stress Testing

OFFICE OF THE PARLIAMENTARY BUDGET OFFICER
BUREAU DU DIRECTEUR PARLEMENTAIRE DU BUDGET

The Parliamentary Budget Officer (PBO) supports Parliament by providing economic and financial analysis for the purposes of raising the quality of parliamentary debate and promoting greater budget transparency and accountability.

This report provides a "stress test" of the Government's fiscal anchor and fiscal objective by estimating the likelihood that the Government's fiscal plan presented in the 2024 Fall Economic Statement, when subject to both economic and fiscal shocks, will reduce the federal debt-to-GDP ratio over the medium term and will keep deficits below 1 per cent of GDP beginning in 2026-27.

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Highlights

Based on historical shocks to debt drivers and the baseline projection from the 2024 Fall Economic Statement, PBO estimates that there is a 61 per cent chance that the Government's fiscal anchor will be achieved over the medium term. That is, there is a 61 per cent chance that the federal debt-to-GDP ratio in 2029-30 will be below its 2023-24 level of 42.1 per cent.

PBO estimates that there is an 18 per cent chance that the Government's fiscal objective will be achieved. That is, there is an 18 per cent chance that deficits in each and every year over 2026-27 to 2029-30 will not exceed 1 per cent of GDP.

To increase the probability of achieving the Government's fiscal anchor to 80 per cent, PBO estimates that additional fiscal adjustment of 1.3 percentage points of GDP, phased in gradually over the medium term, would be required. This would represent $50 billion in higher revenues or lower program spending by 2029-30 relative to the Government's fiscal plan presented in the 2024 Fall Economic Statement.

Summary

This report provides a "stress test" of the Government's fiscal anchor and fiscal objective by estimating the likelihood that the Government's fiscal plan presented in the 2024 Fall Economic Statement (FES), when subject to both economic and fiscal shocks, will reduce the ratio of federal debt to gross domestic product (GDP) over the medium term and will keep deficits below 1 per cent of GDP beginning in 2026-27.

Following recent analysis of public debt by the International Monetary Fund (IMF), the report also illustrates how additional fiscal adjustment—measured as the improvement in the operating balance (that is, revenues less program spending)—could raise the probability of achieving the Government's fiscal anchor over the medium term.

Key results

- Based on shocks to debt drivers drawn from our historical sample and the baseline projection from the 2024 FES, we estimate that there is a 61 per cent chance that the Government's fiscal anchor will be achieved over the medium term. That is, there is a 61 per cent chance that the federal debt-to-GDP ratio in 2029-30 will be below its 2023-24 level of 42.1 per cent.

- Based on shocks to debt drivers drawn from our historical sample and the baseline projection from the 2024 FES, we estimate that there is an 18 per cent chance that the Government's fiscal objective will be achieved. That is, there is an 18 per cent chance that deficits in each and every year over 2026-27 to 2029-30 will not exceed 1 per cent of GDP.

- To increase the probability of achieving the Government's fiscal anchor to 80 per cent, which according to the IMF would be a "meaningful but not extreme increase in the likelihood of debt stabilization", we estimate that additional fiscal adjustment of 1.3 percentage points of GDP, phased in gradually over the medium term, would be required. In nominal terms, this would represent $50 billion in higher revenues or lower program spending by 2029-30 relative to the fiscal plan in the 2024 FES.

Introduction

The International Monetary Fund's October 2024 Fiscal Monitor, Putting a Lid on Public Debt, details the high and rising levels of global public indebtedness. The IMF notes that risks to the elevated global debt outlook are heavily tilted to the upside and that much larger fiscal adjustments than currently planned will be required to stabilize, or reduce debt, with high probability. The IMF's probabilistic analysis of debt reduction is based on its stochastic debt sustainability framework.

In the 2024 Fall Economic Statement, the Government reiterated its commitment to maintain the fiscal anchor of reducing the federal debt-to-GDP ratio over the medium term and to achieve the ongoing "fiscal objective" of keeping the deficit under 1 per cent of GDP in 2026-27 and future years. The Government indicated that the 2024 FES respects its fiscal anchor and fulfills its ongoing fiscal objective. In addition, the 2024 FES presented alternative economic scenarios (one upside scenario and one downside scenario), indicating that by the end of the medium term—even in the downside scenario—the federal debt-to-GDP ratio would still be lower than its current level and the deficit would remain below 1 per cent of GDP.

As noted in PBO's recent analysis of the 2024 FES, these scenarios provide a limited range of possible economic outcomes, reflecting largely temporary shocks to nominal GDP growth and interest rates.[1] Without discretionary fiscal policy measures in response to this economic shock, the federal debt-to-GDP reverts to a downward trajectory and the deficit-to-GDP ratio gradually falls below 1 per cent of GDP.

This report provides a "stress test" of the Government's fiscal anchor and fiscal objective by estimating the likelihood that the Government's fiscal plan presented in the 2024 FES, when subject to both economic and fiscal shocks, will reduce the federal debt-to-GDP ratio over the medium term and will keep deficits below 1 per cent of GDP beginning in 2026-27.[2] Following the IMF's recent analysis, the report also illustrates how additional fiscal adjustment could raise the probability of achieving the Government's fiscal anchor.

In this report, we adopt the IMF's stochastic debt sustainability framework and apply it to the federal government rather than the total government sector as a whole, which is typically assessed in IMF debt sustainability analyses. We also use the more familiar Public Accounts basis instead of the IMF-based (Government Finance Statistics) accounting framework. Further, given the definition of the Government's fiscal anchor we focus on federal debt (that is, total liabilities less financial and non-financial assets) as opposed to gross debt, which is used in IMF stochastic debt sustainability analyses.

Data and methodology

The methodology used in this report is based on the stochastic simulation approach in the IMF's October 2024 Fiscal Monitor.[3] This approach involves generating a distribution of paths of a government's debt-to-GDP ratio over the medium term based on future outcomes of fundamental debt drivers: the effective interest rate on government debt, the growth rate of nominal GDP, and the government's operating balance (that is, revenues less program spending).

Historical shocks to the debt drivers are applied to their corresponding values under a baseline projection. These augmented debt drivers are then used to extrapolate the initial debt-to-GDP ratio forward over a medium-term horizon. The distribution of debt paths is used to construct fan charts, which provide a visual representation of risks to the baseline projection. Moreover, the distributions can be used to estimate the probability of a specific outcome based on historical experience. For example, the probability that the debt-to-GDP ratio does not decline over the medium term or that budgetary deficits exceed a given level.

Federal debt-to-GDP accounting

Following the Government's accounting framework, relative to nominal GDP (Y), the budgetary balance (BB) is defined as the operating balance (revenue (R) less program spending (PS)) less public debt charges (the effective interest rate (i) applied to the previous year's stock of interest-bearing debt (IBD)):

$$\frac{BB_t}{Y_t} = \frac{(R_t - PS_t)}{Y_t} - \frac{i_t \cdot IBD_{t-1}}{Y_t}$$

Given nominal GDP growth (g) and other debt accumulation (OTHD), interest-bearing debt evolves according to:

$$\frac{IBD_t}{Y_t} = \frac{(1+i_t)}{(1+g_t)} \cdot \frac{IBD_{t-1}}{Y_{t-1}} - \frac{(R_t - PS_t)}{Y_t} + \frac{OTHD_t}{Y_t}$$

Given net remeasurement gains, other comprehensive income and adjustments to the accumulated deficit (ADJ), federal debt (FDEBT) relative to nominal GDP is determined as:

$$\frac{FDEBT_t}{Y_t} = \frac{1}{(1+g_t)} \cdot \frac{FDEBT_{t-1}}{Y_{t-1}} - \frac{BB_t}{Y_t} - \frac{ADJ_t}{Y_t}$$

Data

Our analysis is based on the fiscal outlook presented in the 2024 Fall Economic Statement, which serves as the baseline projection. In a departure from the IMF's framework (which is based on a gross debt concept), we use federal debt that is, total liabilities less financial and non-financial assets, consistent with the definition of the Government's fiscal anchor.

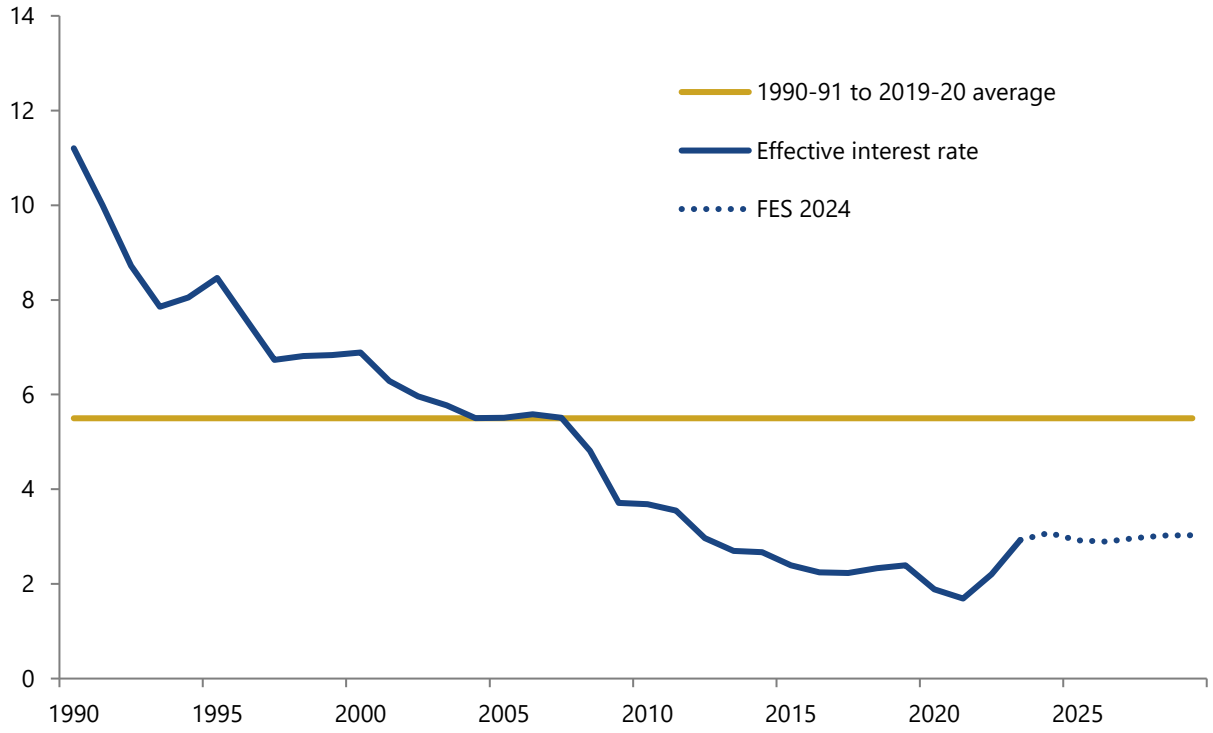
Over the historical period, other debt accumulation serves as a residual term, however, it also reflects government borrowing that is used to purchase financial assets.[4] Other debt accumulation is calculated residually given data on interest-bearing debt, public debt charges, revenue and program spending[5] from the 2024 Fiscal Reference Tables, and nominal GDP from Statistics Canada.

Consistent with the IMF's approach, our historical sample begins in 1990-91, and we limit the sample to 2019-20 to exclude the pandemic and recovery years. Following the IMF, shocks to the future debt drivers are calculated from the historical period as the observed value (in a given year) less its average value over 1990-91 to 2019-20. We consider shocks to four debt drivers: the effective interest rate on interest-bearing debt; nominal GDP growth; the operating balance-to-GDP ratio; and other debt accumulation-to-GDP ratio.[6]

Figure 1 presents the historical and projected series of the effective interest rate on federal interest-bearing debt. The figure shows a clear downward trend through 2015 before stabilizing prior to the pandemic period. With the increase in market interest rates from historical lows in 2020 and tightening of monetary policy, the effective interest rate in 2023 surpassed its pre-pandemic levels. Based on the 2024 FES outlook, the effective interest rate is projected to stabilize at around 3.0 per cent over the planning horizon, which is only marginally higher than the last historical observation of 2.9 per cent in 2023-24.[7]

Figure 1

Effective interest rate on interest-bearing debt, per cent



Source

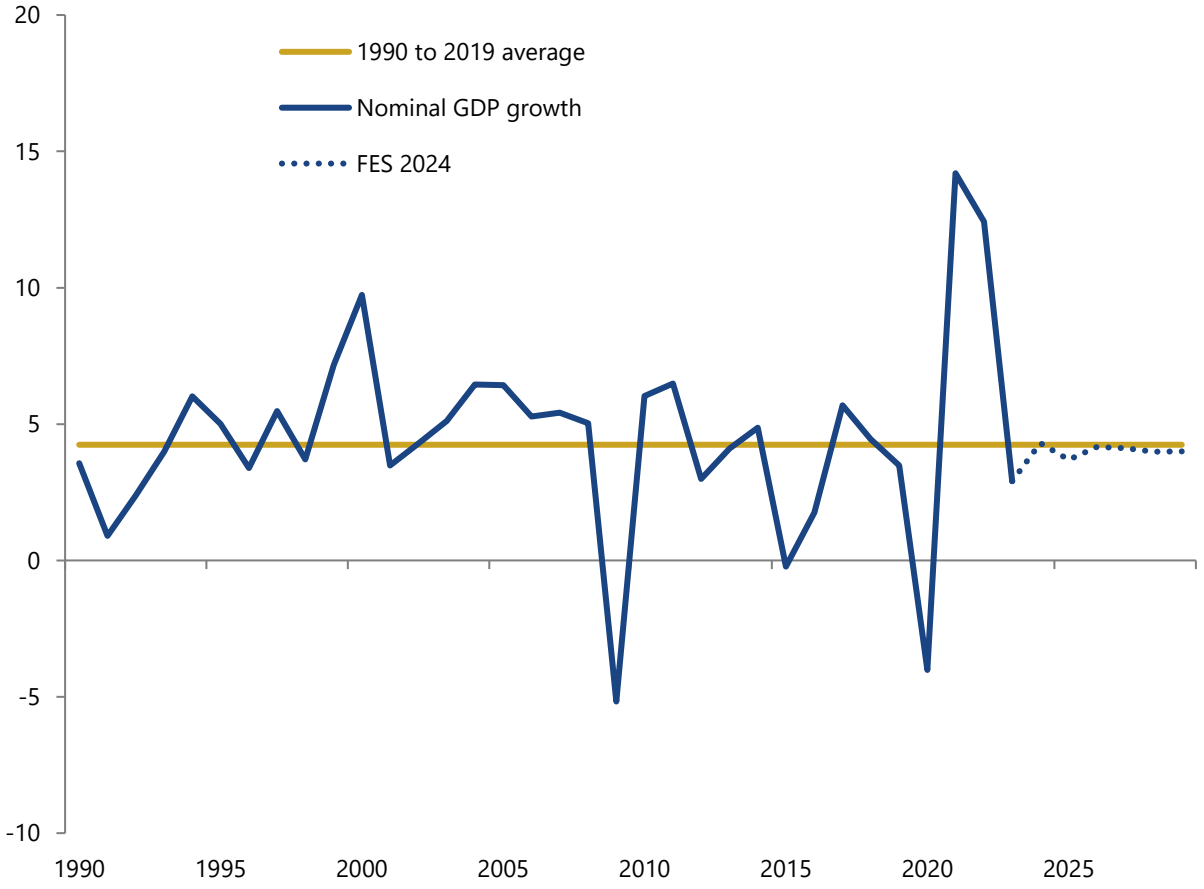
Finance Canada and Office of the Parliamentary Budget Officer.

Note

The series are presented on a fiscal-year basis where 1990 refers to 1990-91. The projection period covers 2024-25 to 2029-30.

In contrast to the trend decline in the effective interest rate, nominal GDP growth over 1990 to 2019 appears to exhibit mean-reverting behaviour (Figure 2). Further, the 2024 FES projection of nominal GDP growth over 2024 to 2029, which averages 4.0 per cent annually, is close to its historical average of 4.2 per cent. Based on our historical sample, downside shocks to nominal GDP growth include the 1990-1991 recession, the global financial crisis and the collapse in oil prices in 2014-2015.

Figure 2
Nominal GDP growth, per cent



Source

Statistics Canada, Finance Canada and Office of the Parliamentary Budget Officer.

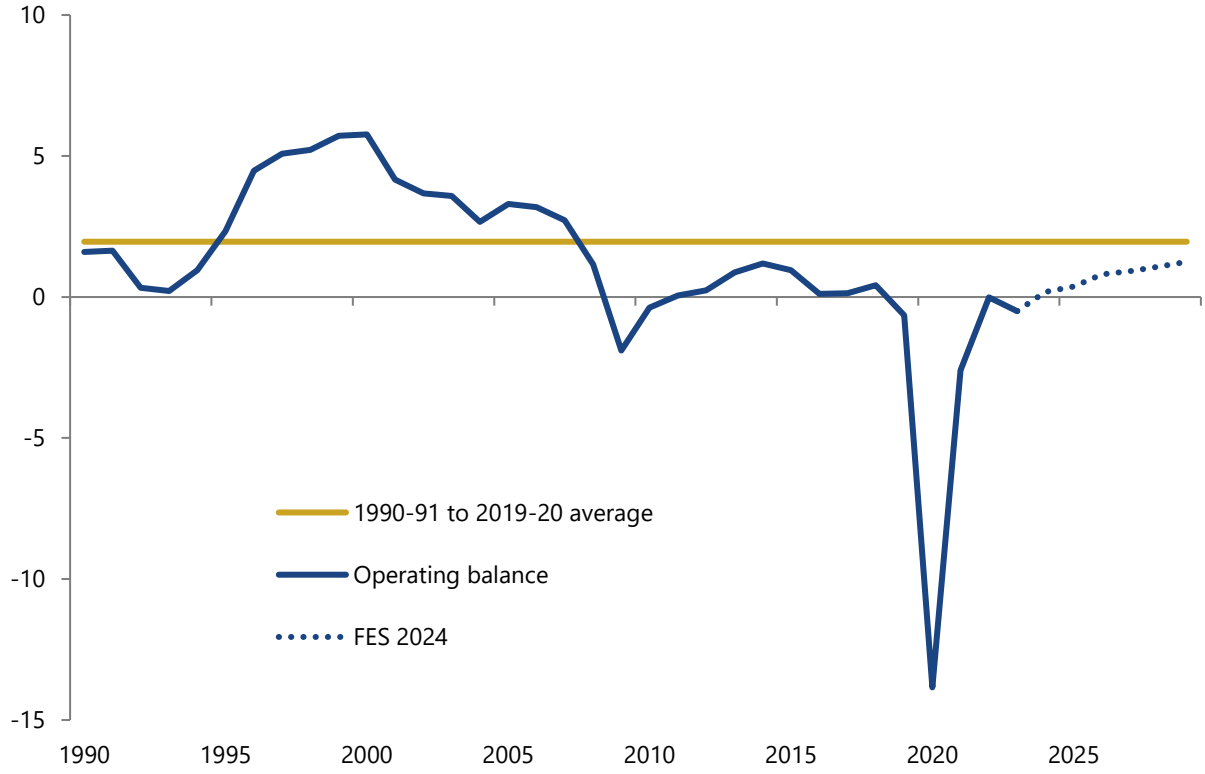
Note

The series are presented on a calendar-year basis. The projection period covers 2024 to 2029.

In terms of the operating balance (that is, revenue less program spending), our historical sample includes the period of fiscal consolidation over 1995-96 to 2000-01 and the subsequent period during which budgetary surpluses were maintained until 2008-09 (Figure 3). Based on the outlook presented in the 2024 FES, the operating balance is projected to return to a surplus position in 2024-25 and then gradually increase to 1.2 per cent of GDP by the end of the planning horizon. That said, the operating balance-to-GDP ratio in the 2024 FES is projected to remain below its pre-pandemic historical average of 2.0 per cent.

Figure 3

Operating balance, per cent of GDP



Source

Finance Canada and Office of the Parliamentary Budget Officer.

Note

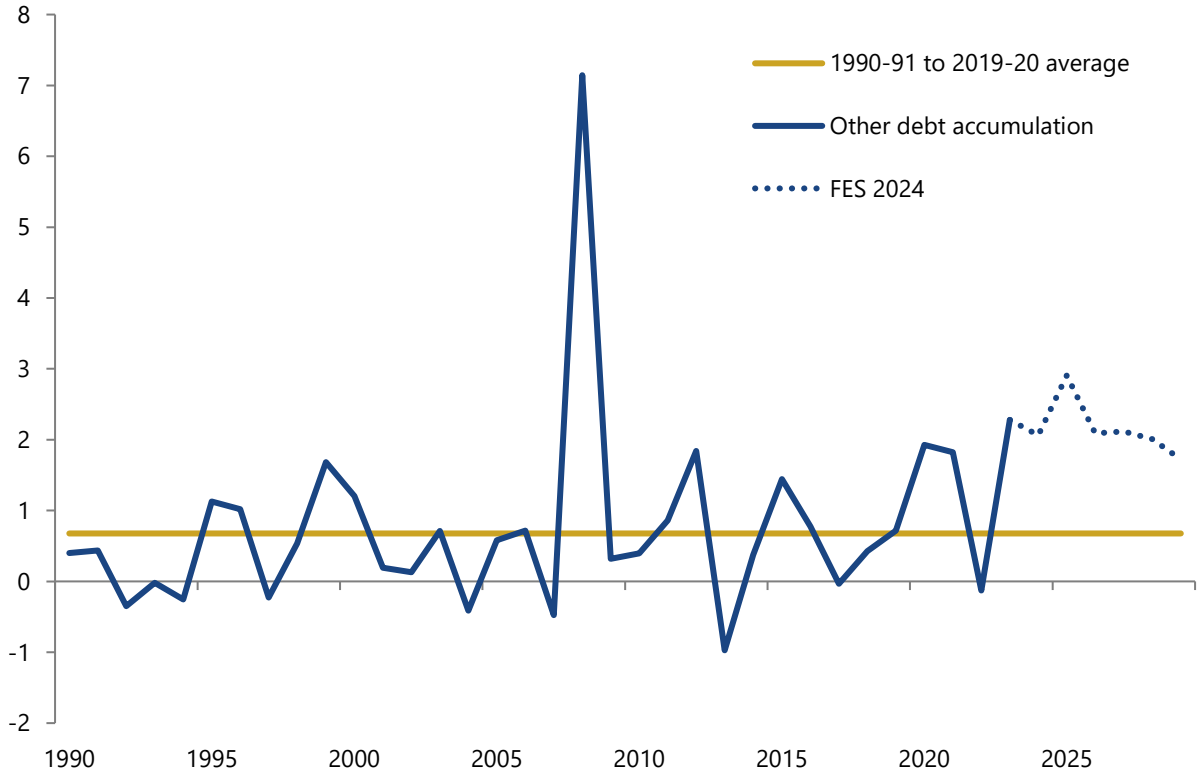
The series are presented on a fiscal-year basis where 1990 refers to 1990-91. The projection period covers 2024-25 to 2029-30.

Relative to GDP, other debt accumulation is calculated as the change in interest-bearing debt that exceeds the budgetary deficit. That is, borrowing that is in addition to the borrowing required to finance the Government's budgetary deficit.[8]

Figure 4 shows that other debt accumulation has fluctuated around its historical average. The notable spike in other debt accumulation in 2008-09 primarily reflects the Government's borrowing to fund the Insured Mortgage Purchase Program, which did not affect the size of federal debt since this borrowing was offset by the Government's purchase of interest-bearing financial assets.[9] Based on the 2024 FES, other debt accumulation relative to GDP is projected to remain above its historical average, reflecting (in part) borrowing to purchase Canada Mortgage Bonds "to help spur housing construction".[10]

Figure 4

Other debt accumulation, per cent of GDP



Source

Finance Canada and Office of the Parliamentary Budget Officer.

Note

The series are presented on a fiscal-year basis where 1990 refers to 1990-91. The projection period covers 2024-25 to 2029-30.

Stochastic simulation approach

Under our approach, the initial fiscal year, 2023-24, is fixed (non-stochastic) taken from the Public Accounts. Stochastic realizations of shocks to the debt drivers are then randomly drawn using a "block-bootstrap" technique, in which draws from the historical sample are taken for consecutive two-year "blocks".[11] The IMF notes that drawing shocks from consecutive years helps to capture the correlations across debt drivers and the intertemporal dependence in the data.[12] Similar to the IMF's approach, we assume that there is no feedback between the debt drivers and the level of federal debt relative to GDP.

The stochastic realizations of the debt drivers are then substituted into the above accounting framework to generate future debt-to-GDP and budgetary balance-to-GDP ratios for each year over the medium-term horizon 2024-25 to 2029-30. This simulation generates one path, and the process is repeated 10,000 times. Following the IMF, we construct fan charts using the 5th-25th, 25th-50th, 50th-75th and 75th-95th percentile intervals of the distributions generated by our simulations.

Results

Based on stochastic simulations of future debt and deficit paths, we first assess the balance of risks to the 2024 FES projection of the federal debt-to-GDP and deficit-to-GDP ratios over the medium term. Next, we estimate the probability that the Government's fiscal anchor and ongoing fiscal objective will be achieved under the fiscal plan presented in the 2024 FES (that is, the baseline path of revenues and spending). In addition, following the IMF's recent analysis of public debt, we illustrate how additional fiscal adjustment affects the probability of reducing the federal debt-to-GDP ratio over the medium term.

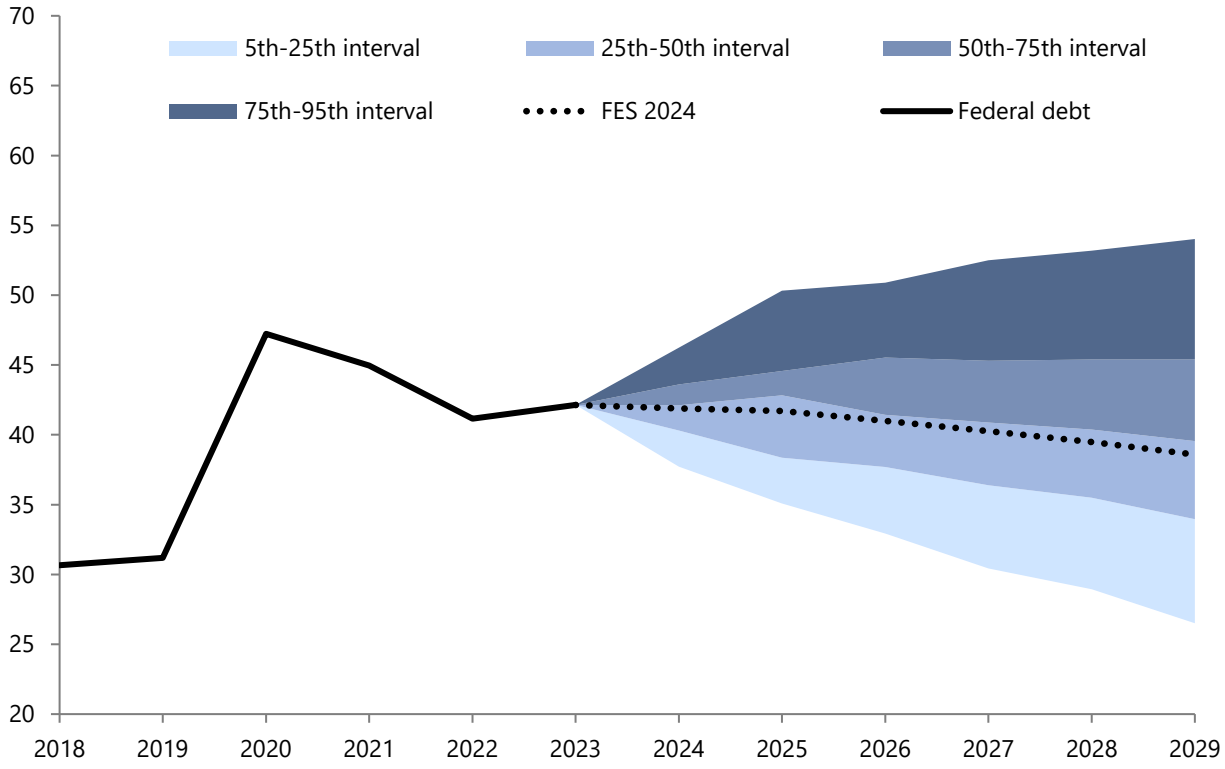
Fiscal anchor: federal debt-to-GDP reduction

Our results suggest that the balance of risks to the 2024 FES projection of the federal debt-to-GDP ratio is tilted to the upside (Figure 5). That is, more than half of the distribution of simulated debt ratio paths lies above the 2024 FES projection in each year of the planning horizon. The width of the 90 per cent interval of the federal debt-to-GDP ratio in 2029-30 is 27.5 percentage points. In other words, 90 per cent of all outcomes for the federal debt ratio in 2029-30 fall within the range of 26.5 per cent of GDP to 54.0 per cent of GDP.

The 2024 FES highlighted the Government's commitment to its fiscal anchor: "to reduce the federal debt-to-GDP ratio over the medium-term". Consistent with past PBO analysis[13] we compare the federal-debt-to-GDP ratio in last year of the medium-term planning horizon (2029-30) to its most recent historical level[14] (2023-24) to determine if the Government's fiscal anchor is achieved over the medium term.[15]

Based on shocks to debt drivers drawn from our historical sample and the baseline projection from the 2024 FES, we estimate that there is a 61 per cent chance that the Government's fiscal anchor will be achieved over the medium term. That is, there is a 61 per cent chance that the federal debt-to-GDP ratio in 2029-30 will be below its 2023-24 value of 42.1 per cent.[16] Most future debt paths result in a lower federal debt-to-GDP ratio after six years, reflecting favorable interest rate and growth rate dynamics (that is, an effective interest below nominal GDP growth) and operating surpluses (that is, revenues exceeding program spending).

Figure 5
Federal debt, per cent of GDP



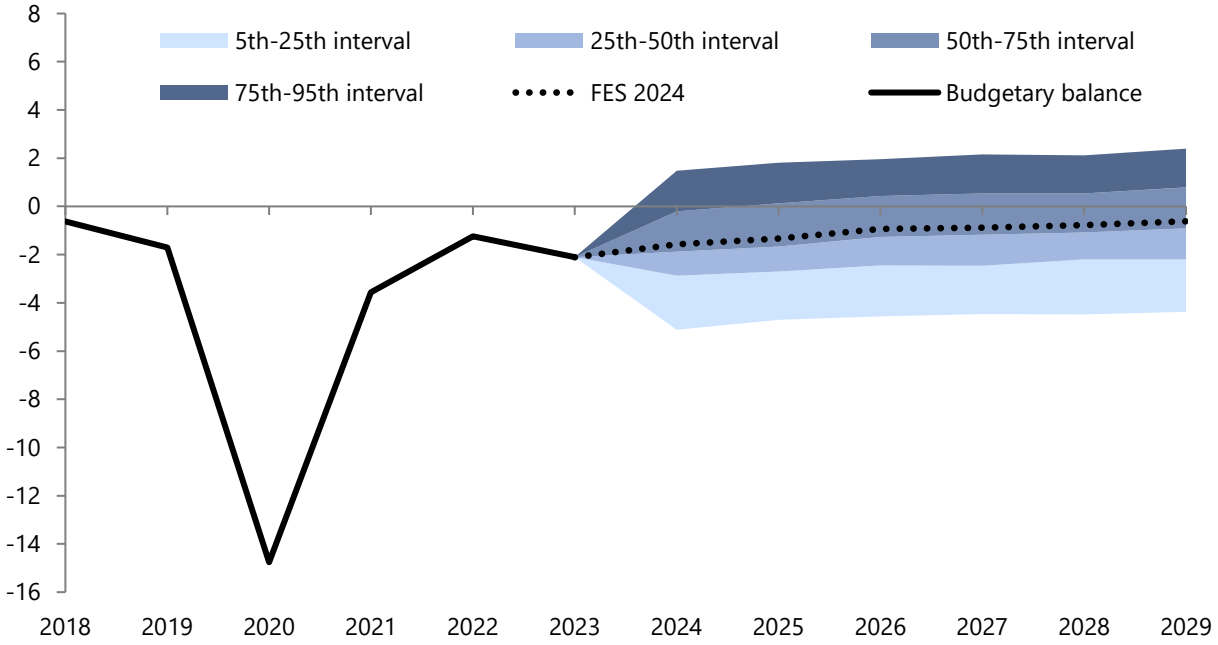
Source
Finance Canada and Office of the Parliamentary Budget Officer.

Note
The series are presented on a fiscal-year basis where 2018 refers to 2018-19. The projection period covers 2024-25 to 2029-30.

Fiscal objective: 1 per cent deficit-to-GDP ratio

Based on shocks to debt drivers drawn from our historical sample, our results suggest that the balance of risks to the 2024 FES projection of the budgetary balance-to-GDP ratio is tilted to the downside (Figure 6). That is, more than half of the distribution of simulated paths of the budgetary balance lies below the 2024 FES projection in each year of the planning horizon. The width of the 90 per cent interval of the budgetary balance-to-GDP ratio in 2029-30 is 6.8 percentage points. In other words, 90 per cent of all outcomes for the budgetary balance ratio in 2029-30 range from a deficit of 4.4 per cent of GDP to a surplus of 2.4 per cent of GDP.

Figure 6
Budgetary balance, per cent of GDP



Source
Finance Canada and Office of the Parliamentary Budget Officer.

Note
The series are presented on a fiscal-year basis where 2018 refers to 2018-19. The projection period covers 2024-25 to 2029-30.

The 2024 FES also highlighted the Government's "ongoing fiscal objective set out in Budget 2024 to keep the deficit under 1 per cent of GDP in 2026-27 and future years". Based on shocks to debt drivers drawn from our historical sample and the baseline projection from the 2024 FES, we estimate that there is an 18 per cent chance that the Government's fiscal objective will be achieved. That is, there is an 18 per cent chance that deficits in each and every year over 2026-27 to 2029-30 will not exceed 1 per cent of GDP.[17]

Additional fiscal adjustment

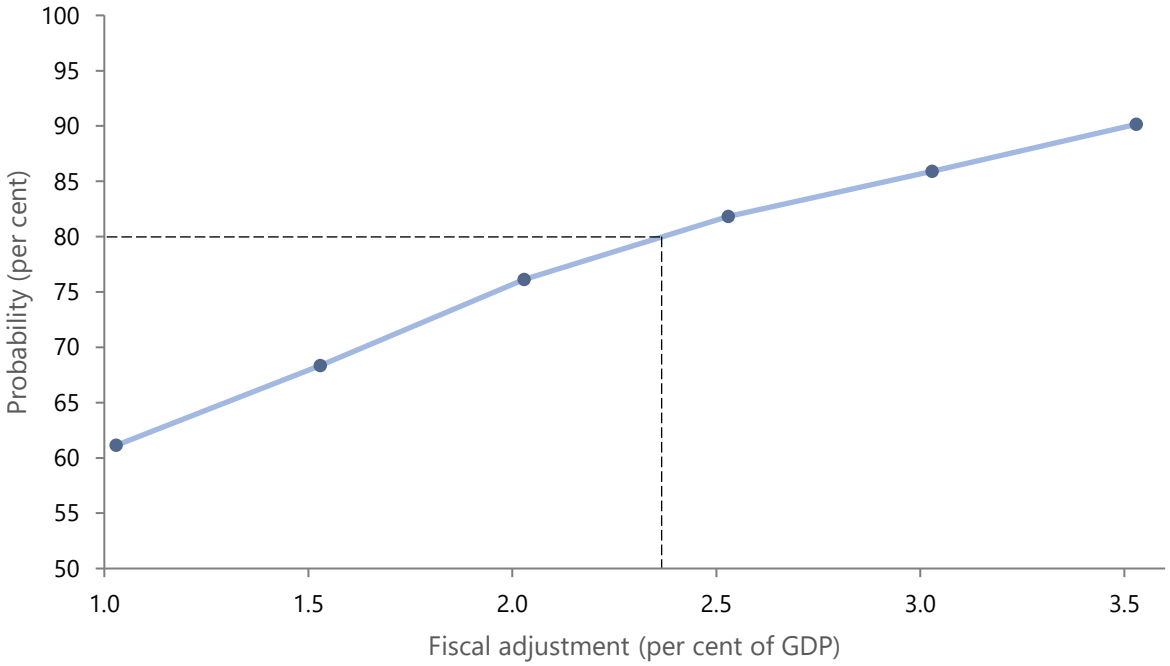
In its recent analysis of public debt, the IMF examines how additional fiscal adjustment over the medium term could raise the probability of stabilizing or reducing a country's debt-to-GDP ratio by 2029. Following the IMF's analysis, we illustrate how additional fiscal adjustment affects the probability of reducing the federal debt-to-GDP ratio over the medium term.

In our analysis, fiscal adjustment is measured as the improvement in operating balance-to-GDP ratio over the projection horizon. The operating balance is used to emphasize the policy component of debt-to-GDP dynamics. Based on the 2024 FES outlook, the operating balance is projected to increase from a deficit of 0.5 per cent of GDP in 2023-24 to a surplus of 1.2 per cent of GDP in 2029-30, an improvement of 1.7 percentage points. The magnitude of this fiscal adjustment is somewhat overstated given that there were large one-time or exceptional spending items in 2023-24. Controlling for these items[18] implies a baseline fiscal adjustment of 1 percentage point of GDP.

We consider additional fiscal adjustment—that is, in addition to the baseline adjustment of 1 percentage point—of 0.5-percentage point of GDP increments (to a maximum of 2.5 percentage points), which is assumed to be phased in gradually over the medium term.[19] In each instance, we calculate the likelihood that the Government's fiscal anchor will be achieved (that is, the probability that the federal debt-to-GDP ratio in 2029-30 will be below its initial 2023-24 value). Figure 7 illustrates the amount of fiscal adjustment and corresponding probability of achieving the Government's fiscal anchor.

Figure 7

Fiscal adjustment and probability of achieving the Government's fiscal anchor



Source

Office of the Parliamentary Budget Officer.

Recall that based on shocks to debt drivers drawn from our historical sample and the baseline projection from the 2024 FES—incorporating a fiscal adjustment of 1 percentage point—we estimated that there is a 61 per cent chance that the Government's fiscal anchor will be achieved over the medium term. Again, following the IMF, to increase this probability to 80 per cent (a "meaningful but not extreme increase in the likelihood of debt stabilization"), would require additional fiscal adjustment of 1.3 percentage points phased in over the medium term.

This additional fiscal adjustment would increase the operating balance-to-GDP ratio in 2029-30 to a surplus of 2.6 per cent of GDP, which is 0.6 percentage points of GDP higher than its pre-pandemic historical average of 2.0 per cent. In nominal terms, this additional fiscal adjustment would represent $50 billion in higher revenues or lower program spending by 2029-30 relative to the fiscal plan in the 2024 FES.

Notes

[1] For example, in the downside scenario, the level of nominal GDP in 2029-30 is only 0.8 per cent lower than the planning assumption for the same year.

[2] PBO's May 2022 report, A stochastic debt sustainability analysis of Budget 2022, applied the IMF's (then new) stochastic simulation approach to assess the prospects of maintaining a declining gross debt-to-GDP ratio and of meeting the Government's medium-term deficit target of 1 per cent of GDP.

Consistent with the IMF's October 2024 debt sustainability analysis, the stochastic simulation approach used in this report has been modified to apply debt-driver shocks to the Government's 2024 FES baseline projection (instead of drawing historical debt drivers as in our May 2022 report). In addition, the debt accounting framework has been extended to include federal debt that is, total liabilities less financial and non-financial assets, which is broader than the measure of interest-bearing debt used in our May 2022 report.

[3] Online Annex 1.5. of the IMF's October 2024 Fiscal Monitor provides a detailed description of the stochastic simulation approach.

[4] For example, during the global financial crisis, the Government purchased mortgage-backed securities (as a temporary liquidity measure) that were financed by issuing Government of Canada securities. More recently, the Government committed to purchase up to an annual maximum of $30 billion of Canada Mortgage Bonds by issuing Government of Canada securities, "to help spur housing construction".

[5] Consistent with Table 7 in the 2024 Fiscal Reference Tables, program spending includes net actuarial losses.

[6] For most of the historical sample, net remeasurement gains, other comprehensive income, and adjustments to the accumulated deficit (which combined are represented by the series (ADJ)) are zero. Since 2006, this series has averaged -0.03 percentage points of GDP and in the 2024 FES is projected to be zero over 2025-26 to 2029-30. In our simulations, we treat the ADJ series as non-stochastic, maintained at its baseline profile in the 2024 FES.

[7] In our stochastic simulations we impose a lower bound on the effective interest rate that is equivalent to its observed level of 1.7 per cent in 2021-22, its historical low, reflecting the period of near-zero market borrowing rates during the pandemic. Over the period 2009-10 to 2019-20, the large negative shocks implied by the difference between the actual effective interest rate and its historical average are constrained such that the augmented effective rates (that is, the baseline value plus the shocks) over the projection horizon do not fall below our assumed lower bound of 1.7 per cent.

[8] See Note 4.

[9] For additional information, see Public Accounts of Canada, 2009 Volume I.

[10] See Legislative Proposals to Support the Canada Mortgage Bond Program in Budget 2024.

[11] See Note 6.

[12] See Note 3.

[13] For example, see PBO's April 2024 report, Budget 2024: Issues for Parliamentarians.

[14] In its recent analysis on public debt, for advanced economies and emerging and developing countries, the IMF estimates the probability of stabilizing or reducing (gross) debt-to-GDP by calculating the number of debt paths for which the baseline primary balance is higher than or equal to a "debt-stabilizing" primary balance as a percentage of the total number of simulated debt paths. While this approach introduces additional complexity, it puts the focus on stabilizing or reducing debt relative to potential outcomes at the end of the medium-term horizon in 2029, as opposed to reducing debt-to-GDP relative to current levels, which is the focus of our analysis.

[15] The 2024 FES notes that a declining federal debt-to-GDP ratio is an important fiscal sustainability metric and that the fiscal outlook presented in the FES, which shows a declining debt ratio "in each and every year of the forecast horizon," respects the Government's fiscal anchor.

That said, in terms of assessing debt-to-GDP reduction in a medium-term stochastic simulation framework, given that federal debt represents a "stock" (that is, the accumulation of annual budgetary deficits), we think it is more meaningful to focus on the federal debt-to-GDP outcomes at the end of the medium-term projection horizon (relative to the current debt ratio) as opposed to focusing on consecutive annual

declines. This view is reflected in the FES scenario analysis, where under the downside scenario the debt ratio initially rises before gradually declining, with the Government noting that "the federal debt-to-GDP ratio would still be lower in 2029-30 than it is today".

[16] We also estimate the probability that the federal debt-to-GDP ratio declines in each and every year of the projection horizon, which is a more restrictive version of the Government's fiscal anchor (see Note 15). We estimate that there is approximately a 10 per cent chance that the federal debt ratio declines in each and every year over 2024-25 to 2029-30. The relatively low probability of consecutive declines reflects the modest decline in the FES baseline projection of the federal debt-to-GDP ratio combined with less-than-perfect correlation (across time) in shocks to each of the debt drivers.

In addition, based on the IMF's debt-stabilizing/reduction metric, we estimate that there is a 65 per cent chance that the possible outcomes of the budgetary balance in 2029-30 will be higher or equal to the debt-stabilizing budgetary balance.

[17] In principle, using a two-year block bootstrap technique could affect the estimated probability of achieving the Government's fiscal objective, which spans a four-year period, by reducing the correlation (across time) of shocks to each of the debt drivers. That said, using a three-year bootstrap technique results in only a marginally lower estimated probability of achieving the Government's fiscal objective.

[18] To control for these items, we removed $21.0 billion (or 0.7 per cent of GDP) in program spending on "significant one-time or exceptional items" shown in Table A1.5 of the 2024 FES, resulting in an adjusted operating balance-to-GDP ratio of 0.2 per cent in 2023-24.

[19] Our assumption that additional fiscal adjustment is gradually phased in implies that one-sixth of the additional adjustment (ranging from 0.5 to 2.5 percentage points of GDP) is applied to the baseline operating balance-to-GDP ratio in the first year of the planning horizon (2024-25), two-sixths of the adjustment is applied in the second year (2025-26), and so on, with the full additional fiscal adjustment in place in the sixth year of the planning horizon (2029-30).

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