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A Seven-Region GIMF Model of the United Kingdom

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 the United Kingdom. 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 stabilization to medium-run supply. Seven fiscal easings of one percent of baseline GDP in each of two years are compared under endogenous interest rates and sequential one-year rate holds, alongside matching US shocks. The second hold is unexpected when Year-1 decisions are made; the fiscal announcement is identical across monetary regimes. The first-year GDP response under endogenous rates ranges from 0.12 to 1.03 percent. Six-panel October 2026 WEO fiscal charts provide the empirical motivation. We solve a lower-debt stationary endpoint and the full nonlinear ten-year consolidation transition, with terminal-horizon and original-equation checks. The release supplies all 4,704 expanded equations, calibrated states and reproducible results. Several regional inputs remain disclosed proxies; this is a working policy-analysis platform rather than an estimated forecasting system.

Keywords: GIMF; United Kingdom; 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?

The United Kingdom's exposure to international financing conditions makes fiscal composition and policy coordination central to a credible adjustment strategy. An intervention can improve the budget balance while weakening the productive base needed to sustain that improvement. The model therefore separates government consumption, productive public investment, transfers and three distortionary taxes. The US and euro area are separate regions, so the same framework can distinguish domestic action from foreign demand and financial transmission.

The UK-centred configuration does not separately identify Canada: Canada belongs to its residual-world region. Its companion Canadian model instead identifies Canada explicitly and places the United Kingdom in the residual world. The papers are paired applications of the same structural framework, not two labels attached to an identical regional decomposition.

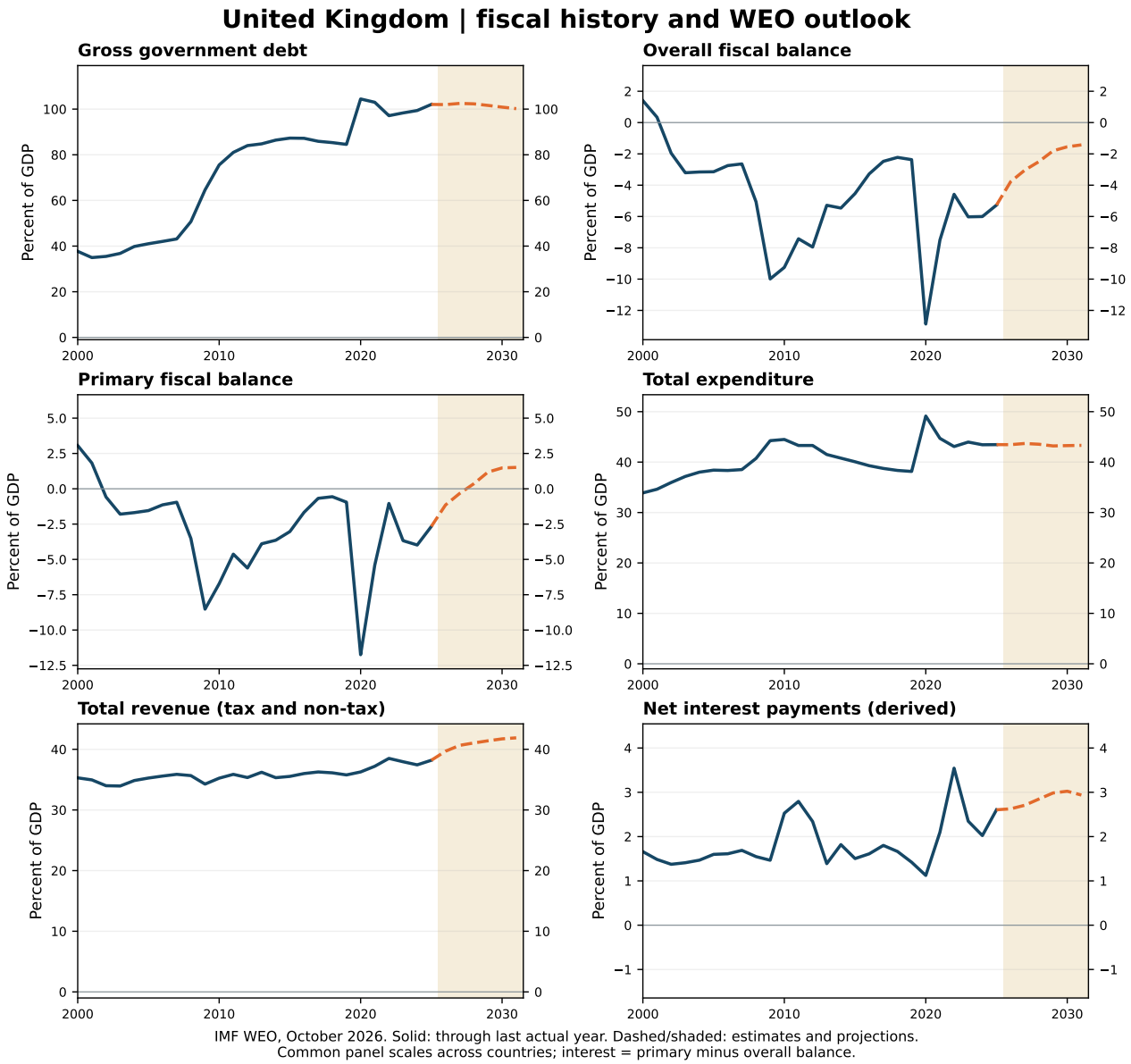
The model's non-Ricardian structure is fundamental to this distinction. Households with finite planning horizons do not fully offset today's government liabilities against taxes imposed on all future generations. Liquidity-constrained households cannot borrow freely against future income. Distortionary 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 United Kingdom's gross debt at about 102 percent of GDP in 2026 and 100 percent in 2031. Its overall balance is about -4 percent of GDP in 2026 and -1 percent in 2031. These are conditional estimates and projections, rather than realized outcomes. The model's calibrated debt ratio is 104 percent; it is an archived structural calibration, not a mechanical initialization from the WEO's 2026 observation.

The overall and primary balances separate the cost of servicing inherited liabilities from the balance on non-interest operations. A primary surplus can coexist with an overall deficit. The WEO debt ratio also reflects denominator changes, valuation and stock-flow adjustments, whereas the model's government budget block imposes its own explicit flow-of-funds identity. Differences between the model and the published data therefore require a measurement bridge, not an unexplained calibration residual.

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, θ is the planning-horizon parameter and χ 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 ψ 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 μ 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. In the endogenous-rate arrangement, all seven central banks follow the gross-rate rule below from Year 1. Under sequential policy it applies to the shock-origin central bank from Year 3 and to the other six central banks throughout:

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

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 Years 1 and 2: higher government consumption, higher government investment, targeted transfers, general transfers, or

a cut in labor, capital or consumption taxes. Both fiscal actions are known initially, and the intervention ends after Year 2. The spending impulses are converted using the baseline government-purchases price; the tax impulses use the corresponding baseline tax bases. Matching US experiments identify foreign transmission. The nominal-rigidity profile and fiscal financing closure are identical across monetary arrangements.

7.1 Endogenous rates and sequential one-year holds

Under endogenous rates, all seven central banks follow the documented reaction rule from Year 1. Under sequential policy, the shock-origin central bank holds its policy rate at baseline in Year 1. Households and firms initially expect the rule to resume in Year 2. At the start of Year 2, policymakers unexpectedly renew the hold for that year. The normal rule resumes in Year 3. The other six central banks retain their endogenous rules throughout. For a US-origin fiscal shock it is therefore the US rate that is held, while the focal-country central bank responds endogenously.

With sticky prices, the rate hold changes expected real financing costs and the forward-looking consumption and investment decisions made against them. When the endogenous rule would raise rates, a hold can strengthen the expansion. When the rule would cut rates, delaying that cut can work in the other direction. The comparison therefore measures a conditional policy response, not an assumption that every rate hold must increase every multiplier. Year-1 decisions reflect the initial policy plan; the surprise renewal changes the continuation.

The computation uses two conditional policy vintages. Let $z^{(1)}$ be the plan formed initially with the two-year fiscal action and only the first one-year rate hold. Year-1 outcomes are then fixed. The Year-2 decision generates a revised continuation:

$$z_1 = z_1^{(1)}, \tag{26}$$

$$z_{2:T} = \mathcal{S}\big(F_{2:T},\ z_1 \text{ fixed},\ i_2 = i^*,\ \text{rule from Year 3}\big). \tag{27}$$

$\mathcal{S}$ denotes the conditional model solution; F is the announced fiscal path. All inherited Year-1 values, including the histories needed by multi-period lag equations, enter the second solution. The fiscal action is unchanged when the monetary decision is revised.

The sequential path is a sequence of decisions with a surprise renewal, not a single perfect-foresight solution in which private agents know both holds initially. Its Year-1 expectations must be checked against the first-vintage plan; its Year-2 continuation must be checked against the second vintage. Re-evaluating the entire stitched path as if the second hold had always been known would impose the wrong information structure. The released files retain the initial conditional plan and the Year-2 forecast revision as well as the realized sequential path.

7.2 Fiscal responses in Years 1 and 2

The impact multiplier is the first-year GDP change divided by the first-year ex-ante fiscal impulse, both measured against baseline GDP, conditional on the known fiscal continuation. The Year-2 column includes the second year's fiscal action and the effects inherited from Year 1. It is not an after-effect of a one-year stimulus.

$$m_1 = \frac{\Delta Y_1/Y_0}{\Delta F_1/Y_0}, \qquad m_H^{cum} = \frac{\sum_{t=1}^{H} \Delta Y_t}{\sum_{t=1}^{H} \Delta F_t}. \tag{28}$$

The second expression defines a cumulative multiplier when numerator and denominator use compatible prices and units. The tables report Year-1 and Year-2 GDP deviations and their simple two-year average. That average summarizes the level responses; it is not independently presented as a discounted cumulative multiplier. Instruments are ranked by first-year GDP under endogenous rates, and the same ordering is retained in the second-year and sequential comparisons.

Table 1: Two-year domestic fiscal easing: GDP responses

Instrument	N Y1	S Y1	N Y2	S Y2	N avg.	S avg.
Government investment	1.03	1.15	1.14	1.23	1.09	1.19
Government consumption	0.66	0.74	0.61	0.78	0.63	0.76
Targeted transfers	0.43	0.48	0.43	0.55	0.43	0.51
Consumption tax cut	0.29	0.33	0.31	0.40	0.30	0.36
Capital tax cut	0.21	0.24	0.22	0.28	0.22	0.26
Labour tax cut	0.16	0.17	0.19	0.20	0.18	0.18
General transfers	0.12	0.13	0.12	0.15	0.12	0.14

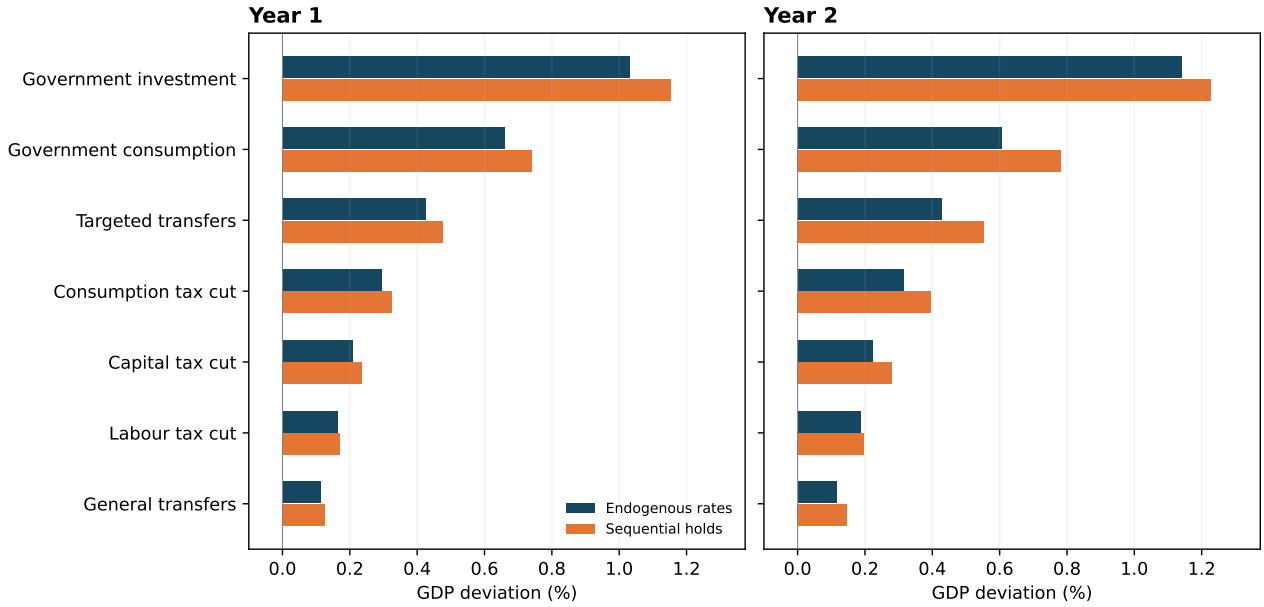
Notes: Percent deviations. N: endogenous rates. S: sequential holds. Easing equals 1% of baseline GDP in each of Years 1 and 2; both fiscal actions are initially known. The average is the simple mean of the two reported GDP responses.

Table 2: Headline CPI inflation: both fiscal years and monetary arrangements

Instrument	N Y1	S Y1	N Y2	S Y2
Government investment	0.086	0.110	-0.021	-0.001
Government consumption	0.036	0.052	0.044	0.081
Targeted transfers	0.022	0.032	0.032	0.058
Consumption tax cut	-1.448	-1.442	0.021	0.039
Capital tax cut	0.013	0.019	0.012	0.024
Labour tax cut	0.003	0.004	0.002	0.005
General transfers	0.004	0.006	0.009	0.015

Notes: Percentage-point deviations. Headline CPI includes the mechanical consumption-tax effect. The origin-country policy-rate deviation is zero in both years under sequential holds; other central banks respond endogenously.

Figure 2: Two-year fiscal easing under endogenous rates and sequential holds



Notes: Both fiscal years are active. Blue: endogenous rates. Orange: sequential one-year holds. The second monetary hold is unexpected at the beginning of the experiment. Ordering is fixed by Year-1 GDP under endogenous rates.

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. Moving between debt levels

8.1 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 104 to 94 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 $2.1e-11$. The three tax-instrument equations are replaced by the disclosed closure constraints; all other source equations are checked.

Table 3: Lower-debt stationary endpoint: changes from the original steady state

Variable	Unit	Change
Consumption	%	0.166
Private investment	%	0.203
Public capital	%	0.000
Labor tax rate	pp	-0.045
Capital tax rate	pp	-0.158
Consumption tax rate	pp	-0.045
Real private rate	pp	-0.006

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.

8.2 A solved nonlinear debt-consolidation transition

We now solve the full perfect-foresight path from the original equilibrium to the lower-debt endpoint. The debt ratio falls by one percentage point per year for ten years and is then held at its new level:

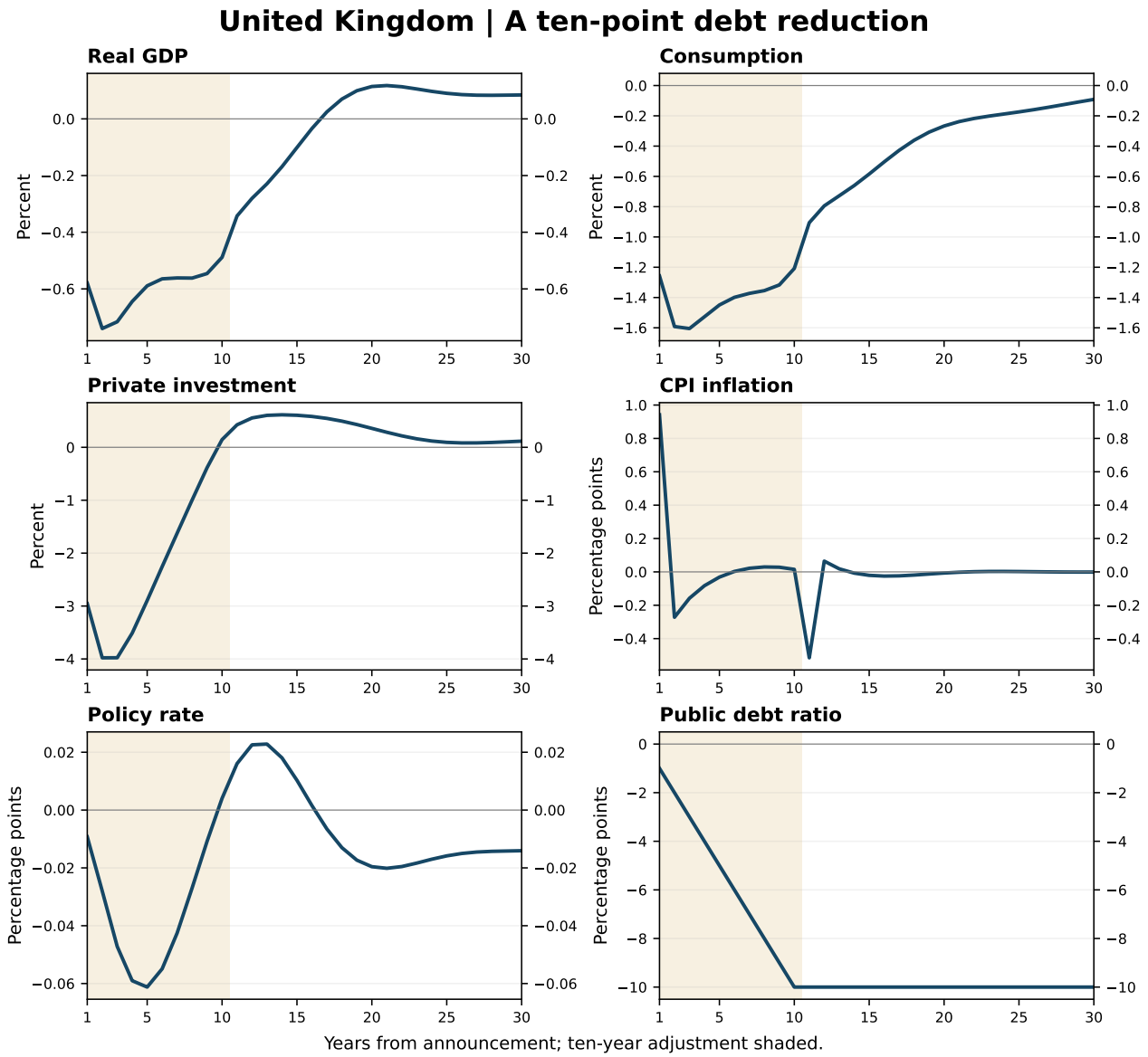
$$b_t = b_0 - 10\min(t/10, 1), \qquad t = 1, 2, \ldots. \tag{29}$$

The entire policy is announced in Year 1. Real general transfers remain at their baseline level. The labor, capital and consumption tax rates adjust jointly, with equal ex-ante revenue changes evaluated at baseline tax bases. Government purchases retain their source settings. All seven central banks follow the endogenous monetary rule used in the fiscal experiments.

The prescribed debt path replaces the focal-country surplus feedback equation. The three tax-instrument equations are replaced by the fixed-transfer and equal-revenue constraints. The government bond identity, tax bases, household decisions, production, trade, investment, financial contracts and market-clearing equations remain active. The surplus-target innovation moves consistently with the debt target. The package identifies each replaced source row explicitly.

All endogenous quantities, prices and interest rates are solved jointly. Every pre-announcement lag is fixed at the original equilibrium; every lead beyond the finite solution horizon is evaluated at the separately solved lower-debt endpoint. This is a nonlinear transition, not debt accounting at fixed growth and interest rates, and not a rescaling of temporary multipliers.

Figure 3: A ten-year transition to lower public debt



Notes: Full nonlinear perfect-foresight solution. Debt falls by ten percentage points over the shaded ten-year adjustment. Taxes finance the transition; general transfers and government-purchase settings are preserved. Quantities are deviations from baseline; interest rates, inflation and debt ratios are percentage-point differences. GDP cumulates log chain-Fisher growth.

Table 4: Nonlinear consolidation: selected UK responses

Variable	Year 1	Year 5	Year 10	Year 20
Real GDP	-0.58	-0.59	-0.49	0.11
Consumption	-1.26	-1.45	-1.21	-0.27
Private investment	-2.96	-2.90	0.15	0.36
Labor tax rate	1.10	0.60	0.57	-0.02
Capital tax rate	3.84	2.09	1.98	-0.08
Consumption tax rate	1.10	0.59	0.57	-0.02
Public debt ratio	-1.00	-5.00	-10.00	-10.00

Notes: GDP, consumption and investment: percent deviations. Tax rates and debt: percentage-point deviations. This is one specified fiscal package, not a welfare ranking.

The tax-financed adjustment initially reduces consumption, investment and output. Headline CPI also includes the direct effect of the consumption tax: its initial increase and later reversals should not be interpreted as pure movements in demand pressure. The adjustment-period tax increases and the eventual tax reductions answer different questions. The former finance the reduction in liabilities; the latter reflect the fiscal resources released once lower debt is established. The model determines the intervening private-demand, investment and monetary responses, including forward-looking responses to the announced policy. These conditional results do not establish that this tax package is optimal or that a different adjustment speed would produce the same costs.

The maximum active-equation residual is 7.5e-09; the maximum residual over unchanged source equations is 7.5e-09. Solutions at forty- and eighty-year horizons differ by at most 0.0008 in the reported percent or percentage-point units over the first twenty years across all seven regions and all reported variables. Consumption, investment, public capital, corporate net worth, gross interest rates and inflation remain positive. Full states, every region's paths and numerical audits are supplied. These numerical checks establish consistency of the specified experiment; the disclosed proxy calibrations still limit its empirical interpretation.

9. Calibration, verification and use in policy work

9.1 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 5: Selected regional calibration values

Region	World GDP	Imports	Gov. cons.	Gov. inv.	Debt
United Kingdom	3.3	32.6	21.5	3.4	103.9
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	17.9	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 6: 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	0.113333
Consumption tax rate	0.171028
Capital tax rate	0.137963

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 $3.8e-13$. All forty-nine nominal adjustment parameters were checked. The fiscal systems are solved at forty- and eighty-year horizons. The largest first-decade GDP difference between those horizons is 0.000400 percentage points, below the specified one-hundredth-point tolerance. The maximum uncondensed stacked linear-system residual is $1.3e-14$. 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.

9.2 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 current experiments compare endogenous monetary responses with sequential one-year rate holds. The initial fiscal announcement remains the same in both arrangements.

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.

10. 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 and transition solvers, 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 all fourteen focal-country and US fiscal cases under both monetary arrangements, including the initial conditional plan and the unexpected Year-2 renewal. The debt command solves the stationary endpoint. Run `UK_Model/solve_debt_transition.py` with `--horizon 40` and `--horizon 80` for the full nonlinear transition, then `complete_uk_paper.py` to rebuild its tables, figure and validation. The transition folder retains all endogenous paths and original-equation audits. The complete response CSV contains all seven receiving regions, both monetary arrangements, nine variables and twenty years. Initial-plan and forecast-revision files retain the information timing used to produce the sequential path.

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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The Better Policy Project (2026c). *A Seven-Region GIMF Model of Canada: Theory, Fiscal Transmission and Debt Adjustment*. BPP Working Paper 2026-12.

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 the original policy rows and the active normal rules. The time-specific rate-hold substitutions, affected equation identifiers and information vintages are recorded in `two_year_policy_results/Policy_Overrides.json`. `All_Active_Equations.txt` gives the normal-rule equation list; `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 7: 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

These tables report GDP responses in every receiving region to the domestic two-year fiscal easing. Both monetary arrangements use the same announced fiscal action. Under sequential policy, only the origin-country central bank holds its rate. US-origin spillovers to the focal country are shown separately.

Table 8: Endogenous rates: Year-1 GDP responses across all seven regions

Instrument	Focal	US	EA	Japan	China	EM	RoW
Government investment	1.032	0.012	0.027	0.026	0.027	0.022	0.023
Government consumption	0.662	0.012	0.025	0.024	0.025	0.022	0.022
Targeted transfers	0.426	0.006	0.011	0.010	0.010	0.010	0.010
Consumption tax cut	0.294	0.004	0.008	0.007	0.007	0.007	0.007
Capital tax cut	0.209	0.005	0.009	0.009	0.010	0.008	0.008
Labour tax cut	0.165	0.002	0.003	0.003	0.003	0.003	0.003
General transfers	0.115	0.002	0.004	0.004	0.003	0.004	0.003

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

Table 9: Sequential holds: Year-1 GDP responses across all seven regions

Instrument	Focal	US	EA	Japan	China	EM	RoW
Government investment	1.154	0.011	0.026	0.025	0.027	0.021	0.022
Government consumption	0.741	0.012	0.025	0.024	0.024	0.021	0.022
Targeted transfers	0.475	0.005	0.011	0.010	0.009	0.009	0.009
Consumption tax cut	0.326	0.004	0.008	0.007	0.007	0.007	0.007
Capital tax cut	0.236	0.005	0.009	0.009	0.010	0.008	0.008
Labour tax cut	0.171	0.002	0.003	0.003	0.003	0.003	0.003
General transfers	0.126	0.002	0.004	0.003	0.003	0.003	0.003

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

Table 10: Endogenous rates: Year-2 GDP responses across all seven regions

Instrument	Focal	US	EA	Japan	China	EM	RoW
Government investment	1.142	0.011	0.025	0.023	0.025	0.021	0.021
Government consumption	0.605	0.012	0.024	0.023	0.023	0.021	0.021
Targeted transfers	0.427	0.005	0.011	0.011	0.010	0.010	0.010
Consumption tax cut	0.314	0.004	0.008	0.008	0.007	0.007	0.007
Capital tax cut	0.224	0.005	0.009	0.009	0.010	0.008	0.008
Labour tax cut	0.187	0.002	0.003	0.003	0.003	0.003	0.003
General transfers	0.115	0.002	0.004	0.004	0.003	0.003	0.003

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

Table 11: Sequential holds: Year-2 GDP responses across all seven regions

Instrument	Focal	US	EA	Japan	China	EM	RoW
Government investment	1.227	0.011	0.025	0.023	0.025	0.021	0.021
Government consumption	0.783	0.011	0.023	0.022	0.022	0.020	0.020
Targeted transfers	0.552	0.005	0.010	0.010	0.009	0.009	0.009
Consumption tax cut	0.396	0.003	0.008	0.007	0.007	0.007	0.006
Capital tax cut	0.280	0.005	0.009	0.009	0.010	0.008	0.008
Labour tax cut	0.197	0.002	0.003	0.003	0.003	0.003	0.003
General transfers	0.147	0.002	0.004	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. US fiscal spillovers and the Year-2 revision

Table 12: Focal-country GDP response to the matching US fiscal easing

US instrument	N Y1	S Y1	N Y2	S Y2
Government investment	0.154	0.148	0.141	0.141
Government consumption	0.150	0.145	0.139	0.133
Targeted transfers	0.065	0.062	0.064	0.059
Consumption tax cut	0.047	0.044	0.047	0.044
Capital tax cut	0.057	0.055	0.056	0.054
Labour tax cut	0.018	0.018	0.019	0.019
General transfers	0.023	0.022	0.022	0.021

Notes: N: endogenous rates. S: sequential US rate holds. The focal-country central bank remains endogenous in both cases. US fiscal easing equals 1% of baseline US GDP in each fiscal year.

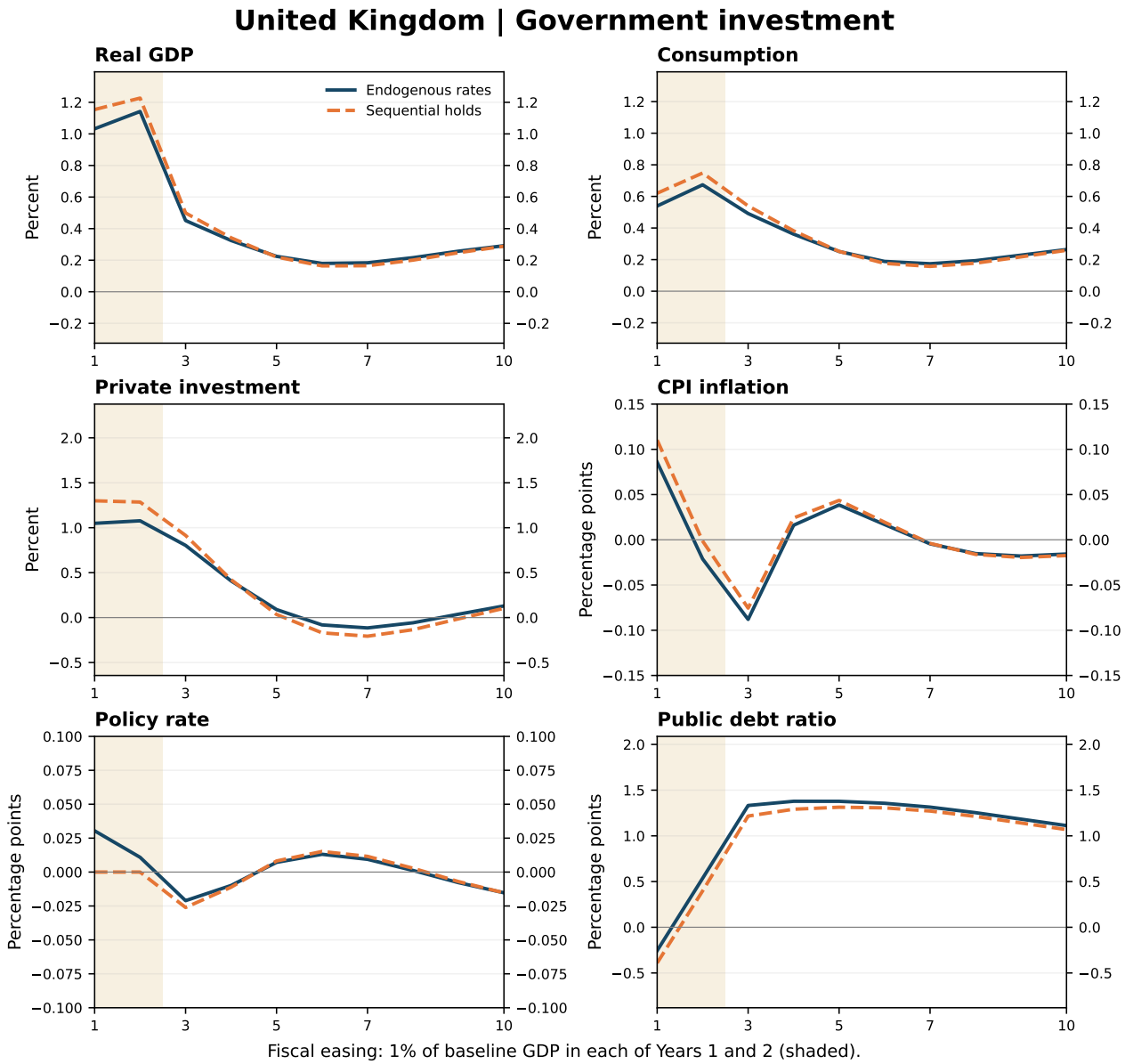
Table 13: Domestic sequential policy: the unexpected Year-2 renewal

Instrument	Y1 realized	Y2 initial plan	Y2 revised	Revision
Government investment	1.154	1.256	1.227	-0.029
Government consumption	0.741	0.679	0.783	0.104
Targeted transfers	0.475	0.474	0.552	0.078
Consumption tax cut	0.326	0.344	0.396	0.052
Capital tax cut	0.236	0.249	0.280	0.031
Labour tax cut	0.171	0.192	0.197	0.005
General transfers	0.126	0.125	0.147	0.022

Notes: GDP percent deviations; revision in percentage points. The initial plan anticipates the normal rate rule in Year 2. The revised path incorporates the unexpected second hold. Every Year-1 variable is fixed at its initial-plan realization.

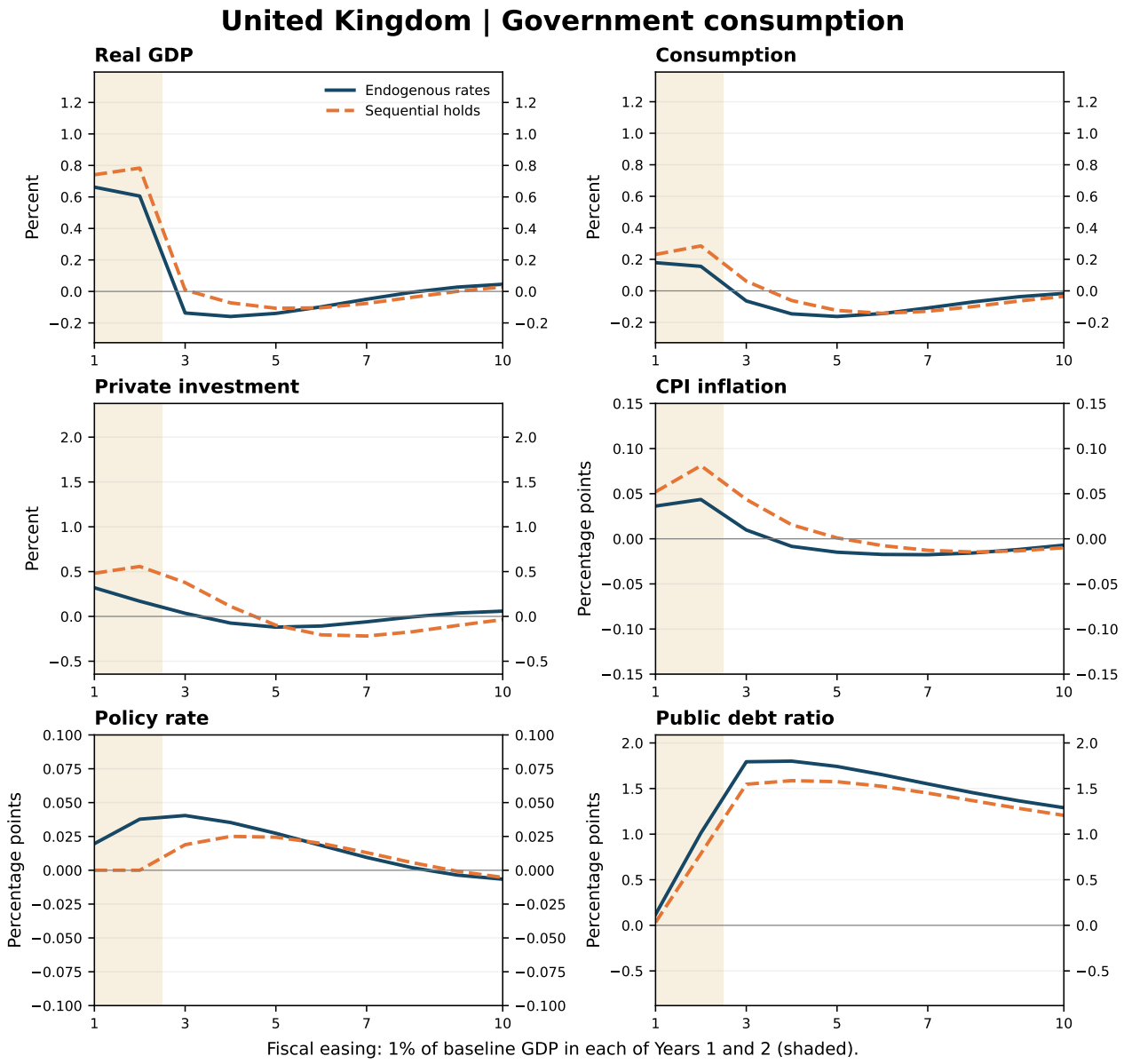
D. Seven fiscal experiments: dynamic paths

Figure 4: Government investment: focal-country responses



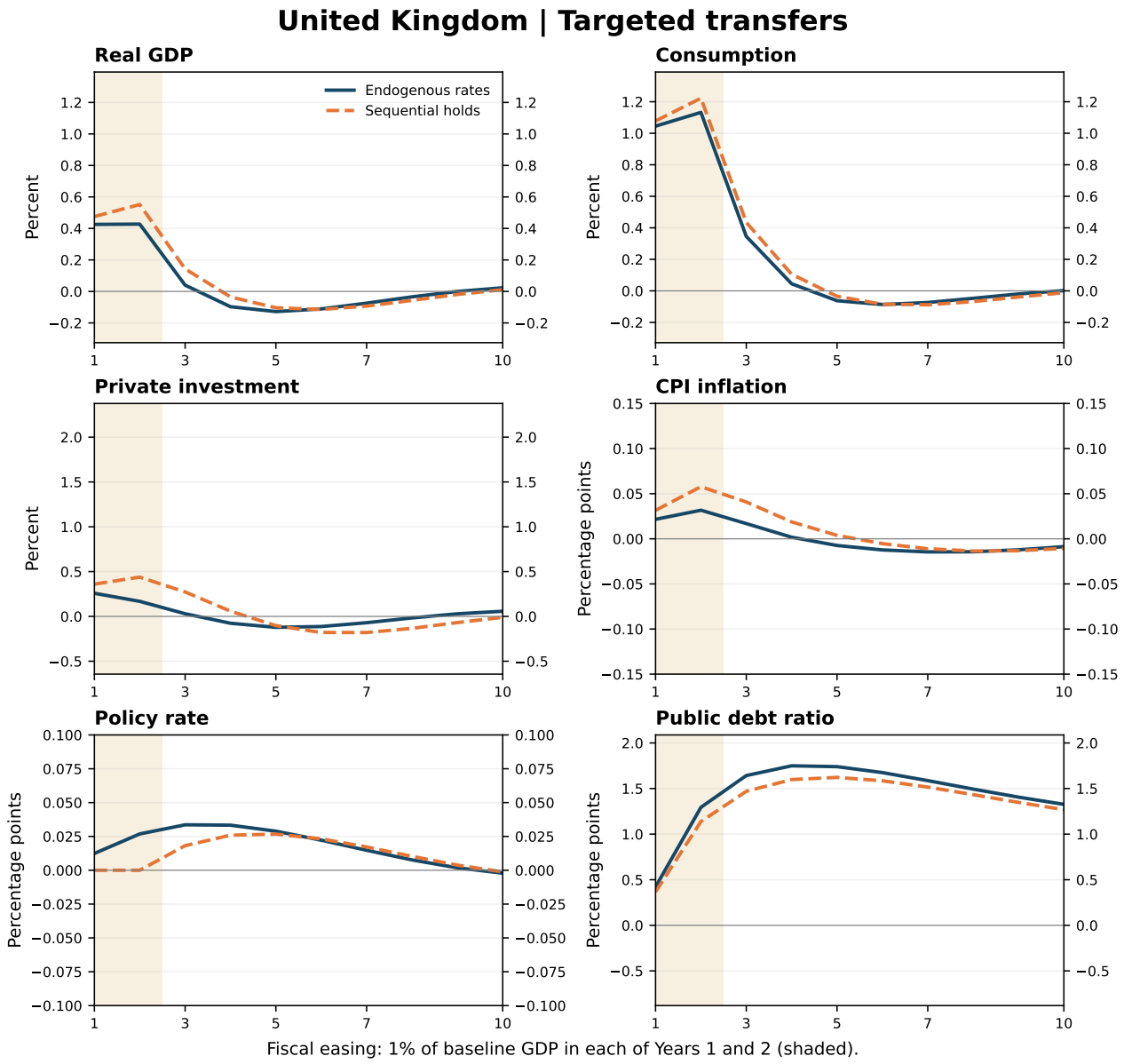
Notes: Domestic fiscal origin. Solid blue: endogenous rates. Orange dashed: sequential one-year holds, with an unexpected renewal in Year 2. Fiscal easing equals 1% of baseline GDP in each shaded year. Quantity responses are percent deviations; rates and debt ratios are percentage-point deviations. Common scales across both country papers; ranges expand where needed to retain the complete responses.

Figure 5: Government consumption: focal-country responses



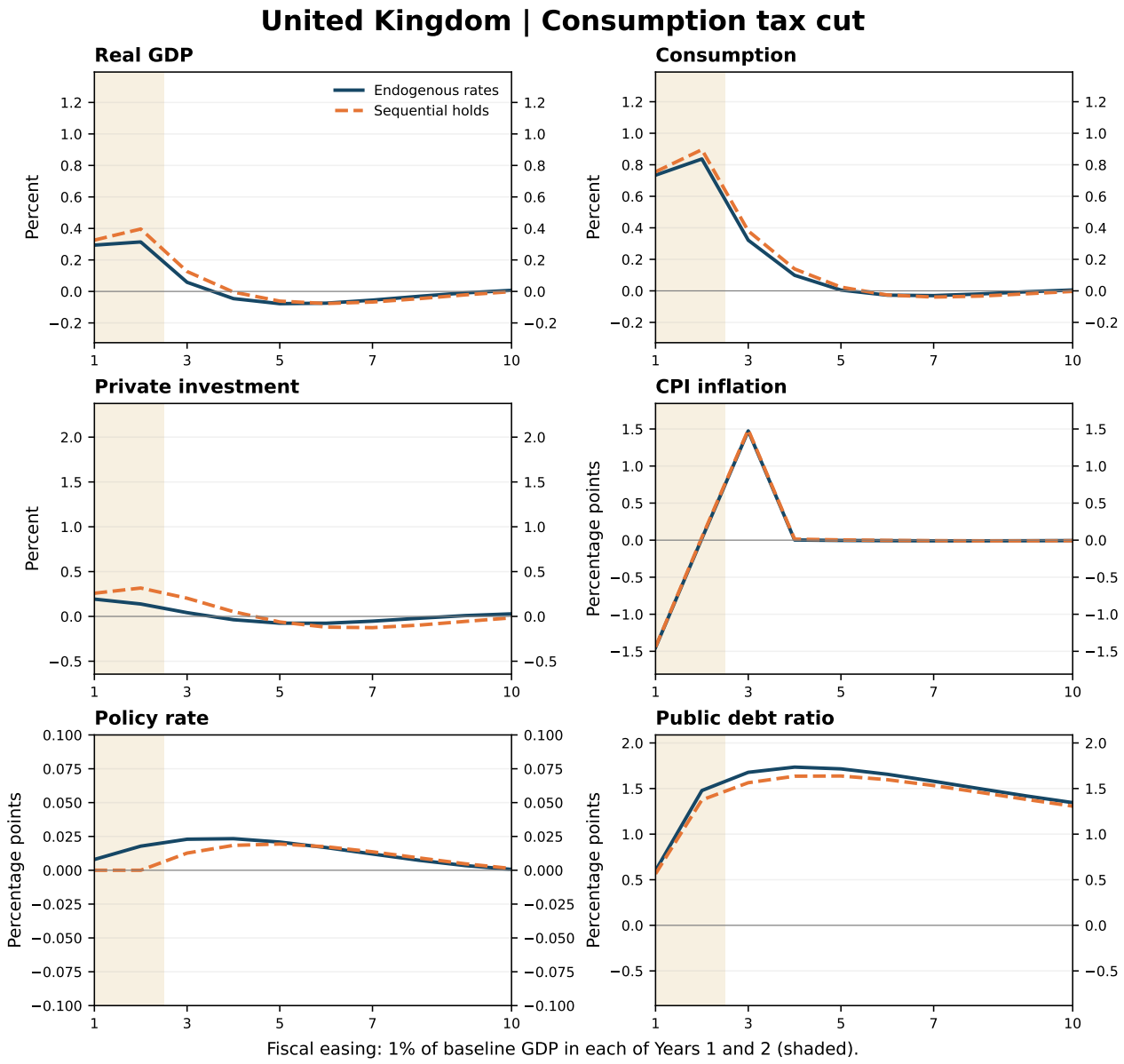
Notes: Domestic fiscal origin. Solid blue: endogenous rates. Orange dashed: sequential one-year holds, with an unexpected renewal in Year 2. Fiscal easing equals 1% of baseline GDP in each shaded year. Quantity responses are percent deviations; rates and debt ratios are percentage-point deviations. Common scales across both country papers; ranges expand where needed to retain the complete responses.

Figure 6: Targeted transfers: focal-country responses



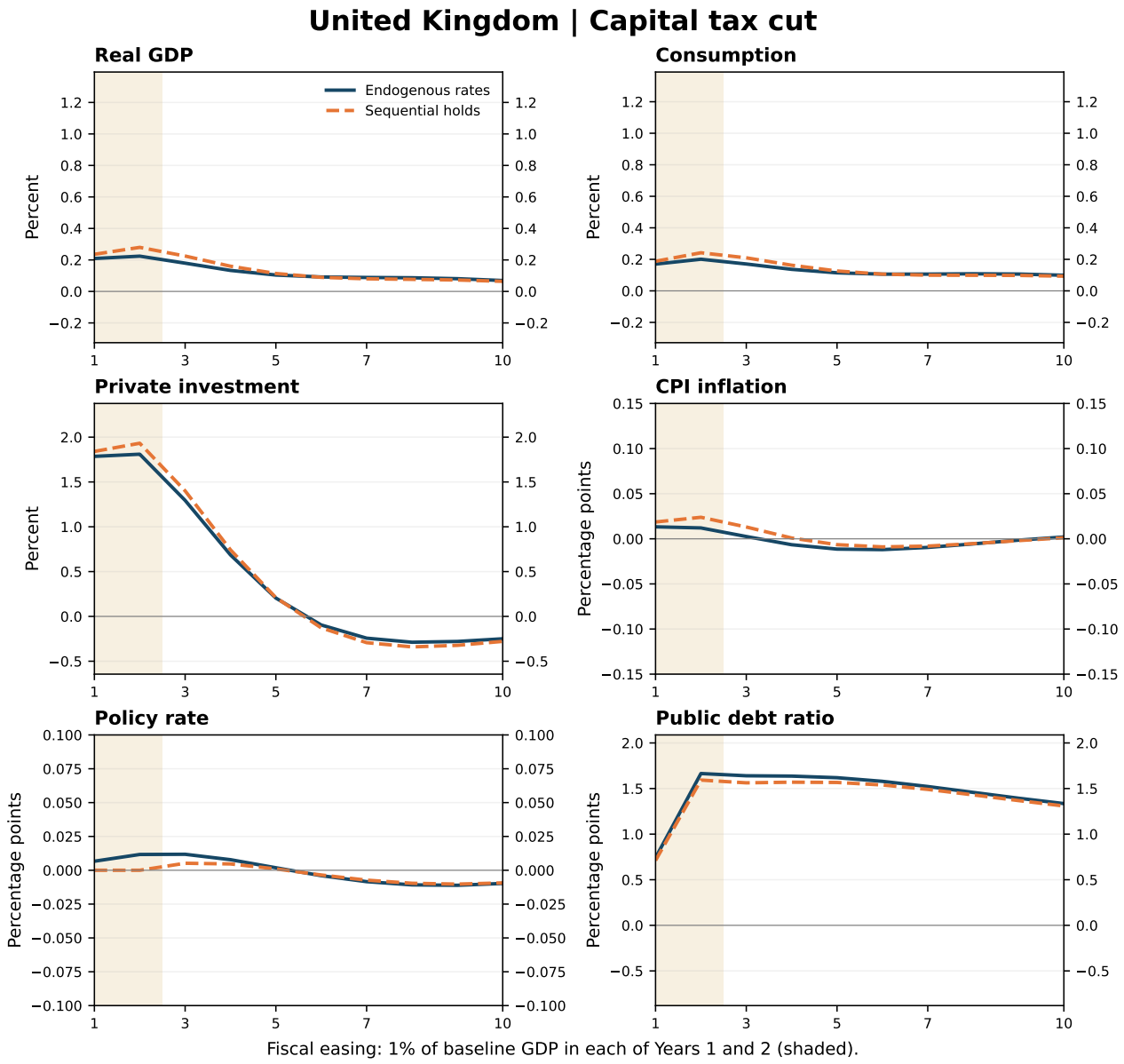
Notes: Domestic fiscal origin. Solid blue: endogenous rates. Orange dashed: sequential one-year holds, with an unexpected renewal in Year 2. Fiscal easing equals 1% of baseline GDP in each shaded year. Quantity responses are percent deviations; rates and debt ratios are percentage-point deviations. Common scales across both country papers; ranges expand where needed to retain the complete responses.

Figure 7: Consumption tax cut: focal-country responses



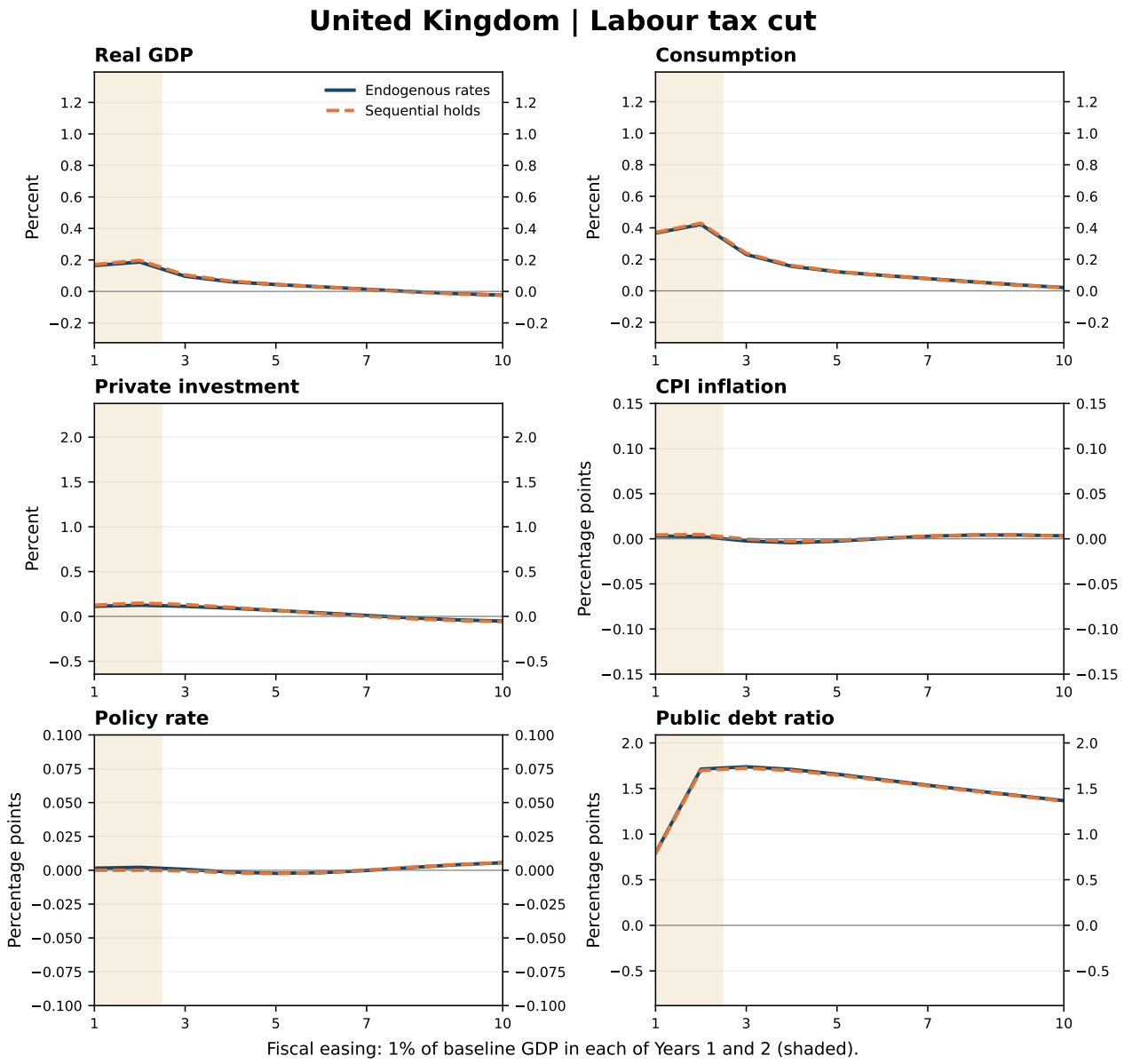
Notes: Domestic fiscal origin. Solid blue: endogenous rates. Orange dashed: sequential one-year holds, with an unexpected renewal in Year 2. Fiscal easing equals 1% of baseline GDP in each shaded year. Quantity responses are percent deviations; rates and debt ratios are percentage-point deviations. Common scales across both country papers; ranges expand where needed to retain the complete responses.

Figure 8: Capital tax cut: focal-country responses



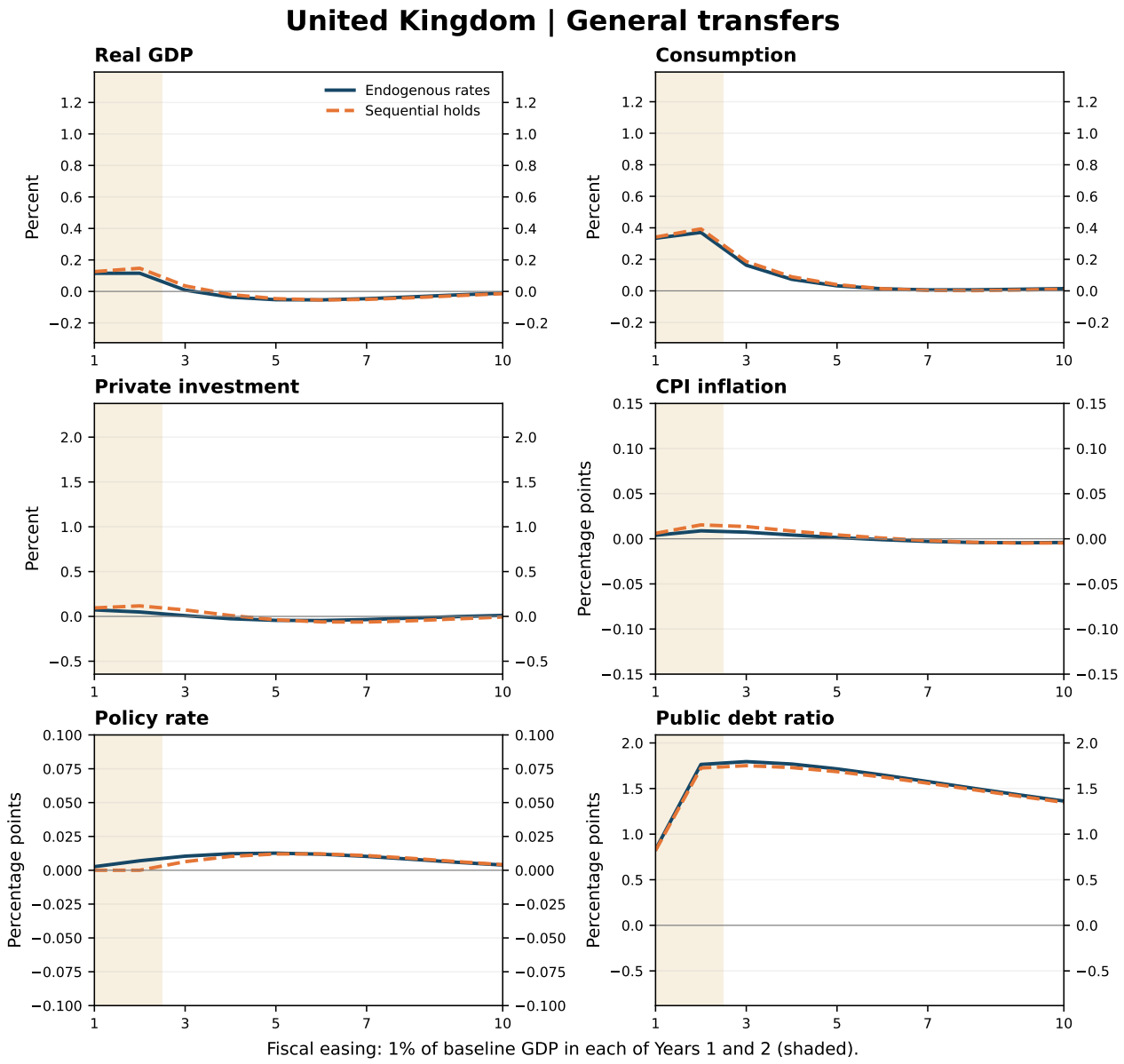
Notes: Domestic fiscal origin. Solid blue: endogenous rates. Orange dashed: sequential one-year holds, with an unexpected renewal in Year 2. Fiscal easing equals 1% of baseline GDP in each shaded year. Quantity responses are percent deviations; rates and debt ratios are percentage-point deviations. Common scales across both country papers; ranges expand where needed to retain the complete responses.

Figure 9: Labour tax cut: focal-country responses



Notes: Domestic fiscal origin. Solid blue: endogenous rates. Orange dashed: sequential one-year holds, with an unexpected renewal in Year 2. Fiscal easing equals 1% of baseline GDP in each shaded year. Quantity responses are percent deviations; rates and debt ratios are percentage-point deviations. Common scales across both country papers; ranges expand where needed to retain the complete responses.

Figure 10: General transfers: focal-country responses



Notes: Domestic fiscal origin. Solid blue: endogenous rates. Orange dashed: sequential one-year holds, with an unexpected renewal in Year 2. Fiscal easing equals 1% of baseline GDP in each shaded year. Quantity responses are percent deviations; rates and debt ratios are percentage-point deviations. Common scales across both country papers; ranges expand where needed to retain the complete responses.