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# A Seven-Region GIMF Model of Canada

## *Theory, Fiscal Transmission and Debt Adjustment*

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## Abstract

This paper documents a seven-region Global Integrated Monetary and Fiscal Model centred on Canada. It links the economic theory to the executable equations, calibration, fiscal closures and replication code. Finite planning horizons and liquidity constraints make government debt economically relevant beyond the timing of taxes; public capital, distortionary taxation, international trade and corporate balance sheets connect short-run stabilization to medium-run supply. Seven two-year fiscal experiments are evaluated under endogenous monetary policy, alongside matching US shocks and three monetary accommodation sequences. The first-year GDP response ranges from 0.11 to 0.96 percent for an ex-ante easing of one percent of baseline GDP. A six-panel fiscal history and outlook from the October 2026 IMF World Economic Outlook provides the empirical motivation. We also solve a lower-debt stationary endpoint and distinguish that calculation from a fully nonlinear transition. The release supplies all 4,704 expanded equations, variable and state files, calibrated model sources and reproducible numerical outputs. Several regional inputs remain disclosed proxies; the model is a working policy-analysis platform rather than an estimated forecasting system.

**Keywords:** GIMF; Canada; fiscal multipliers; government debt; non-Ricardian households; model documentation.

**JEL classification:** E17, E62, F41, H63.

**Acknowledgment.** The Better Policy Project thanks Robert (Bob) Ford for his contribution to the research and mentoring tradition behind this work. The model remains a working calibration with disclosed proxies.

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## 1. A model for fiscal choices that persist

A temporary fiscal multiplier answers a narrow but useful question: how much does output change when the government changes a particular instrument for a short period? A debt strategy asks a larger question. How does an economy move from one balance-sheet position to another, who pays during the adjustment, and what happens to productive capacity and interest costs after the initial stimulus or consolidation has passed?

Canada's fiscal position cannot be understood from gross debt alone. The general government has substantial financial assets, and the definition of net debt matters for cross-country comparisons. At the same time, the close trade relationship with the United States means a domestic fiscal strategy must be evaluated together with foreign demand and interest-rate developments. The Canadian model therefore identifies Canada and the United States separately, and reconciles their trade with five additional world regions.

The Canadian configuration places the United Kingdom in the residual-world region. The companion UK model identifies the United Kingdom separately and places Canada in its residual world. This distinction prevents the two models from being mistaken for an eight-region system or from double-counting a country when regional results are aggregated.

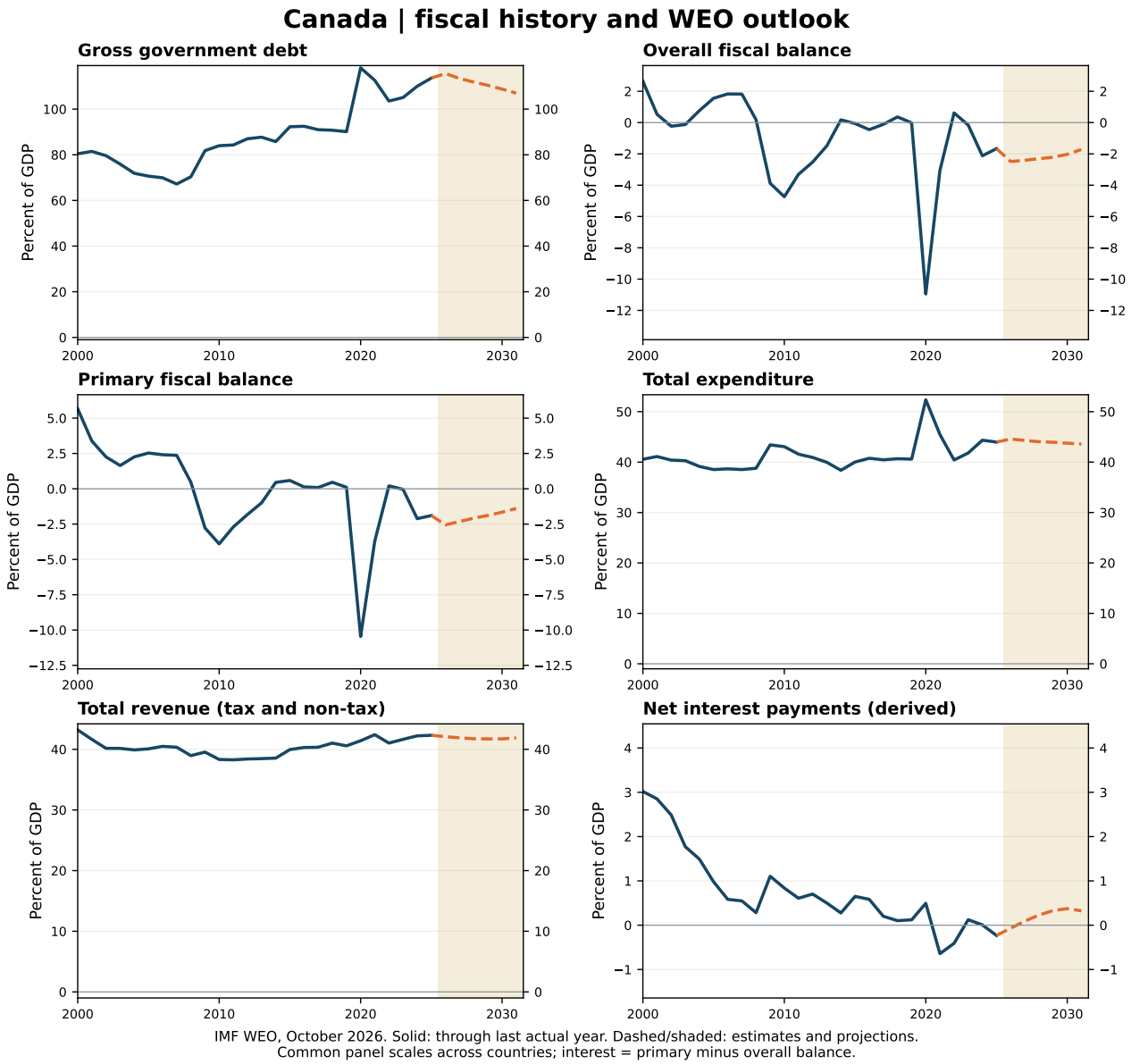
The model's non-Ricardian structure is fundamental to this distinction. Households with finite planning horizons do not fully offset today's government liabilities against taxes imposed on all future generations. Liquidity-constrained households cannot borrow freely against future income. Distortionary taxes alter work, consumption and investment incentives. Public capital changes productive capacity. These mechanisms permit persistent changes in public debt and fiscal composition to alter equilibrium allocations. They do not imply that every borrowing program is desirable, or that a large consolidation can be evaluated by multiplying a temporary multiplier by the proposed debt reduction.

This paper documents the working model as it is implemented. Kumhof, Laxton, Muir and Mursula (2010) supply the foundational theoretical structure; Anderson et al. (2013) describe the simulation properties of an earlier regional configuration. The present seven-region calibration and monetary rule are identified separately. The companion BPP papers, *Fiscal Multipliers Galore* (2026-09) and *When Cheap Credit Becomes Expensive* (2026-10), provide the cross-model fiscal comparison and the nonlinear financial-stress application, respectively. Their numerical results are not substituted for the country-specific results reported here.

## 2. Fiscal history and the question for policy

The six panels show general-government gross debt, the overall fiscal balance, the primary balance, total expenditure, total revenue and net interest payments. Every panel is expressed as a share of GDP. Common scales are used in the UK and Canada papers. The saved October 2026 WEO vintage is held fixed for reproducibility. Each series uses its own latest-actual metadata to identify estimates and projections.

Figure 1: Fiscal history and the WEO outlook




*Notes:* IMF WEO, October 2026. General government; percent of GDP. Net interest equals the primary balance minus the overall balance. Total revenue includes non-tax receipts and is not a tax-only series. Projection shading starts after the latest actual year. Common scales across the two country papers.

The WEO places Canada's gross debt at about 116 percent of GDP in 2026 and 107 percent in 2031. Its overall balance is about -2 percent of GDP in 2026 and -2 percent in 2031. These are conditional estimates and projections, rather than realized outcomes. The model's calibrated debt ratio is 110 percent; it is an archived structural calibration, not a mechanical initialization from the WEO's 2026 observation.

For Canada, the WEO net-debt ratio in 2026 is about nine percent, far below gross debt. The source methodology includes a broad set of financial assets, including equity and investment fund shares. The derived net-interest series is slightly negative in some years: interest revenue exceeds interest expense under this measure. It would be incorrect to relabel this line as gross debt-service payments. The one-bond government block does not separately reproduce all of these public financial assets, so its debt concept must be bridged to the data before a national debt target is imposed.

Total expenditure in the WEO includes interest expenditure, while the model distinguishes primary

spending from interest costs. Transfers belong in the government's budget but are not a direct purchase of final goods in GDP. This distinction is essential when comparing a transfer multiplier with a government-purchases multiplier.

# 3. Regions, households and wealth

## 3.1 Regional structure and units

Each model has seven non-overlapping regions: the focal country, the United States, the euro area, Japan, China, an emerging-market group and the residual world excluding the focal country. The model is annual. Variables in the executable source are generally normalized by trend productivity, population and the model price numeraire. Stocks, flow ratios and gross interest rates therefore cannot be mixed without applying the source normalization.

The equations below use compact teaching notation. Where a composite is introduced, its meaning is given explicitly; the complete expanded equations and auxiliary identities remain in the supplied catalog. The monetary policy equation shown below is the active rule in the fiscal experiments. The appendix maps the main relationships to actual source equation identifiers.

## 3.2 Finite-horizon optimizing households

Optimizing households consume out of total wealth rather than current disposable income alone:

$$C^{O}_{r,t} = m_{r,t} W_{r,t}, \tag{1}$$

$$W_{r,t} = F_{r,t} + H_{r,t} + V_{r,t}, \tag{2}$$

$$m_{r,t} = 1/M_{r,t}. \tag{3}$$

Here $F$ is financial wealth, $H$ is human wealth and $V$ is the capitalized value of other household income. The exact source consumption rule is `C_OLG = MPC * TW`. The inverse propensity to consume obeys

$$M_{r,t} = \frac{P^{O}_{r,t} + \tau^{C}_{r,t} P^{C}_{r,t}}{\eta^{O}_{r}} + \theta_r \, \mathcal{D}_{r,t+1} \, J_{r,t} M_{r,t+1}. \tag{4}$$

$\mathcal{D}$ denotes the source real stochastic discount factor, and $J$ collects the source intertemporal preference, habit and relative-price terms. This is the source recursion for `MPCINV`, not a fixed propensity assumed independently of prices and interest rates.

Human wealth has the recursion

$$H_{r,t} = y^{H}_{r,t} + \frac{\theta_r \chi_r G^{A}_{t+1}}{R_{r,t}} H_{r,t+1}. \tag{5}$$

The current flow $y^H$ is `POPSIZE*(1-PSI)*MRS*(1-TAU_L)*SL` in the code. $G^A$ is trend productivity growth, $R$ is the gross real private interest rate, $\theta$ is the planning-horizon parameter and $\chi$ governs the lifetime-income profile. Future labor income is discounted more heavily than in an infinite-horizon representative-agent benchmark. Government bonds enter financial wealth, while the tax consequences faced by later generations are not fully internalized by current households. This is one reason public debt is not neutral in the model.

Financial wealth includes inherited domestic government bonds, entrepreneurial lending and the foreign-

asset position, with the exchange-rate and growth adjustments specified in the source. The model closes the private and public accounts jointly; a bond is an asset to its holder and a liability of its issuer. A non-Ricardian consumption response does not remove that accounting requirement.

### 3.3 Liquidity-constrained households and transfers

Liquidity-constrained households consume from current after-tax resources. In compact notation their budget is

$$\left(P^L_{r,t} + \tau^C_{r,t} P^C_{r,t}\right) C^L_{r,t} = Y^{L,\text{disp}}_{r,t}, \qquad C_{r,t} = C^O_{r,t} + C^L_{r,t}. \tag{6}$$

$Y^{L,\text{disp}}$ includes the source labor-income allocation, transfers, taxes and relevant income distributions; it is not aggregate GDP. The household population share $\psi$ is one quarter in all regions in this calibration. This common assumption helps explain similarities across country multipliers and should be subjected to sensitivity analysis when stronger country evidence is available.

General transfers are distributed under the inherited allocation rule. The targeted-transfer experiment changes the allocation so the marginal transfer reaches liquidity-constrained households. The source row replacement and exogenized transfer ratio are part of the experiment. Reporting only the common one-percent budget cost would conceal this economically important difference.

## 4. Production, investment and financial amplification

### 4.1 Production and productive public capital

Tradable and nontradable producers combine capital and effective labor through CES technology. A compact representation of the source value-added nest is

$$Z^s_{r,t} = A^s_r \left[ (1-\alpha^s_r)^{1/\sigma_s} (K^s_{r,t})^{(\sigma_s-1)/\sigma_s} + (\alpha^s_r)^{1/\sigma_s} (a^s_{r,t} U^s_{r,t})^{(\sigma_s-1)/\sigma_s} \right]^{\sigma_s/(\sigma_s-1)}, \quad s \in \{T, N\}. \tag{7}$$

Sectoral utilization, wage setting and relative prices determine factor demands. The disabled oil nest is not silently added to this production function. Final domestic output also benefits from public capital:

$$Z^D_{r,t} = Y^A_{r,t} (K^{G1}_{r,t})^{\alpha^{G1}_r} (K^{G2}_{r,t})^{\alpha^{G2}_r} S_r. \tag{8}$$

$K^{G1}$ is productive public capital; $K^{G2}$ is the source stock of public consumption durables. The model does not equate every unit of expenditure with an immediate addition to either stock. Their accumulation equations are

$$G^A_t G^N_t K^{G1}_{r,t} = (1-\delta^{G1}_r) K^{G1}_{r,t-1} + I^G_{r,t-1}, \tag{9}$$

$$G^A_t G^N_t K^{G2}_{r,t} = (1-\delta^{G2}_r) K^{G2}_{r,t-1} + C^G_{r,t-1}. \tag{10}$$

These timing conventions are taken from `KG1` and `KG2`. The growth normalization and one-period investment lag matter when interpreting the first-year response. In both focal-country calibrations, $\alpha^{G1} = 0.1$ and $\alpha^{G2} = 0$: productive public capital raises supply, while the consumption-durables stock has no active production externality. The presence of a stock in the source is not evidence that its output elasticity is positive.

### 4.2 Private capital and investment

For each entrepreneurial sector the installed private capital stock evolves according to

$$G_t^A G_t^N K_{r,t}^s = (1 - \delta_{r,t}^s) K_{r,t-1}^s + I_{r,t-1}^s S_{r,t-1}^{\text{acc}}. \tag{11}$$

Investment adjustment costs and the price of installed capital determine the incentive to invest. A capital tax affects the return after tax and the value of depreciation deductions; it does not have the same intertemporal effect as a lump-sum transfer. Public investment works through current demand and future productive capacity. Consequently, first-year GDP alone is insufficient to assess a permanent shift in either instrument.

### 4.3 Corporate net worth and the credit contract

The financial accelerator is a costly-state-verification contract between lenders and entrepreneurs. For a sector, the funding identity is summarized as

$$Q_t K_{t+1} = N_t + B_t^E. \tag{12}$$

The contract chooses a default cutoff in the distribution of idiosyncratic project returns. In standard contract notation, with $F$ the cumulative distribution and $G(\bar{\omega}) = \int_0^{\bar{\omega}} \omega \, dF(\omega)$, define

$$\Gamma(\bar{\omega}) = G(\bar{\omega}) + \bar{\omega}[1 - F(\bar{\omega})]. \tag{13}$$

The lender's expected receipts are proportional to $\Gamma - \mu G$, where $\mu$ is the fraction of output lost in bankruptcy. This notation summarizes the mechanism; the executable cutoff, contract optimality and net-worth equations are supplied without abbreviation in the equation catalog. A decline in net worth can raise the cost of external finance and reduce investment. Fiscal measures therefore interact with private balance sheets as well as with household demand. The model contains this entrepreneurial accelerator; the presence of the accelerator should not be read as a claim that a separate commercial-bank balance-sheet model is active.

## 5. Trade, nominal rigidities and monetary policy

### 5.1 Trade and international assets

Domestic and imported goods enter final consumption and investment through nested CES aggregates. Bilateral imports also respond to relative delivered prices. In teaching notation for one nest,

$$M_{r,t} = \left[ \sum_{j \neq r} \omega_{rj}^{1/\eta} (m_{rj,t})^{(\eta-1)/\eta} \right]^{\eta/(\eta-1)}, \tag{14}$$

$$m_{rj,t} = \omega_{rj} \left( P_{rj,t} / P_{r,t}^M \right)^{-\eta} M_{r,t}. \tag{15}$$

The full implementation includes separate intermediate and final-good import structures, distribution margins and adjustment costs. These two equations illustrate expenditure switching and are not a replacement for those source nests. Bilateral trade shares must reconcile with each region's imports, exports and size. Several links are reconciled priors rather than observed bilateral data.

International borrowing and lending obey source asset-accumulation equations, exchange-rate valuation and risk-premium relationships. Trade and asset positions interact: a fiscal expansion can raise imports, move the exchange rate and alter net foreign assets. The numerical sum of national GDP responses is not a world GDP response; aggregation requires the model region weights.

### 5.2 Price and wage adjustment

Nominal rigidities are implemented through adjustment costs. For a representative sector, a source-style price adjustment term can be written

$$\mathcal{C}^P_{r,t} = \frac{\phi^P_r}{2} Z_{r,t} \left[ \frac{\pi_{r,t}}{\pi^{1-\iota_r}_{r,t-1}} - (\pi^*_r)^{\iota_r} \right]^2 . \tag{16}$$

The source first-order conditions include forward-looking terms, indexation and sector-specific prices. The adjustment coefficients are 216 for wages, 108 for tradable, nontradable and investment prices, 3.6 for consumption retail prices and 0.72 for imported retail prices. All seven regions use this profile: forty-nine coefficients in total. These values are parameter levels, not percentages or Calvo probabilities. The updates leave the solved zero-adjustment steady state intact but change dynamic derivatives and fiscal transmission.

### 5.3 The active interest-rate rule

Every region floats and follows the same gross-rate rule in the reported experiments:

$$\log\left(\frac{i_{r,t}}{i_{r,t-1}}\right) = \frac{1}{2}\left[\frac{3}{4}\log\left(\frac{\pi_{r,t}}{\pi^*_r}\right) + \frac{1}{4}\log\left(\frac{\pi_{r,t+1}}{\pi^*_r}\right)\right]. \tag{17}$$

The model is annual; the lead is next-year inflation. $i$ denotes the gross policy rate, and the inflation target is the steady source core price-index inflation. Headline CPI is reported in the fiscal results and includes the mechanical effect of the consumption tax. Gross private borrowing rates also include the source spread components. The code replaces seven policy rows in the fiscal Jacobian; the documentation exports the corresponding active equations explicitly.

The euro area is one monetary region. There is no separate oil block in either country model. Oil-related and special union switches that are inactive are recorded as such; an inactive source branch is not an additional estimated channel.

## 6. The government budget and fiscal closure

### 6.1 Taxes, spending and the bond identity

The primary budget separates revenues from purchases and transfers:

$$PS_{r,t} = \mathcal{R}_{r,t} - \mathcal{G}_{r,t}, \tag{18}$$

$$\mathcal{G}_{r,t} = P^G_{r,t}(C^G_{r,t} + I^G_{r,t}) + TR_{r,t} + TR^L_{r,t} + AID_{r,t} + SUB_{r,t}. \tag{19}$$

Revenue includes the source labor, capital, consumption and lump-sum tax components and applicable other receipts. The main tax relationship is

$$TAXREV_{r,t} = \tau^{L}_{r,t}\mathcal{B}^{L}_{r,t} + \tau^{K}_{r,t}\mathcal{B}^{K}_{r,t} + \tau^{C}_{r,t}\mathcal{B}^{C}_{r,t} + LS_{r,t}, \tag{20}$$

with tax bases defined by the source wage bill, taxable capital income and consumption expenditure. Endogenous tax bases imply that an ex-ante tax cut of one percent of GDP need not reduce realized revenue by exactly one percent after output and prices respond.

Let $\mathcal{Q}_t = \pi_{r,t} G^{A}_{t} G^{N}_{t}$ denote the source nominal normalization. The government bond and interest-cost identities are

$$B_{r,t} = B_{r,t-1}/\mathcal{Q}_t - S_{r,t}, \tag{21}$$

$$IC_{r,t} = (i^{B}_{r,t-1} - 1)B_{r,t-1}/\mathcal{Q}_t, \tag{22}$$

$$S_{r,t} = PS_{r,t} - IC_{r,t}, \qquad b_{r,t} = 100B_{r,t}/(\text{FREQU}\, GDP_{r,t}). \tag{23}$$

These are stationary source quantities. $i^{B}$ here denotes the source gross government financing rate used in `INTCOST`; it is not a newly introduced empirical ten-year yield. The annual frequency is one. There is no stock-flow residual in this model identity; observed WEO debt changes may require one.

### 6.2 The inherited feedback rule

The active surplus-rule branch can be summarized as

$$s_{r,t} = s^{*}_{r} + d_y\, 100(y^{gap}_{r,t} - 1) + d_\pi\, \pi^{gap}_{r,t} + d_\tau\, xs^{tax}_{r,t} + d_b(b_{r,t} - b^{*}_{r}). \tag{24}$$

The supplied state determines the feedback coefficients and switching variables. In both focal countries the output-gap coefficient is $d_y = 0.34$, while $d_\pi = d_\tau = d_b = 0$. The active rule therefore has no additional direct debt-gap feedback. Its stationary debt anchor is linked to the surplus target and nominal trend growth through the identity below. In the standard deficit-financed experiments, general transfers act as the residual instrument under the inherited rule. Fiscal closure is therefore part of the experiment, not a free choice left unspecified after a shock has been applied. A stronger debt-feedback rule would be a new policy experiment.

At a stationary equilibrium the source target relationship is

$$b^{*}_{r} = -\frac{s^{*}_{r}}{\text{FREQU}}\frac{\mathcal{Q}^{*}_{r}}{\mathcal{Q}^{*}_{r} - 1}. \tag{25}$$

Holding a deficit target fixed while declaring a different permanent debt target generally violates this relationship. For any permanent debt experiment, the terminal surplus target and residual fiscal instrument must be changed consistently. Government debt also affects the wealth and international equilibrium blocks. It cannot be changed by replacing a number in a chart while retaining all original terminal conditions.

## 7. Seven fiscal experiments and their interpretation

Each experiment is an ex-ante easing of one percent of baseline origin GDP in each of two years: higher government consumption, higher government investment, targeted transfers, general transfers, or a cut in

labor, capital or consumption taxes. The spending impulses are converted using the baseline government-purchases price; the tax impulses use the corresponding baseline tax bases. Monetary policy responds endogenously in every region. Matching US experiments are provided to identify foreign transmission.

The impact multiplier is the first-year GDP change divided by the ex-ante fiscal impulse, both measured against baseline GDP. For a one-percent impulse, its numerical value equals the reported first-year GDP percentage response. The Year-2 column reports GDP during the second fiscal year. The two-year cumulative multiplier is the sum of the first two annual GDP percentage responses divided by two, the cumulative mechanical fiscal impulse in baseline-GDP units.

$$m_1 = \frac{\Delta Y_1/Y_0}{\Delta F_1/Y_0}, \qquad m_H^{cum} = \frac{\sum_{t=1}^{H} \Delta Y_t}{\sum_{t=1}^{H} \Delta F_t}. \tag{26}$$

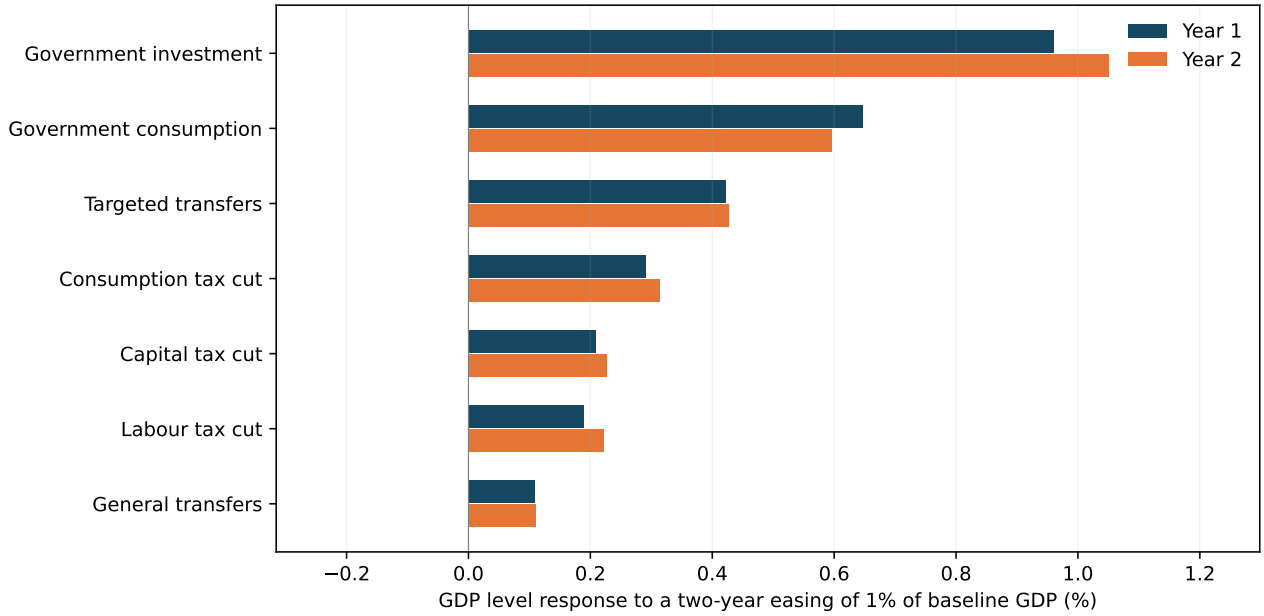
The second expression defines a cumulative multiplier only when the numerator and denominator have compatible prices and units and the fiscal sequence is specified. This paper reports the impact multiplier and later output responses rather than relabeling those responses as a cumulative multiplier.

Table 1: Domestic two-year fiscal easing: GDP and inflation responses

| Instrument | GDP Y1 | GDP Y2 | CPI Y1 | Policy Y1 |
|---|---|---|---|---|
| Government investment | 0.96 | 1.05 | 0.08 | 0.03 |
| Government consumption | 0.65 | 0.60 | 0.03 | 0.02 |
| Targeted transfers | 0.42 | 0.43 | 0.02 | 0.01 |
| Consumption tax cut | 0.29 | 0.31 | -1.45 | 0.01 |
| Capital tax cut | 0.21 | 0.23 | 0.01 | 0.01 |
| Labour tax cut | 0.19 | 0.22 | 0.00 | 0.00 |
| General transfers | 0.11 | 0.11 | 0.00 | 0.00 |

*Notes:* GDP: percent deviation. Headline CPI inflation and policy rate: percentage-point deviation. One-percent-of-GDP ex-ante impulse in each of Years 1 and 2.

Figure 2: The seven fiscal instruments




*Notes:* Both bars describe the same two-year easing. Year 1 is the impact response; Year 2 is the response during the second fiscal year. Both are GDP level deviations, not cumulative multipliers.

Government investment has the largest first-year GDP response in this calibration, about 1 percent for the standardized easing. Its positive later response reflects the persistence of the capital stock as well as general-equilibrium feedback. General transfers have a smaller impact because only part of the transfer immediately finances additional consumption. Targeting raises the response by directing the marginal transfer toward households whose current resources constrain spending.

The ranking is conditional on the fiscal closure, monetary rule, public-capital technology, household shares and trade calibration. A capital tax cut can have a relatively modest immediate response yet a more persistent investment effect. A consumption tax cut affects headline inflation directly through the tax-inclusive consumption price; a decline in headline inflation in that experiment should not be interpreted as a pure decline in demand pressure.

These temporary easing experiments do not rank permanent consolidation packages. Cutting productive investment has a different supply effect from lowering transfers. A permanent tax reform changes incentives and wealth over a different horizon. A crisis may also change sovereign financing costs in ways that are not activated by a standard fiscal impulse.

## 8. Monetary sequencing with two-year fiscal shocks

All seven fiscal impulses last two years and are announced at inception. Each year's mechanical easing equals one percent of baseline origin GDP. Only the fiscal origin's policy rate is held in the accommodation experiments; other regions retain their normal policy rules.

The four comparisons are: the normal monetary rule in every year; an origin-country policy rate held at its baseline level in Year 1, with the normal rule restored in Year 2; sequential one-year holds; and an initially announced two-year hold. For the sequential case, private agents initially expect the rule to resume in Year 2. At the start of Year 2, a further one-year hold is unexpectedly announced. The new solution inherits every realized Year-1 state. Fiscal Year 2 was already anticipated. Thus the sequential and announced cases differ in information available during Year 1, even though both realized policy-rate paths are held at baseline for two years.

The hold is a conditional monetary experiment. It is not a zero lower bound, an endogenous policy recommendation, or a separately estimated central-bank commitment. The figures and tables retain the full model response to the stated information sequence.

Table 2: First-year GDP response

| Instrument | Normal | Hold Y1 | Sequential | Announced Y1–2 |
|---|---|---|---|---|
| Government consumption | 0.65 | 0.72 | 0.72 | 0.83 |
| Government investment | 0.96 | 1.07 | 1.07 | 1.03 |
| Targeted transfers | 0.42 | 0.47 | 0.47 | 0.55 |
| General transfers | 0.11 | 0.12 | 0.12 | 0.14 |
| Labour tax cut | 0.19 | 0.19 | 0.19 | 0.19 |
| Capital tax cut | 0.21 | 0.24 | 0.24 | 0.27 |
| Consumption tax cut | 0.29 | 0.32 | 0.32 | 0.38 |

*Notes:* Percent deviation; the impact multiplier has the same numerical value under the one-percent annual normalization.

Table 3: Two-year cumulative GDP multiplier

| Instrument | Normal | Hold Y1 | Sequential | Announced Y1–2 |
|---|---|---|---|---|
| Government consumption | 0.62 | 0.69 | 0.74 | 0.81 |
| Government investment | 1.01 | 1.11 | 1.10 | 1.08 |
| Targeted transfers | 0.42 | 0.47 | 0.50 | 0.56 |
| General transfers | 0.11 | 0.12 | 0.13 | 0.14 |
| Labour tax cut | 0.21 | 0.21 | 0.21 | 0.20 |
| Capital tax cut | 0.22 | 0.24 | 0.26 | 0.28 |
| Consumption tax cut | 0.30 | 0.33 | 0.35 | 0.39 |

*Notes:* Sum of GDP percentage deviations in Years 1 and 2 divided by the two-percent cumulative ex-ante fiscal impulse. No discounting.

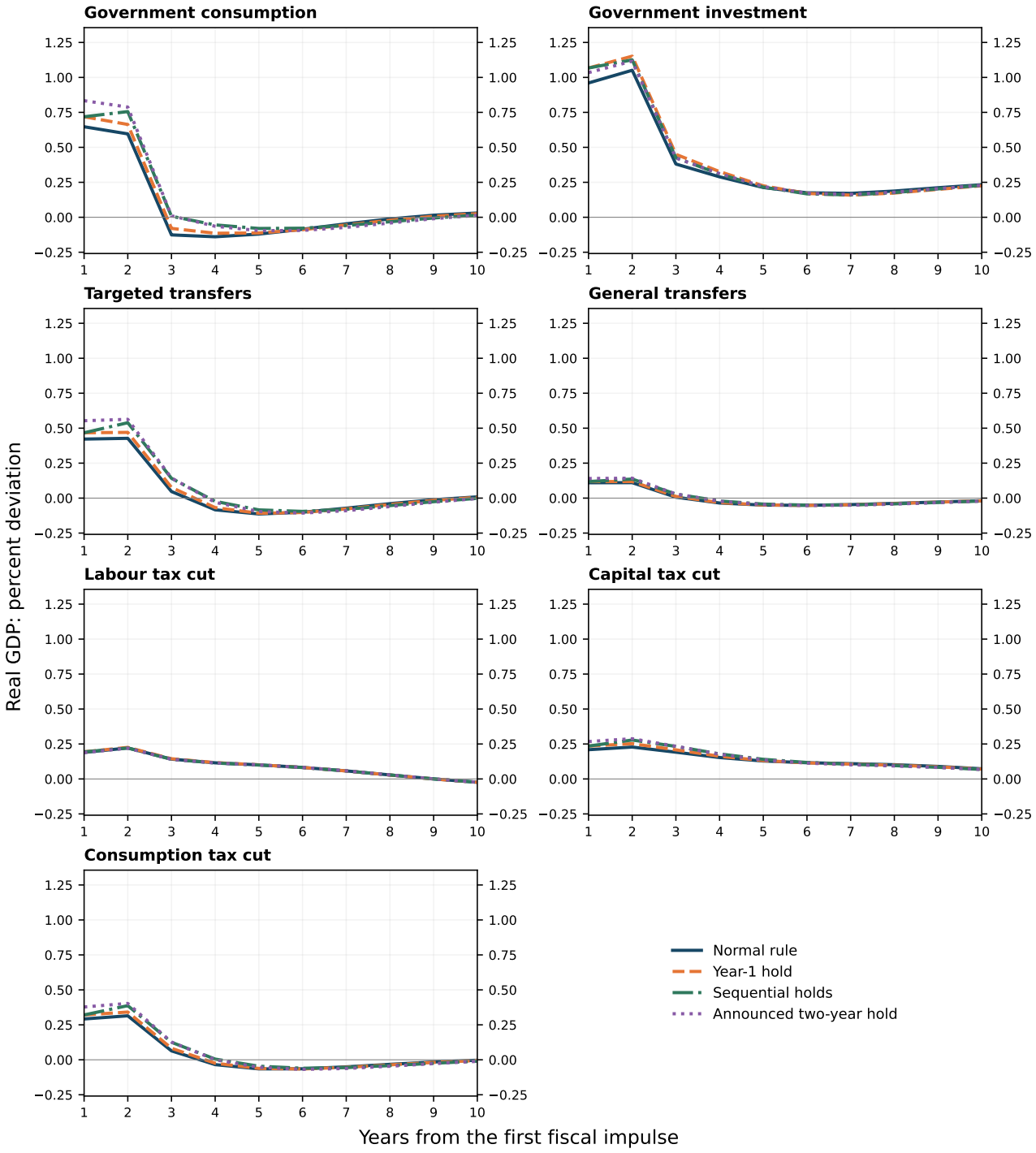
Table 4: First-year headline inflation response

| Instrument | Normal | Hold Y1 | Sequential | Announced Y1–2 |
|---|---|---|---|---|
| Government consumption | 0.03 | 0.05 | 0.05 | 0.07 |
| Government investment | 0.08 | 0.10 | 0.10 | 0.09 |
| Targeted transfers | 0.02 | 0.03 | 0.03 | 0.05 |
| General transfers | 0.00 | 0.00 | 0.00 | 0.01 |
| Labour tax cut | 0.00 | 0.00 | 0.00 | 0.00 |
| Capital tax cut | 0.01 | 0.02 | 0.02 | 0.03 |
| Consumption tax cut | -1.45 | -1.45 | -1.45 | -1.44 |

*Notes:* Percentage points. Consumption-tax changes directly affect tax-inclusive headline inflation.

The difference between the announced and sequential cases measures the effect of communicating Year-2 accommodation at inception, conditional on this model and fiscal path. It should not be interpreted as a welfare comparison. Rate holds change expected real rates, private demand and exchange rates; public investment also builds productive capital. Rankings therefore depend on the instrument, announcement and fiscal closure.

Figure 3: GDP under alternative monetary sequences




*Notes:* Two-year domestic fiscal impulses. Common GDP scale across all seven instruments and both country papers; all plotted values are shown.

# 9. Moving between debt levels

## 9.1 A nonlinear lower-debt endpoint

The release solves an illustrative stationary endpoint with the focal-country debt ratio ten percentage points below its calibrated baseline. General transfers are held at their baseline real level; changes in the labor, capital and consumption tax rates are constrained to equal ex-ante revenue changes evaluated at baseline tax bases. Government purchases and the other structural parameters retain their source settings. This is one explicit closure for demonstrating the mechanism, not a recommended tax package.

The calculation moves the model debt ratio from 110 to 100 percent of GDP. It solves the nonlinear stationary equations and then restores a source surplus target consistent with that lower debt level. The maximum residual across the unchanged source equations is $2.3e-11$. The three tax-instrument equations are replaced by the disclosed closure constraints; all other source equations are checked.

Table 5: Lower-debt stationary endpoint: changes from the original steady state

| Variable | Unit | Change |
|---|---|---|
| Consumption | % | 0.183 |
| Private investment | % | 0.244 |
| Public capital | % | -0.000 |
| Labor tax rate | pp | -0.052 |
| Capital tax rate | pp | -0.173 |
| Consumption tax rate | pp | -0.051 |
| Real private rate | pp | -0.004 |

*Notes:* A nonlinear endpoint comparison, not a transition path or a welfare ranking. Tax changes use baseline tax bases in the equal-revenue constraints.

The endpoint shows why the model is useful for debt analysis. Lower inherited liabilities can release fiscal resources and alter household wealth, capital accumulation and international asset positions. The long-run tax change need not have the same sign as the temporary adjustment needed to reach that endpoint. A government can raise taxes during a consolidation and ultimately operate with lower rates once interest costs and debt have fallen. The magnitude depends on the closure and should not be treated as an unconditional empirical estimate.

## 9.2 The transition requires its own solution

A transparent debt-accounting benchmark is

$$b_t = \frac{1 + i^B_{t-1}}{1 + g^n_t} b_{t-1} - pb_t + \text{sfa}_t, \tag{27}$$

where $pb$ is the primary surplus and sfa is an observed stock-flow adjustment, set to zero in the simple benchmark. For a prescribed target path,

$$b_t = b_0 + (b^* - b_0)\min(t/H, 1), \qquad pb_t = \frac{1 + i^B_{t-1}}{1 + g^n_t} b_{t-1} - b_t. \tag{28}$$

This calculation identifies the required primary balance conditional on rates and growth. It does not determine how taxes and spending affect those rates, growth, consumption or investment. That is the task of the structural transition solution.

For a credible comparison, specify the debt definition, starting equilibrium, target debt, adjustment pace, instrument mix and the treatment of expectations. Solve the new steady state, impose its nonzero terminal conditions and solve the entire intervening path. Then check original-equation residuals, fiscal identities, variable bounds and terminal-horizon sensitivity. The initial and terminal households' wealth positions must be consistent with the government liabilities and international asset position. A sequence of independently chosen primary balances is insufficient.

The present release provides the nonlinear endpoint and the temporary fiscal benchmarks. It does not claim a fully nonlinear debt-consolidation transition. In particular, multiplying a two-year GDP response by the ten-point debt reduction would confuse a fiscal flow with a debt stock. The exact endpoints, full model and experiment definitions make subsequent transition work concrete and reproducible.

# 10. Calibration, verification and use in policy work

## 10.1 What is calibrated and what remains a proxy

The model is a solved working calibration, not an estimated country forecasting model. Focal-country tax, spending, import and asset targets are inherited from the supplied country states. Foreign fiscal proxies include Austria for the euro area, Korea for China and the emerging-market group, and Switzerland for the residual world. Several foreign net-asset anchors and non-focal bilateral trade links are explicit working assumptions. There is no separate oil block. Policy work should prioritize sensitivity to these inputs rather than treat numerical precision as evidence of empirical identification.

Table 6: Selected regional calibration values

| Region | World GDP | Imports | Gov. cons. | Gov. inv. | Debt |
|---|---|---|---|---|---|
| Canada | 2.0 | 32.6 | 21.4 | 4.0 | 110.0 |
| United States | 26.3 | 12.4 | 13.9 | 3.6 | 122.3 |
| Euro area | 14.9 | 18.0 | 21.4 | 3.9 | 79.0 |
| Japan | 3.8 | 22.4 | 20.1 | 3.8 | 213.6 |
| China | 16.9 | 17.5 | 17.5 | 4.6 | 49.6 |
| Emerging market group | 16.9 | 18.0 | 17.5 | 4.6 | 49.6 |
| Rest of world | 19.2 | 22.0 | 11.9 | 3.1 | 40.4 |

*Notes:* Percent of world GDP in column 2; percent of own-region GDP otherwise. Archived calibration values; the WEO chart is not used to silently replace them.

Table 7: Selected focal-country structural parameters and steady tax rates

| Parameter | Value |
|---|---|
| Liquidity-constrained share | 0.250 |
| Planning-horizon parameter | 0.945106 |
| Preference curvature | 2.000 |
| Productivity growth (gross annual) | 1.015 |
| Population growth (gross annual) | 1.010 |
| Inflation target (gross annual) | 1.020 |
| Labor tax rate | 0.350520 |
| Consumption tax rate | 0.149279 |
| Capital tax rate | 0.235188 |

*Notes:* Source parameters and effective model tax rates, not statutory tax rates. The complete state file retains all parameters and calibration switches.

The original steady state satisfies all 4,704 source equations, with a maximum absolute raw residual of $3.0e-11$. All forty-nine nominal adjustment parameters were checked. The fiscal systems are solved at forty- and eighty-year horizons. The largest first-twenty-year GDP difference between those horizons is 0.000538 percentage points, below the specified one-hundredth-point tolerance. The maximum uncondensed stacked linear-system residual is $7.2e-15$. These checks establish numerical consistency for the stated systems; they do not prove that the calibration is empirically correct or that a first-order response remains accurate for a large shock.

### 10.2 A prudent risk management application

The model helps frame alternatives before financing conditions force abrupt decisions. Useful scenarios vary the adjustment pace, protect or reduce productive investment, target transfers differently and test foreign consolidation. A prudent risk management analysis also asks what would happen if financing costs or growth were less favorable than assumed. An explicit sovereign-risk shock is different from an endogenously estimated debt-risk feedback, and should be labeled accordingly.

The fiscal Three Cs—Comprehensive, Consistent and Coordinated—are a practical discipline. Comprehensive means include the spending, tax, asset and liability channels needed for the question. Consistent means the initial conditions, budget identities and terminal equilibrium agree. Coordinated means evaluate the interactions among fiscal, monetary and international policies. The main fiscal benchmarks use endogenous monetary policy; the monetary sequencing section compares these with temporary origin-country rate holds.

The companion papers clarify the division of labor. *Fiscal Multipliers Galore* compares conditional fiscal responses across model variants. The financial-accelerator paper studies two nonlinear stress scenarios in the Canada-centred seven-region system. This documentation supplies the country structure, equation map and fiscal benchmarks needed to make further applications auditable. Results from different regions, calibrations and solution methods should be connected by an explicit mapping rather than merged as if they were the same experiment.

## 11. Reproduction and public model release

The code package contains the original structural model files, calibrated states, Python model engine, local dynamic solver, fiscal experiment script, the nonlinear endpoint solver, WEO input vintage, plotting code and editable publication source. The documentation folder provides every expanded source and active policy equation, a variable dictionary and the effective state. The seven policy-row replacements and the targeted-transfer allocation closure are disclosed separately.

Start with `START_HERE.md`. The commands distinguish checks and rebuilding from a fresh structural solve. Rebuilding tables and graphics uses saved model paths. A fiscal rerun reconstructs derivatives and solves fifty-six focal-country and US experiments across four monetary sequences. The debt command solves the stated nonlinear endpoint and does not claim a transition. The complete regional response CSV contains all seven receiving regions, nine reported variables and twenty years, even where the printed appendix displays fewer series.

The theory section deliberately uses compact equations to explain the mechanisms. It is not an alternative model specification. The source and expanded equation catalog are the complete implementation, including auxiliary variables, tax bases, normalization, adjustment costs and active closure choices. This separation makes the paper readable while giving another researcher enough information to inspect and reproduce the model.

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# A. Equation map and executable specification

The model expands to 4,704 equations in 4,704 endogenous variables. The identifiers below refer to the expanded source list in `documentation/Equation_Catalog.csv`. The catalog includes both the original policy rows and the active rules used in the fiscal experiments. `All_Active_Equations.txt` gives a plain-text version; `Variable_Dictionary.csv` records variable names, indices and steady-state levels. The three replaced tax-instrument rows in the endpoint experiment are recorded in its verification file.

Table 8: Main source variables and expanded-equation identifiers

| Source left-hand-side variable | Equation ID |
|---|---|
| C_OLG_R1 | 8 |
| MPCINV_R1 | 10 |
| MPC_R1 | 11 |
| TW_R1 | 15 |
| FW_R1 | 12 |
| HW_R1 | 13 |
| C_LIQ_R1 | 17 |
| CONS_R1 | 18 |
| KKT_R1 | 22 |
| KG1_R1 | 161 |
| KG2_R1 | 162 |
| ZD_R1 | 111 |
| GOVREV_R1 | 175 |
| GOVSPEND_R1 | 154 |
| TAXREV_R1 | 176 |
| PRIMSUR_R1 | 169 |
| GOVSUR_R1 | 166 |
| INTCOST_R1 | 170 |
| DEBTSTAR_R1 | 167 |
| B_RAT_R1 | 583 |
| TRANSFER_R1 | 189 |
| INTMP_R1 | 193 |

## B. All-region output responses

The following tables report the first-year GDP response in every receiving region to a domestic two-year easing. The companion CSV also reports Year 2. US-origin responses are included in the complete response files and compared with domestic-origin responses in the next appendix.

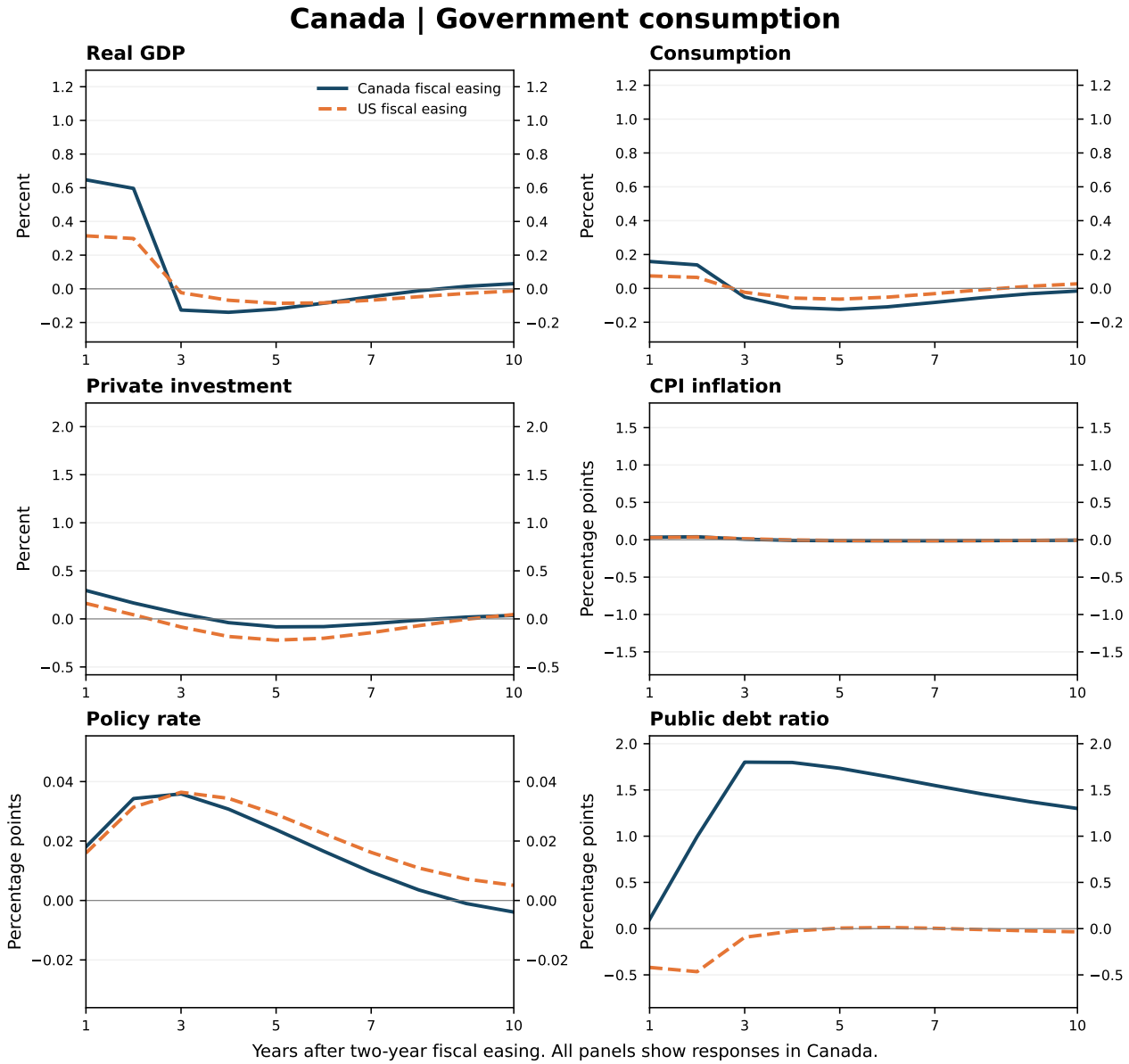
Table 9: First-year GDP response across all seven regions

| Instrument | Focal | US | EA | Japan | China | EM | RoW |
|---|---|---|---|---|---|---|---|
| Government consumption | 0.647 | 0.023 | 0.009 | 0.009 | 0.009 | 0.008 | 0.008 |
| Government investment | 0.960 | 0.026 | 0.008 | 0.008 | 0.008 | 0.007 | 0.007 |
| Targeted transfers | 0.422 | 0.008 | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 |
| General transfers | 0.110 | 0.002 | 0.002 | 0.002 | 0.001 | 0.002 | 0.001 |
| Labour tax cut | 0.190 | 0.003 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 |
| Capital tax cut | 0.209 | 0.009 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 |
| Consumption tax cut | 0.292 | 0.006 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 |

*Notes:* Percent deviations. Origin is the focal country. Responses are not weighted contributions to world GDP.

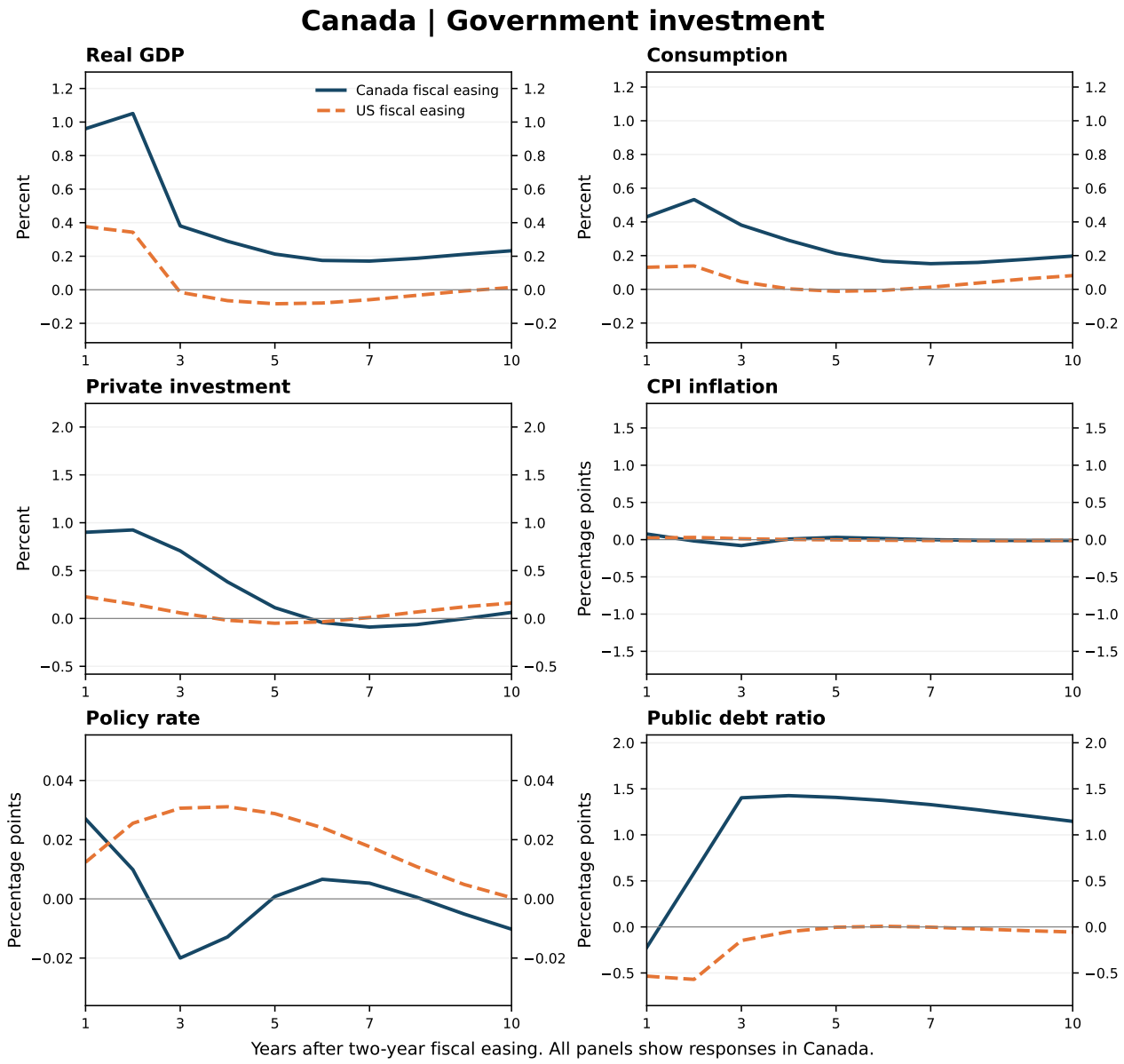
## C. Seven fiscal experiments: dynamic paths

Figure 4: Government consumption: focal-country responses



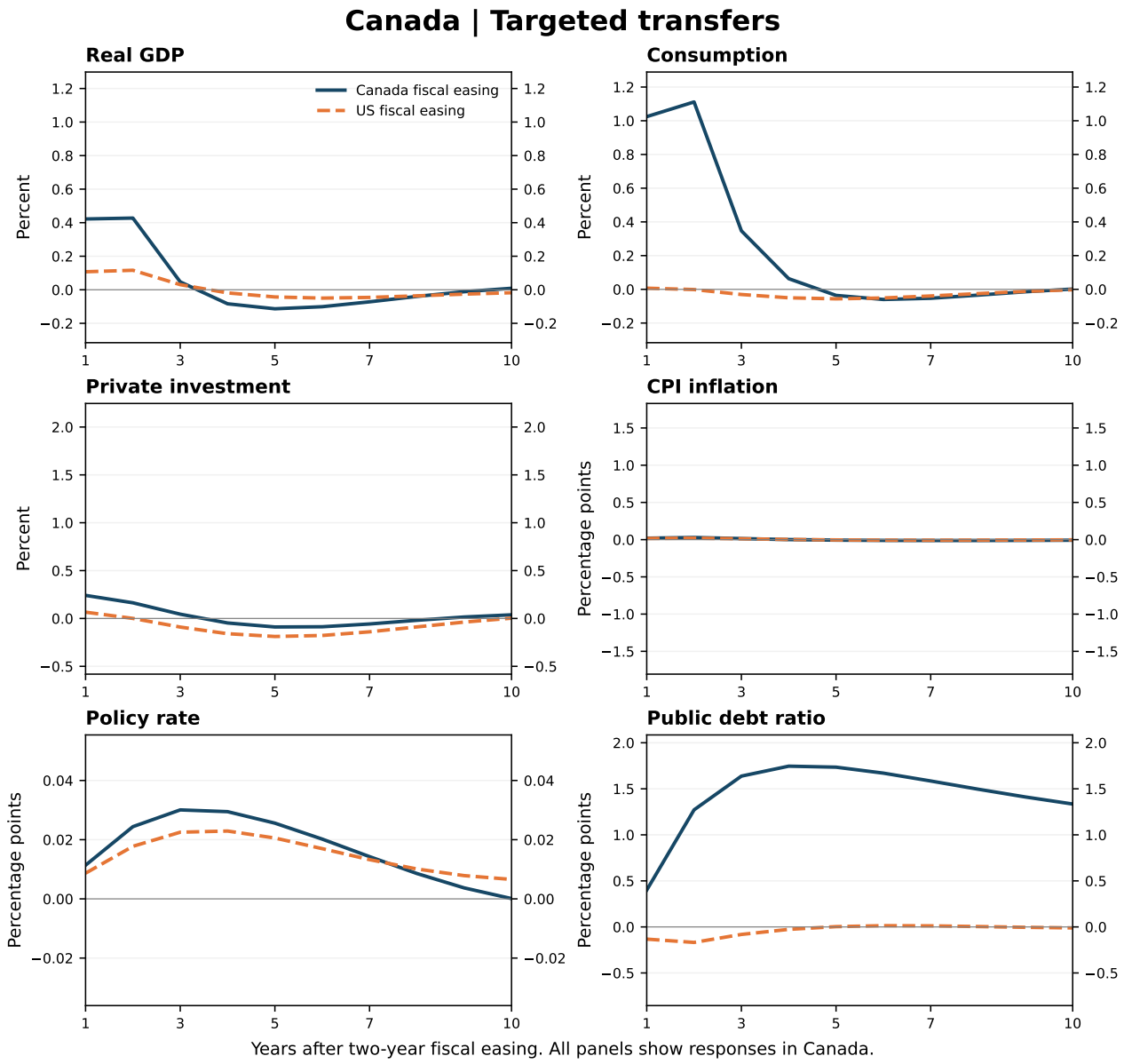

*Notes:* Solid blue: focal-country fiscal origin. Orange dashed: US fiscal origin. In both cases the receiving economy is Canada. Quantity responses are percent deviations; rates and debt ratios are percentage-point deviations. Common scales across both country papers. All panels show the full plotted range; scales are common across both country papers.

Figure 5: Government investment: focal-country responses



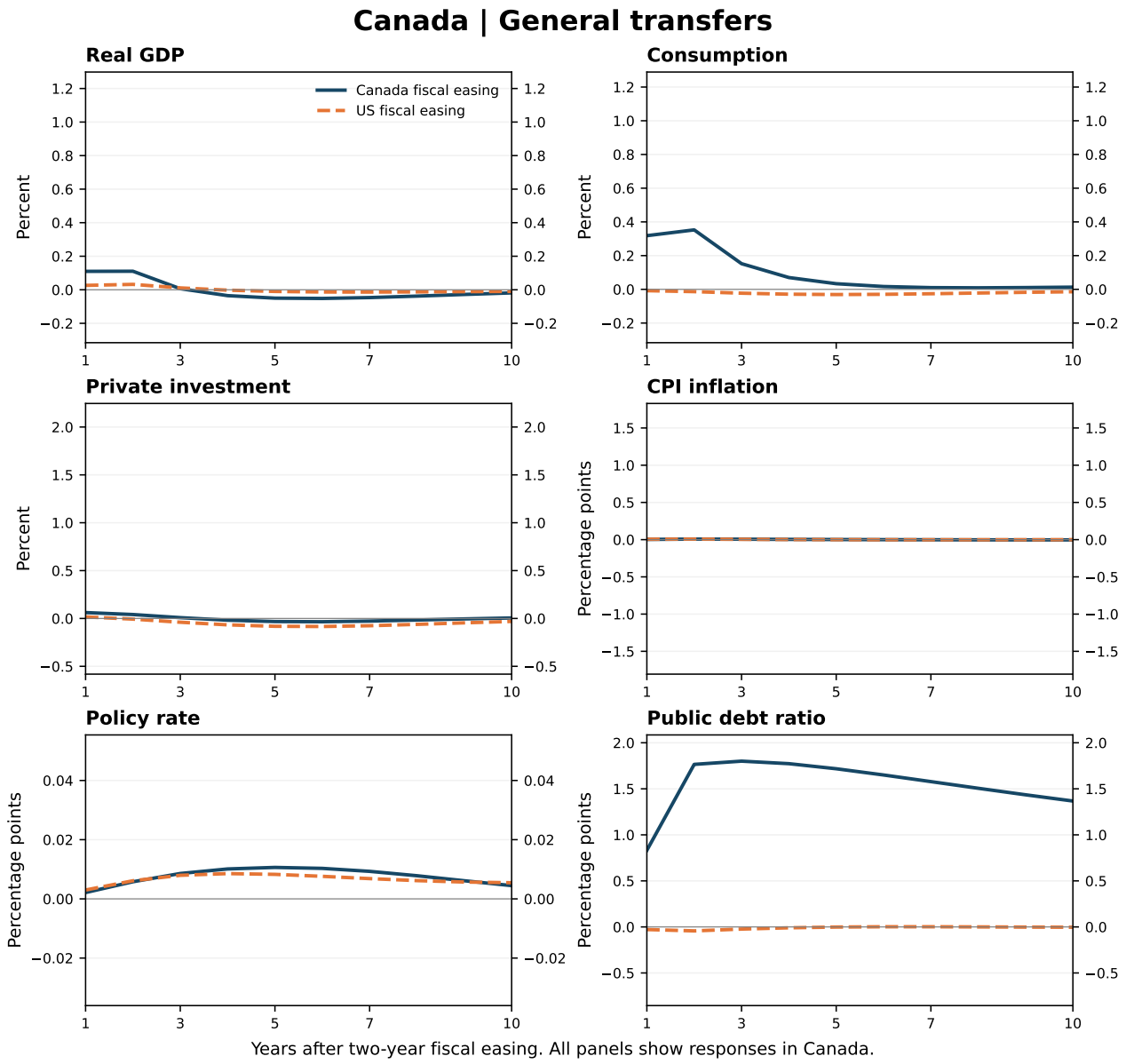

*Notes:* Solid blue: focal-country fiscal origin. Orange dashed: US fiscal origin. In both cases the receiving economy is Canada. Quantity responses are percent deviations; rates and debt ratios are percentage-point deviations. Common scales across both country papers. All panels show the full plotted range; scales are common across both country papers.

Figure 6: Targeted transfers: focal-country responses



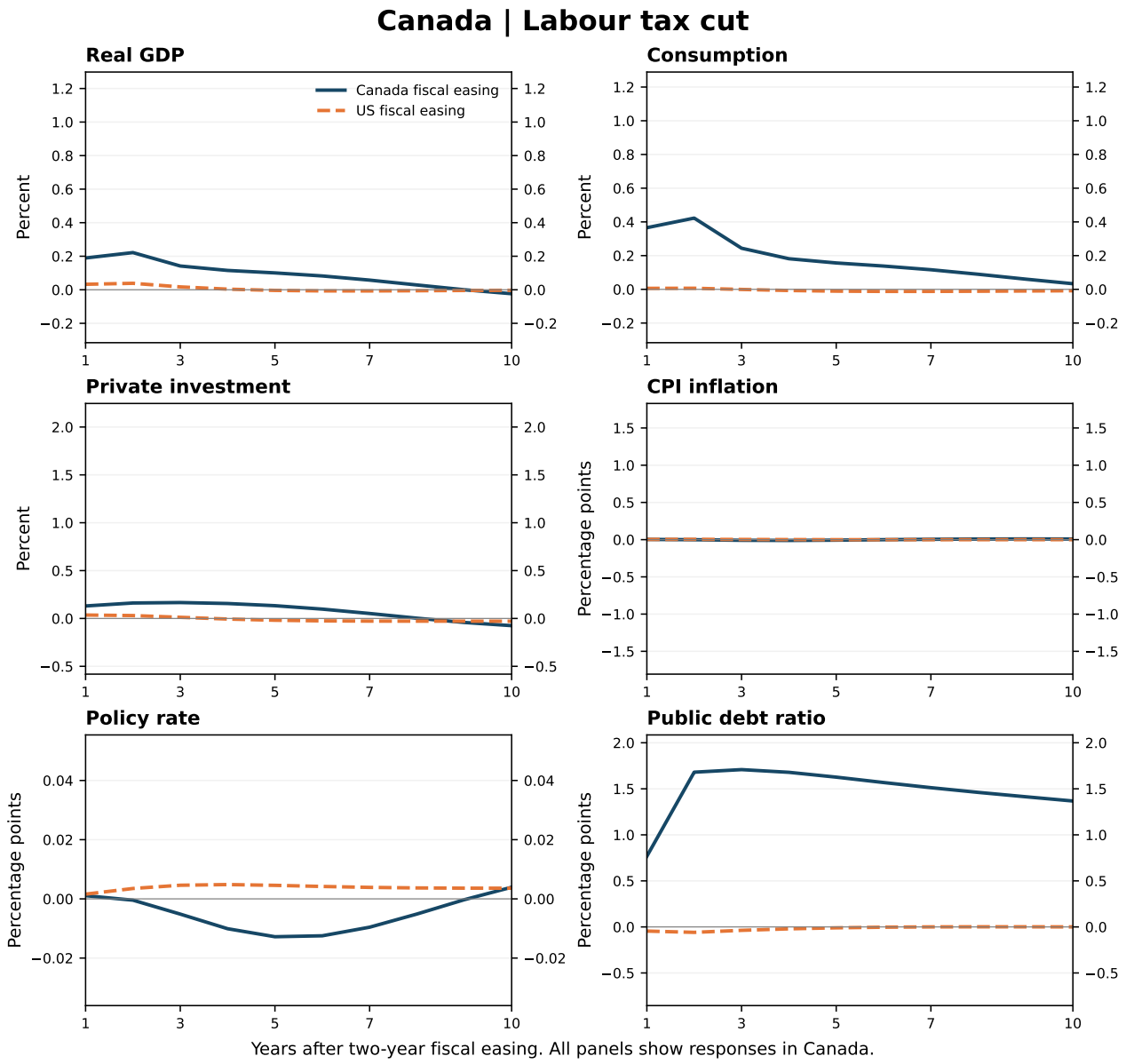

*Notes:* Solid blue: focal-country fiscal origin. Orange dashed: US fiscal origin. In both cases the receiving economy is Canada. Quantity responses are percent deviations; rates and debt ratios are percentage-point deviations. Common scales across both country papers. All panels show the full plotted range; scales are common across both country papers.

Figure 7: General transfers: focal-country responses



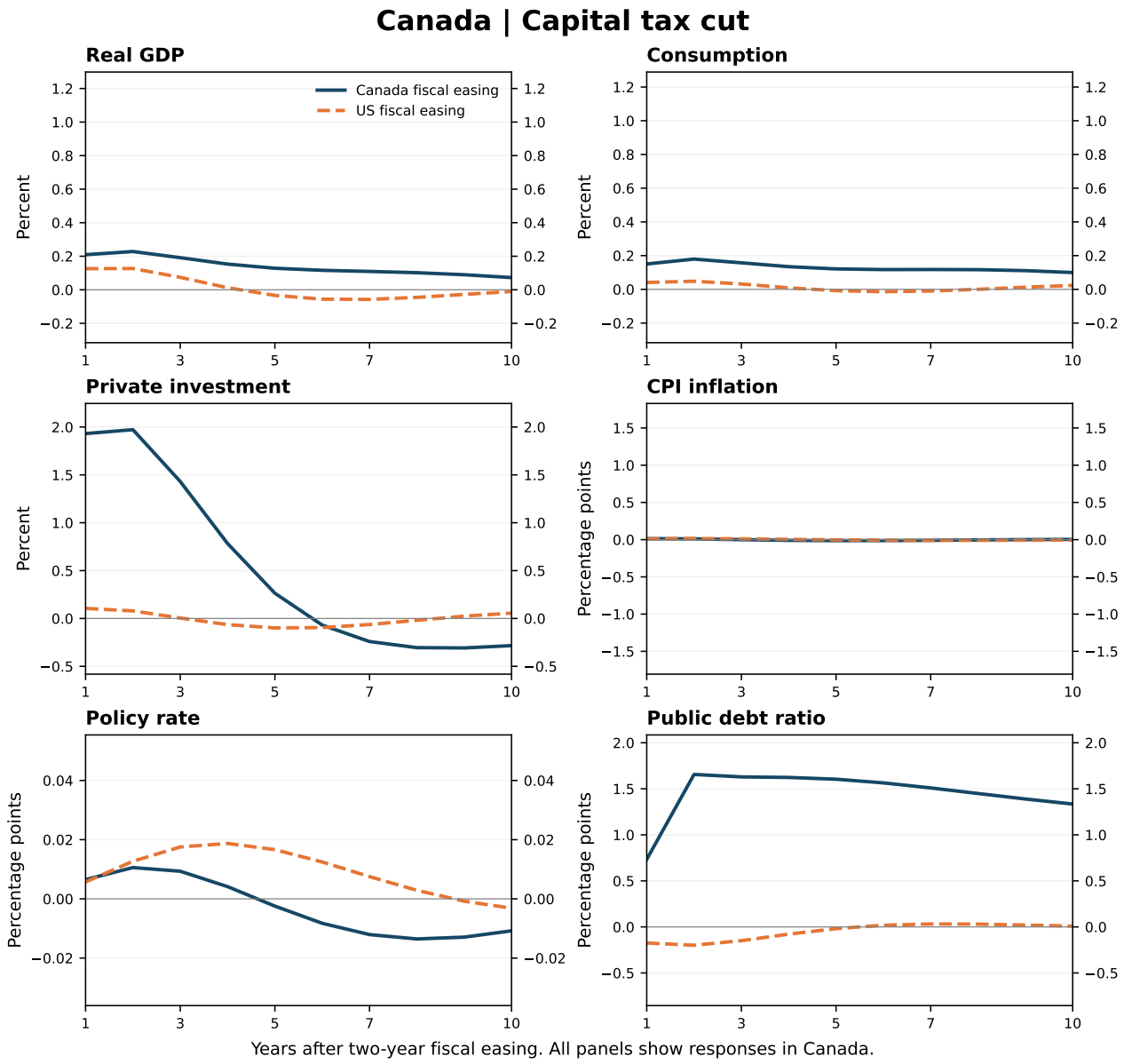

*Notes:* Solid blue: focal-country fiscal origin. Orange dashed: US fiscal origin. In both cases the receiving economy is Canada. Quantity responses are percent deviations; rates and debt ratios are percentage-point deviations. Common scales across both country papers. All panels show the full plotted range; scales are common across both country papers.

Figure 8: Labour tax cut: focal-country responses



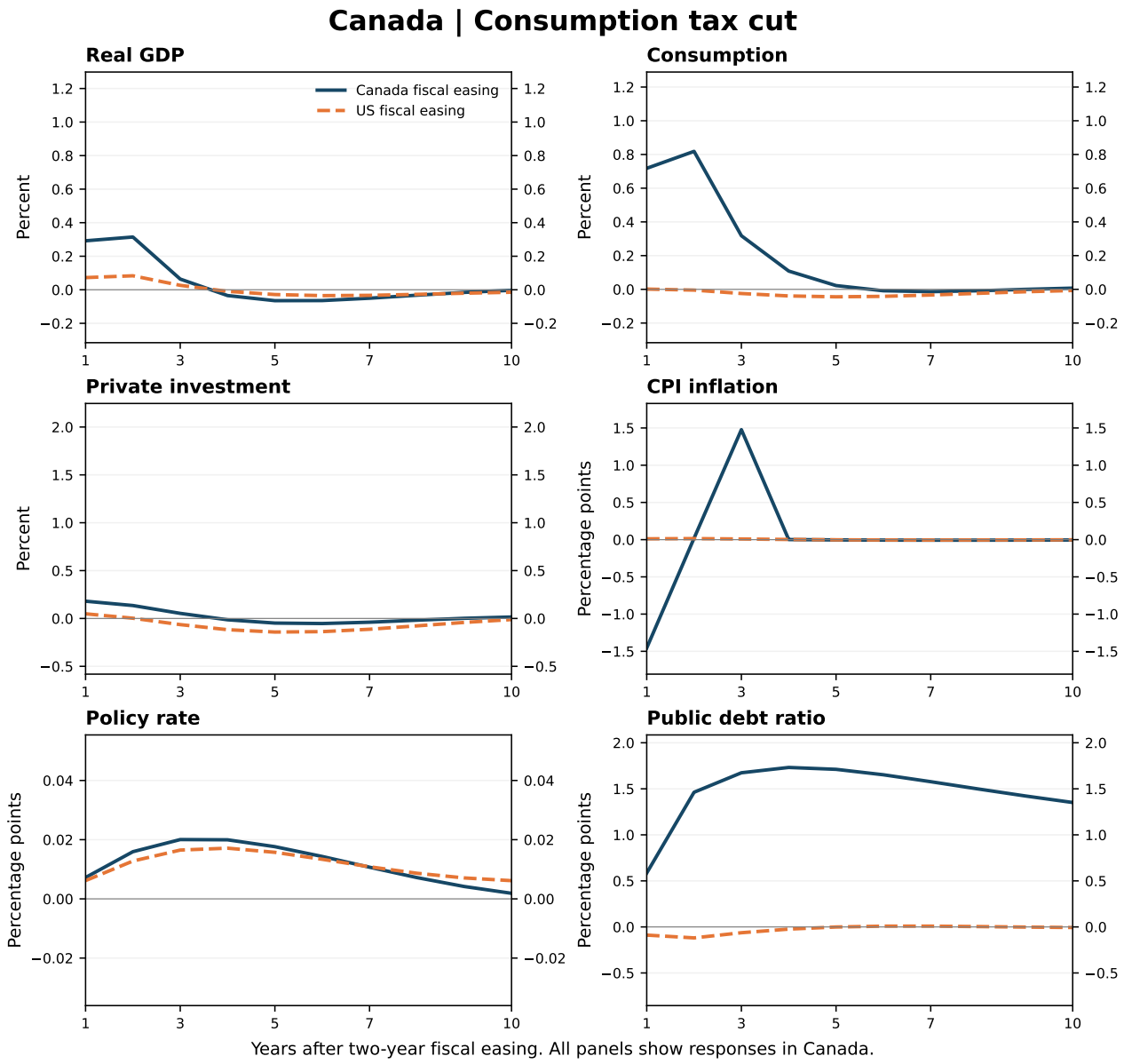

*Notes:* Solid blue: focal-country fiscal origin. Orange dashed: US fiscal origin. In both cases the receiving economy is Canada. Quantity responses are percent deviations; rates and debt ratios are percentage-point deviations. Common scales across both country papers. All panels show the full plotted range; scales are common across both country papers.

Figure 9: Capital tax cut: focal-country responses




*Notes:* Solid blue: focal-country fiscal origin. Orange dashed: US fiscal origin. In both cases the receiving economy is Canada. Quantity responses are percent deviations; rates and debt ratios are percentage-point deviations. Common scales across both country papers. All panels show the full plotted range; scales are common across both country papers.

Figure 10: Consumption tax cut: focal-country responses




*Notes:* Solid blue: focal-country fiscal origin. Orange dashed: US fiscal origin. In both cases the receiving economy is Canada. Quantity responses are percent deviations; rates and debt ratios are percentage-point deviations. Common scales across both country papers. All panels show the full plotted range; scales are common across both country papers.