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Armenia: Prudent Risk Management and GIMF Applications

New Research Chapters and Model-Result Reports

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The Better Policy Project

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Armenia: Prudent Risk Management and GIMF Applications

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Douglas Laxton
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Abstract

How can a structural global model support a central bank that sets policy by prudent risk management? This paper applies the Global Integrated Monetary and Fiscal Model (GIMF) to Armenia, building on the Central Bank of Armenia's 2026 book *Prudent Risk Management Approach to Price Stability: Theory and Practice at the Central Bank of Armenia*. Part II sets out new research chapters on seven fiscal instruments under alternative monetary sequencing, a cross-region fiscal audit, financial stress, the cost of lowering the inflation target from 3 to 2 percent, learning about a staged announcement, and the 2024 decision to move from a 4 to a 3 percent target. Part III assembles the available model-result reports from the three-, five- and seven-region Armenia branches, each with its original version-specific qualifications. The responses are conditional experiments around solved stationary equilibria, not forecasts or empirical estimates of policy effects. The disinflation exercises are first-order diagnostics; a nonlinear transition test remains outstanding.

Keywords: GIMF; Armenia; prudent risk management; fiscal policy; country risk; disinflation; inflation target; learning.

JEL classification: E17, E52, E58, E62, F41.

Status. Research draft for discussion. The new material is not an approved Central Bank of Armenia edition, and the author list for the new chapters is provisional. The published book is cited, not reproduced. Section F is issued separately as BPP Working Paper 2026-14.

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Reference. Laxton, D., H. Avetisyan and V. Avagyan (eds.) (2026). *Prudent Risk Management Approach to Price Stability: Theory and Practice at the Central Bank of Armenia.* Yerevan: Central Bank of Armenia.

Model versions. Branch A (seven regions: US, Armenia, euro area, Russia, rest of world, China, Georgia) uses two-year fiscal shocks and an incremental monetary rule with separate target-change diagnostics. Branch B uses the same regions with a different saved monetary closure and own-region shocks in every region. The three-region harmonized release, the five-region research calibration and the legacy financial-shock reports retain their original calibrations, dates and limits.

1. A structural model inside prudent risk management

Armenia offers a useful setting for connecting prudent risk management to a structural account of fiscal policy, financial conditions and inflation. The existing book explains how a central bank can make decisions when forecasts are uncertain and the consequences of mistakes are asymmetric. The new chapters ask how GIMF can support that process: by making assumptions explicit, tracing policy tradeoffs and comparing coherent alternatives.

The model is especially useful when a question crosses the boundary between the budget and monetary policy. A change in public investment affects demand immediately and productive capacity over time. A tax reduction changes household income and relative prices. A sovereign-risk shock affects borrowing costs, exchange rates and expenditure. These channels interact, so a policy label alone does not determine the outcome.

The contribution of these chapters is a set of reproducible experiments, accompanied by an account of what they establish. The experiments are local model responses around solved stationary equilibria. They are neither forecasts for Armenia nor empirical estimates of policy effects. Their value lies in the conditional comparisons they permit. A numerical result becomes informative when the reader can identify the shock, financing, expectations, monetary response and calibration that generated it.

Three applications organize the research draft. The first compares seven fiscal instruments and the consequences of monetary sequencing. The second examines financial disturbances and the possibility that weak domestic demand coexists with resilient measured GDP. The third studies a lower inflation target, separating the historical 4-to-3 episode from hypothetical 3-to-2 experiments and from learning about a staged announcement.

The central discipline is to retain the same underlying nominal rigidities when comparing fiscal policy and disinflation. Parameters should change because evidence or a clearly labeled sensitivity exercise justifies the change. They should not be chosen to make one experiment produce a more attractive answer. The draft therefore preserves the large disinflation responses as diagnostic findings, alongside the alternatives that explain them.

2. How to read the assembled results

The evidence comes from several saved Armenia research branches. Region count, monetary closure, shock duration and solution date differ across them. A larger model can add a trading partner without making an older simulation directly comparable to a newer one. The complete archive accompanies this draft so that a reader can reconstruct the particular experiment behind each table.

Branch A is the seven-region standard-shock package used for the recent target-change diagnosis. It contains two-year Armenian fiscal shocks, sequential policy-rate holds, risk experiments and several target reductions. Its original incremental monetary rule differs from the rule saved in the separate cross-region fiscal audit, called Branch B here. Branch B reports shocks originating separately in all seven regions. Its own-region multipliers are not Armenian spillovers.

The three-region harmonized release, five-region research calibration and older financial-shock release remain valuable reference points. They retain their original dates and qualifications in the appendix. The Armenia-Georgia seven-region paper documents a calibration branch; it does not supply a fresh set of dynamic experiments for every question considered in the new chapters.

All newly quoted activity numbers are percent deviations from an experiment-specific baseline. Inflation and interest-rate responses are percentage-point changes unless explicitly described as annual inflation levels. A 1 percent of GDP fiscal intervention specifies the instrument change, not an assumption that output rises by 1 percent. Two years of intervention contain two annual fiscal flows.

The compilation preserves the published book as Part I, adds these draft chapters as Part II, and places complete available result reports in Part III. Archived report titles and author credits are retained for provenance. They do not establish an agreed author list for a new edition. This working compilation has not been approved as a new Central Bank of Armenia publication.

3. Households, firms and the policy mechanism

GIMF links household decisions, production, fiscal accounts and international trade in a single accounting framework. Overlapping-generations households give public debt and fiscal changes effects that need not disappear through a representative household's complete offset of future taxes. Liquidity-constrained households respond more directly to current disposable income. This distinction matters when comparing targeted transfers with transfers distributed more broadly.

Firms employ labor and capital, purchase intermediate goods and sell across domestic and foreign markets. Investment changes capital gradually. Wage and price adjustment costs delay nominal responses, while real adjustment costs affect consumption and investment. The financial accelerator adds a connection between balance sheets and the cost of external finance. These mechanisms make the composition and timing of a shock consequential.

Capital accumulation can be summarized as K(t+1) = (1 - depreciation) K(t) + investment(t), with the full source equations specifying adjustment costs and sector details. A fiscal intervention also satisfies a budget constraint: additional spending or lower revenue must appear in debt, financing costs or an offsetting fiscal instrument. The archived multiplier exercises should not be read as debt-stabilization programs when their debt feedback is inactive.

A useful demand identity is real output = consumption + investment + government demand + net exports, subject to the model's real-volume accounting. The diagnostic tables use the model's Fisher real GDP measure rather than simply summing percentage changes in components. Import compression or an export response can offset weaker household consumption and private investment. A positive GDP response to a risk shock therefore does not by itself imply an improvement in welfare.

The code is the authoritative equation record. Some older documents refer to different equation counts because calibration and operational closures, and model branches, differ. The current seven-region disinflation source has 4,704 operational equations. Its stationary residual is below 10^-8. The transition calculations solve the linearized system around that equilibrium; satisfying that linear system does not establish an accurate nonlinear response to a large disturbance.

4. Armenia and its six external regions

The current seven-region configuration contains the United States, Armenia, the euro area, Russia, the rest of the world, China and Georgia. Armenia is R2. The expansion creates separate trade and policy channels for partners that would otherwise be absorbed into a residual region. It is useful for asking whether an Armenian outcome is driven by domestic policy or by developments in different external economies.

The calibration is a research accounting system assembled from measured aggregates, inherited structural coefficients and explicit proxies. Those categories must remain distinguishable. The available Armenia reference settings include a 3 percent inflation target, government debt of 48 percent of GDP, government investment of about 5.5 percent of GDP and structural import openness of 55 percent. These are calibration inputs, not statements about today's observed economy.

Structural openness was set below recorded gross trade partly to limit the influence of re-exports. This does not create a separate measured re-export sector. Some bilateral shares rely on dated observations or EU-for-euro-area proxies. The five-region source describes these limitations in its data-lineage file; adding regions does not automatically repair those inputs.

The model also does not acquire explicit remittances, tourism, transit, sanctions or an energy-production block simply because Russia, China or Georgia is separately named. A study centered on one of these mechanisms needs the relevant equations and data. Otherwise the result describes the trade and financial-price channels actually included.

A further limitation concerns fiscal residuals. In the seven-region work, the Chinese fiscal perimeter can imply negative residual general transfers. That is a warning about the calibration and interpretation of the residual instrument. It is not evidence of a measured transfer program. Cross-country comparisons involving that branch should therefore be treated as research diagnostics until fiscal definitions are reconciled.

Region	Model role
United States	R1: external demand and financial conditions
Armenia	R2: domestic policy and household outcomes
Euro area / Russia	R3 / R4: distinct external policy and trade channels
Rest of world	R5: residual global accounts
China / Georgia	R6 / R7: additional named trading partners

5. Seven fiscal instruments

Branch A compares seven Armenian fiscal expansions. Each instrument changes by 1 percent of initial Armenian GDP in each of two years, with the sequence announced at the start. Spending and transfers rise; tax experiments reduce the relevant tax. The normal-policy column uses the archived endogenous monetary rule. These comparisons condition on the saved financing and household structure.

Public investment has the largest first-year GDP effect in this set and a larger second-year effect. Government consumption also has a substantial immediate effect. Targeted transfers produce a larger response than general transfers because the marginal recipient allocation differs. The ranking is a model property under the given normalization. It does not constitute a ranking of social returns or distributional desirability.

The VAT experiment deserves special care. A tax reduction changes the consumer price index directly as well as affecting demand. Headline inflation can fall while demand strengthens. A policymaker who reacts mechanically to that headline movement can generate a different output path from one who looks through the direct tax effect. The archived reports show the GDP deflator as an additional price measure.

For a two-year intervention, the cumulative two-year multiplier divides the sum of the two annual output gains by the sum of the two annual fiscal flows. With equal 1-percent flows, it is the average of the first two annual GDP responses. Adding the annual responses without dividing by two would overstate that multiplier.

Two-year expansion	GDP Y1: normal	GDP Y2: normal	GDP Y1: sequential
Government consumption	0.54	0.48	0.59
Government investment	0.71	0.78	0.82
Targeted transfers	0.31	0.30	0.34
General transfers	0.13	0.12	0.14
Labor tax cut	0.17	0.19	0.18
Capital tax cut	0.20	0.21	0.23
VAT cut	0.24	0.24	0.26

Source: Branch A, 80-year solutions. Activity is percent from baseline. Sequential policy decisions are described in Chapter 6; they are not an announced two-year peg.

6. Monetary sequencing changes the comparison

A fiscal multiplier depends on how monetary policy responds. If additional demand or a direct tax-price effect changes expected inflation, the policy rule can amplify or offset the intervention. The alternative labeled sequential holds is designed to examine a sequence of rate decisions while respecting the history that actually occurred.

The first decision holds the policy rate in Year 1. When the next decision is made, the model is solved again using the realized lagged state. The second-year hold is a fresh decision. It should not be described as a fully anticipated two-year rate commitment announced at the beginning of Year 1. Anticipation changes private decisions before the second decision is taken.

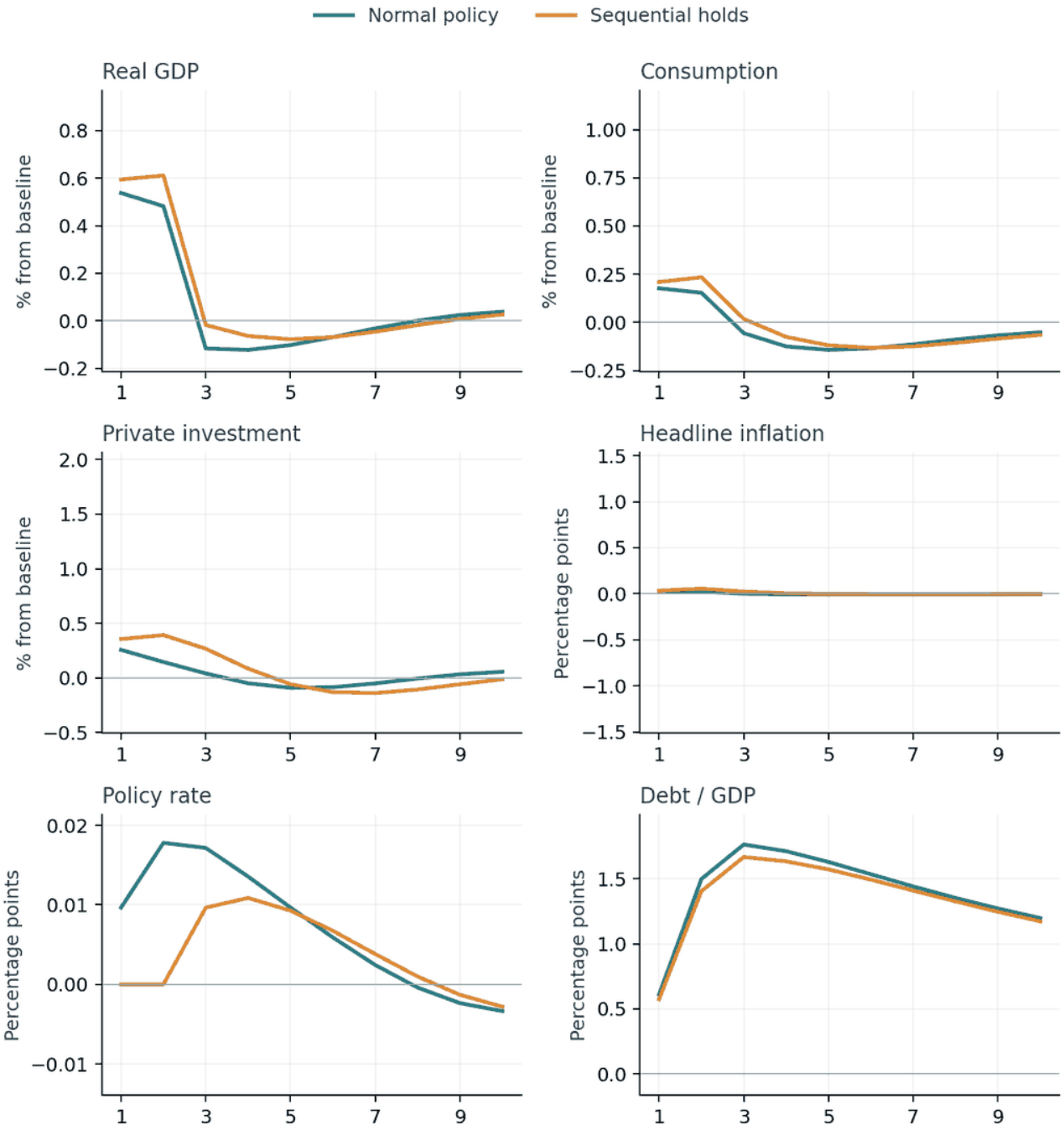
For government consumption, first-year output rises about 0.54 percent under the normal rule and 0.59 percent with sequential holds. The second-year responses are about 0.48 and 0.61 percent. Government investment produces about 0.71 and 0.82 percent in Year 1, respectively. The six-panel figures that follow retain consumption, investment, inflation, interest rates and debt so that the GDP comparison is not isolated from its mechanism.

These experiments demonstrate why a fiscal simulation needs an explicit monetary assumption. They do not establish that keeping the rate fixed is preferable. A rate hold can change the inflation path, real borrowing conditions and debt dynamics. Those consequences belong in the policy assessment.

A useful next experiment is to compare a fixed total fiscal envelope allocated across investment, targeted support and tax relief. It should use a common financing rule, common nominal parameters and an explicit rate-decision information set. That would turn the instrument catalogue into a comparison of concrete budget choices. Such a package has not yet been computed in this draft.

Fiscal atlas 1. Government consumption

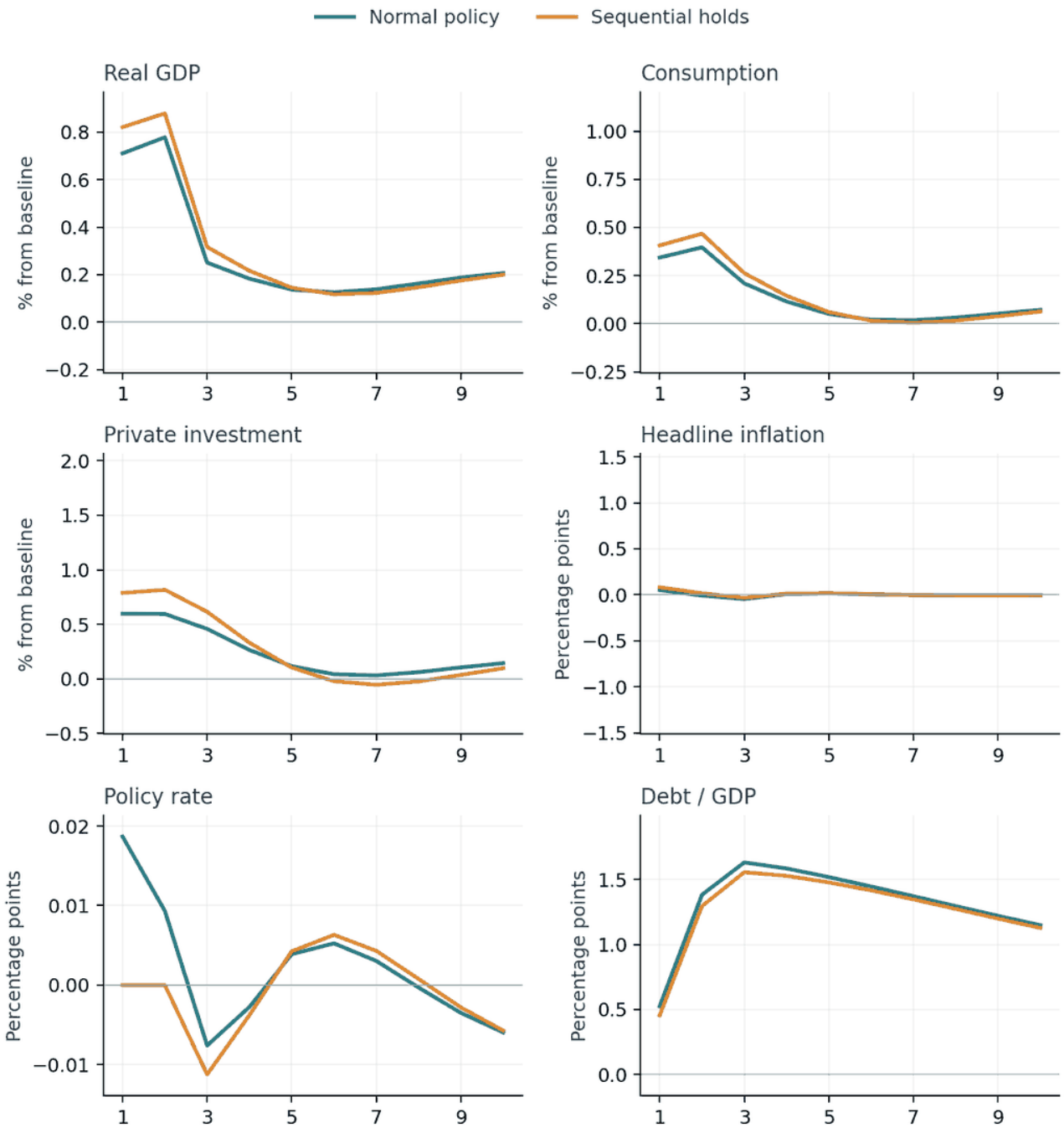
Armenian intervention: 1 percent of initial GDP in each of Years 1 and 2. Both fiscal flows are announced initially. The teal line uses normal policy; the orange line uses sequential policy-rate holds. All panels show Armenian responses. See Chapter 6 for the timing of the fresh monetary decisions.



Source: Branch A, 80-year linearized solution; first ten years displayed. Each variable uses a common vertical scale across all seven fiscal instruments. Inflation and rates are percentage-point changes, not percent changes. Small price and rate responses can appear nearly flat on these common scales; raw values are in the response CSV.

Fiscal atlas 2. Government investment

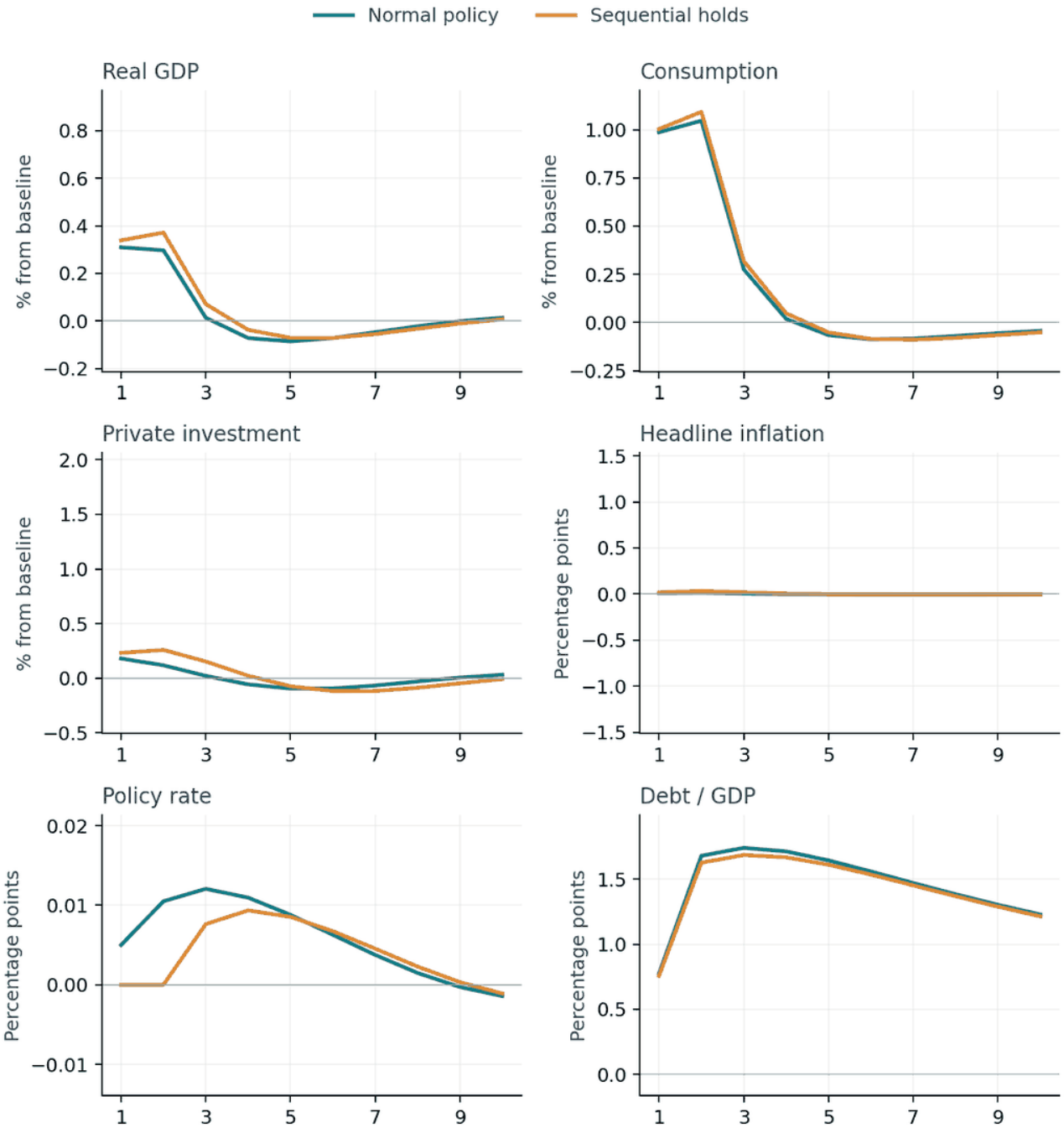
Armenian intervention: 1 percent of initial GDP in each of Years 1 and 2. Both fiscal flows are announced initially. The teal line uses normal policy; the orange line uses sequential policy-rate holds. All panels show Armenian responses. See Chapter 6 for the timing of the fresh monetary decisions.



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Fiscal atlas 3. Targeted transfers

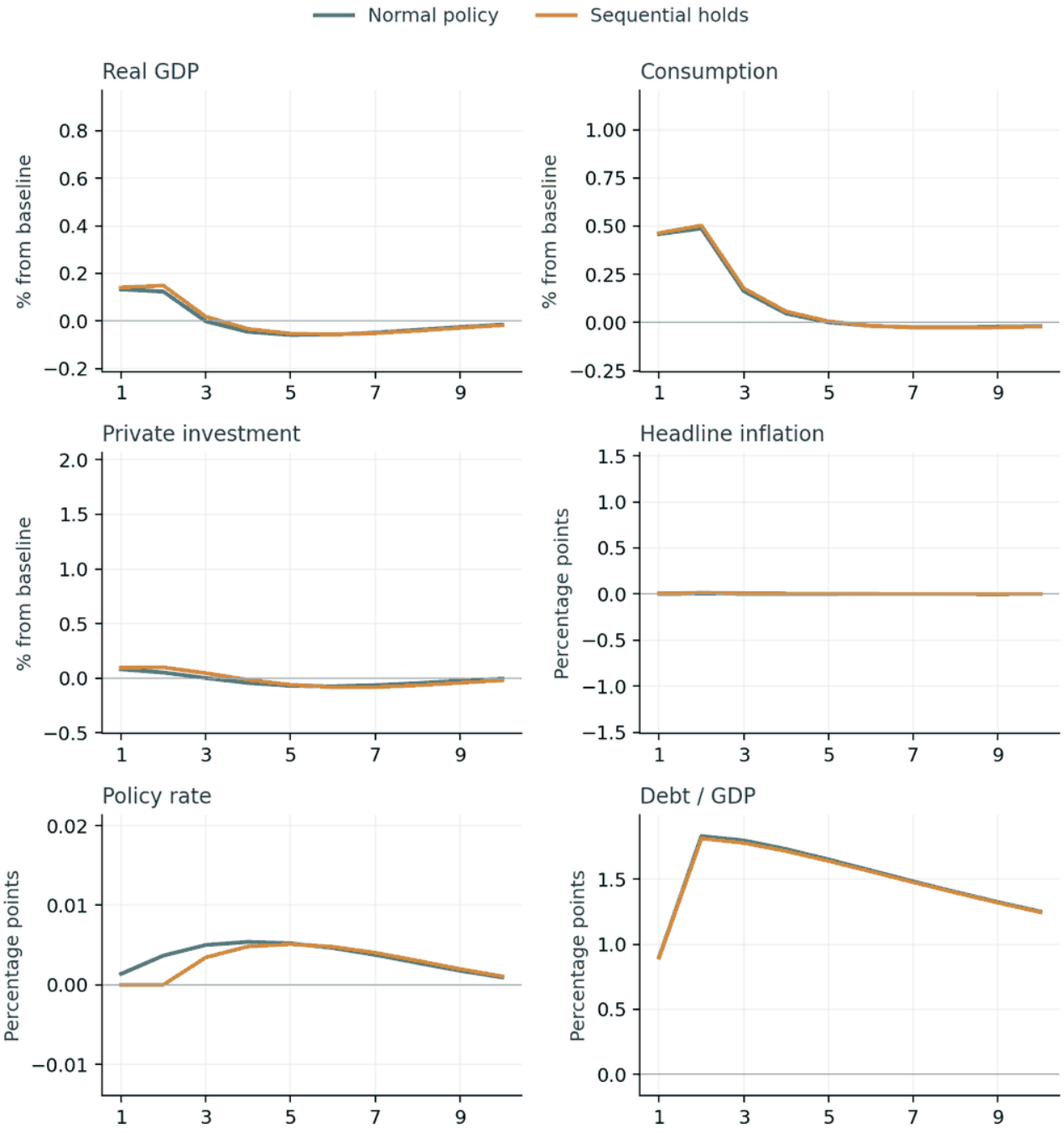
Armenian intervention: 1 percent of initial GDP in each of Years 1 and 2. Both fiscal flows are announced initially. The teal line uses normal policy; the orange line uses sequential policy-rate holds. All panels show Armenian responses. See Chapter 6 for the timing of the fresh monetary decisions.



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Fiscal atlas 4. General transfers

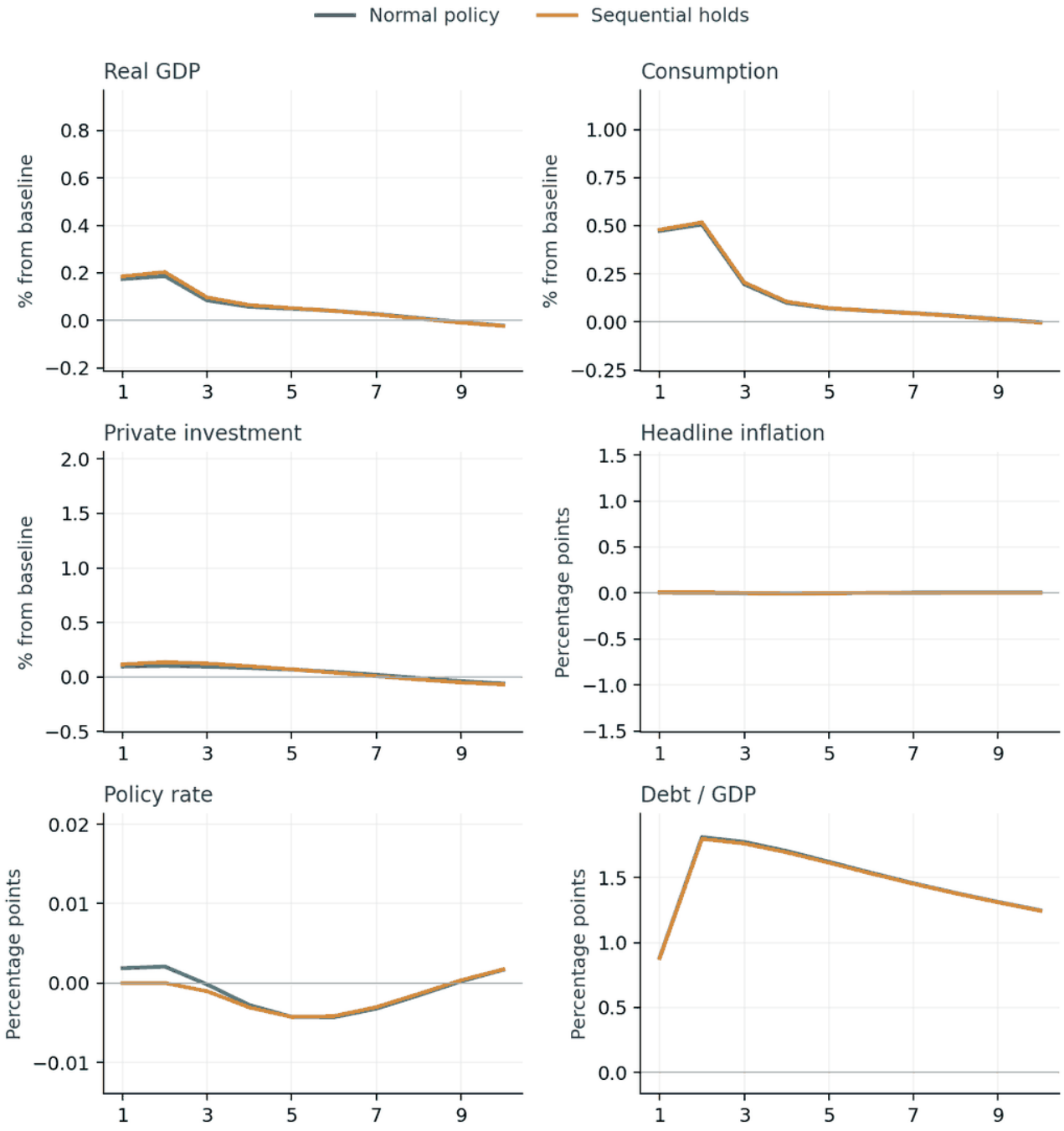
Armenian intervention: 1 percent of initial GDP in each of Years 1 and 2. Both fiscal flows are announced initially. The teal line uses normal policy; the orange line uses sequential policy-rate holds. All panels show Armenian responses. See Chapter 6 for the timing of the fresh monetary decisions.



Source: Branch A, 80-year linearized solution; first ten years displayed. Each variable uses a common vertical scale across all seven fiscal instruments. Inflation and rates are percentage-point changes, not percent changes. Small price and rate responses can appear nearly flat on these common scales; raw values are in the response CSV.

Fiscal atlas 5. Labor tax cut

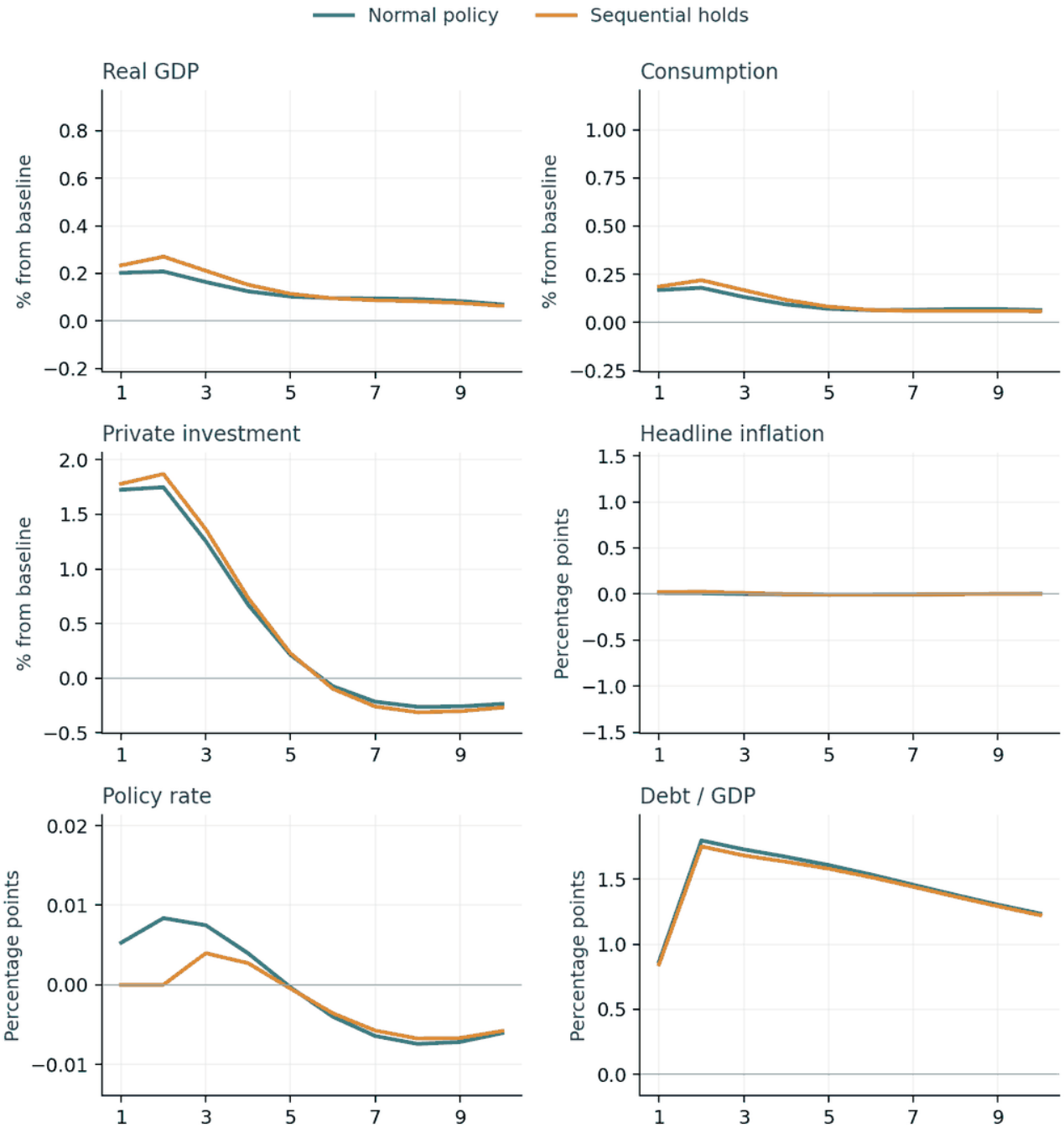
Armenian intervention: 1 percent of initial GDP in each of Years 1 and 2. Both fiscal flows are announced initially. The teal line uses normal policy; the orange line uses sequential policy-rate holds. All panels show Armenian responses. See Chapter 6 for the timing of the fresh monetary decisions.



Source: Branch A, 80-year linearized solution; first ten years displayed. Each variable uses a common vertical scale across all seven fiscal instruments. Inflation and rates are percentage-point changes, not percent changes. Small price and rate responses can appear nearly flat on these common scales; raw values are in the response CSV.

Fiscal atlas 6. Capital tax cut

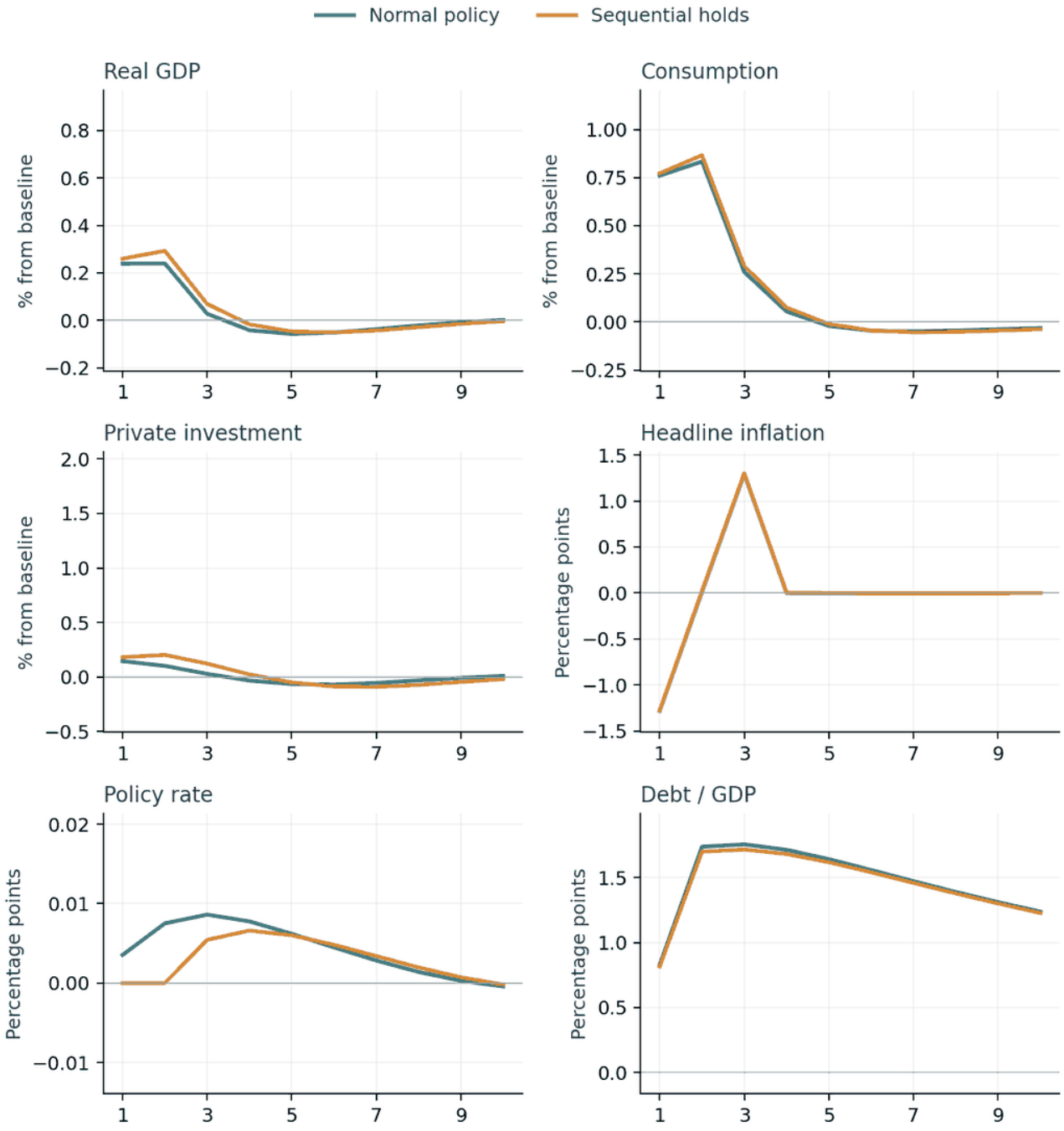
Armenian intervention: 1 percent of initial GDP in each of Years 1 and 2. Both fiscal flows are announced initially. The teal line uses normal policy; the orange line uses sequential policy-rate holds. All panels show Armenian responses. See Chapter 6 for the timing of the fresh monetary decisions.



Source: Branch A, 80-year linearized solution; first ten years displayed. Each variable uses a common vertical scale across all seven fiscal instruments. Inflation and rates are percentage-point changes, not percent changes. Small price and rate responses can appear nearly flat on these common scales; raw values are in the response CSV.

Fiscal atlas 7. VAT cut

Armenian intervention: 1 percent of initial GDP in each of Years 1 and 2. Both fiscal flows are announced initially. The teal line uses normal policy; the orange line uses sequential policy-rate holds. All panels show Armenian responses. See Chapter 6 for the timing of the fresh monetary decisions.



Source: Branch A, 80-year linearized solution; first ten years displayed. Each variable uses a common vertical scale across all seven fiscal instruments. Inflation and rates are percentage-point changes, not percent changes. Small price and rate responses can appear nearly flat on these common scales; raw values are in the response CSV.

7. A separate cross-region fiscal audit

The cross-region audit asks whether the seven-region calibration produces intelligible fiscal properties in each region. It applies a two-year intervention of 1 percent of the originating region's GDP in each year and reports that region's output. The table below therefore compares own-region responses. It does not show what happens to Armenia when each foreign government spends more.

This audit is Branch B. Its saved monetary settings are rate smoothing of 0.30 and inflation feedback of 1.00, with weights of 0.25 on current and 0.75 on next-year inflation. Branch A uses an incremental rule with a different weighting and response structure. Even when nominal adjustment costs are harmonized, these fiscal tables are not one interchangeable sample.

The first-year government-consumption multiplier is smaller in Armenia and Georgia than in several larger regions. Import leakage is one possible channel within this structural calibration. The model is not an empirical cross-country regression, and the comparison also reflects fiscal composition, household behavior and policy closure. The ranking should be interpreted through those mechanisms rather than attributed to openness alone.

Branch B passes its saved numerical equilibrium and linear-equation checks, including an alternative-horizon comparison. Those checks establish computational consistency of the saved exercise. They do not resolve the negative Chinese residual transfer or convert inherited coefficients into estimated country parameters.

Before combining these results with a policy recommendation, a common-rule rerun should align policy closure, shock timing and financing. The complete audit report is retained in Part III, and its raw CSV is included in the companion archive. The branch distinction is part of the result.

Own-region GDP, Year 1	Government consumption	Government investment
Armenia	0.56	0.82
Georgia	0.64	0.85
Russia	0.92	1.47
China	1.04	1.13
Euro area	0.95	1.38
United States	1.09	1.52
Rest of world	1.04	1.41

8. Financial stress and the GDP puzzle

A country-risk disturbance need not reduce every aggregate in the same direction. In the current seven-region standard-shock branch, an Armenian government-risk component shock of 100 basis points with persistence 0.7 produces a positive first-year GDP response of about 0.56 percent, even as consumption and private investment decline. Export expansion and import compression help explain the difference.

That result should not be presented as a beneficial crisis. GDP measures production. Consumption, investment, real borrowing costs, balance sheets and the external adjustment describe different consequences. A useful financial-risk assessment reports those outcomes together and asks whether the implied exchange-rate and trade responses are plausible for the policy question.

The distinction between a primitive risk component and the aggregate premium also matters. The source includes a government-risk-to-FX-premium linkage. A 100-basis-point shock to the government component need not mean a 100-basis-point change in the total wedge relevant for uncovered interest parity. In the five-region calibration, the documented 0.66 loading makes the combined impact 166 basis points.

The five-region report illustrates sensitivity to persistence: first-year GDP is about unchanged at persistence 0.7 and falls about 0.33 percent at 0.9, while consumption and investment fall in both settings. These numbers come from a different calibration branch. Their purpose here is to show why persistence and external adjustment must be inspected, not to substitute them into the seven-region table.

The older three-region financial report contains three distinct disturbances: a sovereign-risk shock, an external-finance riskiness shock scaled to an initial debt-weighted premium increase, and a sector capital/net-worth destruction shock. The latter changes capital as well as balance sheets; it is not a pure household wealth loss. The full legacy report and code are retained in the appendix and archive.

A persuasive Armenia application would compare risk persistence and an explicit mitigating fiscal package, keeping the primitive shock and premium normalization visible. It would also show the probability of default and borrowing spread where supported by that branch. Those experiments can illustrate GIMF's joint fiscal-financial mechanism, but no new combined package has been solved for this draft.

9. The reaction function behind disinflation

The original annual seven-region target-change source uses an incremental policy rule. In gross-rate notation its Armenian equation is shown below. PIE is gross inflation, PIESTAR the gross inflation target, INTMP the gross policy rate, and SINT the monetary disturbance. One model period is one year.

Original rule
INTMP(t) = INTMP(t-1) x [PIE(t)/PIESTAR(t)]^0.375
x [PIE(t+1)/PIESTAR(t+1)]^0.125 x SINT(t).

In an approximate net-rate representation, the change in the nominal rate responds to 0.5 times a weighted inflation gap: 0.75 on current inflation and 0.25 on next-year inflation. The previous nominal rate enters directly. There is no explicit target-change term in that archived equation.

Target-adjusted diagnostic
Multiply the right-hand side by PIESTAR(t)/PIESTAR(t-1). This smooths the nominal rate relative to the inflation target. At a constant target, the original and adjusted rules coincide. During a target change, the new term permits the nominal benchmark to move with the target.

The orange-line diagnostic uses this target adjustment. A separate additive policy disturbance can be linked to the target cut. The initial 1-percentage-point impulse largely reverses the adjustment; reducing the impulse to 0.1 percentage point produces a smaller tightening. This is an imposed policy-rule shock. It is not a demonstrated increase in the economy's equilibrium real interest rate.

With a single common driver, a target-down and rate-shock-up pair has perfect negative correlation when both variables retain their signed units. Their magnitudes have positive correlation. Perfect correlation does not require equal amplitudes: a 1-percentage-point target cut can be paired with a 0.1-percentage-point policy impulse. This deterministic illustration specifies a linked sequence, not an estimated stochastic correlation.

A further diagnostic shifts the Armenian inflation-gap terms to one and two years ahead, preserving the 0.75/0.25 weighting. It corresponds to the desired four- and eight-quarter horizons in an annual model. Foreign policy rules remain unchanged. The draft treats each of these choices as a separate specification rather than silently replacing the source rule.

10. Why the 3-to-2 responses are large

The original permanent target reduction generates a first-year GDP decline of about 5.18 percent and an investment decline of about 10.29 percent. Inflation falls below the new target immediately. These magnitudes triggered the diagnosis. The archived equations were reproduced, but replication alone does not make such large first-order responses suitable policy estimates.

The target-adjusted policy rule reduces the first-year GDP decline to about 1.76 percent. Adding the smaller, linked 0.1-percentage-point monetary impulse increases the decline to about 2.09 percent. Moving the inflation terms to one and two years ahead, while retaining that small impulse, gives a first-year decline of about 1.51 percent and a second-year decline of about 2.02 percent. These are conditional experiments, not a confidence interval.

Why can the nominal rate fall and disinflation still be contractionary? Expected inflation also falls. The relevant ex ante real rate can rise, while backward-looking wage and price indexation makes a lower nominal inflation path costly. The target-adjusted rule removes one source of inherited nominal-rate inertia but leaves those adjustment mechanisms in place.

The stationary endpoint is a separate question. A nonlinear equilibrium at the 2 percent target has been solved; its long-run real activity is essentially unchanged relative to the initial stationary equilibrium. That verifies the endpoint, not the transition. The first-order transition paths do not pass a full nonlinear-equation tolerance of 10^-8 when evaluated in the nonlinear system.

Consequently, the book should not quote a single number as the cost of Armenia reducing its target from 3 to 2. It can explain the mechanisms, show specification sensitivity and state the remaining work: empirical parameter review, a credible information structure and a nonlinear transition check at the policy-relevant amplitude.

Annual diagnostic	GDP Y1 (%)	CPI Y1 (%)
Original rule	-5.18	1.41
Target-adjusted rule	-1.76	2.34
Adjusted + 0.1 pp policy impulse	-2.09	2.25
One-/two-year forward rule + impulse	-1.51	2.40

CPI columns are annual inflation levels; initial target 3 percent, final target 2 percent. The first three cases use the original current/next-year horizons. The final case changes only the Armenian horizons. Sources: diagnosis CSVs and validation report.

11. Annual frequency and common rigidities

The frequency audit finds FREQU = 1. The target changes from a gross annual value of 1.03 to 1.02. No factor-of-four shock-scaling error has been established. The recovered upstream source is also annual. Dividing an adjustment-cost coefficient by four or sixteen solely because the result looks large would not be an evidence-based conversion.

The harmonized settings include an aggregate wage adjustment coefficient of 216 and upstream price coefficients of 108. Those settings apply across regions in the recent fiscal work. The nominal adjustment system also uses past inflation indexation in the original Armenian specification. Rational knowledge of a target announcement does not automatically remove that contractual indexation.

Lower-rigidity diagnostics make the first-year GDP contraction smaller. Reducing the wage coefficient to 48 and the upstream coefficients to 24 together gives roughly a 0.66 percent first-year decline under the forward-horizon diagnostic, compared with about 1.51 percent at the harmonized settings. But the recovered historical values do not by themselves establish a validated Armenian empirical calibration.

The fiscal and disinflation exercises should therefore retain the harmonized parameters in the main comparison. If empirical work justifies a change, the fiscal experiments should be rerun under the same revised values. Otherwise the apparent difference in costs would partly reflect using different economic structures to answer different questions.

The audit distinguishes three levels of validation. Stationary equations check the calibration and final equilibrium. Linear transition equations check the computation conditional on a local approximation. Nonlinear transition equations test whether that approximation is adequate at the chosen shock size. The current work passes the first two levels; a validated nonlinear disinflation transition remains outstanding.

This distinction is also the reason to keep large GDP and investment responses visible in the archive. They are useful diagnostic evidence about the interaction of indexation, nominal inertia and expectations. They should not be turned into a forecast by relabeling the axes or suppressing an inconvenient path.

12. Learning about a staged announcement

The proposed experiment is intuitive. The authority announces a reduction from 3 to 2 percent in four steps of 0.25 percentage point. The public believes each delivered step will last, but initially does not believe the remaining announced cuts. Delivery then reveals the next step. This can separate credibility about the current target from credibility about the promised future path.

The requested timetable is four quarters within one year. The available GIMF implementation is annual. The completed timing diagnostic therefore spreads the four steps across four years. It is not an implementation of the requested quarterly experiment. Interpreting its first year as its first quarter would change adjustment speeds, discounting and shock duration without rebuilding the model.

The annual diagnostic keeps the harmonized wage and price coefficients unchanged. Full credibility and delivered-step learning share the same implemented target sequence and the same small linked policy impulses: 0.025 percentage point in each step, totaling 0.1 percentage point. Each learning vintage is solved using the actual lagged state. Conditional inflation and target forecasts in the policy rule use the same information vintage.

The result is more nuanced than a uniformly higher disinflation cost. Learning reduces the immediate response and delays the trough. Over the first five years, cumulative output loss is smaller under learning. Over ten and twenty years, it is slightly larger. The comparison depends on the observation window, so the book reports all three rather than selecting the one that supports a preferred story.

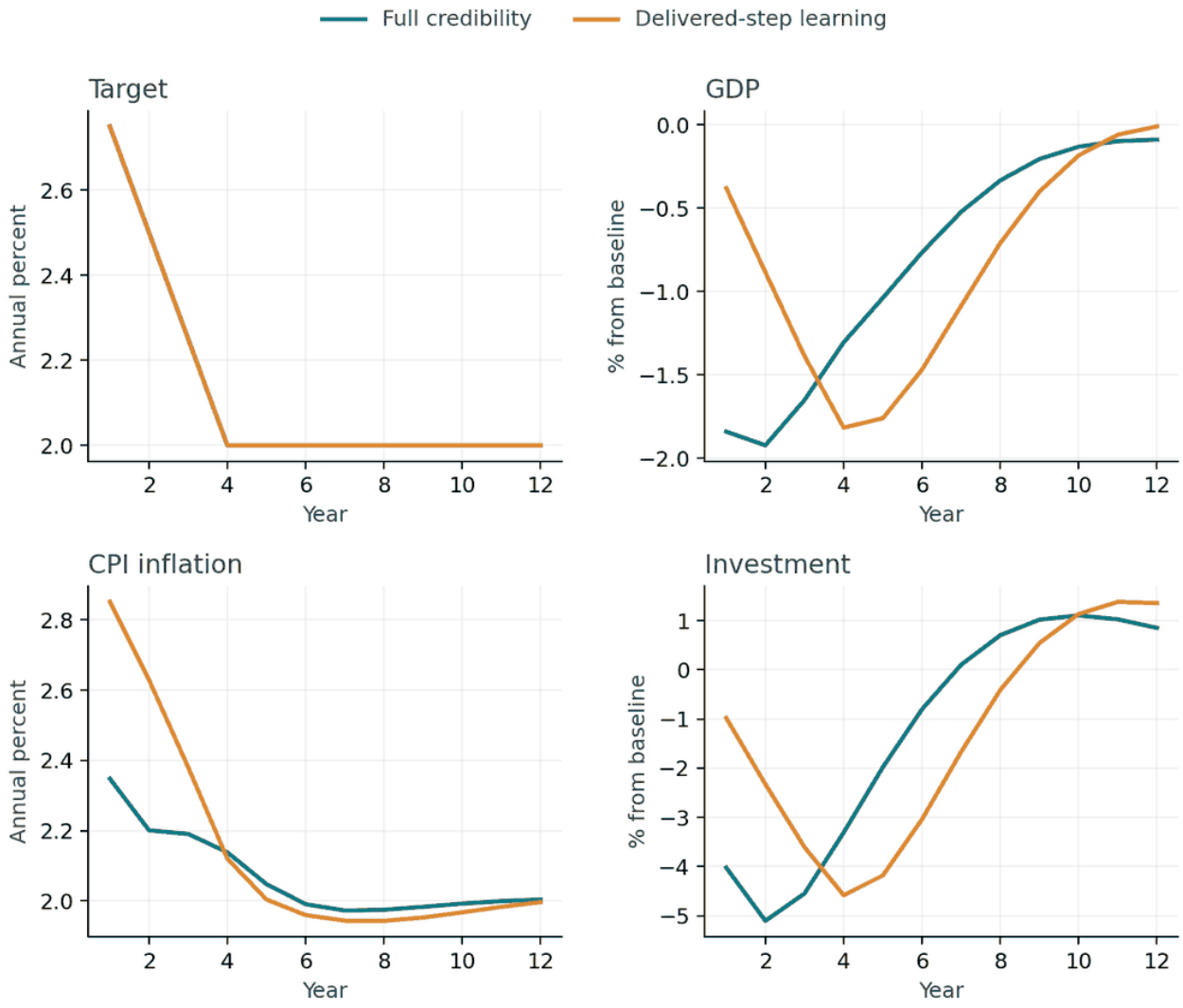
A defensible next step is to implement a consistently quarterly model, or to study annual staged policies as annual policies. The quarterly version needs a frequency conversion of the full economy and a verified steady state. If the central bank knows more than the public about future delivery, its information set and policy behavior also need an explicit treatment.

Four-year diagnostic	Full credibility	Delivered-step learning
GDP Year 1 (%)	-1.84	-0.38
GDP trough (%) / year	-1.92 / 2	-1.82 / 4
Cumulative loss, 5 years	7.75	6.22
Cumulative loss, 10 years	9.70	10.07
Cumulative loss, 20 years	10.19	10.47

Cumulative losses are negative sums of GDP deviations, in percentage-point years, with no discounting. These are annual four-year timing experiments. They are not the proposed one-year quarterly policy.

Learning atlas. Same delivered target, different beliefs

The implemented target is common to both cases. Beliefs about future steps differ. The full-credibility case anticipates all four annual reductions; delivered-step learning anticipates no additional reduction beyond the target already delivered. The lagged state is carried into each subsequent solution.



Source: annual_staged_learning_responses.csv, 80-year solutions. The target and CPI panels show annual percentage levels. GDP and investment are percent deviations from the unchanged-target baseline. The adjustment-cost coefficients remain those of the harmonized fiscal calibration.

Numerical checks validate the conditional linear plans at each information vintage. An independent superposition check reproduces the surprise-step construction within the saved tolerance. These checks support the implemented annual experiment; they do not validate a quarterly interpretation or a nonlinear transition.

13. Armenia's 4-to-3 decision in context

The historical episode should begin with the information available before the target changed. Inflation had already fallen sharply: from 8.3 percent in December 2022 to -0.6 percent in December 2023, and to -1.2 percent in March 2024. It was about 0.6 percent in September 2024 and 1.4 percent in November. These are year-on-year readings, not annual averages. The fall cannot be attributed to a target reduction adopted later. [H1-H3]

The CBA published its analytical rationale for a lower target on 22 October 2024. The proposal was being discussed publicly by the governor's 29 October press conference. The 2025 budget, adopted on 4 December, incorporated the 3 percent target. The CBA issued its official explanatory statement on 10 December, with the new objective applying from 2025. This chronology does not support treating 12 November as the formal adoption date. [H1-H3]

The CBA's statement describes a 3 percent target with a variation band of plus or minus 1 percentage point. The band recognizes inflation variability; it should not be described as permission to aim persistently away from the target. The historical change was from a 4 percent objective to a 3 percent objective. It was not the start of a conventional experiment in which the economy begins at a steady 4 percent inflation rate and policy then engineers the entire decline. [H2]

An opportunistic interpretation is therefore plausible: favorable inflation developments created an opportunity to consolidate a lower nominal anchor. Commodity and food-price developments, dram appreciation and earlier monetary restraint were among the background forces. That interpretation does not establish that lowering the target had no incremental cost, that expectations were already fully anchored at 3 percent, or that the same opportunity exists for a move from 3 to 2. [H2-H4]

The book's historical claim is deliberately narrower: much of the observed disinflation preceded the formal target change. The model question is the incremental consequence of choosing a lower anchor from that initial state. It requires a counterfactual, not a comparison of annual GDP growth before and after the announcement.

14. WEO revisions and the lower-anchor opportunity

Successive IMF World Economic Outlook vintages provide an external record of how the inflation outlook changed. They are useful evidence about the environment in which the CBA acted. They are not the board's own forecasts, and a revision does not identify the effect of a policy decision. Average-year and end-year inflation must also be kept separate. [W1-W3]

Between April and October 2024, the WEO forecast for Armenia's 2024 average inflation fell from 3.1 to 0.2 percent. The forecast for 2025 average inflation fell from 3.7 to 3.1 percent. Yet the terminal 2029 average inflation forecast stayed at 4 percent. This combination is consistent with substantial near-term disinflation news alongside the old long-run anchor. It predates the December formal statement. [W1-W2]

In April 2025, the WEO showed 2024 average inflation of 0.3 percent and forecast 3.2 percent for 2025 and 3 percent for 2026. Its terminal 2030 forecast was 3 percent. The later terminal figure is consistent with incorporation of the new target. It does not measure credibility or establish that changing the target caused the intervening forecast revisions. [W3]

Doug's proposed story can therefore be framed as a testable question: did an unusually low inflation outlook create an opportunity for the board to lock in a lower anchor? The next historical step is to align CBA forecast vintages, speeches and board decisions on the same calendar, recording the forecast horizon and policy assumptions in each case.

The relevant model comparison would hold favorable initial shocks and inherited states fixed, then compare retaining a 4 percent target with adopting 3 percent. That incremental target-choice experiment differs from a permanent target shock imposed on a stationary 4 percent economy. It has not yet been solved from an historically reconstructed initial state.

WEO vintage	2024 average	2025 average	Terminal average
April 2024	3.1	3.7	4.0 (2029)
October 2024	0.2	3.1	4.0 (2029)
April 2025	0.3	3.2	3.0 (2030)

Annual CPI inflation, percent. Source: IMF WEO Statistical Appendix, Table A7, April 2024, October 2024 and April 2025. Later figures may be historical estimates rather than forecasts; terminal years differ. Original PDFs are preserved in the companion archive.

15. Research questions for the weekend

Fiscal composition under a common budget envelope. Compare a two-year investment program with targeted transfers or tax relief, using the same ex ante fiscal cost and financing rule. Report consumption, private investment, output, inflation and debt, including spillovers. This would illustrate why a structural fiscal model is useful when the same deficit can finance very different policies. The present instrument catalogue provides the starting point, but the combined packages need to be solved.

Risk, policy response and domestic living standards. Compare a temporary sovereign-risk disturbance with a more persistent one and examine a precisely specified mitigation package. Show the premium components and consumption alongside GDP. This would demonstrate how trade adjustment can conceal a large domestic-demand deterioration, and why a positive GDP response is not an adequate welfare verdict.

A lower target when inflation is already low. Use the documented 2024 forecast revisions to design common initial conditions. Compare retaining the old anchor with consolidating a lower one, under full and imperfect credibility. Preserve the fiscal nominal rigidities. This would connect the historical decision to a model question without attributing the earlier inflation fall to the later announcement.

The immediate request to Global Forecasting School colleagues is for one or two collaborators to help choose one or two of these questions, or propose better ones, today. Each suggestion needs only the policy question, the shock or comparison, and the mechanism that makes GIMF informative. A short, concrete proposal is more useful at this stage than a long research outline.

Weekend work on 14-15 November can then begin from a frozen source branch: confirm the experiment, retain the baseline, run the comparison and inspect all relevant outcomes. An application is ready for discussion when another researcher can identify what changed and reproduce it. A finished empirical paper or a validated nonlinear disinflation estimate should not be promised before those steps are complete.

16. Reproducibility and the publication threshold

The companion archive contains the available Armenia result reports and replication packages from the three-, five- and seven-region branches, together with the current disinflation diagnosis, raw response tables, learning vintages and the build source for these draft chapters. The original published PRM book is also preserved. A manifest records file sizes and SHA-256 hashes so that the materials used in this compilation can be identified.

Begin with START_HERE in the companion archive. The branch registry identifies which report belongs to which model, shock duration and monetary closure. Use each nested package's own reproduction instructions; scripts from different branches are not interchangeable. The disinflation diagnosis has its own audit instructions and should not be regenerated by blindly invoking the historical standard-shock launcher.

For the linear experiments, the numerical checks include full-system residuals and alternative solution horizons. The current stationary equilibria have been solved independently where noted. The larger disinflation paths remain first-order diagnostics with an outstanding nonlinear transition test. The annual learning construction has conditional-vintage checks and an independent shifted-shock check.

A publishable application also needs economic validation. Fiscal categories must correspond to the intervention being discussed. A risk premium must be normalized to the wedge actually shocked. Forecast vintages must use the same inflation concept. Assumed credibility must be explicit. A region label must not stand in for an omitted channel such as remittances or energy.

The next substantive revision should reconcile the two seven-region monetary closures, finish the empirical calibration review and select a small number of policy applications. The existing model results provide a useful laboratory. Their qualifications are part of the research record, and keeping them visible makes the book a stronger basis for collaboration.

Sources and version notes

References H1-H4 and W1-W3 support the historical discussion. M1-M4 refer to the source model reports and archives reproduced with this compilation. New prose is a working synthesis; the published book retains its own references and editorial credits.

[H1] Central Bank of Armenia (22 October 2024), Inflation Target in Armenia.
https://www.cba.am/en/Publication/9428/

[H2] Central Bank of Armenia (10 December 2024), Official Statement on Inflation Target in Armenia.
https://old.cba.am/EN/News/Pages/news_10122024_02.aspx

[H3] CBA, 29 October and 10 December 2024 press-conference materials; Armenia budget-adoption report, 4 December 2024.
https://armenpress.am/en/article/1203528

[H4] IMF (December 2024), Republic of Armenia, Fourth Review under the Stand-By Arrangement, Country Report 24/348; staff report completed 22 November 2024.
https://www.imf.org/-/media/files/publications/cr/2024/english/1armea2024002-print-pdf.pdf

[W1] IMF, World Economic Outlook, April 2024, Statistical Appendix Table A7, printed page 148.
https://www.imf.org/en/Publications/WEO/Issues/2024/04/16/world-economic-outlook-april-2024

[W2] IMF, World Economic Outlook, October 2024, Statistical Appendix Table A7, printed page 125.
https://www.imf.org/en/Publications/WEO/Issues/2024/10/22/world-economic-outlook-october-2024

[W3] IMF, World Economic Outlook, April 2025, Statistical Appendix Table A7.
https://www.imf.org/en/Publications/WEO/Issues/2025/04/22/world-economic-outlook-april-2025

[M1] Armenia Seven-Region Standard Shocks (13 November 2026), Branch A. Current source, response CSV and solved-state audit in diagnosis package.

[M2] Armenia Seven-Region Fiscal Multiplier Audit (13 November 2026), Branch B. Raw table and archived effective state in separate audit package.

[M3] Armenia Disinflation Diagnosis, Validation Audit and Staged Disinflation Learning (13 November 2026). Individual CSVs, scripts and validation notes included.

[M4] Armenia Harmonized GIMF Working Paper; Armenia Five-Region Calibration and Properties; Armenia Three Financial Shocks; Armenia-Georgia Seven-Region Working Paper and Calibration Note. Complete source reports in Part III.

Armenia: Standard Shocks in a Seven-Region Model

Fiscal policy, country risk, and disinflation | 13 November 2026

This report starts with seven two-year fiscal easings, then examines a country risk premium shock and permanent inflation-target reductions. All paths are first-order simulations around audited nonlinear stationary equilibria. They are conditional research experiments, not forecasts.

Fiscal results: normal monetary policy

Fiscal easing	GDP Year 1	GDP Year 2	CPI Year 1	CPI Year 2
Government investment	0.711	0.778	0.051	-0.009
Government consumption	0.537	0.482	0.018	0.021
Targeted transfers	0.309	0.297	0.009	0.013
VAT cut	0.239	0.240	-1.283	0.009
Capital tax cut	0.202	0.208	0.011	0.008
Labor tax cut	0.174	0.186	0.004	0.002
General transfers	0.132	0.123	0.002	0.005

GDP: percent from baseline. Inflation: percentage points from baseline. The fiscal impulse lasts two years; headline inflation in the VAT experiment includes the direct tax-price wedge.

What stands out

Government investment produces the largest initial GDP response in this calibration. Targeted transfers have a larger response than general transfers. A VAT cut directly lowers tax-inclusive CPI inflation; that measurement effect is not a comparable decline in domestic production costs.

The sovereign risk experiment gives a small initial GDP increase, followed by adjustment. It must not be presented as an established recession scenario. The report separately shows a pure FX-risk wedge to make the shock definition transparent.

The disinflation experiments produce large output contractions under the inherited wage and price adjustment costs. These linear responses require nonlinear validation before drawing quantitative policy conclusions. No endogenous gain in credibility, productivity, or trend growth has been added.

Experiment definitions and policy sequencing

Layer	Specification
Fiscal	Government consumption, government investment, targeted transfers, general transfers, labor tax, capital tax, VAT. Two-year ex ante easing of 1% of initial GDP in each year, announced at inception.
Fiscal financing	A one-percentage-point deficit-target easing accompanies each fiscal instrument. General transfers are the source fiscal-budget residual and need not rise by exactly 1% of GDP after automatic responses. Other fiscal feedbacks remain active.
Monetary comparison	Normal policy versus sequential one-year holds. The first-year hold is known initially. At the start of year two a new hold is imposed, freezing the entire realized first-year history and re-solving the future. This differs from an initially announced two-year hold.
Country risk	A 100-basis-point increase in the sovereign premium component GBPREM, with annual persistence 0.7. Its exchange-rate-premium linkage remains active, so the aggregate premium is endogenous and can rise by more than 100 basis points.
FX-risk diagnostic	A separate 100-basis-point SFXPREM wedge, persistence 0.7, with no direct sovereign-component shock. This is not substituted for the main country-risk experiment.
Disinflation	Three independent permanent target changes: 4% to 3%, 3% to 2%, and 4% to 2%. Full credibility and immediate announcement. The nominal surplus anchor adjusts to preserve the stationary debt ratio to first order.

Historical motivation and counterfactual scope

The CBA official statement explains the move from a 4% inflation target to a 3% target for monetary-policy decisions in 2025, with a variation band of one percentage point on either side. The 2% endpoint here is hypothetical. These experiments do not reconstruct Armenia's actual historical disinflation.

Source: Central Bank of Armenia, Official Statement on Inflation Target in Armenia, December 2024. Official statement.

The model has Armenia, US, Russia, Georgia, China, euro area and residual world. The seven-region calibration retains harmonized nominal coefficients: wages 216; tradable/nontradable/investment prices 108; consumption prices 3.6; import prices 0.72.

Fiscal policy with sequential rate holds

Fiscal easing	GDP Year 1 Normal	GDP Year 1 Holds	GDP Year 2 Normal	GDP Year 2 Holds
Government investment	0.711	0.821	0.778	0.879
Government consumption	0.537	0.595	0.482	0.611
Targeted transfers	0.309	0.339	0.297	0.371
VAT cut	0.239	0.259	0.240	0.293
Capital tax cut	0.202	0.233	0.208	0.270
Labor tax cut	0.174	0.185	0.186	0.203
General transfers	0.132	0.141	0.123	0.148

The hold fixes Armenia's nominal policy rate at its baseline level in each realized hold year. Foreign monetary rules continue to respond endogenously.

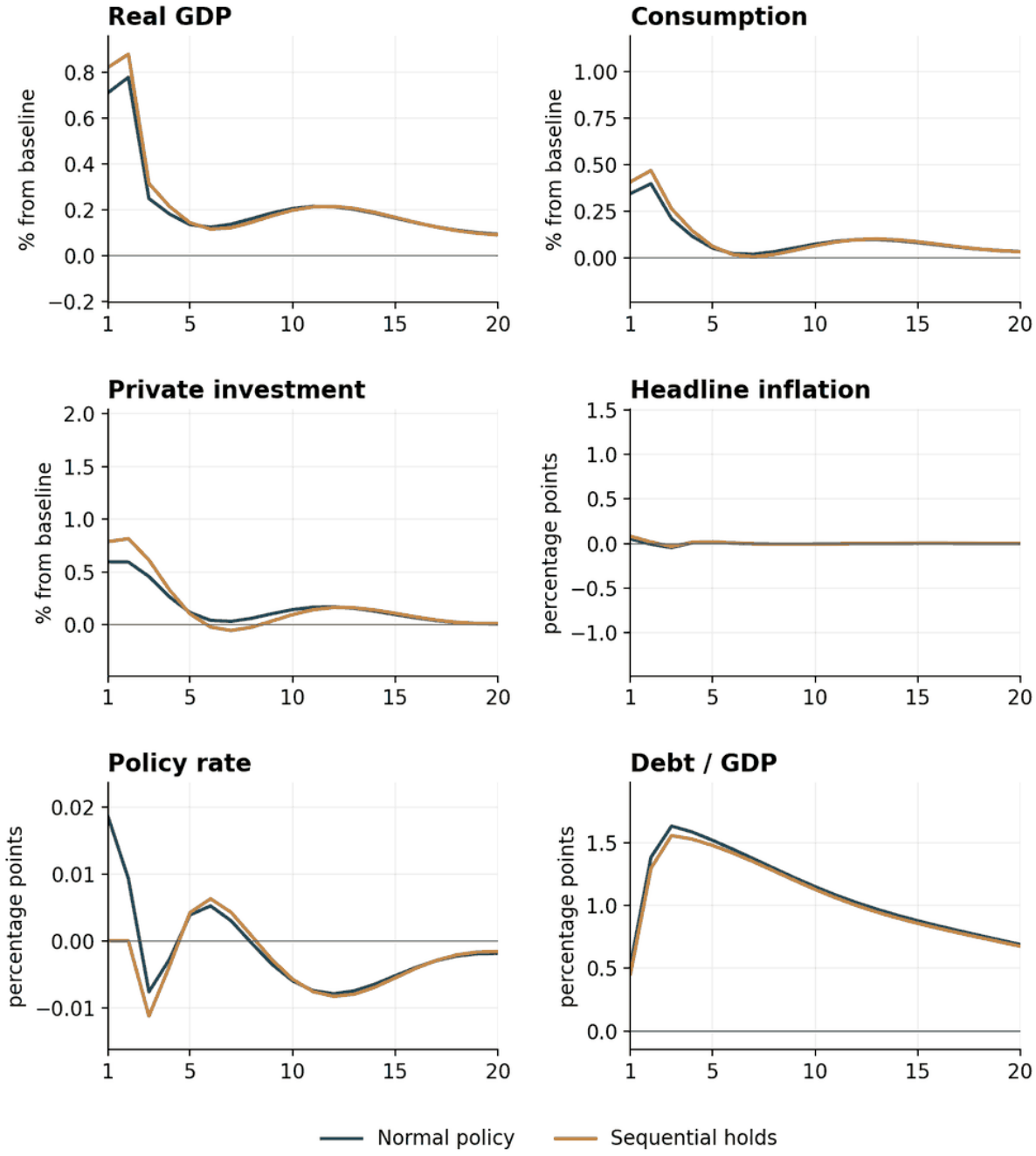
Reading the following charts

Each fiscal experiment has six panels: real GDP, consumption, private investment, headline inflation, policy rate and public debt. The two lines compare normal policy with sequential holds. All fiscal pages use identical limits for each corresponding variable. The large direct CPI effect of the VAT cut therefore makes the other headline inflation responses appear small.

Real GDP uses accumulated first-order chain-Fisher growth. Consumption and private investment are percentage deviations from baseline. Inflation and nominal rates are gross-rate changes expressed in percentage points. Public debt is the change in the debt-to-GDP ratio in percentage points.

Government investment

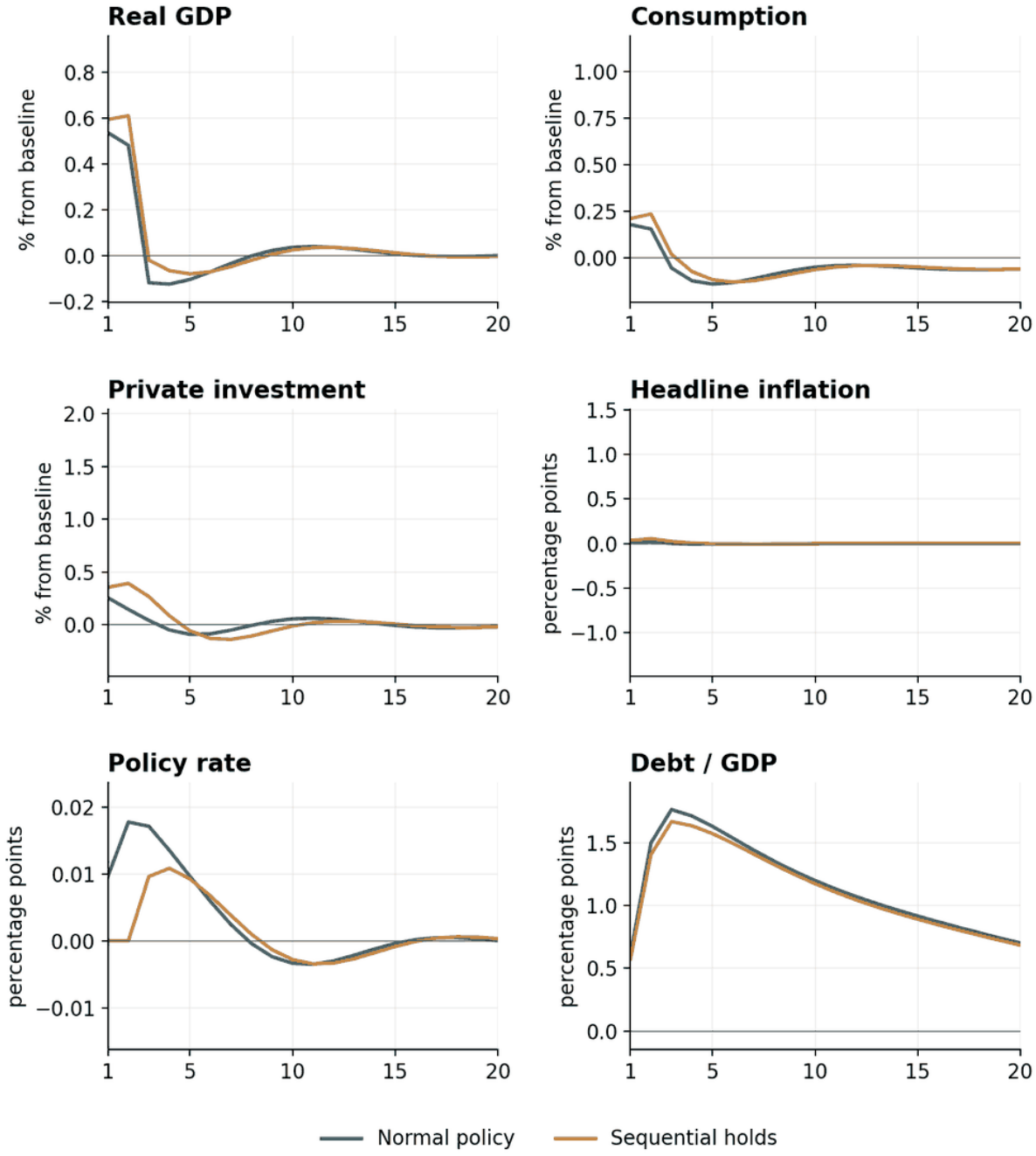
Armenia | Two-year fiscal easing | Common scales across fiscal experiments



The shock is active in Years 1 and 2. Orange: sequential holds; blue: normal monetary policy. General transfers use the source residual fiscal closure.

Government consumption

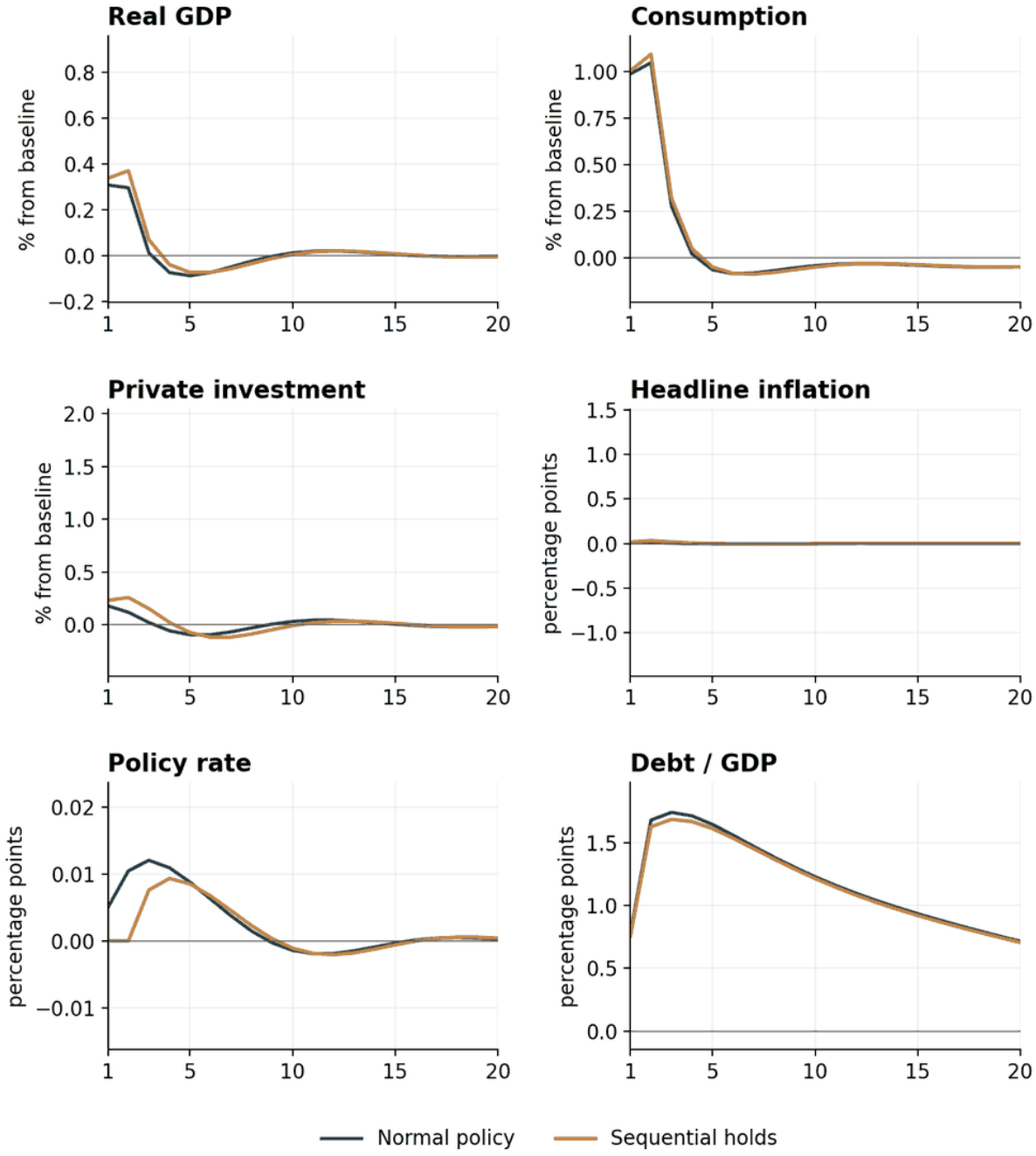
Armenia | Two-year fiscal easing | Common scales across fiscal experiments



The shock is active in Years 1 and 2. Orange: sequential holds; blue: normal monetary policy. General transfers use the source residual fiscal closure.

Targeted transfers

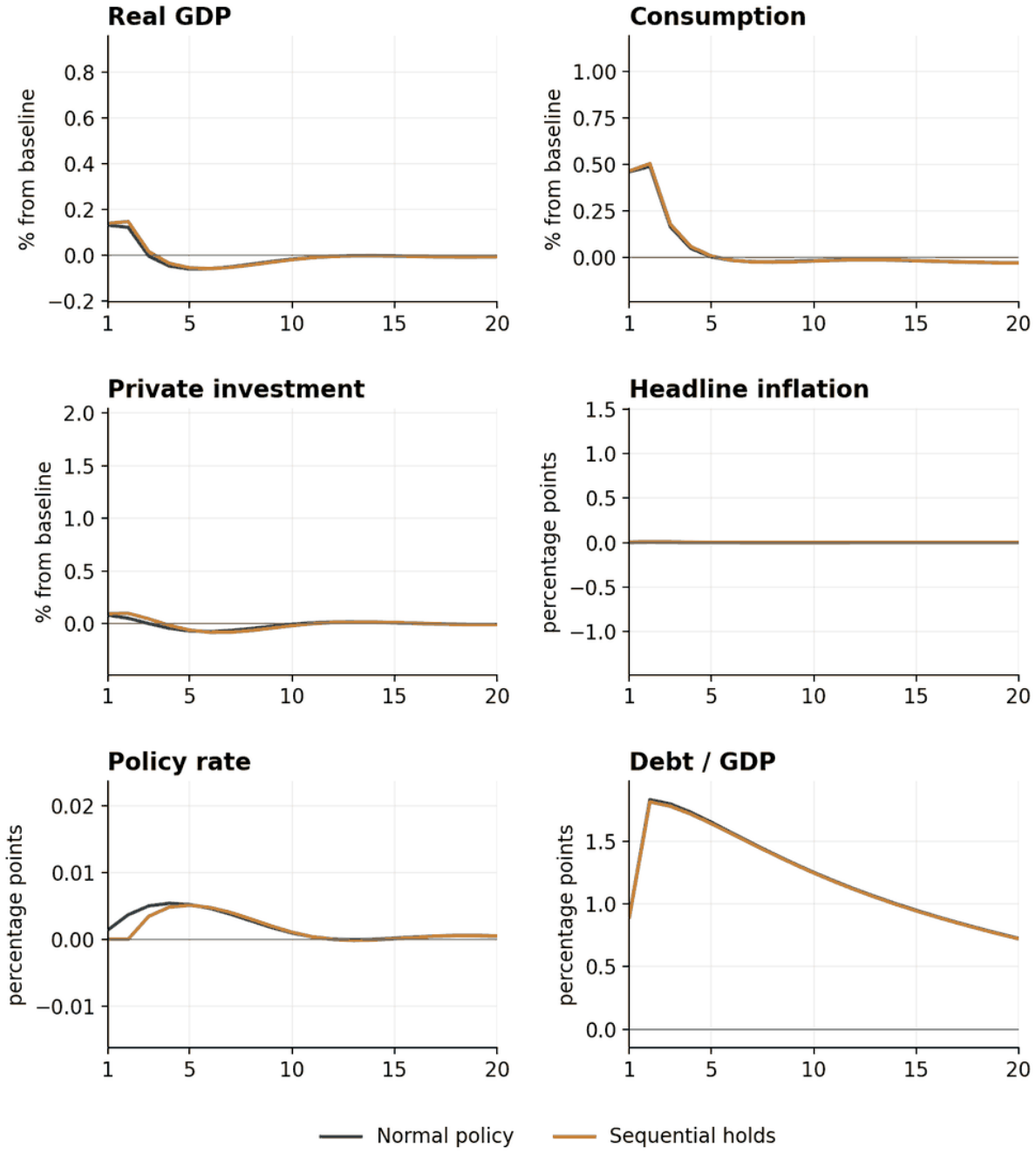
Armenia | Two-year fiscal easing | Common scales across fiscal experiments



The shock is active in Years 1 and 2. Orange: sequential holds; blue: normal monetary policy. General transfers use the source residual fiscal closure.

General transfers

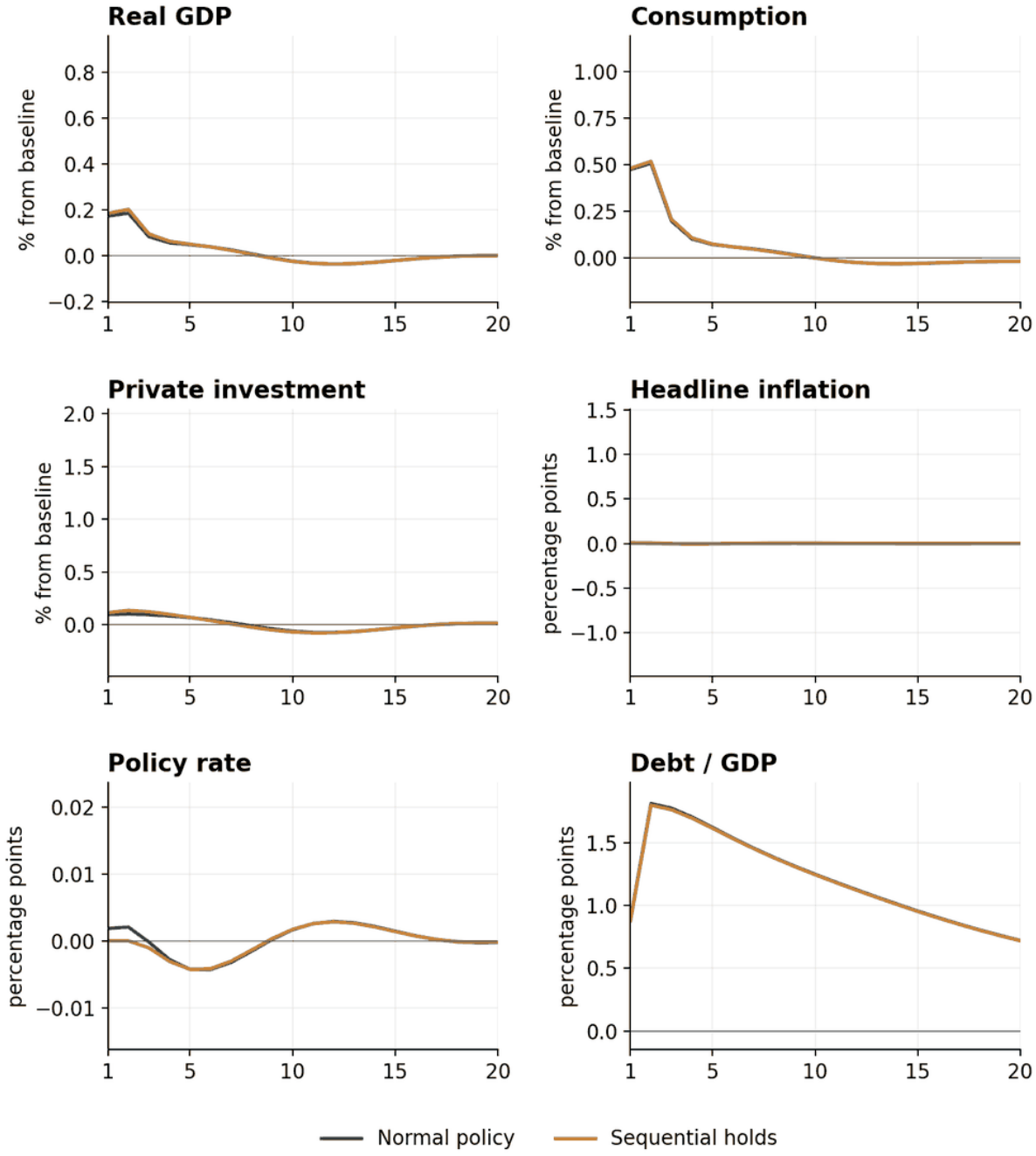
Armenia | Two-year fiscal easing | Common scales across fiscal experiments



The shock is active in Years 1 and 2. Orange: sequential holds; blue: normal monetary policy. General transfers use the source residual fiscal closure.

Labor tax cut

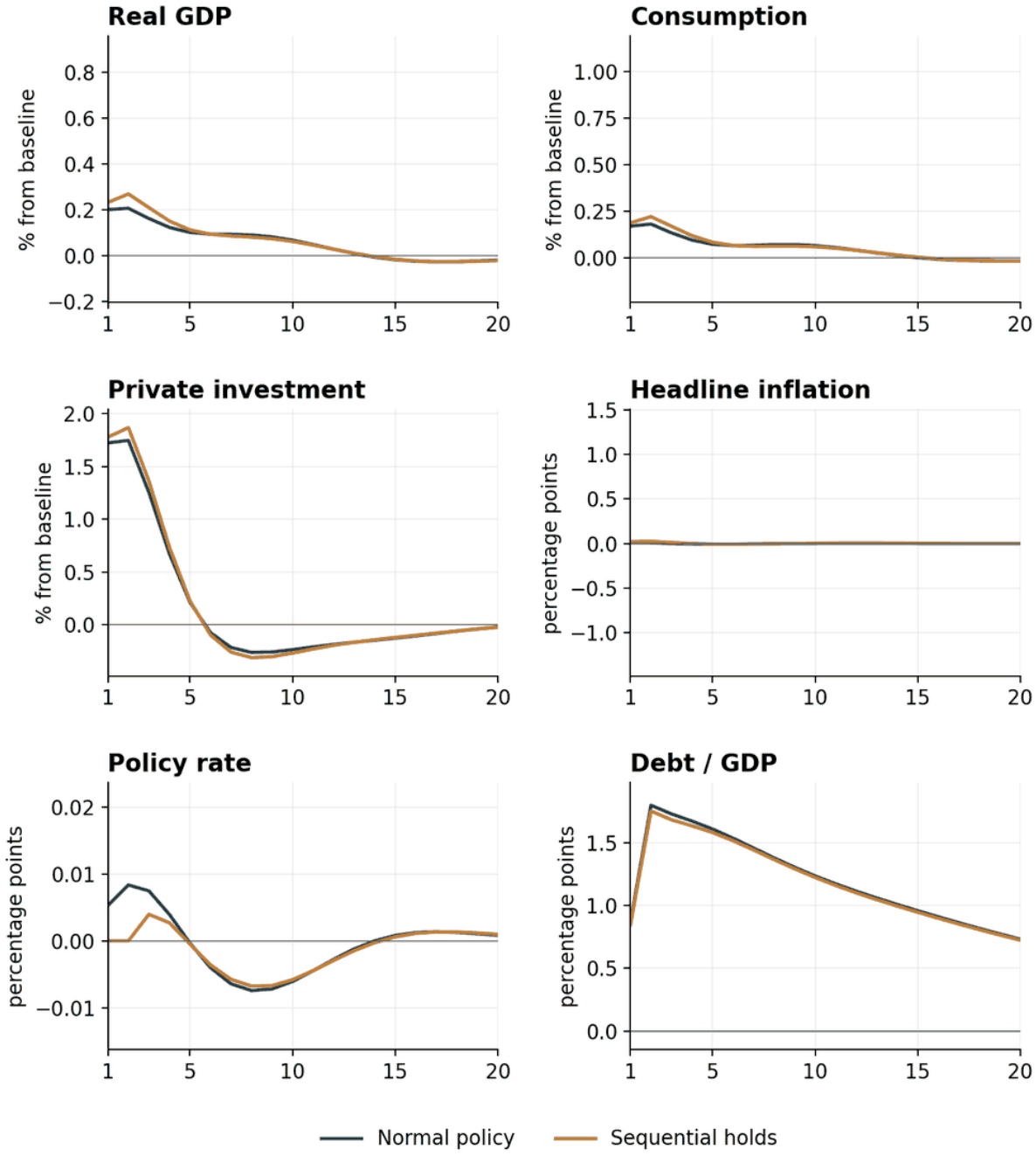
Armenia | Two-year fiscal easing | Common scales across fiscal experiments



The shock is active in Years 1 and 2. Orange: sequential holds; blue: normal monetary policy. General transfers use the source residual fiscal closure.

Capital tax cut

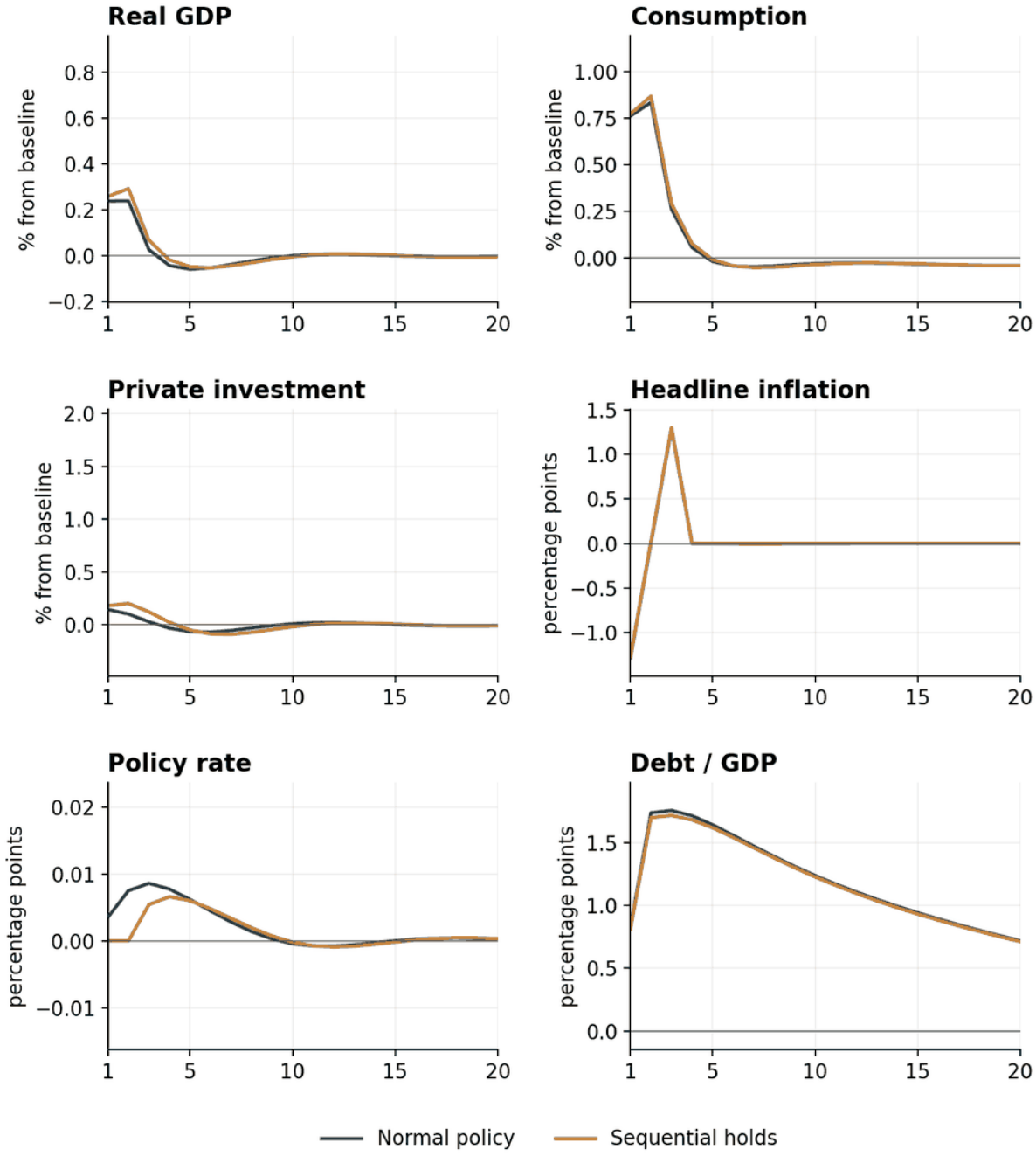
Armenia | Two-year fiscal easing | Common scales across fiscal experiments



The shock is active in Years 1 and 2. Orange: sequential holds; blue: normal monetary policy. General transfers use the source residual fiscal closure.

VAT cut

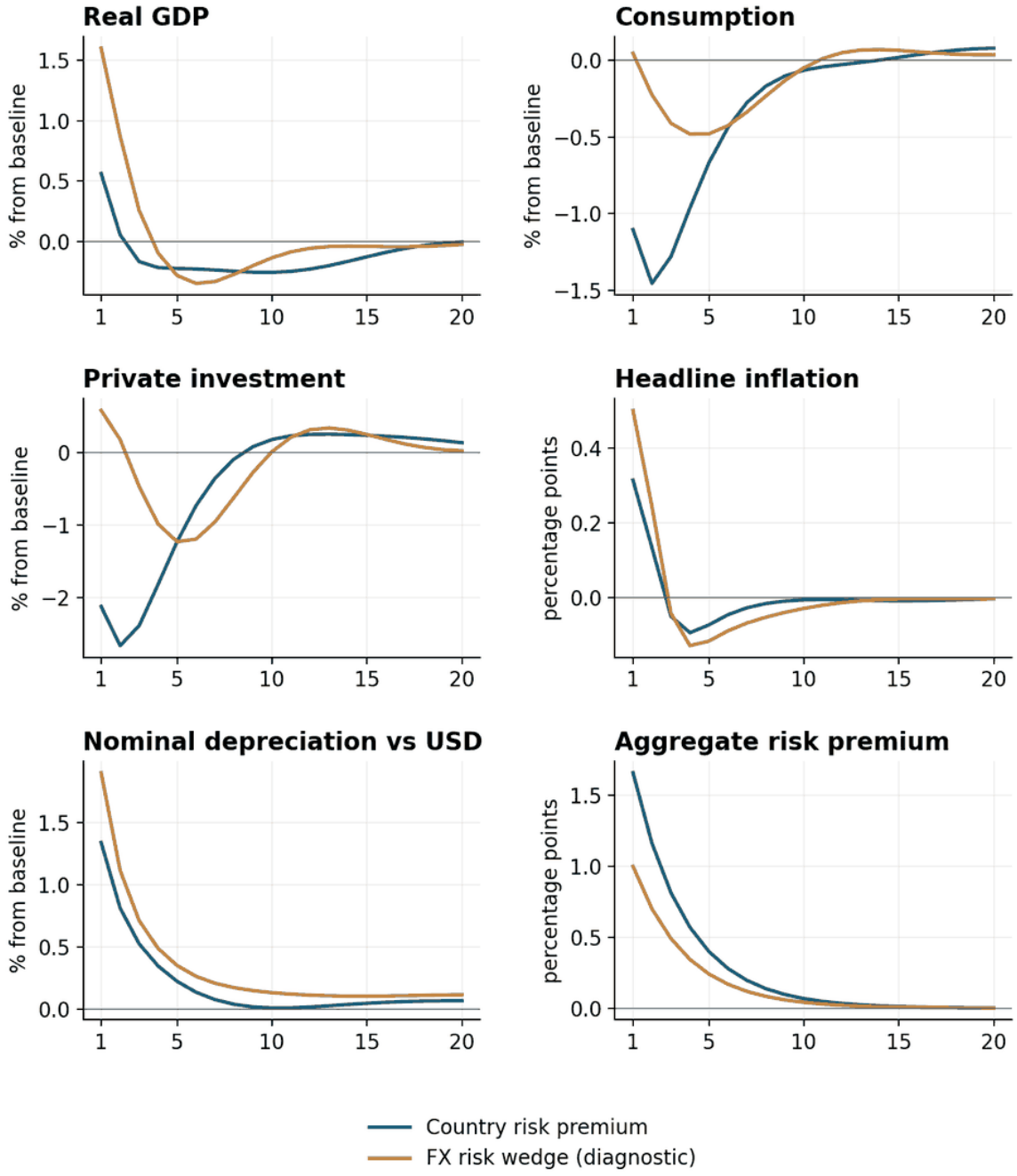
Armenia | Two-year fiscal easing | Common scales across fiscal experiments



The shock is active in Years 1 and 2. Orange: sequential holds; blue: normal monetary policy. General transfers use the source residual fiscal closure.

Country risk premium: inspect the transmission

Normal monetary policy. Sovereign-component shock versus the separate FX-risk diagnostic.

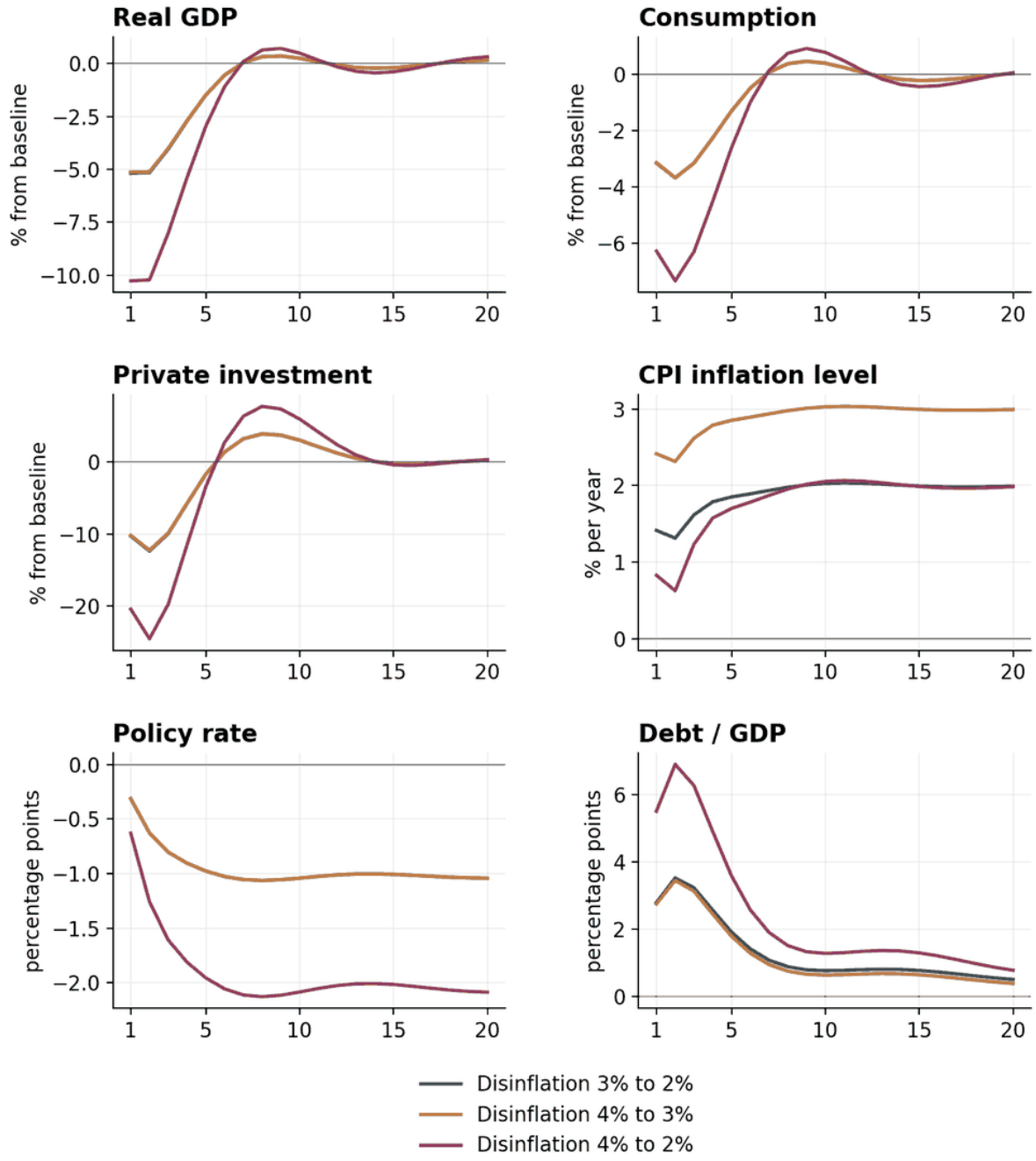


Response	Sovereign shock Year 1	Sovereign shock Year 2
Real GDP	0.564	0.055
Consumption	-1.104	-1.456
Private investment	-2.127	-2.667
Headline inflation	0.315	0.134
Nominal depreciation vs USD	1.341	0.812
Aggregate risk premium	1.660	1.162

A positive output response is a conditional feature of this calibration, not evidence that financing stress is beneficial. Exports expand and imports contract, more than offsetting declines in consumption and investment in the first-year expenditure accounting. Identifying causal contributions requires matched mechanism experiments.

Disinflation: three independent target reductions

Blue/gold/purple identify the three cases. CPI inflation is shown as a level; other panels are deviations from the relevant starting equilibrium.



Target change	GDP Year 1	GDP Year 2	CPI Year 1 level	CPI Year 2 level
Disinflation 3% to 2%	-5.182	-5.157	1.414	1.313
Disinflation 4% to 3%	-5.135	-5.111	2.415	2.313
Disinflation 4% to 2%	-10.269	-10.222	0.829	0.627

Permanent target shocks use a new first-order stationary terminal condition. The 4% starting equilibrium is solved independently while keeping structural parameters and long-run real-rate/premium smoothers fixed. No zero-deviation terminal return to the old target is imposed.

International spillovers

Real GDP

Region	Public investment Year 1	Country risk Year 1	3% to 2% Year 1
Armenia	0.7105	0.5640	-5.1818
Georgia	0.0441	-0.0407	-0.0964
Russia	0.0046	-0.0047	-0.0093
China	0.0000	-0.0003	0.0006
Euro area	0.0002	-0.0006	0.0007
United States	0.0000	-0.0003	0.0004
Rest of world	0.0002	-0.0003	0.0001

Headline inflation

Region	Public investment Year 1	Country risk Year 1	3% to 2% Year 1
Armenia	0.0513	0.3149	-1.5858
Georgia	0.0014	-0.0019	0.0035
Russia	0.0003	-0.0007	0.0009
China	0.0000	-0.0001	0.0002
Euro area	0.0000	-0.0001	0.0001
United States	0.0000	-0.0000	0.0000
Rest of world	0.0000	-0.0001	0.0002

All three shocks originate in Armenia. GDP is percent from baseline; inflation is a percentage-point deviation. Small foreign responses are shown with additional precision for visibility.

Why GDP rises initially in the risk experiment

Expenditure quantity component	Year-1 GDP contribution
Consumption	-0.748
Private investment	-0.337
Government demand	0.000
Exports	0.959
Less imports	0.690
Total	0.564

Contributions are percentage points. Imports contract, so subtracting imports adds to measured GDP. This reconciles the GDP response and is an expenditure decomposition, not a causal identification exercise.

Numerical checks and replication

Check	Result
Operational equations / endogenous variables	4704 / 4704
3% stationary residual	9.09e-13
4% stationary residual	9.09e-13
Maximum linear-system / stationary-terminal residual	2.27e-13
Maximum GDP horizon difference, first twenty years	0.000349 percentage points
Sequential holds	First-year history frozen; policy rate checked at baseline in both hold years
Stationary smoother normalization	Real-rate, FX-premium and sovereign-premium smoothers retain their original long-run values

The source contains stationary unit roots in smoothed reporting/benchmark variables. Rank-revealing QR selects independent stationary equations; the long-run smoothers are fixed explicitly. Every original operating equation is then checked, including rows omitted only from the numerical stationary factorization.

The package includes frozen inputs, source equations, 3% and 4% states, fiscal and monetary simulation scripts, all-region CSV responses, horizon comparisons, numerical audits, chart code and this PDF. START_HERE.md gives the reproduction commands.

Limits that matter for interpretation

These are first-order paths around nonlinear stationary equilibria, not solved nonlinear transitions. The sizable disinflation responses, especially the two-point cut, need nonlinear follow-up. No imperfect-credibility block or welfare calculation is added. The inherited seven-region calibration uses observed, inherited and proxy inputs; it contains no new oil, remittance, transit or tourism equations. A signed fixed-cost parameter in the China block remains an economic-review flag.

Model parent: GIMF_Seven_Region_Collection_11Nov2026.zip, Armenia configuration. Historical motivation: CBA official inflation-target statement, December 2024. Model periods are annual; charts use scenario years rather than calendar forecasts.

Armenia: seven-region fiscal multiplier audit

Two-year fiscal easing, one region at a time | Research calibration

Each experiment costs 1% of the originating region's initial GDP in each of two years. All measures are expansions: spending and transfers rise; tax rates fall. Both years are announced at the start. The tables compare each region's own real GDP response, not spillovers from an Armenia-only shock.

Year 1: endogenous monetary policy

Region	Gov. cons.	Gov. inv.	Targeted	General	Labor tax	Capital tax	Cons. tax
Armenia	0.56	0.82	0.31	0.13	0.19	0.31	0.24
Georgia	0.64	0.85	0.36	0.15	0.22	0.36	0.28
Russia	0.92	1.47	0.53	0.14	0.21	0.31	0.37
China	1.04	1.13	0.55	0.14	0.20	0.39	0.38
Euro area	0.95	1.38	0.51	0.14	0.20	0.43	0.35
United States	1.09	1.52	0.59	0.16	0.22	0.41	0.41
Rest of world	1.04	1.41	0.55	0.15	0.21	0.34	0.38

Entries are multipliers: the percentage deviation of real GDP divided by a fiscal impulse of 1% of initial GDP. Values are calculated from the model's chain-weighted Fisher growth measure.

Two issues prevent publication sign-off: China's fiscal-perimeter mapping and a discrepancy between the documented and saved inflation weights in the monetary rule. See the validation discussion. These simulations use the saved settings.

Year 1: origin policy rate held at baseline

Region	Gov. cons.	Gov. inv.	Targeted	General	Labor tax	Capital tax	Cons. tax
Armenia	0.67	0.92	0.38	0.15	0.22	0.42	0.29
Georgia	0.76	0.96	0.42	0.17	0.24	0.47	0.32
Russia	1.08	1.53	0.63	0.16	0.22	0.37	0.44
China	1.24	1.31	0.66	0.17	0.21	0.48	0.45
Euro area	1.13	1.50	0.62	0.16	0.21	0.53	0.43
United States	1.25	1.59	0.69	0.19	0.23	0.48	0.47
Rest of world	1.17	1.48	0.63	0.18	0.22	0.39	0.44

The hold applies only in Year 1 in the originating region; its endogenous rule resumes in Year 2. Foreign monetary policies remain endogenous. China retains an unresolved fiscal-perimeter mapping and generic behavioral priors; its entries are diagnostic research results.

Year 2: endogenous monetary policy

Region	Gov. cons.	Gov. inv.	Targeted	General	Labor tax	Capital tax	Cons. tax
Armenia	0.54	0.93	0.32	0.13	0.22	0.39	0.26
Georgia	0.63	0.94	0.37	0.15	0.24	0.44	0.30
Russia	0.91	1.59	0.57	0.14	0.24	0.35	0.41
China	1.02	1.12	0.57	0.15	0.22	0.44	0.41
Euro area	0.93	1.53	0.54	0.14	0.23	0.50	0.39
United States	1.07	1.64	0.63	0.16	0.26	0.46	0.45
Rest of world	1.00	1.51	0.57	0.15	0.24	0.36	0.41

Year 2 and cumulative multipliers

Year 2: Year-1 policy-rate hold

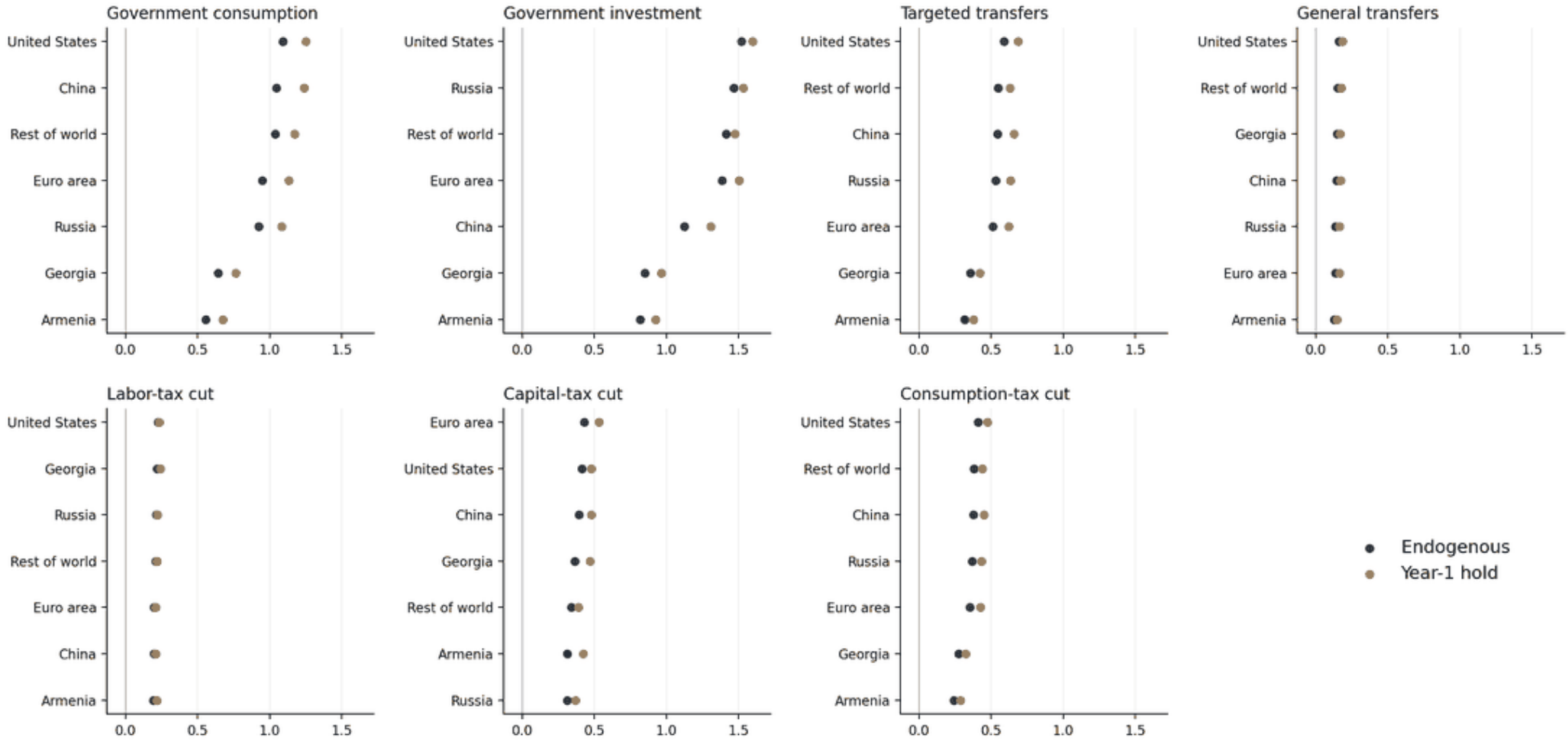
Region	Gov. cons.	Gov. inv.	Targeted	General	Labor tax	Capital tax	Cons. tax
Armenia	0.62	1.00	0.36	0.14	0.24	0.46	0.29
Georgia	0.71	1.01	0.42	0.16	0.26	0.52	0.33
Russia	1.01	1.63	0.64	0.16	0.25	0.38	0.46
China	1.17	1.27	0.67	0.17	0.23	0.51	0.47
Euro area	1.09	1.63	0.63	0.16	0.24	0.59	0.45
United States	1.20	1.70	0.71	0.19	0.27	0.52	0.51
Rest of world	1.11	1.57	0.64	0.17	0.25	0.40	0.46

Cumulative multiplier over Years 1-2: endogenous policy

Region	Gov. cons.	Gov. inv.	Targeted	General	Labor tax	Capital tax	Cons. tax
Armenia	0.55	0.87	0.32	0.13	0.21	0.35	0.25
Georgia	0.63	0.90	0.36	0.15	0.23	0.40	0.29
Russia	0.92	1.53	0.55	0.14	0.23	0.33	0.39
China	1.03	1.12	0.56	0.14	0.21	0.42	0.39
Euro area	0.94	1.46	0.53	0.14	0.22	0.47	0.37
United States	1.08	1.58	0.61	0.16	0.24	0.44	0.43
Rest of world	1.02	1.46	0.56	0.15	0.22	0.35	0.40

The cumulative multiplier equals the sum of the two annual real-GDP percentage responses divided by the sum of the two ex-ante fiscal impulses (2 percentage points of initial annual GDP). It is not the sum of the two annual multipliers.

Compare the regions under the same instrument



Year-1 real GDP multipliers. Every panel uses the same horizontal scale. Region rankings are descriptive; they do not establish that an instrument or calibration is optimal.

Validation and interpretation

Check	Observed result
Operational steady-state equations	Maximum residual 1.99e-12
Linear dynamic systems	Maximum residual 2.27e-13
40- versus 80-year horizon	Largest Year 1-2 GDP difference: 0.000491 percentage points
Year-1 interest-rate hold	Largest absolute rate deviation: 2.78e-17 percentage points

Important limits

These are newly computed first-order perfect-foresight simulations around the saved Armenia-centered seven-region steady state. A small linear-system residual confirms that the linear equations were solved; it does not establish nonlinear accuracy, global determinacy or empirical validity. Horizon sensitivity must be assessed separately.

China's saved fiscal split implies general transfers of about minus 10% of GDP, interpreted mechanically as a net lump-sum tax. Its fiscal perimeter requires reconciliation before its multipliers are used for policy analysis. Selected bilateral trade links, Russia inputs and euro-area settings also retain documented proxies.

Fiscal shocks use the inherited surplus-target closure: a deficit-target relaxation accompanies each instrument. Debt feedback is zero in the saved calibration; these are temporary fiscal actions, not a debt-consolidation transition. The monetary rule is the rule in the saved state, without a new recalibration.

The saved monetary settings have DELTAI=0.3, DELTAPIE=1, PIEWT0=0.25 and PIEWT1=0.75 in all seven regions. The accompanying nominal-cost metadata describes different inflation weights. Nominal adjustment-cost coefficients themselves are harmonized; the discrepancy concerns monetary-policy documentation versus the executable state.

Headline CPI: Year 1, endogenous monetary policy

Region	Gov. cons.	Gov. inv.	Targeted	General	Labor tax	Capital tax	Cons. tax
Armenia	0.02	0.07	0.01	0.00	0.01	0.03	-1.24
Georgia	0.03	0.07	0.01	0.00	0.01	0.03	-1.26
Russia	0.07	0.13	0.04	0.01	0.01	0.03	-1.55
China	0.08	0.09	0.05	0.01	0.01	0.04	-1.98
Euro area	0.07	0.12	0.04	0.01	0.01	0.04	-1.60
United States	0.09	0.13	0.05	0.01	0.01	0.04	-1.42
Rest of world	0.08	0.12	0.04	0.01	0.01	0.03	-1.43

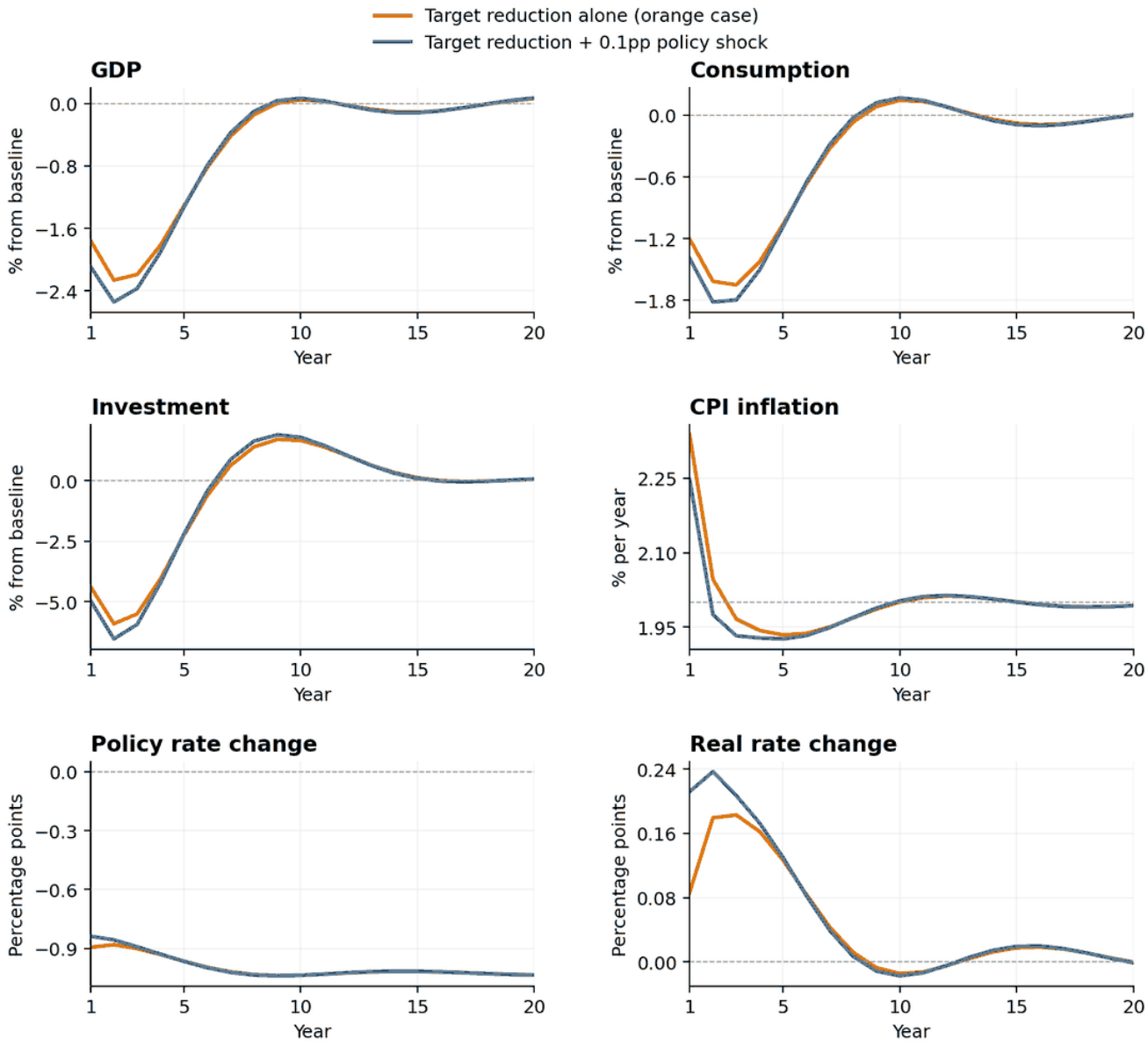
CPI entries are percentage-point deviations. A consumption-tax cut directly lowers tax-inclusive consumer prices; a negative CPI response need not indicate declining underlying inflation. The accompanying CSV retains full numerical precision and both horizons.

Sources: Armenia_Georgia_Seven_Region_Replication.zip (11 November 2026), Armenia/dynamic_state.txt, Armenia_inputs.json, original GIMF operational equations, and the new audit_multipliers.py run. The original paper is a calibration release; these simulations are a separate diagnostic supplement.

Disinflation from 3% to 2%

Revised experiment: 0.1pp linked monetary reaction-function shock | 13 November 2026

The inflation target falls permanently by one percentage point. Simultaneously, a one-year positive policy-rule intercept impulse of 0.1 percentage point partly offsets the direct nominal-rate adjustment in the orange specification. Both components are announced together. Inherited wage and price indexation is retained.



Orange: target reduction alone under the target-adjusted rule. Blue: the same experiment with the linked policy impulse. CPI inflation is a level; other panels show deviations. These are first-order model responses.

Reducing the policy impulse from 1 to 0.1 percentage point lowers the Year-1 GDP loss from 5.1% to 2.1%. The smaller case initially keeps inflation above the 2% target, although modest undershooting develops later.

Results and specification

Linked-shock response	Year 1	Year 2	Year 5
GDP	-2.09	-2.54	-1.33
Consumption	-1.39	-1.82	-1.09
Investment	-4.95	-6.53	-2.21
CPI inflation	2.25	1.98	1.93
Policy rate change	-0.84	-0.86	-0.97
Real rate change	0.21	0.24	0.13
Debt / GDP	0.85	1.23	0.88

Activity: percent from baseline. Inflation: percent per year. Interest rates: percentage-point changes. Debt: percentage points of GDP.

Economic interpretation

Year-1 GDP falls 2.09%, consumption 1.39%, and investment 4.95%; inflation reaches 2.25%. The expected real rate rises 0.21 percentage point. The Year-2 GDP loss is 2.54% and investment loss is 6.53%. These costs remain substantial. The shock magnitude is a sensitivity assumption, not a parameter chosen to validate a preferred output loss.

Linked shock and timing

Annual model (FREQU = 1). The gross inflation target changes from 1.03 to 1.02 permanently. The policy intercept impulse u is +0.001 (0.1 percentage point, or 10 basis points) in Year 1 and zero thereafter. This one-year duration is an explicit working assumption. The underlying equilibrium real rate is unchanged. The two innovations share one driver with opposite signs; their signed correlation is -1.

Active reaction function

$$INTMP(t) = INTMP(t-1) \times [PIE(t)/PIESTAR(t)]^{0.375} \times [PIE(t+1)/PIESTAR(t+1)]^{0.125} \times SINT(t) \times PIESTAR(t)/PIESTAR(t-1) + u(t).$$

The added term is a policy-rule intercept impulse, not an increase in the economy's natural real rate or a permanent r-star level shift. Its +0.1 percentage point magnitude offsets only part of the roughly -1.03 percentage point direct target adjustment under exact gross-rate arithmetic. No target-indexation recalibration is applied.

Numerical checks and limits

The 0.1pp case uses exact superposition of the solved first-order 0pp and 1pp cases. All stacked linear equations were independently re-evaluated and pass below 1e-8. The largest first-20-year GDP difference between 40- and 80-year solutions is 0.000044 percentage points. An independently solved nonlinear 2% endpoint passes all equations and preserves long-run real activity. The fiscal anchor preserves stationary debt to first order. A nonlinear transition remains unsolved; horizon agreement does not validate the size of the economic response.

Regions: Armenia, United States, euro area, Russia, rest of world, China and Georgia. This hypothetical 3%-to-2% experiment does not reconstruct Armenia's historical target change. The updated replication package preserves the earlier diagnosis and adds the linked experiment.

Czech disinflation: historical context

Two episodes need to be distinguished. Early-1990s disinflation followed price liberalization and the transition from central planning. Inflation targeting began in 1998, after the 1997 currency crisis. Neither episode is a clean one-percentage-point inflation-target experiment.

Early 1990s: inflation and real GDP

Year	CPI inflation (%)	Real GDP growth (%)
1991	56.6	-11.5
1992	11.1	-3.3
1993	20.8	0.6
1994	10.0	3.2
1995	9.1	6.4

Annual averages for inflation; annual real GDP growth. Historical data vintage: Czech Government report, 2 March 1999, Tables 3-1 and 3-3, citing the Czech Statistical Office. These are historical estimates, not a claim to the latest revised national-accounts series. [1]

Inflation fell 45.5 percentage points between 1991 and 1992, while GDP continued to contract. The initial inflation spike reflected price liberalization; the output collapse also involved the loss of former CMEA trading markets and structural adjustment. The 1993 inflation increase was associated with the introduction of VAT. These simultaneous changes prevent attributing the entire output decline to disinflation. [2, 3]

1998-1999: the inflation-targeting episode

Year	CPI inflation (%)	Real GDP growth (%)
1998	10.7	-2.2
1999	2.1	-0.2

Source: IMF Article IV Public Information Notice 00/60 (2000 vintage), selected indicators. Inflation is the annual average, not December-on-December inflation. [4]

Average inflation fell 8.6 percentage points. The CNB attributes rapid disinflation in mid-1998 to mid-1999 to both weak domestic activity and falling world food and raw-material prices; external factors contributed substantially to target undershooting. The CNB also cut interest rates sharply. This episode is useful context but does not identify a monetary-policy sacrifice ratio. [3]

Implication for the Armenia exercise

Historical GDP growth is not the same quantity as model GDP relative to an unobserved baseline. Use these episodes to check mechanisms and orders of magnitude, not to fit the 0.1pp impulse or validate a causal output cost. An empirical sacrifice ratio would require a counterfactual output path and controls for transition, supply and external shocks.

Sources

[1] Czech Government (1999), economic transformation report, Tables 3-1 and 3-3

[2] CNB history: economic development on Czech territory

[3] CNB (2003), Czech National Bank 1993-2003, sections on 1993 and 1999-2001

[4] IMF (2000), Czech Republic Article IV consultation, PIN 00/60

Armenia: the cost of moving from 3% to 2%

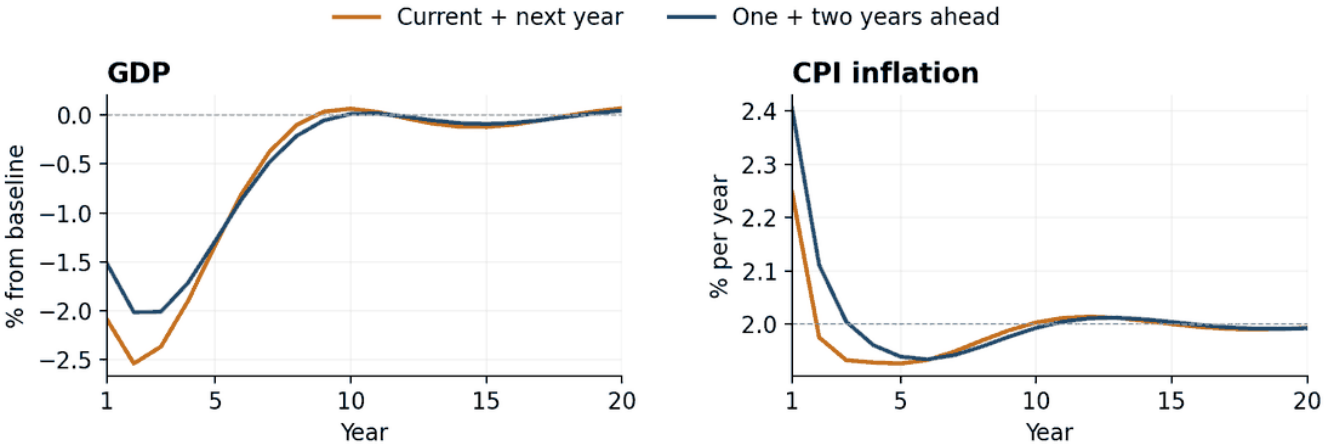
Audit conclusion: the available simulations do not establish a defensible numerical policy cost. They are reproducible conditional responses whose size depends on the monetary rule and inherited indexation. A successful equation solve is not empirical validation.

1. Forecast-horizon mismatch

The executable annual rule uses 75% weight on current inflation and 25% on inflation one year ahead. This differs from the previously stated one- and two-year-ahead formulation. The comparison below shifts only Armenia's forecast horizons to +1 and +2 years; foreign rules, structural calibration, target adjustment and the 0.1pp one-year policy impulse remain unchanged.

Measure	Current + next year	One + two years ahead
GDP, Year 1 (%)	-2.09	-1.51
Largest GDP shortfall (%)	-2.54	-2.02
Year of largest GDP shortfall	2	2
Sum of GDP deviations, Years 1-5 (pp-years)	-10.23	-8.55
CPI inflation, Year 1 (%)	2.25	2.40
Real-rate change, Year 1 (pp)	0.21	0.03

The summed GDP response is the sum of annual percentage deviations from baseline: percentage-point-years. It is not an annual growth rate, a GDP level loss in Year 5, an exact discounted loss in currency, or a welfare measure.



2. What the implementation actually contains

FREQU = 1 and the permanent gross target change is 1.03 to 1.02. No factor-of-four shock-unit error was found. There is no explicit neutral-real-rate term in the active rule. The +0.1pp addition is an additive monetary-policy impulse in Year 1, not a change in the natural real rate. Its one-year duration remains an assumption.

Nominal adjustment costs are harmonized assumptions: PHI_P_U = 216 for wages; PHI_P_T, PHI_P_N and PHI_P_I = 108. Armenia has ROTEMBERG = 0 and UPSILON1 = UPSILON2 = 0, implying inherited own-inflation indexation without direct target indexation. These coefficients have not been estimated against an Armenian disinflation episode in this audit.

What Armenia's experience tells us

Verified observation	Source
The target was reduced from 4% to 3% in 2025.	CBA price-stability objective [1]
December 2024 inflation was 1.5%; core inflation was 1%.	CBA, 4 February 2025 [2]
On 4 February 2025 the CBA cut its policy rate to 6.75%.	CBA decision [2]
Year-end 2025 inflation was 3.3%; real GDP growth was 7.2%, as reported by the CBA.	CBA annual report 2025 [3]

The actual target reduction did not begin from an economy in steady equilibrium at 4% inflation. Inflation was already below the new 3% target. Consequently, this episode cannot identify the cost of deliberately moving inflation from a steady 3% to 2%. Positive observed growth also does not reveal the growth rate that would have occurred without the target change.

Nominal-rate cuts are not inherently inconsistent with disinflation. The economically relevant stance depends on expected real rates, expectations, the exchange rate and other conditions. A lower target can coexist with nominal easing; an imposed upward policy impulse should therefore be treated as an additional scenario assumption, not a necessary consequence of disinflation.

Validation status

Check	Finding
Initial nonlinear 3% equilibrium and independent 2% endpoint	Pass full equation audits; long-run real activity unchanged.
First-order transition equations	Pass; maximum residual in the +1/+2 horizon experiment is 4.58e-14.
40/80-year boundary sensitivity	Maximum first-20-year GDP difference: 0.000077 percentage points.
Nonlinear transition, determinacy and empirical fit	Not established by these checks.
Interpretation of earlier 2.1% figure	Year-1 conditional output shortfall; not a validated cost estimate or an observed recession.

Assessment

A credible, well-timed transition may have a smaller cost than an abrupt reduction with backward indexation and an added tightening shock. The current work cannot quantify that judgment. A policy estimate needs empirical discipline on expectations, wage and price dynamics, monetary transmission, initial conditions and the implementation horizon, followed by nonlinear transition validation. No numerical range is justified merely by taking the smallest and largest sensitivities.

Sources and replication

[1] CBA: Our Price Stability Objective

[2] CBA: Executive Monetary Policy Statement, 4 February 2025

[3] CBA: Annual Report 2025, published 30 April 2026

Model evidence: operational_source/modeqs.mod, policy.py, harmonized_costs.json and the loaded Armenia state. New experiment: model/audit_forecast_horizons.py. Outputs: forecast_horizon_responses.csv, forecast_horizon_audit.json and validation_cost_comparison.csv. Earlier simulations are retained for comparison. This note supersedes interpreting any prior sensitivity as an established policy cost.

Frequency audit: annual source confirmed

Correction to the earlier hypothesis: the available source does not support diagnosing the large responses as a confirmed quarterly-to-annual conversion error. The included archived MAT and current model both have FREQU = 1. Technology growth is 1.015 and population growth is 1.01 per annual period in both. The published GIMF theoretical calibration is also explicitly annual. [4]

Parameter / meaning	Loaded Armenia	Archived same name
FREQU / periods per year	1	1
Capital depreciation per period	0.10	0.10
PHI_I / real investment adjustment	1	1
PHI_C_OLG / consumption adjustment	2	2
PHI_C_LIQ / consumption adjustment	1	1
PHI_P_U / nominal wage adjustment	216	48
PHI_P_T, N, I / upstream price adjustment	108 each	24 each

The MAT contains R1/R2/R3 labels; the original geographic mapping and full legacy equation normalization are not established. Values in its R2 slot are reference magnitudes, not a recovered Armenian calibration. Consumption-price and import-price coefficients also differ and are left unchanged in the tests below. No blanket division by four or sixteen is justified by this evidence.

Isolating wage and upstream price costs

All tests retain annual frequency, the Armenia one-/two-year-ahead reaction function, permanent 3%-to-2% target cut and +0.1pp Year-1 policy impulse. Only the named Armenian cost coefficients change; foreign calibration, indexation and real adjustment costs remain fixed. These are calibration sensitivities, not corrections certified by frequency conversion.

Case	GDP Year 1 (%)	Investment Year 1 (%)	Sum GDP, Years 1-5 (pp-years)
Loaded wage and price costs	-1.51	-3.92	-8.55
Lower wage cost only	-1.26	-3.89	-6.48
Lower upstream price costs only	-0.92	-1.92	-4.36
Both changes	-0.66	-1.65	-2.45

The replication package includes a two-line comparison chart (annual_rigidity_comparison.png) for GDP and CPI inflation.

Interpretation and checks

The difference across these cases measures the contribution of the selected cost assumptions within this model. It does not identify the true output cost of Armenian disinflation. The starting equilibrium and the same first-order terminal equilibrium pass the equations after each change; all transitions pass below 1e-8 and 40/80-year first-20-year GDP differences remain below 0.01 percentage point. No nonlinear transition or empirical fit is established.

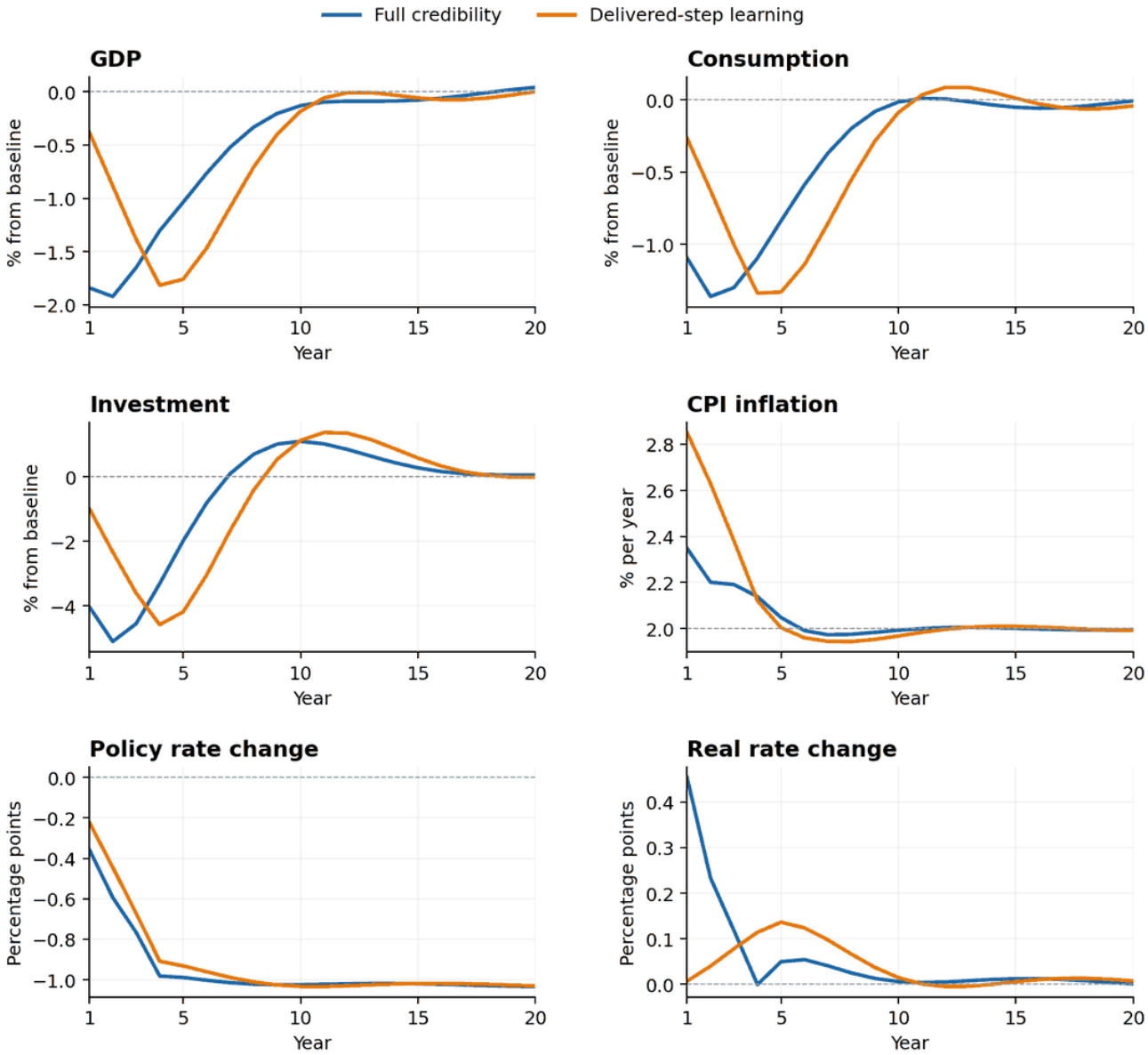
Source files: operational_source/calib/oeolg_steady7_results.mat; models/Armenia/stationary_state.txt; harmonized_costs.json. Reproduce with model/audit_annual_rigidities.py, then make_frequency_audit.py. Parameter comparisons and full audit records accompany the replication package.

[4] Kumhof, Laxton, Muir and Mursula (2010), GIMF - Theoretical Structure, Section XIX.

Staged disinflation and learning

Annual timing diagnostic: four cuts over FOUR YEARS. This is not the requested four-quarter, one-year experiment. A verified quarterly GIMF calibration was not located; no annual period has been relabeled as a quarter.

The implemented target falls from 3% to 2% in four 0.25 percentage-point steps. Wage and price rigidities remain exactly those used for the fiscal-multiplier experiments. The only difference between the two paths is information about future cuts.



Two lines only: blue is full credibility of the entire staged target path; orange accepts each delivered target permanently but expects no remaining cuts. CPI inflation is a level; its dashed line marks the eventual 2% target, not the intermediate targets. Real rates are ex ante rates under the governing information vintage.

Learning shifts the contraction later. It lowers the first-five-year cumulative loss, but modestly increases the ten- and twenty-year loss. A larger credibility cost is not automatic in this specification.

Beliefs, costs and numerical checks

Year	Implemented target	Believed eventual target: full credibility	Believed eventual target: learning
1	2.75%	2.00%	2.75%
2	2.50%	2.00%	2.50%
3	2.25%	2.00%	2.25%
4	2.00%	2.00%	2.00%

The full-credibility case knows the dates and sizes of all four cuts from Year 1. The learning case treats the currently delivered target as permanent. Before the next decision, the next delivered cut is unexpected; agents then update and reoptimize. This is discrete updating, not an estimated Bayesian or endogenous-credibility process.

Measure	Full credibility	Learning
GDP response, Year 1 (%)	-1.84	-0.38
Largest GDP response (%)	-1.92	-1.82
Year of largest GDP shortfall	2	4
Cumulative shortfall, first 5 years (pp-years)	7.75	6.22
Cumulative shortfall, first 10 years (pp-years)	9.70	10.07
Cumulative shortfall, first 20 years (pp-years)	10.19	10.47

Cumulative shortfall is minus the sum of annual GDP percentage deviations from baseline. It is not a GDP level loss in a single year, a discounted welfare cost or an empirically estimated sacrifice ratio. The ranking varies with the measurement window, which must be shown explicitly.

Common assumptions

FREQU = 1. Armenia wage coefficient PHI_P_U = 216; upstream price coefficients PHI_P_T, N, I = 108. No lower-rigidity sensitivity values are substituted. Both cases use the same one-/two-year-ahead policy rule with the target-adjustment term. Each 0.25pp target cut is linked to a +0.025pp policy-rule impulse, preserving a total of +0.1pp across the four steps. The nominal fiscal anchor follows the same implemented target path.

Information and state handling

At every learning vintage, the solver retains the full actual lag history, including predetermined stocks and lagged inflation. It then solves the conditional future path under that vintage's permanently believed target. Future inflation and target forecasts in the policy equation come from this same conditional plan. Separate central-bank private information about future cuts is not modeled. The actual path combines the implemented first period from each vintage with the final vintage's continuation.

Verification

All full-credibility and learning-vintage linear plans pass below 1e-8 (maximum residual 4.58e-14). The realized target path matches the same four implemented steps in both cases. Maximum first-20-year GDP sensitivity to 40/80-year boundaries is 0.000113 percentage points. An independent decomposition into four shifted surprise permanent cuts also verifies the learning path within the documented finite-boundary tolerance. Each plan is checked against its governing beliefs, not against subsequently realized surprises. No nonlinear transition is claimed.

One-year experiment remains uncomputed

Four cuts within one year require a coherent quarterly calibration and quarterly stock-flow accounting, policy horizons and inflation measurement. Changing FREQU alone is insufficient. Any frequency conversion must apply consistently to fiscal and disinflation experiments. The present annual result establishes a working belief-updating implementation; it does not establish the cost of the proposed one-year transition.

Replication: model/run_staged_learning_annual.py; annual_staged_learning_responses.csv; annual_learning_vintage_forecasts.csv; annual_staged_learning_audit.json; annual_staged_learning_paths.npz.

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Armenia and Georgia in the Global Economy

Seven-Region GIMF Models for Fiscal Policy and Regional Spillovers

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11 NOVEMBER 2026

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Armenia and Georgia in the Global Economy

Seven-Region GIMF Models for Fiscal Policy and Regional Spillovers

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Abstract

Fiscal choices in small open economies depend on who receives the income, how public spending affects productive capacity, and how domestic policy interacts with foreign demand and financing conditions. This paper develops and documents seven-region configurations of the Global Integrated Monetary and Fiscal Model for Armenia and Georgia. The models combine finite-horizon optimizing households, liquidity constraints, distortionary taxation, productive public capital, nominal rigidities and a corporate financial accelerator. Separate regional structures identify Russia, China, the United States and the euro area; Armenia additionally identifies Georgia, while Georgia identifies Turkiye. We solve the stationary equilibria, preserve the domestic fiscal and external calibration targets, impose a common nominal-adjustment profile, and verify the expanded operational equations. The contribution is a reproducible structural foundation for fiscal and regional-risk analysis, with clear distinctions between measured inputs, development assumptions and solved quantities. Several bilateral links remain proxies. The inherited China fiscal split generates a large net lump-sum tax residual and requires reconciliation. The paper therefore reports calibration results and a disciplined design for subsequent policy experiments; it does not present newly simulated fiscal multipliers or debt-transition paths.

Keywords: GIMF; Armenia; Georgia; fiscal policy; regional spillovers; public debt; prudent risk management.

JEL classification: E17, E62, F41, H54, H63.

Lead author: Vazgen Poghosyan. We thank Robert (Bob) Ford for the research and mentoring tradition that informs this work. The views expressed are those of the authors and do not necessarily reflect those of the Central Bank of Armenia or The Better Policy Project.

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1. Fiscal policy in economies shaped by their external links

A government can protect productive investment during a fiscal adjustment, or it can achieve the same immediate budget saving by cutting infrastructure expenditure. It can support households through transfers, reduce the tax on employment, or lower the tax on consumption. These choices may have similar first-round budget costs and very different consequences for demand, productive capacity, public debt and the external balance. For Armenia and Georgia, the consequences also depend on what happens beyond their borders.

The central policy question is therefore broader than the size of a single fiscal multiplier. How should a small open economy combine stabilization, public investment and debt management when foreign demand and financing conditions can change sharply? An appropriate framework must connect the government budget to household behavior, private investment, international trade and monetary policy. It must also separate the domestic policy decision from the external shock that prompted it.

This paper develops two seven-region configurations of the Global Integrated Monetary and Fiscal Model (GIMF). They share a structural core and a common profile of nominal adjustment costs, while retaining distinct domestic calibrations and regional decompositions. The Armenia configuration includes Georgia as a separate neighbor. The Georgia configuration assigns that additional regional slot to Turkiye. Both distinguish the United States, the euro area, Russia and China from the residual world.

The model's non-Ricardian household structure is central to its fiscal applications. Government liabilities do not disappear from current households' balance sheets through a complete offset against taxes on all future generations. Finite planning horizons and liquidity constraints give the timing and distribution of fiscal measures economic significance. Distortionary taxes, investment adjustment costs and productive public capital connect short-run stabilization to medium-run supply. These features make GIMF particularly useful for examining fiscal composition and debt adjustment, while leaving ample room for uncertainty about parameter values and policy implementation.

Our contribution has three parts. First, we document the economic mechanisms and the exact regional structures. Second, we solve and audit the two stationary calibrations, distinguishing inherited country targets, assumed partner weights and quantities determined by equilibrium. Third, we supply an executable replication package, including the operational equations and the source inputs needed to rebuild the results.

The numerical results in this paper concern the stationary equilibria. They are not impulse responses, forecasts or estimates of causal fiscal effects. The release provides a foundation for subsequent two-year fiscal experiments, alternative monetary responses and country-risk scenarios. Those transitions require their own solutions and validation. This distinction is especially important when a model is intended to support actual policy decisions.

The theoretical lineage is the GIMF structure of Kumhof et al. (2010), with earlier simulation properties documented by Anderson et al. (2013). The executable source accompanying this paper determines the present implementation. The application is also consistent with the emphasis on coherent alternative scenarios in the *Prudent Risk Management Approach to Price Stability*, edited by Laxton, Avetisyan and Avagyan (2026).

2. Two regional structures for two policy perspectives

2.1 What the seven regions identify

The regional decomposition is an economic choice. Giving an economy its own block permits its demand, productivity, fiscal policy and financing conditions to move separately. Placing it in the residual world combines those disturbances with developments elsewhere. The appropriate decomposition therefore depends on the shocks the domestic policymaker needs to understand.

Table 1: The two seven-region configurations

Slot	Armenia model	Georgia model
1	Armenia	Georgia
2	United States	United States
3	Euro area	Euro area
4	Russia	Russia
5	China	China
6	Georgia	Turkiye
7	Rest of world	Rest of world

Notes: Regions are mutually exclusive within each model. The rest of world excludes all six explicitly modeled economies or groups. The euro area is a single consolidated block.

Russia is identified in both models so that a Russia-specific disturbance need not be represented as a shock to the entire foreign economy. China separates a major source of imported goods and global supply developments. The United States and euro area permit distinct global demand and monetary-financial scenarios. Their inclusion is useful even when the domestic economy's direct merchandise trade with the United States is limited.

For Armenia, a separate Georgia block creates a basis for studying bilateral demand and trade-price spillovers. It does not, by itself, identify the value of transit access or the consequences of opening a particular transport route. For Georgia, a separate Turkiye block reflects the importance of that trading relationship and allows a different regional shock to be isolated. The two configurations are thus tailored perspectives rather than interchangeable labels attached to the same regional system.

2.2 Coverage and the limits of regional identification

The present models represent trade and international financial arbitrage through the inherited GIMF equations. They do not add separately measured remittance flows, a tourism sector, transport corridors or an energy-production block. A country can be important through several of these channels even when its direct goods-trade weight is small. Merely adding its name to the regional list does not implement those mechanisms.

This boundary matters for interpretation. A fall in foreign demand can be represented within the current trade structure. A disruption to a specific transit route requires a mapping into trade costs, productive capacity or another explicit equation. A remittance shock requires a transfer mechanism that is consistent with household income and the external accounts. These are substantive extensions rather than changes to a chart label.

3. Households, public debt and the distribution of fiscal income

3.1 Finite horizons and consumption from wealth

The optimizing households in the source model consume out of financial wealth, labor-income wealth and the present value of other income. In compact notation, the implemented consumption relationship is

$$C_t^O = \mathrm{MPC}_t \, TW_t, \qquad TW_t = FW_t + HW_t + OW_t. \tag{1}$$

The labels correspond to `C_OLG`, `MPC`, `TW`, `FW`, `HW` and `OTHW` in the executable source. This is an aggregate relationship within the overlapping-generations structure, not an assumption that every household has the same balance sheet.

The recursion for human wealth makes the horizon mechanism transparent. Suppressing the regional subscript, the source can be written as

$$HW_t = N(1-\psi)\, w_t^m (1-\tau_t^L) SL_t + \theta\chi \frac{g_{t+1}}{R_t} HW_{t+1}. \tag{2}$$

Here w^m denotes the source's marginal-rate-of-substitution valuation of labor income, N is the population normalization, ψ is the liquidity-constrained share, θ is the finite-horizon parameter and χ captures the decline in individual labor-income prospects. The source's growth normalization is retained. In both domestic calibrations the planning-horizon and labor-income-decline inputs correspond to twenty years.

A government bond is a claim held by current households. Its servicing requires future fiscal resources, but the household valuation of those resources differs from the government's indefinitely lived budget. Consequently, the effects of a change in debt cannot generally be reduced to the date on which an otherwise identical tax is collected. This is the mechanism that permits a sustained debt adjustment to affect consumption and saving even when the initial fiscal action is temporary.

The magnitude of the effect remains a calibration question. A non-Ricardian structure does not guarantee a large multiplier, establish an optimal debt ratio or imply that additional borrowing is always beneficial. It creates a coherent setting in which those questions can be investigated.

3.2 Liquidity constraints and targeted support

Liquidity-constrained households finance current consumption from current disposable income. The source's budget relationship has the form

$$C_t^L \left(P_{L,t}^R + \tau_t^C P_t^C \right) = YD_t^L, \tag{3}$$

where disposable income includes after-tax labor income, the household's share of general transfers and transfers specifically assigned to the liquidity-constrained group. The domestic liquidity-constrained population share is forty percent in both models. This is an inherited structural input, not a new household-survey estimate.

The distinction between general and targeted transfers matters. General transfers are distributed across household groups according to the model's population and allocation conventions. Targeted transfers have their own distribution parameter. A measure that reaches households with limited borrowing opportunities can support current consumption more directly than a measure accruing to households that can smooth income through their assets. Prices, imports, labor supply and monetary policy then

determine the general-equilibrium response.

This distributional mechanism is one reason to compare fiscal instruments within a common model. A transfer, a consumption-tax reduction and a purchase of domestic goods all enter household income and demand through different equations. Their budget costs should be normalized consistently before their output effects are compared.

4. Production, public investment and financial amplification

4.1 Private production and productive public capital

The model distinguishes tradable and nontradable production, private capital, labor and intermediate inputs. Domestic and imported goods enter expenditure through aggregators, while adjustment costs make changes in prices and quantities gradual. Public infrastructure augments the aggregate production and distribution system through the source relationship

$$Z_t^D = Y_t^A (K_t^{G1})^{\alpha_{G1}} (K_t^{G2})^{\alpha_{G2}} \, \mathcal{S}, \tag{4}$$

where $\mathcal{S}$ is the steady-state scale normalization. In the delivered calibrations, $\alpha_{G1} = 0.1$ and $\alpha_{G2} = 0$ in every region. Productive public investment therefore has a direct supply channel; government consumption does not inherit that channel merely because a public-consumption stock appears in the source.

The public-capital accumulation equation preserves the source's timing:

$$g_t n_t K_t^{G1} = (1 - \delta_{G1}) K_{t-1}^{G1} + G_{t-1}^I. \tag{5}$$

Gross trend productivity and population growth are denoted by g and n. Public infrastructure depreciates at an annual rate of four percent in the inherited calibration. Expenditure today raises the stock available subsequently, which separates its immediate demand effect from its later productive contribution.

This distinction has a direct policy implication. Reducing investment can improve a fiscal balance in the short run while weakening the capacity that supports future tax revenue. Conversely, an investment program can raise demand and productive capacity while still failing to improve welfare if projects are poorly selected, financing is costly or implementation is slow. The present calibration does not estimate project-specific efficiency. Such an experiment must identify the relevant productivity or implementation assumption explicitly.

4.2 Corporate balance sheets and the cost of finance

The financial accelerator links corporate borrowing conditions to the balance sheets of firms. Investment is affected by the value of capital, its expected return, financing costs and adjustment costs. A weakening of net worth can therefore amplify a disturbance that initially originates in demand, risk or asset valuations.

A useful schematic representation is

$$\mathcal{F}_t = \mathcal{F}\left(\frac{Q_t K_t}{NW_t}, \; \sigma_t, \; \mu_t \right), \tag{6}$$

where QK/NW describes leverage and the other arguments summarize borrower risk and monitoring or recovery conditions. Equation (6) is an explanatory summary, not a substitute for the source's credit-contract equations. The package retains the separate tradable and nontradable financial blocks and their exact variable definitions.

This mechanism allows fiscal and financial disturbances to interact. A policy that supports near-term cash flow may affect investment differently from a policy that lowers the expected tax on capital income. A rise in sovereign financing costs can also coexist with a separate change in corporate risk. These shocks must be distinguished before an interpretation is attached to their combined effects.

The present release verifies the stationary financial quantities and default-percentage bounds. It does not report a newly solved financial-stress transition. Large shocks require nonlinear transition checks, including the behavior of net worth and default probabilities, rather than a mechanical extrapolation of a local response.

5. Trade, relative prices and policy closure

5.1 International trade and external positions

Imports are separated into consumption, investment and intermediate-use categories. Final-goods and intermediate-goods partner weights determine where foreign demand is sourced, with relative prices affecting quantities through the model's substitution elasticities. A representative final-import relationship is

$$M^D_{ij,t} = \zeta^D_{ij}\, M^D_{i,t} \left(\frac{P^D_{ij,t}}{P^D_{i,t}} \right)^{-\xi^D_i}, \qquad i \neq j. \tag{7}$$

The source requires partner coefficients to add to one. A CES coefficient is not automatically an observed expenditure share away from the price configuration at which it is calibrated. The release therefore keeps target expenditure shares, solved import ratios and solved CES coefficients in separate files.

The model's exchange-rate convention is particularly important for international aggregation. Regional nominal GDP is converted to the common numeraire by division by E_i. The regional world-GDP share is

$$\omega_i = \frac{Y_i/E_i}{\sum_j Y_j/E_j}, \qquad \sum_i \omega_i = 1. \tag{8}$$

World trade clearing is checked using the same valuation. External-asset positions satisfy the corresponding weighted accounting restriction. The international financial block uses the inherited global bond and arbitrage structure; it is not a measured bilateral portfolio network.

5.2 Nominal adjustment and monetary policy

The two calibrations impose identical nominal-adjustment parameters in all regions. This removes one avoidable source of inconsistency when country models are compared. It does not make all their economic structures identical: openness, fiscal composition, external positions and household settings still differ.

The domestic monetary rule retains the source interest-rate smoothing coefficient of 0.3 and inflation-response coefficient of 1, with zero direct output-gap coefficient in the delivered state. The source's inflation composite `PIEPLUS` is a weighted forward-looking average. A new monetary rule is not inferred from the fact that nominal adjustment costs have been harmonized. Armenia and Georgia each retain

a domestic policy block and an inflation target of three percent; the euro area is represented by its consolidated monetary block.

For policy exercises, the inflation series used in the policy rule must be distinguished from the inflation measure shown to the reader. Headline consumer prices and the GDP deflator answer different questions when import prices, the exchange rate or consumption taxes change. A comparison should retain the rule as implemented and state the reporting measure explicitly.

5.3 The government budget and the fiscal adjustment instrument

The source relates the total government surplus, S_t, to changes in normalized government debt:

$$S_t = -\left(B_t - \frac{B_{t-1}}{\Pi_t g_t n_t}\right), \qquad IC_t = \frac{(I_{t-1}-1)B_{t-1}}{\Pi_t g_t n_t}. \tag{9}$$

Interest costs are IC_t and the gross nominal financing rate is I_t. Revenue is separated from purchases, transfers, subsidies and interest. Government purchases enter GDP directly; transfers change disposable income without being a direct purchase of final output.

A stationary debt target consequently implies a stationary total-surplus ratio. With annual frequency and a debt ratio b expressed in percent of GDP,

$$s^* = -b\left(1 - \frac{1}{\Pi^* gn}\right). \tag{10}$$

This is a model accounting condition. It is not a projection of a country's reported fiscal balance, which may incorporate valuation effects, stock-flow adjustments and different institutional coverage.

The inherited domestic fiscal switches select an overall-surplus rule with a cyclical output-gap response. The debt-feedback coefficient is zero in the delivered state, and general transfers close the budget. We therefore do not describe this release as imposing an active automatic return of the debt ratio to target after every disturbance. A permanent debt strategy requires an explicitly specified adjustment instrument and transition rule.

6. Calibrating the domestic economies and their partners

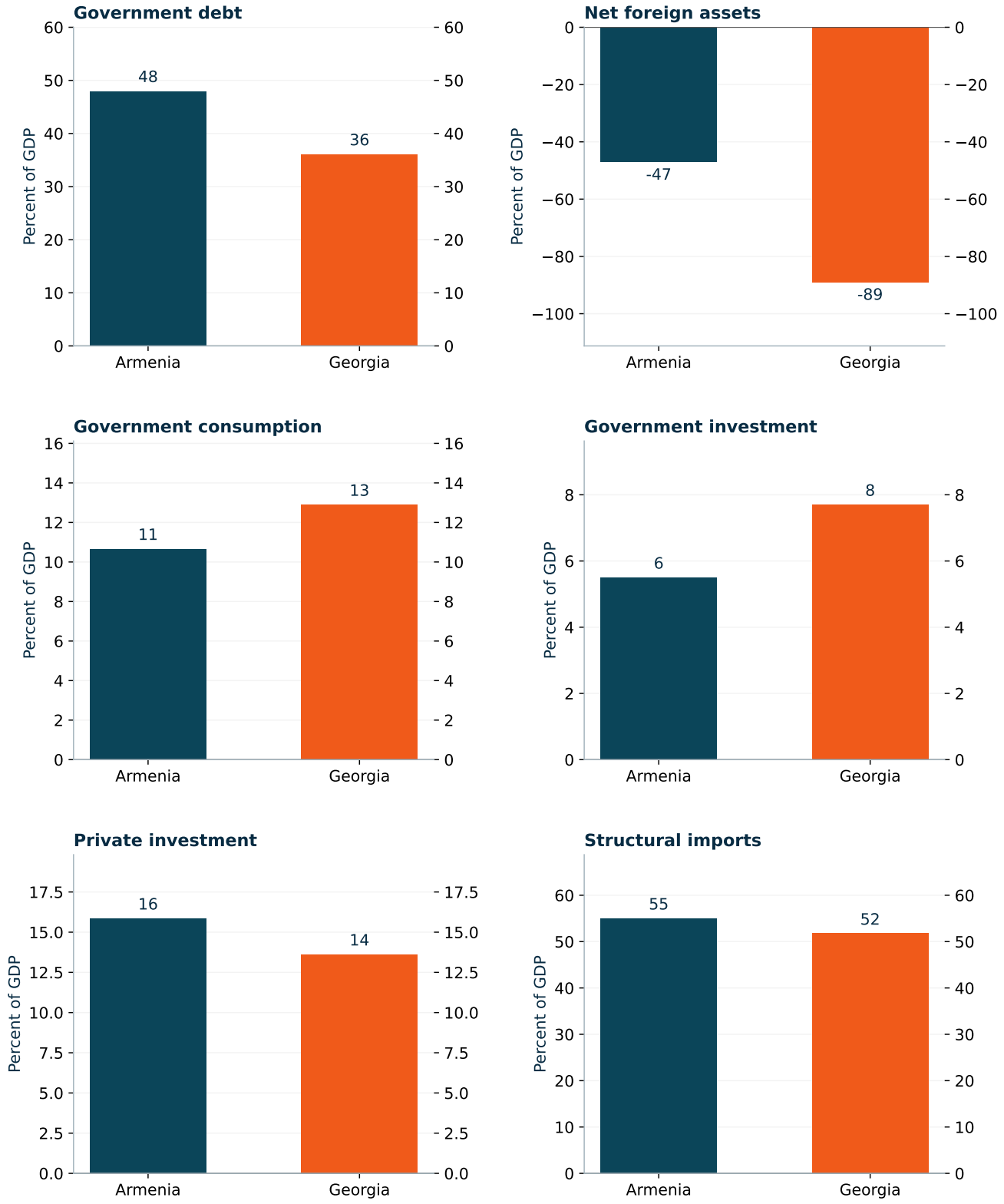
6.1 Domestic fiscal and external targets

The calibration preserves the existing domestic targets while rebuilding the regional system around them. Armenia's calibrated public debt is about forty-eight percent of GDP, compared with thirty-six percent in Georgia. Both domestic economies have negative net foreign assets. These positions are inherited research targets rather than newly assembled estimates for the current year.

The fiscal composition differs as well as the debt level. Georgia has a larger calibrated public-investment ratio, while Armenia has a larger private-investment ratio in the preserved target set. The calibration distinguishes the government-purchase price from the private expenditure prices. A shock to a real quantity must therefore be valued at the appropriate baseline price when its budget cost is normalized.

The domestic constrained-household shares and planning horizons are common across the two models, but that does not eliminate differences in fiscal transmission. Import leakage, relative prices, domestic factor proportions and the financing of public debt all remain relevant. Calibration comparisons help

Figure 1: Domestic fiscal and external calibrations



Notes: Stationary model ratios, percent of GDP. Armenia is shown in teal and Georgia in orange. Imports are structural calibration inputs, including the inherited treatment of re-exports and use categories. These bars are not historical observations or simulated policy responses.

Source: Delivered seven-region steady states and archived domestic-country inputs.

identify which mechanisms should be tested; they do not reveal the size of a dynamic multiplier on their own.

6.2 Trade weights and the problem of re-exports

The bilateral calibration begins with dated reporter or mirror goods-trade information, including WTO profiles for 2024. Several cells substitute an EU27 aggregate for the exact euro-area group. Selected Russian weights retain an older vintage, and several additional links remain explicit development priors. Applying these shares to both final and intermediate imports supplies a workable starting configuration; it does not establish their accuracy at the individual use-category level.

Gross customs flows can differ substantially from the imported content of domestic final demand. Re-exported goods may cross a border without generating the domestic absorption implied by a simple import-to-GDP ratio. The inherited Armenia calibration therefore uses structural openness adjusted for re-exports. Georgia retains its existing use-category split. Neither treatment should be mistaken for a newly estimated multi-year goods-and-services matrix.

The residual world is more than an accounting label. Once the sizes, openness and asset positions of the explicitly modeled regions are imposed, world trade and asset clearing restrict its remaining choices. In the delivered closure, rest-of-world final import demand and selected final-goods partner coefficients adjust as residuals. Their solved values are therefore equilibrium outcomes conditional on the imposed targets, not independent empirical measurements.

6.3 Regional GDP weights and the price normalization

World-GDP weights use the frozen 2024 aggregation underlying the earlier Armenia model, supplemented by the existing Georgia and Turkiye country GDP inputs. China's world weight is retained at the rounded development value of approximately seventeen percent. All seven regions are non-overlapping, and the residual world is recomputed after the explicit regions are assigned.

The size calibration adjusts population normalizations so that the desired regional GDP shares hold at the model's endogenous prices. These normalizations are computational scaling choices. They are not population forecasts and should not be interpreted as fitted demographic responses. Likewise, China's technology normalization is set to one with generic structural priors; the release does not claim to estimate China's behavioral equations.

Table 2: Armenia-centered model: selected stationary ratios

Region	G^C	G^I	Private I	Revenue	Debt	NFA	Imports
Armenia	10.7	5.5	15.9	22.4	48.0	-47.1	55.0
United States	17.1	3.2	15.3	25.2	87.9	0.0	12.4
Euro area	21.7	3.5	17.7	40.9	86.6	10.9	25.0
Russia	18.9	2.8	19.3	35.1	20.3	43.4	17.6
China	16.7	18.3	19.7	25.6	56.3	16.4	17.0
Georgia	12.9	7.7	13.6	25.3	36.1	-89.0	51.7
Rest of world	17.1	3.2	15.3	25.2	87.9	-12.9	17.4

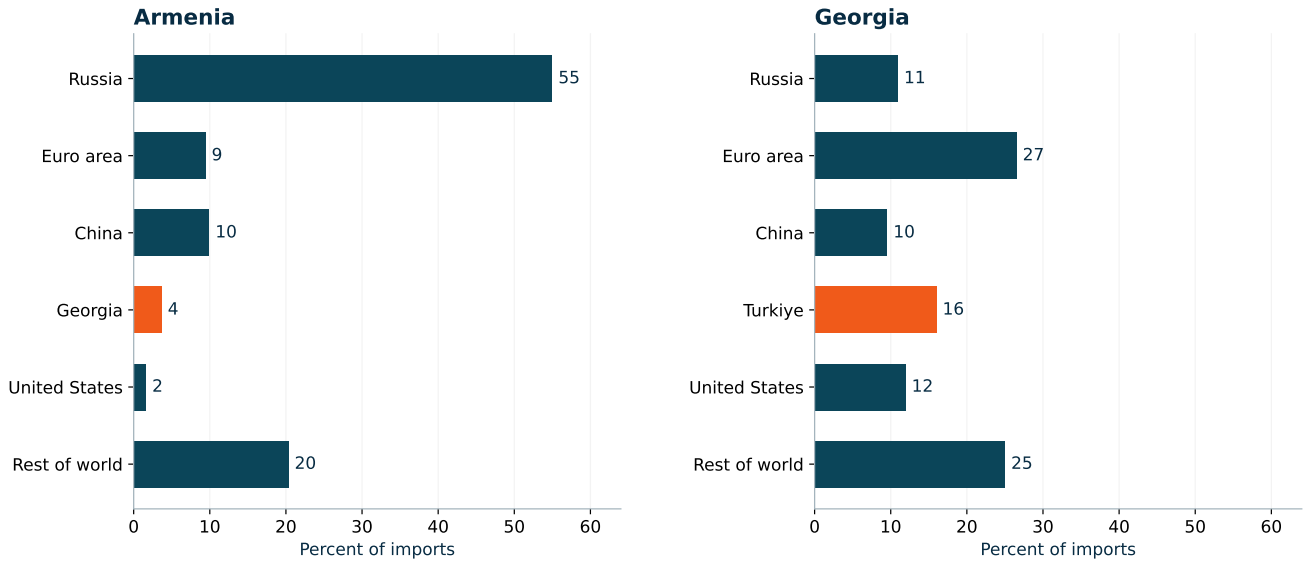
Notes: Percent of regional GDP. Revenue is the source fiscal mapping, whose statistical coverage differs across regions. NFA and rest-of-world final import demand are subject to the model's world-accounting closure.

Table 3: Georgia-centered model: selected stationary ratios

Region	G^C	G^I	Private I	Revenue	Debt	NFA	Imports
Georgia	12.9	7.7	13.6	25.3	36.1	-89.0	51.7
United States	17.1	3.2	15.3	25.2	87.9	0.0	12.4
Euro area	21.7	3.5	17.7	40.9	86.6	10.9	25.0
Russia	18.9	2.8	19.3	35.1	20.3	43.4	17.6
China	16.7	18.3	19.7	25.6	56.3	16.4	17.0
Turkiye	14.5	3.0	28.3	23.9	23.6	-25.8	27.3
Rest of world	17.1	3.2	15.3	25.2	87.9	-12.5	17.7

Notes: Same definitions as above. China macro targets come from an existing development candidate; its fiscal-coverage problem is discussed in Section 7.2. Generic rest-of-world settings are priors rather than an estimate of a representative foreign economy.

Figure 2: Which external suppliers are identified?



Notes: Domestic import-partner targets, percent. The additional neighbor is Georgia for Armenia and Turkiye for Georgia, highlighted in orange. EU27 proxies and mirror-data adjustments remain in selected cells. The residual group includes all omitted suppliers. Rounded labels are for presentation; calibration inputs retain full precision.

Source: WTO 2024 profiles, archived partner inputs and documented development assumptions.

7. What the stationary equilibria reveal

7.1 A coherent world accounting system

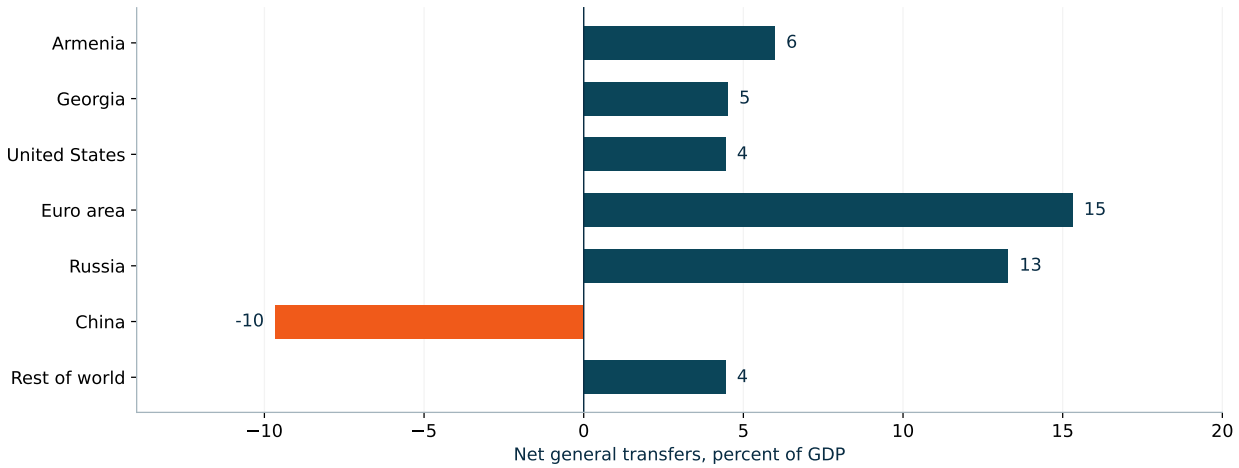
The numerical solution simultaneously satisfies the domestic resource constraints, household and firm equations, government budgets, trade identities and international asset accounting. This is a stronger requirement than assembling a table of macro ratios whose rows look individually plausible. A bilateral matrix, a set of GDP weights and a list of net foreign asset positions cannot be chosen independently without an explicit closure.

Figure 4 illustrates why an accounting closure also needs an economic interpretation. In the domestic regions, the general-transfer residual is positive under the inherited targets. For China, the same budget discipline exposes a mismatch in the development fiscal inputs. The model does not conceal that mismatch in an equation residual; it places it in an economically meaningful fiscal item.

7.2 The China fiscal residual

The inherited China candidate combines public investment of roughly eighteen percent of GDP with government consumption of roughly seventeen percent and revenue of roughly twenty-six percent. Alongside the debt-stabilizing balance and interest costs, this produces net general transfers of approximately minus ten percent of GDP. In the model, a negative general transfer acts as an additional net lump-sum tax.

Figure 4: Fiscal closure can expose inconsistent coverage



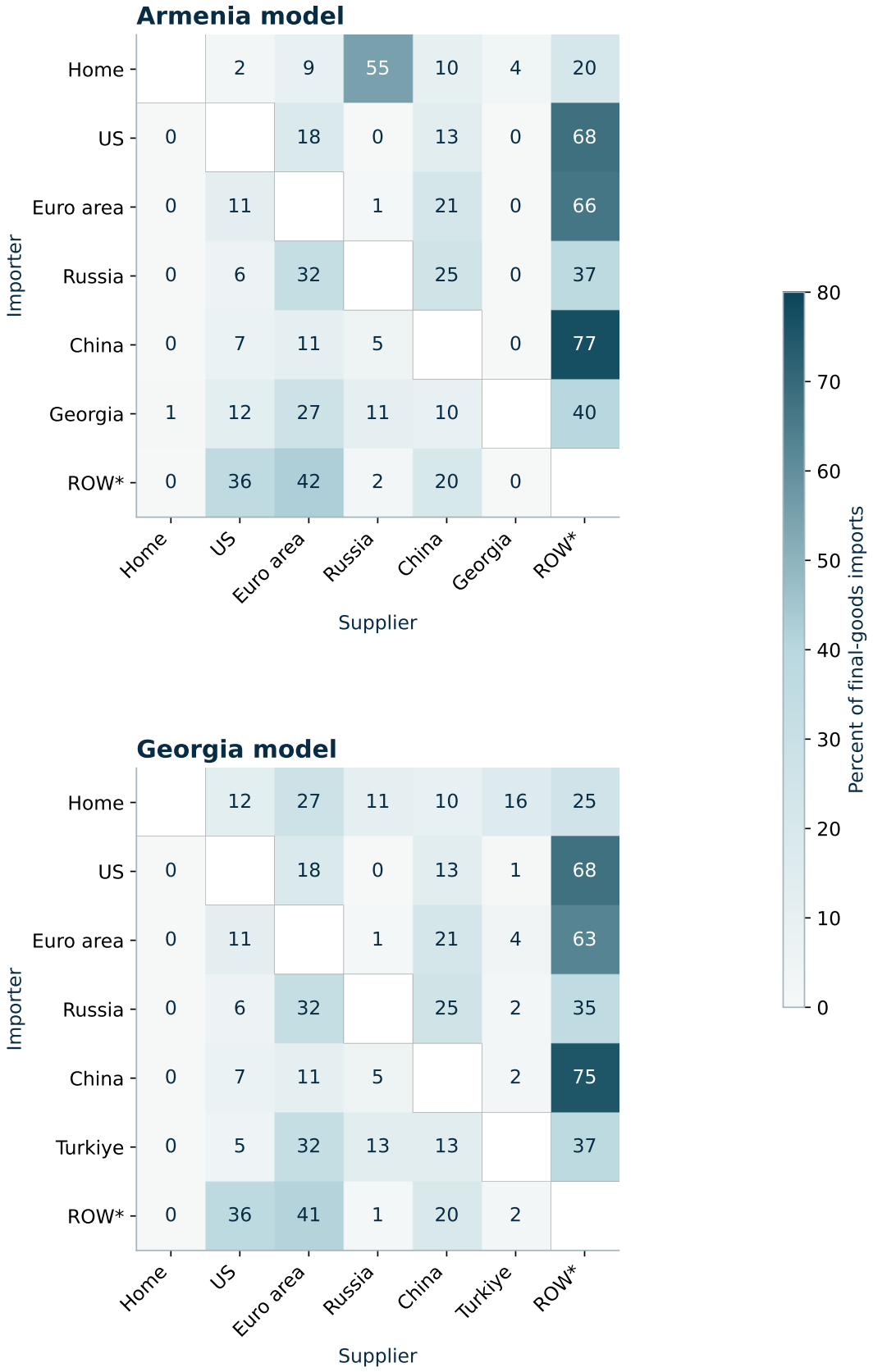
Notes: Net general transfers in the Armenia-centered stationary calibration, percent of GDP. The negative China residual is shown in orange. Its value is effectively the same in the Georgia-centered calibration. This is a model closure item, not observed Chinese benefit spending.

Source: Solved government budget and transfer equations.

The numerical solution is internally consistent, but the fiscal interpretation is not yet ready for a China policy application. Broad public-investment measures may include activity outside the revenue or debt perimeter represented elsewhere in the inputs. The present paper does not replace the inherited split with an unsupported alternative. Reconciliation must establish a consistent perimeter for investment, consumption, revenue, transfers and debt.

This issue is material even when China is an external region. It qualifies the interpretation of policy disturbances originating there and any claim that its fiscal block is empirically validated. It does not

Figure 3: The solved network of final-goods imports



Notes: Rows are importers and columns are suppliers. Entries show solved final-goods import expenditure shares in percent, rounded to whole numbers. Home denotes Armenia in the upper panel and Georgia in the lower panel. ROW* is the residual importer whose final-goods allocation is partly solved by equilibrium. These are calibration networks, not estimated causal spillover coefficients.

Source: Solved bilateral import ratios in the delivered states.

overturn the equation checks or change the fact that the domestic targets are met. It does require sensitivity analysis before conclusions are drawn from a particular international scenario.

7.3 What is not identified by a steady-state comparison

A larger import ratio may suggest stronger leakage of a domestic demand expansion, but the dynamic response also depends on relative prices, expenditure composition, the import content of investment, financial conditions and monetary policy. A lower initial debt ratio does not identify the available fiscal space without a view of financing risks and the durability of future primary balances. A larger public-investment ratio does not establish that marginal projects are more productive.

The stationary results therefore organize the next questions. They show which inputs differ, whether the implied accounting is coherent, and where measurement problems reside. They do not rank fiscal instruments or forecast the consequences of a crisis.

8. Numerical solution, validation and replication

8.1 A staged nonlinear calibration

Directly moving from a symmetric seed to country-specific sizes and extreme bilateral shares proved an inefficient route through the calibration space. The adopted procedure separates the task into two stages. The first establishes regional GDP sizes with a homogeneous starting structure and development trade weights. The second imposes the country-specific fiscal, external and structural inputs together with the final partner targets.

Each stage uses adaptive homotopy, damped sparse Newton steps and a continuation predictor. The equations themselves remain nonlinear; the method does not replace them with a hand-chosen multiplier system. Failed intermediate steps cause a reduction in the continuation step. Only completed endpoints are accepted as the delivered calibrations.

Table 4: Independent equation checks

Model	Calibration equations	Operational equations	Maximum calibration error	Maximum baseline error
Armenia	4931	4711	1.99e-12	1.99e-12
Georgia	4931	4711	3.33e-11	3.33e-11

Notes: Maximum absolute residuals are evaluated on the source equations. The acceptance threshold is 10^{-8}. Operational counts refer to the expanded dynamic equations evaluated at the stationary baseline; they are not the number of independently estimated behavioral equations.

The operational baseline check restores the source GDP, price and sectoral normalization constants and evaluates the dynamic equations at the stationary state. Regional GDP shares sum to one. World trade and external assets clear in the common numeraire. The audit also checks selected positive quantities, trade-weight adding-up, discount-factor and effective-tax-rate bounds, and default-percentage bounds.

A fresh rebuild from the packaged source reproduces both calibrations to numerical precision. This verifies that the delivered states are recoverable through the supplied workflow. It does not establish global uniqueness, a stable dynamic solution, empirical identification or finite-horizon transition accuracy.

Those are separate questions and need separate evidence.

8.2 A transparent release

The replication package retains source states, country inputs, region mappings, calibration targets, assumptions, completed continuation histories and validation records. It also supplies the full expanded operational equation lists, making the abbreviated theoretical exposition auditable against the actual implementation.

A reader can re-evaluate the supplied states without repeating the calibration. A full rebuild reconstructs the seed, completes the regional-size stages, applies the final targets and regenerates the note and tables. Computational metadata and hashes identify the inherited archives. Presentation rounding never replaces the precision of the stored inputs or solved states.

9. A disciplined program of fiscal and regional experiments

9.1 Seven fiscal instruments with comparable budget costs

The next stage of policy analysis should compare the seven standard fiscal instruments under a common announcement and budget-cost convention. A natural benchmark is a fiscal easing costing one percent of initial GDP in each of two years. For government purchases, the quantity change must be valued at the baseline government-purchase price. For tax changes, the targeted revenue loss must be distinguished from the change in the statutory rate.

Table 5: Policy experiments supported by the model structure

Instrument	Main initial channel	Main interpretation issue
Government consumption	Direct purchases and factor demand	Import content and monetary response
Government investment	Purchases followed by public-capital accumulation	Implementation and productive efficiency
Targeted transfers	Disposable income of selected households	Allocation to constrained households
General transfers	Broad household disposable income	Saving and distribution across groups
Labor-tax reduction	Disposable income and work incentives	Effective rate and labor-tax base
Capital-tax reduction	After-tax capital returns and investment	Financing, adjustment and expected duration
Consumption-tax reduction	Consumer purchasing power and tax-inclusive prices	Timing and inflation measurement

Notes: This table specifies an experimental design. Newly solved impulse responses for these seven-region models are not reported in this calibration release.

The monetary comparison must preserve the same fiscal announcement. One regime can retain the endogenous rule. Another can hold the policy rate for one year and then evaluate a separately announced extension. If the second hold is unexpected when first-year decisions are made, the second-year response must be solved under the revised information set. A perfectly anticipated two-year hold answers a different question.

9.2 Regional demand, sovereign risk and debt adjustment

The regional blocks permit foreign fiscal and demand shocks to be separated from domestic measures. They also permit country-risk scenarios to be distinguished from a common global financing shock. A larger sovereign premium is not automatically a direct shift in inflation expectations. If an imperfect-credibility effect is added, it needs its own equation, calibration and attribution.

A permanent reduction in the public-debt target is another distinct exercise. The new stationary endpoint may change consumption, capital, tax rates and external positions. The transition requires an adjustment path that explains which households and instruments bear the fiscal cost. Neither the difference between two steady states nor a temporary fiscal multiplier can substitute for that transition.

The model's international bond structure and the inherited fiscal switches are particularly relevant here. With zero domestic debt feedback in the delivered state, a debt-reduction experiment must specify an active adjustment rule rather than rely on an unstated mechanism. Claims about sovereign foreign-currency exposure would likewise require an explicit mapping beyond the present domestic-bond accounting.

10. Prudent risk management and the Three Cs

The value of a structural model is that it makes the economic narrative, financing assumptions and policy response fit together. Prudent risk management uses that discipline to construct a reference scenario, identify material risks and compare coherent alternatives rather than rely on a single forecast.

For fiscal policy, the Three Cs—comprehensive, consistent and coordinated—provide an organizing principle. Comprehensive analysis covers fiscal composition, household incidence, productive capacity and financing costs. Consistency reconciles the budget with debt, domestic resources and external accounts. Coordination examines the monetary response and conditions in partner economies. The present calibrations support these tasks while identifying empirical priorities: remittances, tourism, transit access, energy transmission and China's fiscal perimeter.

For Armenia and Georgia, the practical questions are whether a package remains credible when foreign demand weakens or financing costs rise, how productive investment can be protected during adjustment, and how support can reach constrained households. The models provide a common language for those questions; policy judgment still depends on scenario quality and empirical evidence.

11. Conclusions

Two seven-region GIMF calibrations provide a reproducible framework for fiscal analysis in Armenia and Georgia. Their regional structures distinguish major foreign economies and the additional neighbor relevant to each domestic perspective. Non-Ricardian households, distortionary taxes, public capital and corporate balance sheets give fiscal composition and public debt a meaningful economic role.

Both stationary systems satisfy the source equations and world accounting restrictions. Their empirical interpretation remains conditional on dated inputs, provisional bilateral links and an unresolved China fiscal mapping. The next stage is to reconcile those inputs and solve explicitly defined fiscal and regional-risk transitions. A useful policy model makes its mechanisms and its limits equally visible.

References

Anderson, D., B. Hunt, M. Kortelainen, M. Kumhof, D. Laxton, D. Muir, S. Mursula and S. Snudden (2013). *Getting to Know GIMF: The Simulation Properties of the Global Integrated Monetary and Fiscal Model*. IMF Working Paper 13/55. https://doi.org/10.5089/9781475559415.001.

International Monetary Fund (2025). *Republic of Armenia: 2025 Article IV Consultation*. Country fiscal reference preserved in the Armenia calibration archive. https://www.imf.org/-/media/Files/Publications/CR/2025/English/1armea2025001-print-pdf.ashx.

International Monetary Fund (2025). *Georgia: 2025 Article IV Consultation*. IMF Country Report 25/216. https://www.imf.org/-/media/files/publications/cr/2025/english/1geoea2025001-source-pdf.pdf.

International Monetary Fund (2026). *People's Republic of China: 2025 Article IV Consultation*. IMF Country Report 26/44. Fiscal-perimeter and data-coverage context. https://www.imf.org/-/media/files/publications/cr/2026/english/1chnea2026001-source-pdf.pdf.

Kumhof, M., D. Laxton, D. Muir and S. Mursula (2010). *The Global Integrated Monetary and Fiscal Model (GIMF): Theoretical Structure*. IMF Working Paper 10/34. https://doi.org/10.5089/9781451962734.001.

Laxton, D., H. Avetisyan and V. Avagyan, eds. (2026). *Prudent Risk Management Approach to Price Stability: Theory and Practice at the Central Bank of Armenia*. Central Bank of Armenia. https://www.cba.am/en/analytical-materials/10081/.

National Statistics Office of Georgia (2025). *External Merchandise Trade of Georgia in 2024*. Preliminary release, 20 January. https://geostat.ge/media/67898/External-Merchandise-Trade-of-Georgia-in-2024.pdf.

World Trade Organization (2026 access). *Tariff and Trade Data: Member Profiles*. 2024 partner inputs for Armenia, Georgia, China and Turkiye. https://ttd.wto.org/en/profiles/armenia; https://ttd.wto.org/en/profiles/georgia; https://ttd.wto.org/en/profiles/china; https://ttd.wto.org/en/profiles/turkiye.

The Better Policy Project (2026). *Armenia and Georgia: Seven-Region GIMF Calibration Note and Replication Package*. Source states and computational release, 11 November. This paper's replication package preserves the earlier note and updates the publication materials.

A. Equation map and implementation conventions

Table 6: From economic mechanism to executable source

Block	Selected source variables	Role in this paper
Optimizing households	C_OLG, MPC, TW, HW	Consumption from wealth and finite horizons
Constrained households	C_LIQ, PSI, TRANSFER_LIQ	Current-income and transfer channel
Public capital	KG1, GOVINV, ALPHA_KG1	Productive infrastructure and accumulation
Corporate finance	NW, LEVERAGE, ZZ_BUST	Sector-specific balance sheets and default percentages
Trade	YDM, YTM, ZETA_D, ZETA_T	Bilateral quantities and partner coefficients
International accounting	E, GDPSIZE, F_RAT	Common numeraire and asset clearing
Government budget	GOVSUR, B, INTCOST	Debt-flow identity and financing cost
Fiscal closure	XX_GOVSUR, XX_TRANSFER	Surplus rule and residual transfers
Monetary policy	INTMP, PIEPLUS, DELTAI	Inherited interest-rate reaction function

Notes: Region suffixes and sector suffixes are omitted for readability. The full expanded equation lists identify every operational equation separately.

The source contains both calibration and operational equation configurations. Calibration flips replace selected structural parameters with ratio targets so that the nonlinear system can recover the parameters and steady-state quantities jointly. Additional size constraints determine population normalizations. The operational configuration restores the model's behavioral interpretation and is evaluated at the recovered stationary state.

The seven-region configurations have 4,931 calibration equations and 4,711 operational equations before the separate GDP-size constraints used by the calibration solver. These counts describe expanded source systems. They should not be presented as a measure of empirical information or as a claim that each equation is independently estimated.

All macroeconomic flows are annual in the delivered configuration. Percentage-of-GDP ratios retain the source definitions and expenditure-price valuation. The reporting tables round to one decimal place; stored data and computational checks retain native precision. Default measures are percentages, while gross interest and inflation variables require their source transformations before they can be reported as annual rates.

B. Provisional inputs and priorities for empirical refinement

Table 7: Material empirical qualifications

Input	Current treatment	Refinement needed
Armenia openness	Structural re-export adjustment retained	Multi-year goods-and-services absorption bridge
Georgia public investment	Acquisition of nonfinancial assets proxy	Productive public GFCF with consistent coverage
Domestic external stocks	Inherited NFA targets	Reconciled current IIP vintage and model valuation
Euro-area trade	EU27 proxy in selected cells	Exact extra-euro-area partner matrix
Use-category weights	Goods shares common across final and intermediate uses	Category-specific partner evidence
Russia inputs	Dated fiscal/external proxies and selected older trade shares	Consistent current coverage and bilateral vintage
China fiscal block	Existing development macro split; signed transfer residual	Common perimeter for public investment, revenue, debt and transfers
China behavior	Generic ROW priors; unit technology normalization	China-specific structural evidence and sensitivity
Residual world	Final demand and selected partner coefficients solved	Independent residual accounts where feasible
Additional channels	No new remittance, tourism, corridor or energy equations	Explicit structural additions tied to measured inputs

Specific provisional partner-share inputs include euro-area imports from China, Turkiye and Georgia; Russian imports from China, Turkiye and Georgia; and Chinese imports from Turkiye. The US–China input is a rounded 2024 goods-share assumption. Small Armenia–Georgia and regional partner cells include mirror observations with origin/consignment differences. The JSON inputs retain the exact values and their development status.

These qualifications are not interchangeable. A dated observation, an institutional-coverage proxy, a behavioral prior and an accounting residual carry different kinds of uncertainty. Sensitivity analysis should vary the relevant input or mechanism rather than attach a uniform error band to every cell.

C. Contents of the replication release

The publication directory includes the editable LaTeX source, the original BPP template lineage, generated figure files, table fragments, a figure-generation script and full expanded operational equation lists for both models. The model directory retains the source equations, calibration software, inherited reference states, completed steady states and audit records.

To check the numerical results, run `python validate.py` in the model directory. To reproduce both calibrations from the seed, run `python run_all.py`. To rebuild the paper assets, run `python build_assets.py` in the publication directory, then compile `main.tex` twice with XeLaTeX. Source and output directories are retained together so that the published figures can be regenerated from the delivered states.

Armenia and Georgia
Seven-Region GIMF Calibrations

The Better Policy Project / Global Forecasting School
Calibration note | 11 November 2026

Two numerically solved research calibrations extend the existing country models. Both use the agreed region structures and the harmonized nominal adjustment costs. Inputs, numerical results and unresolved empirical mappings are recorded separately.

Regional composition

Slot	Armenia model	Georgia model
1	Armenia	Georgia
2	United States	United States
3	Euro area	Euro area
4	Russia	Russia
5	China	China
6	Georgia	Turkiye
7	Rest of world	Rest of world

Domestic calibration

Percent of GDP	Armenia	Georgia
Government consumption	10.66	12.90
Government investment	5.50	7.70
Private investment	15.86	13.62
Fiscal revenue mapping	22.40	25.30
Government debt	48.00	36.10
Net foreign assets	-47.10	-89.00
Structural imports	55.00	51.73

Both domestic inflation targets are 3 percent. Imports are structural model inputs: Armenia retains the re-export adjustment, and Georgia retains its existing use-category calibration. These are not newly measured national-account ratios.

Fiscal and external steady states

All entries are percent of regional GDP. Values are solved model ratios, conditional on the documented inputs. Revenue coverage differs across inherited country sources and is not a harmonized statistical measure.

Armenia model

Region	G cons.	G inv.	Priv. inv.	Revenue	Debt	NFA	Imports
Armenia	10.66	5.50	15.86	22.40	48.00	-47.10	55.00
United States	17.10	3.20	15.30	25.20	87.90	0.00	12.43
Euro area	21.68	3.46	17.68	40.90	86.60	10.90	25.00
Russia	18.90	2.80	19.33	35.10	20.30	43.38	17.59
China	16.70	18.27	19.70	25.60	56.30	16.40	17.00
Georgia	12.90	7.70	13.62	25.30	36.10	-89.00	51.73
Rest of world	17.10	3.20	15.30	25.20	87.90	-12.92	17.44

Georgia model

Region	G cons.	G inv.	Priv. inv.	Revenue	Debt	NFA	Imports
Georgia	12.90	7.70	13.62	25.30	36.10	-89.00	51.73
United States	17.10	3.20	15.30	25.20	87.90	0.00	12.43
Euro area	21.68	3.46	17.68	40.90	86.60	10.90	25.00
Russia	18.90	2.80	19.33	35.10	20.30	43.38	17.59
China	16.70	18.27	19.70	25.60	56.30	16.40	17.00
Turkiye	14.46	3.00	28.32	23.95	23.60	-25.80	27.30
Rest of world	17.10	3.20	15.30	25.20	87.90	-12.54	17.74

China fiscal mapping requires reconciliation

The existing China development candidate combines public investment of 18.27 percent of GDP with revenue of 25.60 percent. Under the model debt-stabilizing fiscal closure, this produces net general transfers of -9.66 percent of GDP in both calibrations. The negative transfer is a net lump-sum tax in the model; it is not an observed Chinese benefit payment.

This closure is retained transparently as a development input. China fiscal experiments and publication claims about its fiscal structure should wait for consistent coverage of public investment, revenue, debt and transfers. China behavioral settings use the generic rest-of-world priors with technology normalized to one.

The rest-of-world asset position and final import demand are solved residuals. Its fiscal and behavioral settings remain inherited generic priors.

Bilateral import calibration

Rows are importers; columns are suppliers. Entries are target partner shares in percent. Goods shares are applied uniformly to final and intermediate import categories. Dashes mark domestic trade. The residual rest-of-world importer row is solved by the model and is excluded from the imposed-target tables.

Armenia model

Importer	Home	US	EA	Russia	China	Neighbor	ROW
Armenia	-	1.63	9.44	54.99	9.93	3.68	20.34
United States	0.00	-	18.38	0.09	13.40	0.01	68.12
Euro area	0.02	11.30	-	0.98	21.30	0.03	66.38
Russia	0.24	5.88	32.00	-	24.80	0.20	36.87
China	0.04	6.67	10.93	5.26	-	0.01	77.09
Georgia	0.92	11.95	26.53	10.95	9.54	-	40.10

Neighbor = Georgia. EA = euro area; ROW = rest of world.

Georgia model

Importer	Home	US	EA	Russia	China	Neighbor	ROW
Georgia	-	11.95	26.53	10.95	9.54	16.01	25.01
United States	0.01	-	18.38	0.09	13.40	0.51	67.61
Euro area	0.03	11.30	-	0.98	21.30	3.80	62.60
Russia	0.20	5.88	32.00	-	24.80	2.00	35.12
China	0.01	6.67	10.93	5.26	-	1.70	75.43
Turkiye	0.13	4.72	32.12	12.80	13.06	-	37.17

Neighbor = Turkiye. EA = euro area; ROW = rest of world.

Observed inputs and development priors

WTO 2024 profiles supply the main Armenia, Georgia, China and Turkiye import shares. Small Armenia-Georgia links use mirror exports. EU27 substitutes for EA20 in flagged cells. Several links remain explicit priors: EA-China, EA-Turkiye, EA-Georgia, Russia-China, Russia-Turkiye, Russia-Georgia and China-Turkiye. The exact cells and values are in the input JSON files.

These are single-vintage development weights. A multi-year, re-export-adjusted goods-and-services matrix has not been estimated. Transit trade, tourism, remittances and energy transmission are not represented by new dedicated equations.

Numerical validation

Check	Armenia	Georgia
Calibration equations	4931	4931
Dynamic baseline equations	4711	4711
Maximum calibration residual	1.99e-12	3.33e-11
Maximum dynamic baseline residual	1.99e-12	3.33e-11
GDP-share target error	0.00e+00	5.55e-17
World net trade (% world GDP)	1.22e-15	5.62e-14
World NFA (% world GDP)	5.69e-16	-1.88e-14

Both systems pass the numerical threshold of 1e-8. Regional GDP shares sum to one. World trade and net foreign assets clear. Checked GDP, consumption, investment, capital, exchange rates and net-worth quantities are positive. Trade weights sum to one and lie within bounds; discount factors and effective tax rates are within their checked bounds. Borrower default percentages remain between zero and one hundred.

The dynamic baseline is checked against the operational equations after restoring the steady-state normalization constants. No new impulse-response experiments, dynamic stability test or finite-horizon sensitivity exercise is included in this calibration task.

Harmonized nominal adjustment costs

Source parameter	Value in every region
PHI_P_U	216
PHI_P_T	108
PHI_P_N	108
PHI_P_I	108
PHI_P_C	3.6
PHI_P_DM	0.72
PHI_P_TM	0.72

These are the effective parameters in the delivered states. The new models retain the source monetary-policy and fiscal-rule specification; this task does not replace those equations.

Sources and replication

Primary model files

Armenia_Five_Region_Model_Reproducibility.zip: solved five-region structure, regional states, calibration flips and solver; 7 November 2026.

Armenia_Harmonized_GIMF_Complete_Replication.zip: effective nominal-cost profile; retrieved 11 November 2026.

Georgia_GIMF3_current.zip: domestic Georgia fiscal, external and behavioral inputs.

GIMF_All_59_Countries.zip: Turkiye country state and source metadata.

China_R2_matrix_reconciled_candidate_steady_state.txt: existing development macro targets; not a certified empirical China calibration.

External statistical references

https://ttd.wto.org/en/profiles/armenia

https://ttd.wto.org/en/profiles/georgia

https://ttd.wto.org/en/profiles/china

https://ttd.wto.org/en/profiles/turkiye

https://geostat.ge/media/67898/External-Merchandise-Trade-of-Georgia-in-2024.pdf

https://www.imf.org/-/media/files/publications/cr/2026/english/1chnea2026001-source-pdf.pdf

Additional inherited limitations

GDP weights use the frozen 2024 world, US, euro-area and Russia levels; Georgia and Turkiye use their existing 2024 source GDP. China retains the rounded 16.77 percent world-GDP weight. Euro-area openness and investment contain inherited proxies. Russia retains dated fiscal/external inputs and selected 2021 partner shares. Armenia retains its structural openness and NFA proxies. Georgia public investment uses acquisition of nonfinancial assets as a proxy.

Reproduction

Install the packages in requirements.txt. Run python run_all.py from the extracted package. The workflow first constructs a seven-region seed, then calibrates regional sizes with balanced development trade shares, applies the final country and partner inputs, and validates the solved states. Use python validate.py for a quick independent re-evaluation of the delivered states. Source files, inputs, solved states, stage checkpoints, logs and audit records are supplied.

Numerical consistency establishes that the model equations are satisfied. It does not establish empirical accuracy, uniqueness or readiness for publication. The signed China fiscal residual and provisional bilateral cells remain material research limitations.

THE BETTER POLICY PROJECT

Armenia

Fiscal Policy, Monetary Responses and Prudent Risk Management

A harmonized three-region GIMF application

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10 November 2026 | Working paper discussion draft

Additional Ministry of Finance coauthors: names and affiliations pending. The six-author research team is provisional.

Abstract

This paper develops a reproducible Armenia application of the supplied GIMF model using the common nominal adjustment-cost profile adopted in Fiscal Multipliers Galore. The model has three regions, 1,668 equations and 309 parameters. We rebuild the local dynamics from the harmonized calibration and compare seven fiscal instruments, one-year and two-year interventions, and alternative monetary responses. The exercise identifies conditional transmission mechanisms and provides a starting point for joint work with Armenian policy institutions. It is not an updated macroeconomic forecast or an empirically estimated Armenia multiplier study.

The core comparison holds the initial fiscal impulse at one percent of baseline GDP per intervention year. Spending increases, transfer increases and tax reductions are compared under the policy rule and a first-year policy-rate hold. General transfers retain their special role as the residual financing instrument. Numerical tables and charts report both GDP-deflator and headline inflation. All reported responses are deviations from the inherited steady-state baseline.

1. The policy question

How much domestic activity does a fiscal measure generate, which private expenditures move with it, and what happens to inflation, imports and public debt? For Armenia, a model-based answer must make the external sector and the monetary response explicit. A domestic-demand expansion can support production while also raising imports. Investment, consumption and tax measures need not have similar effects even when their initial budget costs are normalized equally.

The aim is a framework for disciplined policy discussion. A multiplier is conditional on the instrument, duration, financing rule, household structure and monetary regime. The broader GIMF framework is documented by Kumhof et al. (2010). This application retains the supplied Armenia equations and structural anchors, while removing inherited cross-region differences in nominal adjustment costs.

2. What has been built and verified

The three regions are United States (R1), Armenia (R2), and rest of world (R3). The source model and solved state are taken from the uploaded GIMF59 master archive. The harmonized profile is applied to all three regions before rebuilding derivatives. The adjustment costs leave the steady state unchanged; they alter the transition dynamics. The solution is first order around the nonlinear steady state. Financial amplification embedded in those local derivatives does not constitute a nonlinear crisis simulation.

3. Calibration: common rigidities, Armenia anchors

Parameter family	Common value
Wage adjustment: PHI_P_U	216
Tradable prices: PHI_P_T	108
Nontradable prices: PHI_P_N	108
Investment prices: PHI_P_I	108
Consumption prices: PHI_P_C	3.6
Domestic distribution: PHI_P_DM	0.72
Imported distribution: PHI_P_TM	0.72

These are the exact common parameter values in CURRENT_CALIBRATION.json, rather than a further proportional increase in the inherited Armenia parameters. Their values are adjustment-cost coefficients, not probabilities or estimated durations of price contracts.

Inherited Armenia anchor	Model value
Imports / GDP	55%
Government consumption / GDP	10.66%
Government investment / GDP	5.5%
Public debt / GDP	48%
Fiscal deficit / GDP	2.54%

These entries describe the inherited model calibration. They have not been refreshed against current Armenian statistics in this exercise. The import share is an aggregate anchor; it does not mean that every fiscal instrument has the same marginal import content. Model tax parameters likewise should not be read as statutory tax rates.

4. Fiscal experiments and financing

We increase government consumption, government investment, targeted transfers or general transfers, or reduce labor tax, capital tax or VAT. Spending and targeted-transfer paths are fixed at their normalized increases during the intervention and return to baseline afterward. Tax-rate reductions are normalized using baseline tax bases, so their initial static revenue cost equals one percent of GDP; realized revenue also responds endogenously.

The standard driver eases the fiscal-deficit target by one percentage point during the intervention, retaining the source fiscal feedback afterward. General transfers clear the budget constraint. Consequently, the general-transfer experiment is a deficit-target easing with residual transfers, not an independently fixed transfer path of exactly one percent of GDP in every year. The other measures may also entail residual-transfer movements. This financing convention is part of the experiment and matters for interpretation.

5. Monetary responses and inflation measurement

The domestic policy rule changes the interest rate in response to a weighted combination of current and next-year underlying inflation deviations, with weights of three-quarters and one-quarter and an overall response coefficient of one-half. This is the rule implemented in the supplied annual driver. It should not be presented as an estimated Central Bank of Armenia reaction function. The other regions retain their source policy closures.

The central comparison uses the rule and an announced first-year policy-rate hold. Additional experiments use a two-year announced hold or sequential one-year holds: the second hold is introduced after the first year has been realized, preserving that history. These regimes can produce different expectations and real borrowing rates. A fixed nominal policy rate does not imply a fixed real interest rate or a fixed exchange rate.

GDP-deflator inflation is the main domestic-production price measure. Headline consumer inflation remains visible because imported prices and VAT can produce different movements. The reported deflator is constructed on the source model valuation basis and excludes a separate VAT wedge. Neither inflation series should be substituted for the other without changing the interpretation.

6. First-year results: one-year fiscal interventions

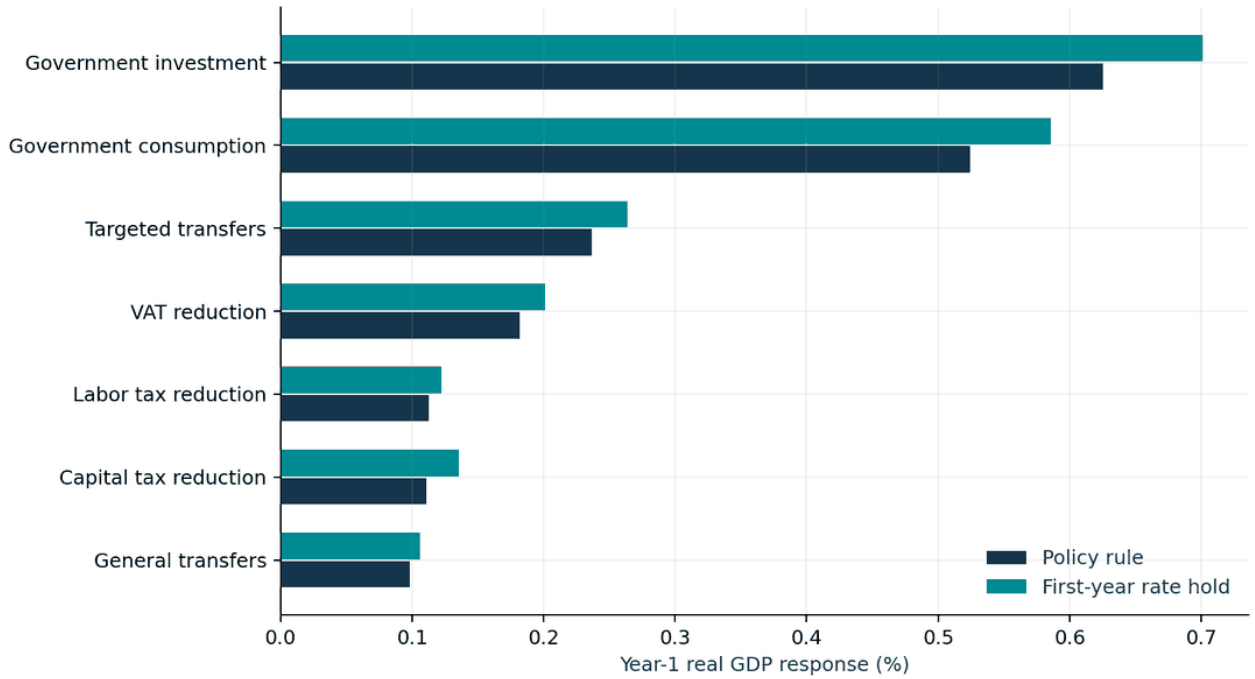


Figure 1. First-year real GDP responses to a one-year measure with an initial static budget impulse of one percent of GDP. Ranking follows the policy-rule result. For the general-transfer case, the transfer path is endogenous.

7. Instrument comparisons

Instrument	GDP, rule	GDP, hold	Deflator, rule	CPI, rule
Government investment	0.63	0.70	0.02	0.04
Government consumption	0.52	0.59	0.03	0.02
Targeted transfers	0.24	0.26	0.02	0.01
VAT reduction	0.18	0.20	0.01	-1.28
Labor tax reduction	0.11	0.12	0.00	0.00
Capital tax reduction	0.11	0.14	0.00	0.01
General transfers	0.10	0.11	0.01	0.00

Table 1. Year-1 responses. GDP is percent from baseline; inflation is percentage points. Hold denotes the first-year policy-rate hold. Decimal precision is retained in tables for reproducibility.

Government investment generates the largest first-year GDP response under the policy rule in this calibration; general transfers generates the smallest. This ranking is a model result conditional on the stated financing and policy assumptions. It is not a welfare ranking: distribution, service quality, implementation capacity and longer-run productivity also matter.

The expenditure identity supplies a useful organizing device: output equals private consumption, private investment, government consumption, government investment and net exports. The attached paths show which components support or offset the initial impulse. An import increase can reduce the domestic output response while still representing useful purchases. Aggregate openness alone does not identify the cause of a particular multiplier; import content, substitution, financing and private-demand responses must be considered together.

8. Persistence and public investment

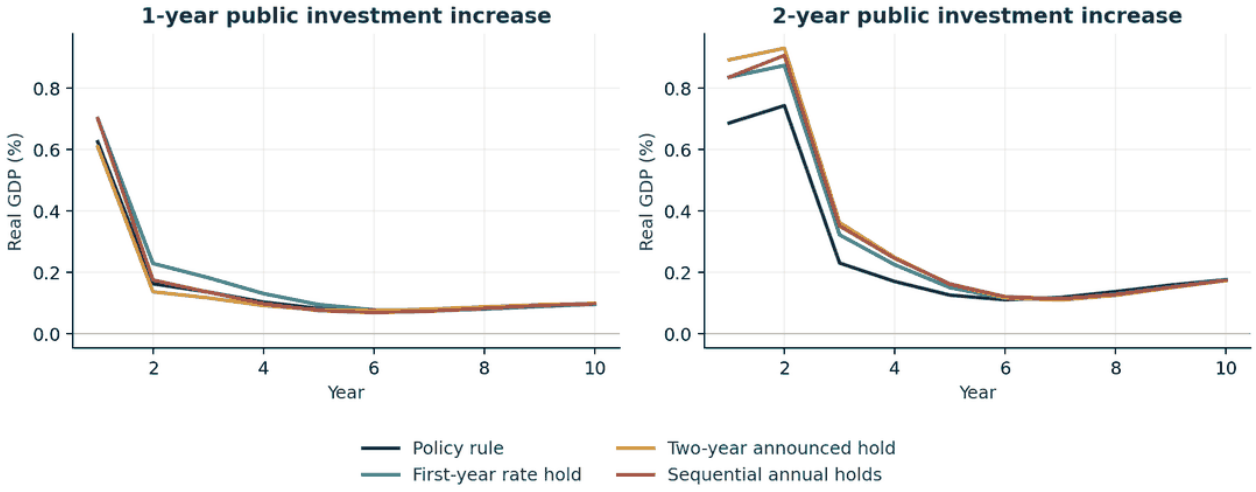


Figure 2. Public investment response under one-year and two-year interventions, with identical vertical scales. Each intervention year carries an initial static impulse of one percent of baseline GDP. A larger total response to the longer intervention does not by itself imply a larger multiplier per unit of cumulative fiscal cost.

Year-2 results: duration and monetary response

Instrument	1-year, rule	1-year, hold	2-year, rule	2-year, hold
Government investment	0.16	0.23	0.74	0.87
Government consumption	-0.01	0.05	0.48	0.54
Targeted transfers	0.06	0.08	0.29	0.33
VAT reduction	0.05	0.07	0.24	0.26
Labor tax reduction	0.05	0.06	0.18	0.20
Capital tax reduction	0.13	0.15	0.27	0.32
General transfers	0.02	0.03	0.12	0.13

Table 2. Year-2 real GDP responses, percent from baseline. Hold denotes a policy-rate hold in the first year only; the policy rule resumes in the second year. The one-year fiscal measure has ended in Year 2, while the two-year fiscal measure remains active.

External spillovers

Instrument	US GDP, Year 1	RoW GDP, Year 1
Government investment	0.000036	0.000421
Government consumption	0.000083	0.000396
Targeted transfers	0.000047	0.000189
VAT reduction	0.000036	0.000145
Labor tax reduction	0.000010	0.000081
Capital tax reduction	0.000024	0.000102
General transfers	0.000024	0.000079

Table 3. Percent deviations under the policy rule for a one-year Armenian fiscal intervention. Small foreign responses reflect the small size of Armenia in this three-region calibration. Additional decimal places prevent small simulated spillovers from being hidden by rounding. Russia and the euro area are part of the aggregated rest of world; their separate responses cannot be identified from this model.

9. Debt, risk and policy design

Public debt and the current account are reported alongside GDP. A temporary activity gain is only one part of the policy assessment. The longer-run public-capital response, the private-investment response and the fiscal adjustment that follows the initial intervention determine whether the package supports sustained improvement. The model does not establish that a particular Armenian project meets a social rate-of-return threshold.

A prudent risk management approach evaluates the package across plausible outcomes. For fiscal policy, the Three Cs provide an organizing principle: comprehensive measures address the relevant spending, revenue and implementation margins; consistent measures fit a credible medium-term budget; coordinated measures account for monetary conditions and external financing. These principles motivate the policy discussion here; this draft has not simulated a new Three Cs reform package or an endogenous credibility improvement.

The next joint calibration stage should verify fiscal and trade anchors, the household liquidity constraint, public-capital productivity, import content by expenditure category and financing assumptions with Ministry of Finance and Central Bank colleagues. A separately identified sovereign-risk shock and productivity experiments can then extend this baseline. They should be reported as additional experiments with explicit assumptions rather than inferred from these fiscal responses.

10. Numerical validation and reproducibility

Suite	Steady residual	Dynamic residual	GDP horizon difference
1-year suite	1.34e-12	3.55e-15	2.69e-07
2-year suite	1.34e-12	3.55e-15	5.51e-07

Each suite is solved at horizons of one hundred and one hundred sixty annual periods. The table reports the largest checked dynamic residual and the largest GDP-path difference across these horizons over the reported period, including all three regions. The driver checks the imposed instrument paths, targeted-transfer allocation, monetary-rule equations, held rates and deflator identity. All results must be finite. Numerical consistency is distinct from economic identification or empirical validation.

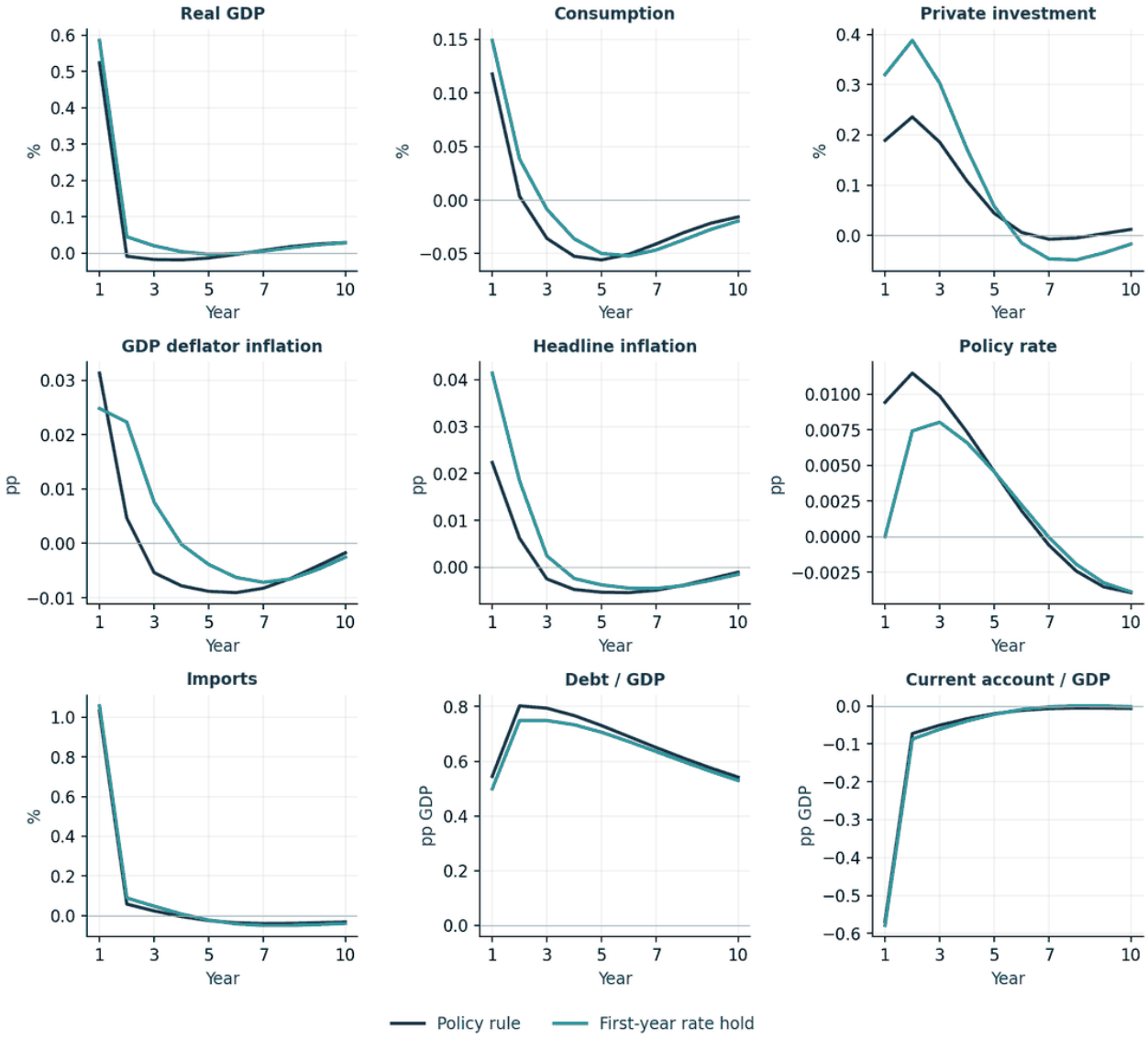
The replication package contains expanded equations, source code, the inherited and effective state, the exact common profile, raw local solutions, full reported paths for all three regions, and both fiscal durations. Run python run_armenia.py from the model_package folder after installing requirements. Remove a completed results subfolder to force a rerun; the driver intentionally skips completed suites. The charts and this paper are rebuilt by build_paper.py from the saved results.

References

Kumhof, Michael, Douglas Laxton, Dirk Muir, and Susanna Mursula (2010). The Global Integrated Monetary and Fiscal Model (GIMF) - Theoretical Structure. IMF Working Paper 10/34. https://www.imf.org/external/pubs/ft/wp/2010/wp1034.pdf

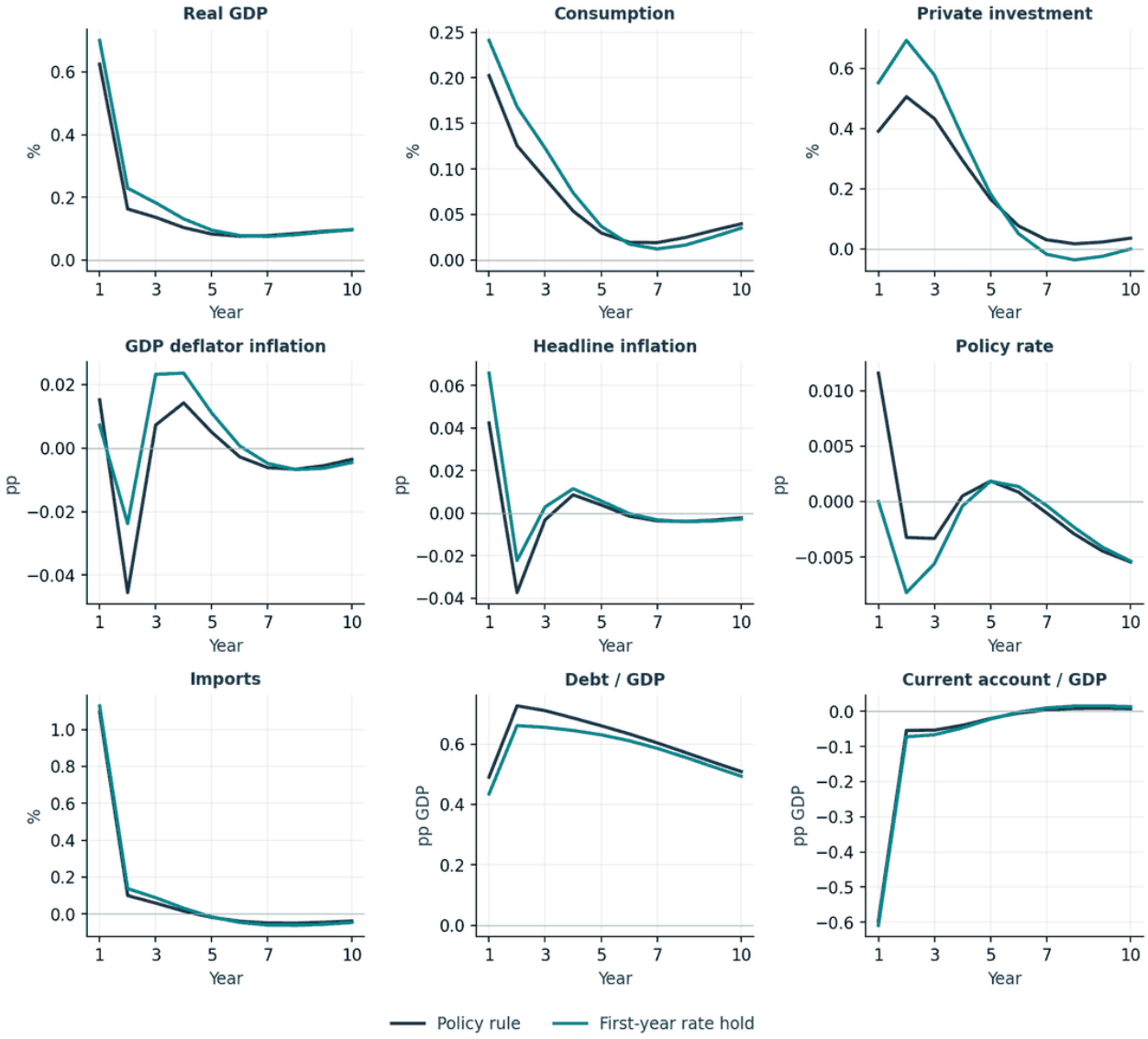
Kostanyan et al. (2026). Fiscal Multipliers Galore. The Better Policy Project. Supplied GIMF59 master archive, harmonized calibration vintage dated 9 November 2026. Source for the executable Armenia calibration and experiment conventions.

Appendix 1. Government consumption



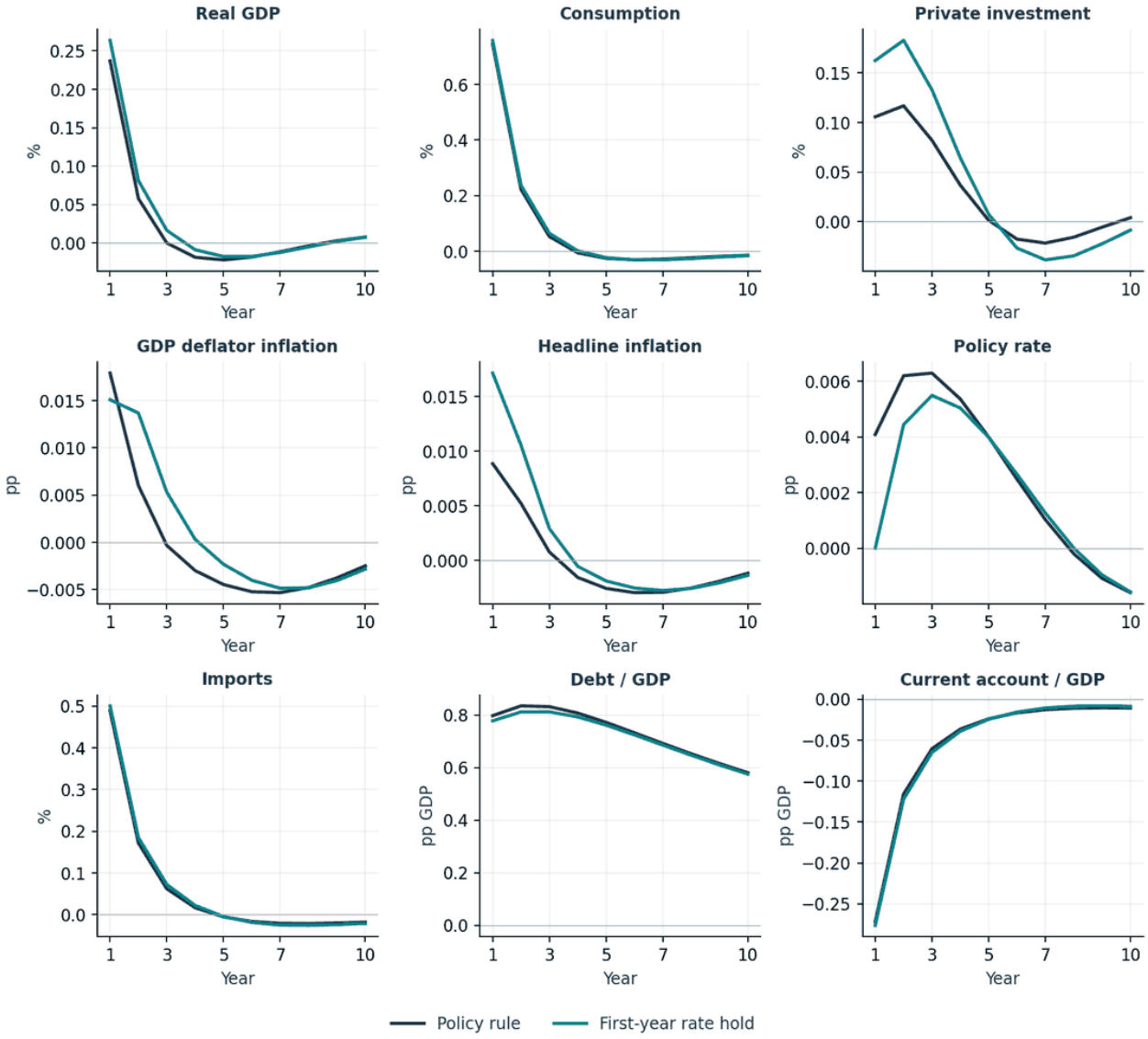
One-year fiscal intervention. Blue: policy rule. Teal: first-year policy-rate hold. Quantities are percent deviations; inflation and interest rates are percentage-point deviations; fiscal and external ratios are percentage points of GDP. The same scale applies to the two regimes within each panel. Each variable has its own axis. All plotted responses are Armenia results; full United States and rest-of-world paths are supplied separately.

Appendix 2. Government investment



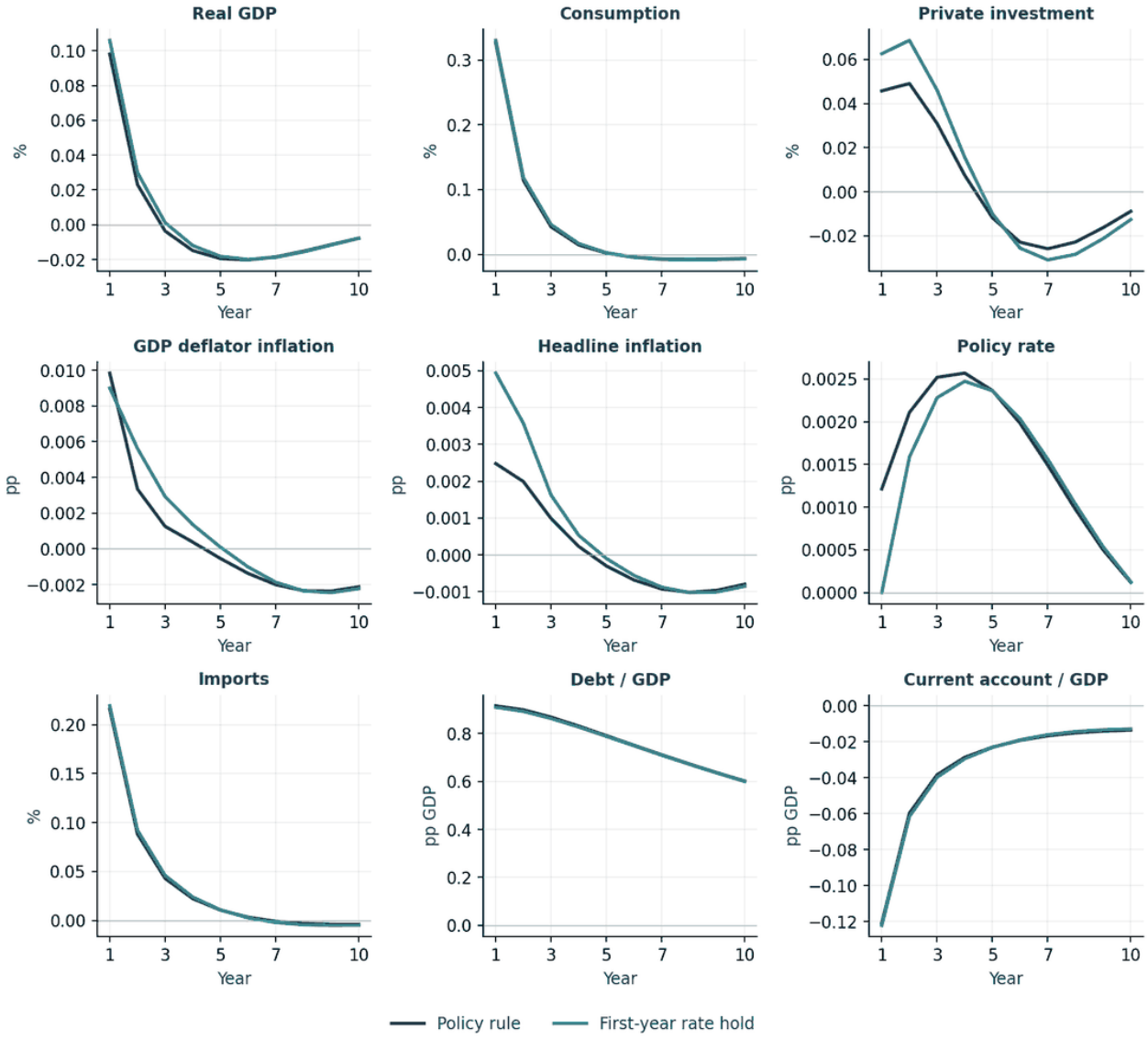
One-year fiscal intervention. Blue: policy rule. Teal: first-year policy-rate hold. Quantities are percent deviations; inflation and interest rates are percentage-point deviations; fiscal and external ratios are percentage points of GDP. The same scale applies to the two regimes within each panel. Each variable has its own axis. All plotted responses are Armenia results; full United States and rest-of-world paths are supplied separately.

Appendix 3. Targeted transfers



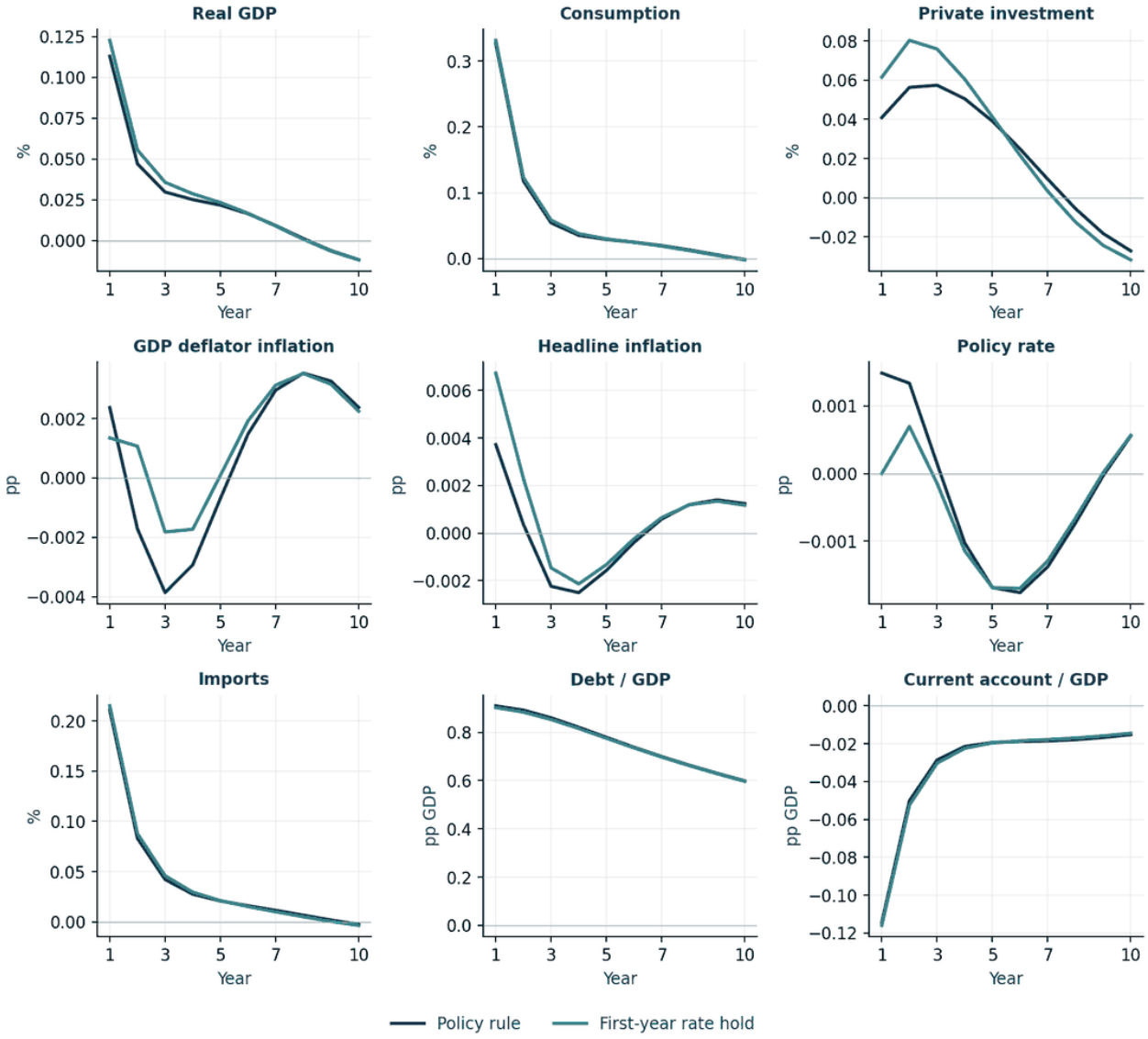
One-year fiscal intervention. Blue: policy rule. Teal: first-year policy-rate hold. Quantities are percent deviations; inflation and interest rates are percentage-point deviations; fiscal and external ratios are percentage points of GDP. The same scale applies to the two regimes within each panel. Each variable has its own axis. All plotted responses are Armenia results; full United States and rest-of-world paths are supplied separately.

Appendix 4. General transfers



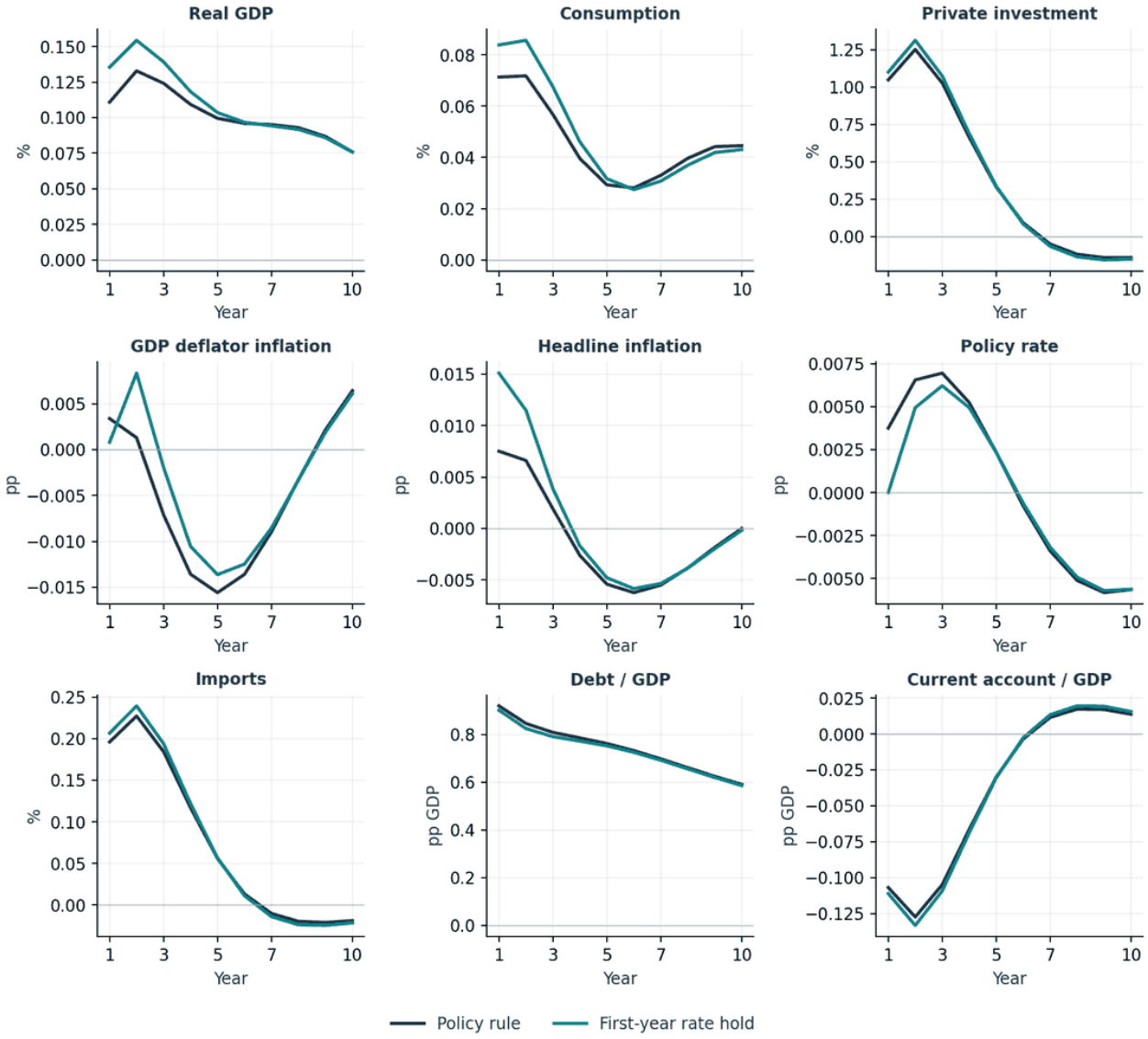
One-year fiscal intervention. Blue: policy rule. Teal: first-year policy-rate hold. Quantities are percent deviations; inflation and interest rates are percentage-point deviations; fiscal and external ratios are percentage points of GDP. The same scale applies to the two regimes within each panel. Each variable has its own axis. All plotted responses are Armenia results; full United States and rest-of-world paths are supplied separately.

Appendix 5. Labor tax reduction



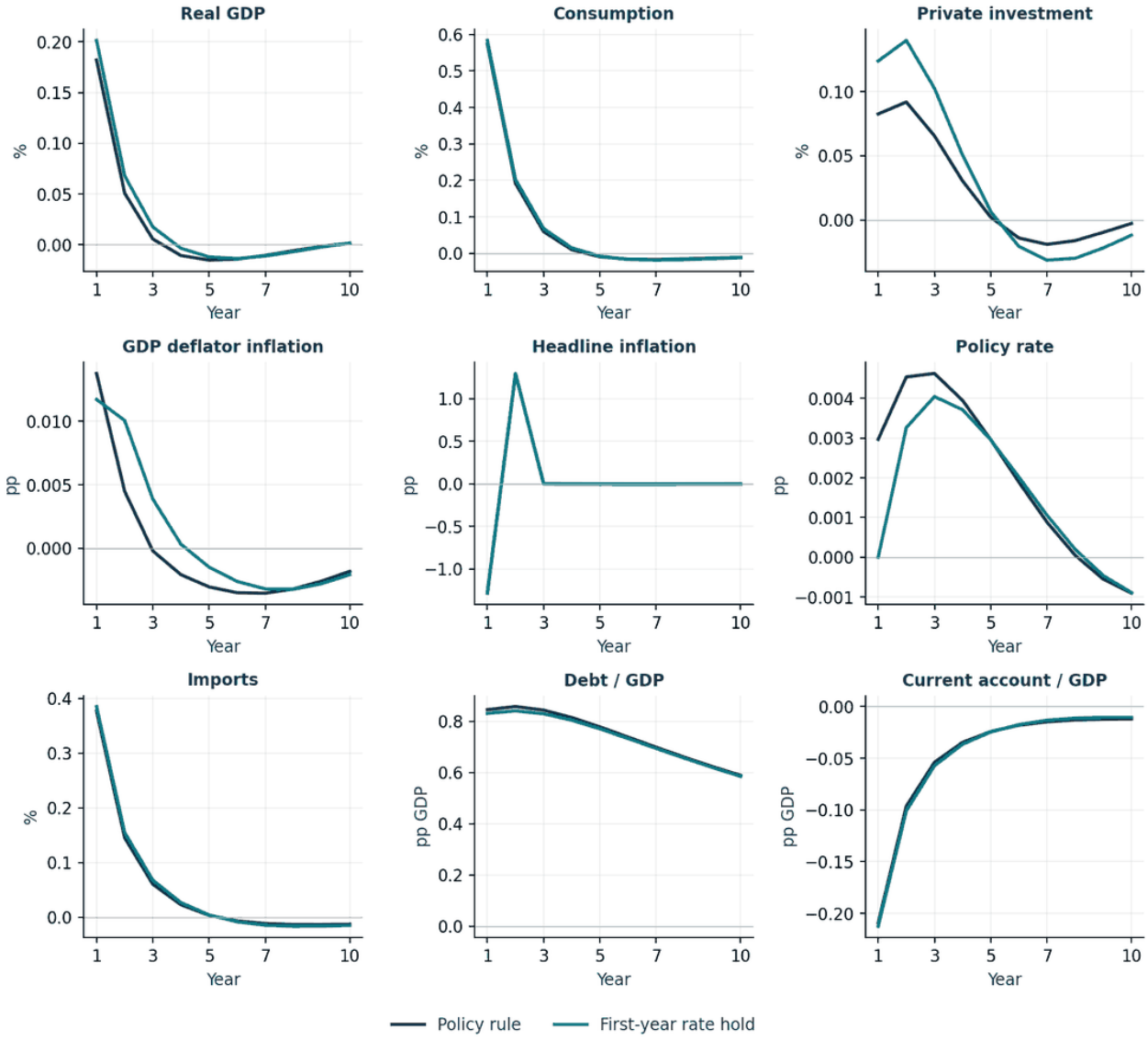
One-year fiscal intervention. Blue: policy rule. Teal: first-year policy-rate hold. Quantities are percent deviations; inflation and interest rates are percentage-point deviations; fiscal and external ratios are percentage points of GDP. The same scale applies to the two regimes within each panel. Each variable has its own axis. All plotted responses are Armenia results; full United States and rest-of-world paths are supplied separately.

Appendix 6. Capital tax reduction



One-year fiscal intervention. Blue: policy rule. Teal: first-year policy-rate hold. Quantities are percent deviations; inflation and interest rates are percentage-point deviations; fiscal and external ratios are percentage points of GDP. The same scale applies to the two regimes within each panel. Each variable has its own axis. All plotted responses are Armenia results; full United States and rest-of-world paths are supplied separately.

Appendix 7. VAT reduction



One-year fiscal intervention. Blue: policy rule. Teal: first-year policy-rate hold. Quantities are percent deviations; inflation and interest rates are percentage-point deviations; fiscal and external ratios are percentage points of GDP. The same scale applies to the two regimes within each panel. Each variable has its own axis. All plotted responses are Armenia results; full United States and rest-of-world paths are supplied separately.

Armenia in a Five-Region World

Calibration and standard model properties
United States | Armenia | Euro area | Russia | Rest of world

The Better Policy Project / Global Forecasting School
7 November 2026

Result. A new nonlinear five-region steady state has been solved, with Armenia's current three-region settings carried forward. All five world GDP shares now match the specified 2024 aggregation. The rest-of-world external position and final-goods imports close the global accounts.

Numerical checks. The operational system has 3,077 equations. Its maximum steady-state error is 1.09e-11. All 24 reported first-order shock solutions pass the 1e-8 equation-error criterion; the largest dynamic error is 1.42e-14.

Fiscal properties. A one-year government-consumption expansion of 1% of Armenian GDP raises first-year GDP by 0.59% under the CBA rule and 0.64% with the rate fixed in Year 1. The corresponding government-investment effects are 0.69% and 0.67%.

Risk properties. A 100-basis-point increase in the Armenian government-risk component changes first-year GDP by -0.01% at persistence 0.7 and -0.33% at persistence 0.9. Persistence is an explicit scenario assumption.

Domestic demand. In the persistence-0.7 risk case, first-year consumption falls 1.30% and private investment falls 2.46%. Stronger exports partly offset these declines in aggregate GDP.

Interpretation. These are local, first-order responses around a nonlinear steady state, under model-consistent expectations. They are model properties, not economic forecasts or fully nonlinear stress outcomes. Numerical validation does not turn dated trade proxies or structural assumptions into measured facts.

Main empirical limits. Bilateral shares still include flagged EU-for-euro-area proxies and dated Russian observations. The euro-area openness and import-use split are provisional structural choices. Remittances, a separate energy sector, sanctions and a measured bilateral portfolio network are absent. Russian spillovers here therefore describe the included trade and common financial-price channels.

1. Calibration: what is matched

Steady-state target	United States	Armenia	Euro area	Russia	RoW
World GDP share (%)	26.236	0.023	14.867	1.958	56.916
Inflation target (%)	2.0	3.0	2.0	4.0	2.0
Government consumption / GDP	17.10	10.66	21.68	18.90	17.10
Government investment / GDP	3.20	5.50	3.46	2.80	3.20
Private investment / GDP	15.30	15.86	17.68	19.33	15.30
Model fiscal revenue / GDP	25.20	22.40	40.90	35.10	25.20
Government debt / GDP	87.90	48.00	86.60	20.30	87.90
Net foreign assets / GDP	-0.00	-47.10	10.90	43.38	-4.32
Imports / GDP	12.43	55.00	25.00	17.59	10.76
Exports / GDP	12.43	55.24	24.94	17.37	10.78
Net transfers / GDP	4.45	5.99	15.31	13.29	4.45

All fiscal and external ratios are percentage points of the relevant region's GDP. GDP weights use the preserved 2024 World Bank WDI aggregation. RoW GDP is the world residual; its NFA and final-goods import allocation are solved jointly with the explicit-region targets. US and RoW fiscal and behavioral coefficients remain inherited model priors.

Armenia. Government consumption 10.664%, government investment 5.5%, private investment 15.855%, model revenue 22.4%, government debt 48.0%, NFA -47.1% and a 3% inflation target carry forward the November Armenia release. Import openness is calibrated to 55%, below recorded gross trade, to limit re-export distortions. This model does not explicitly separate re-export margins from domestic value added.

Euro area. R3 now includes Germany. Debt is calibrated to Eurostat's revised 2024 EA20 ratio of 86.6%; NFA uses the ECB's end-2024 10.9% observation. Consumption and total investment use explicit 2024Q4 ratio proxies; government investment uses 3.457%. External imports of 25% of GDP and the C/I/T split are structural assumptions, not recovered annual observations.

Russia. The old narrow central-tax target produced negative net transfers. A broad fiscal-resource envelope of 35.1% of GDP, including non-tax receipts through the lump-sum residual, replaces it. It must not be interpreted as a measured tax-only ratio. Other Russian fiscal, investment and external inputs retain dated proxy status.

2. How the model was solved and checked

The preserved GIMF source is expanded to five regions, with independent currencies and policy rules for the US, Armenia, Russia and RoW. The euro area is one monetary region. OLG and liquidity-constrained households, capital accumulation, nominal wage and price adjustment, international trade and the financial accelerator remain active.

A balanced symmetric continuation state replaces the unfinished cloned seed. The source calibration flips solve preferences, home biases, fiscal residuals, financial parameters and discount factors against the specified ratios. A first continuation introduces country settings and dated bilateral shares. A second continuation imposes world GDP weights while releasing RoW final-goods allocations and its consumer-import ratio as residual quantities. This prevents the trade matrix, NFA and GDP-weight targets from overconstraining each other.

Dynamics are rebuilt from the operational five-region equations at the new steady state. Sparse, shift-specific derivatives use complex-step differentiation and an independent finite-difference directional check. Variables determined within each period are eliminated algebraically for efficiency, then reconstructed. Every reported path is checked against all original linearized equations, including those eliminated for the solve.

The operational smoothed real-rate and risk-premium processes are activated with XX_STEADY = 0. The current Armenia pass-through and nominal-rigidity settings are retained. The inherited policy closure has interest-rate smoothing 0.30 and inflation feedback 1.00; its inflation measure weights current inflation 0.25 and next-year inflation 0.75. Output-gap and exchange-rate feedback coefficients are zero. This is a model closure, not an estimated CBA decision rule. This exercise does not add a new credibility block.

Check	Outcome
Operational nonlinear steady-state maximum residual	1.091e-11
Maximum error in imposed explicit-region GDP shares	0.000e+00
Largest full linear-equation residual across reported runs	1.421e-14
Horizon	80 years; figures show Years 1-10
First-year fixed-rate implementation	CBA rate deviation is set to zero in Year 1; source rule resumes in Year 2
Expectations and shock announcement	Model-consistent expectations; one surprise at the start of Year 1

Horizon check. Extending the solve from 80 to 100 years for government consumption and the persistence-0.9 Armenian risk shock, under both monetary settings, changes first-ten-year GDP responses by at most 5.73e-06 percentage point. Across consumption, investment, GDP and the bilateral exchange rate, the largest difference is 1.52e-05 percentage point. The largest inflation or policy-rate difference is 1.34e-06 pp.

The government-risk shock targets GBPREM itself, with its actual geometric decay checked against the specified persistence. The associated FX-premium loading is retained explicitly: a 100 bp GBPREM innovation produces a 166 bp combined UIP-premium increase on impact in this calibration.

The report uses Fisher real GDP growth cumulated into a real GDP level response. Trade volumes use the corresponding Laspeyres growth construction. CPI inflation and interest rates are annual log-rate deviations in percentage points. A positive real exchange-rate response denotes depreciation. Fiscal shocks are normalized to 1% of initial Armenian GDP for one year; tax reductions are expansionary and transfers are deficit-financed through the source fiscal rule.

3. Fiscal multipliers: first two years

One-year instrument	GDP Y1: rule	GDP Y1: fixed	GDP Y2: rule	GDP Y2: fixed
Government investment	0.69	0.67	0.20	0.18
Government consumption	0.59	0.64	0.01	0.07
Targeted transfers	0.26	0.29	0.07	0.10
VAT reduction	0.20	0.23	0.06	0.08
Capital income tax reduction	0.13	0.17	0.17	0.21
Labor income tax reduction	0.13	0.13	0.06	0.07
General transfers	0.11	0.12	0.02	0.04

The first-year GDP response is also the first-year multiplier because each fiscal impulse equals 1% of baseline GDP. The second-year column is a GDP level response after the one-year impulse has ended; it is not a second fiscal injection. Monetary accommodation changes real financing costs, private spending and the exchange rate, so the paired regimes identify a policy-closure effect within this calibration.

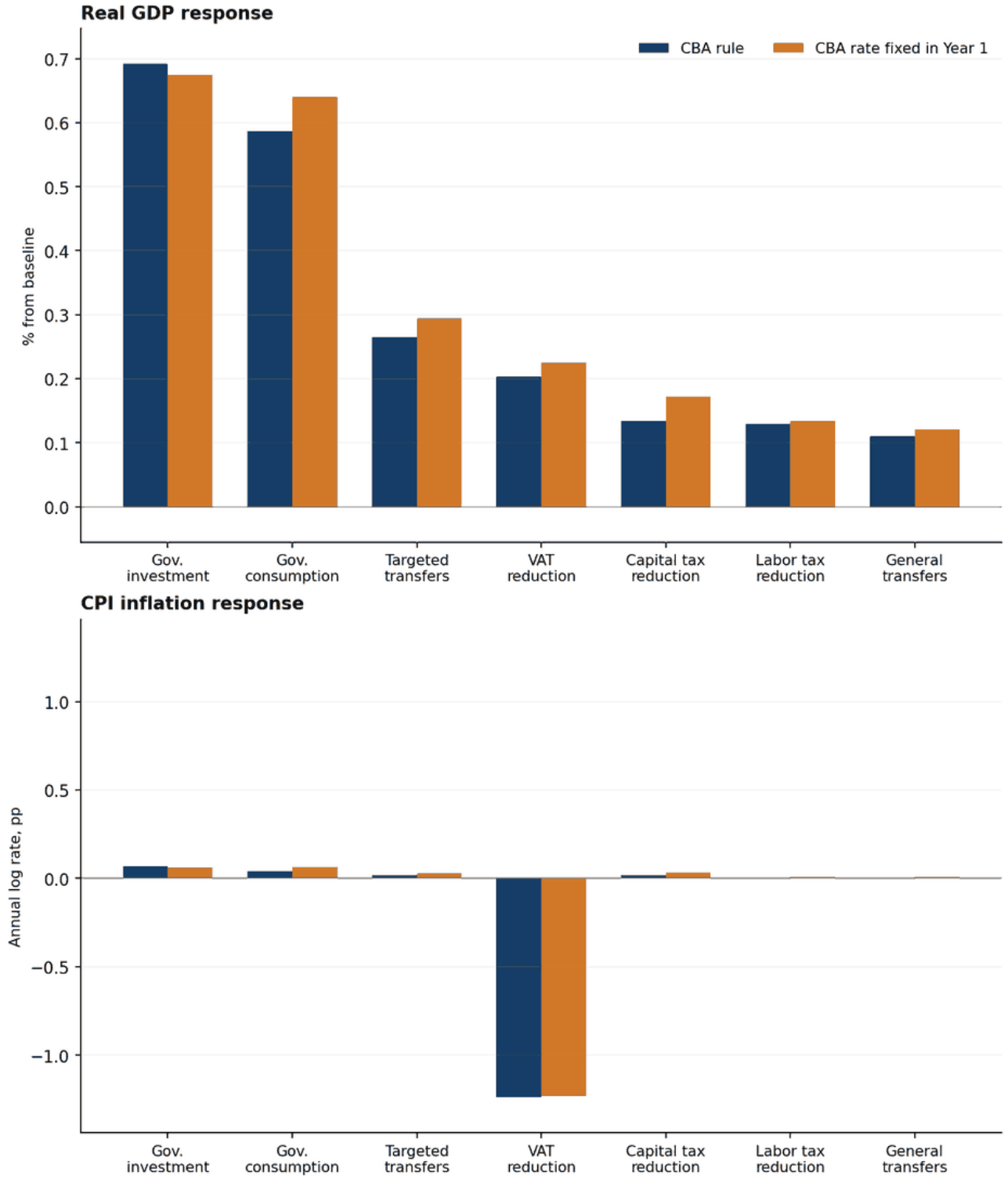
A fixed first-year rate need not raise every multiplier. In the government-investment experiment, the source rule cuts the first-year rate slightly because expected future inflation falls as productive capacity expands. Fixing the rate prevents that easing and slightly lowers the first-year GDP response. The inflation panel can therefore show an initial increase even when the forward-looking rule cuts the rate.

External origin	Armenia GDP Y1: G	Armenia GDP Y2: G	Armenia GDP Y1: risk	Armenia GDP Y2: risk
United States	0.043	0.048	-0.147	-0.227
Euro area	0.082	0.057	-0.223	-0.290
Russia	0.061	0.037	-0.137	-0.198

G denotes a one-year government-consumption increase of 1% of the originating region's GDP. Risk denotes a 100 bp increase in the government-risk component with persistence 0.7 in that region. These are different-sized shocks in world-GDP terms; the table is not a ranking of equally sized global disturbances. More digits are shown for small spillovers to preserve their sign and size.

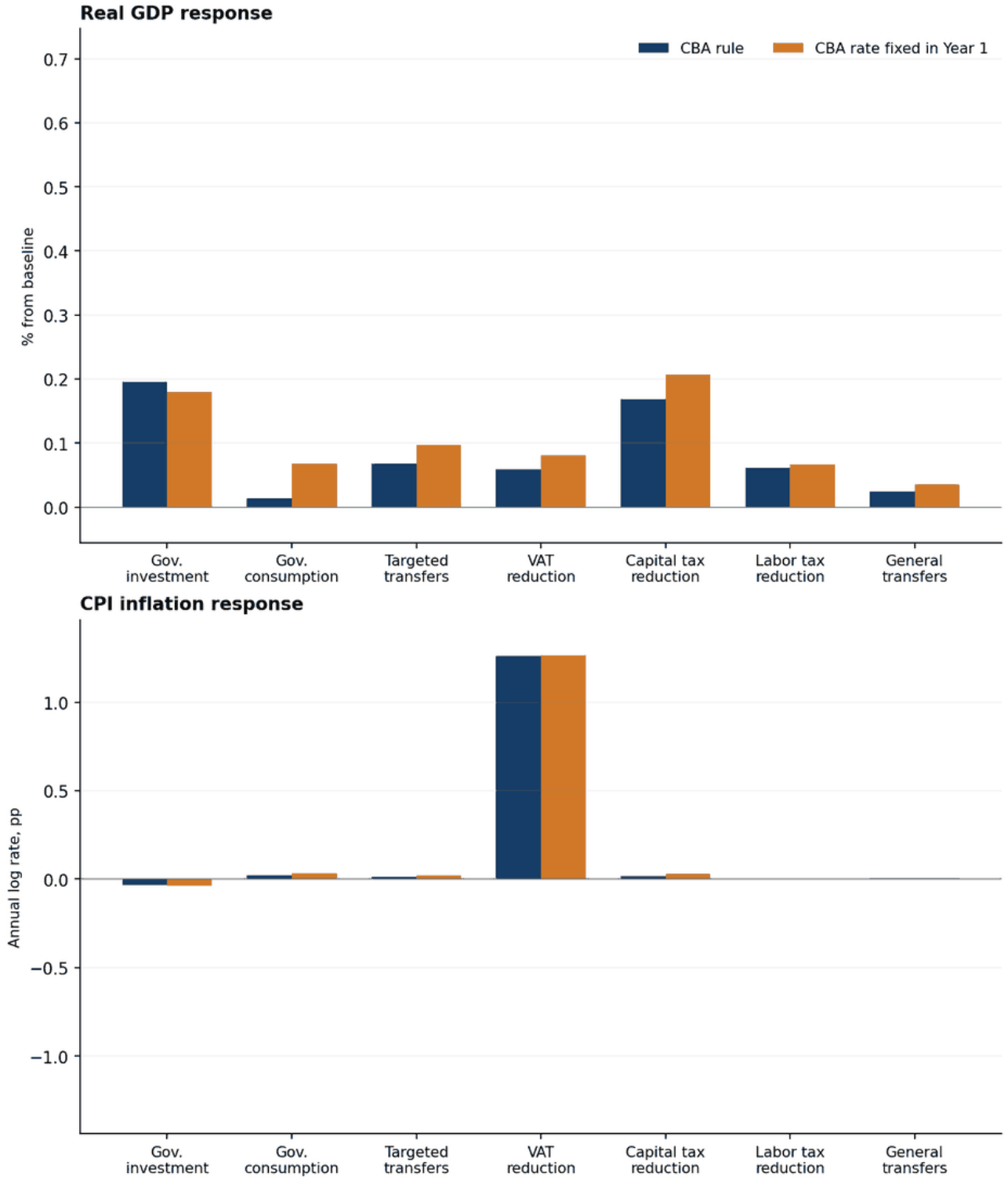
4. Ranked fiscal effects: Year 1

Instrument ordering follows the Year-1 GDP response under the CBA rule, highest to lowest. Ordering and axis scales are retained across the two years and the CPI panels.



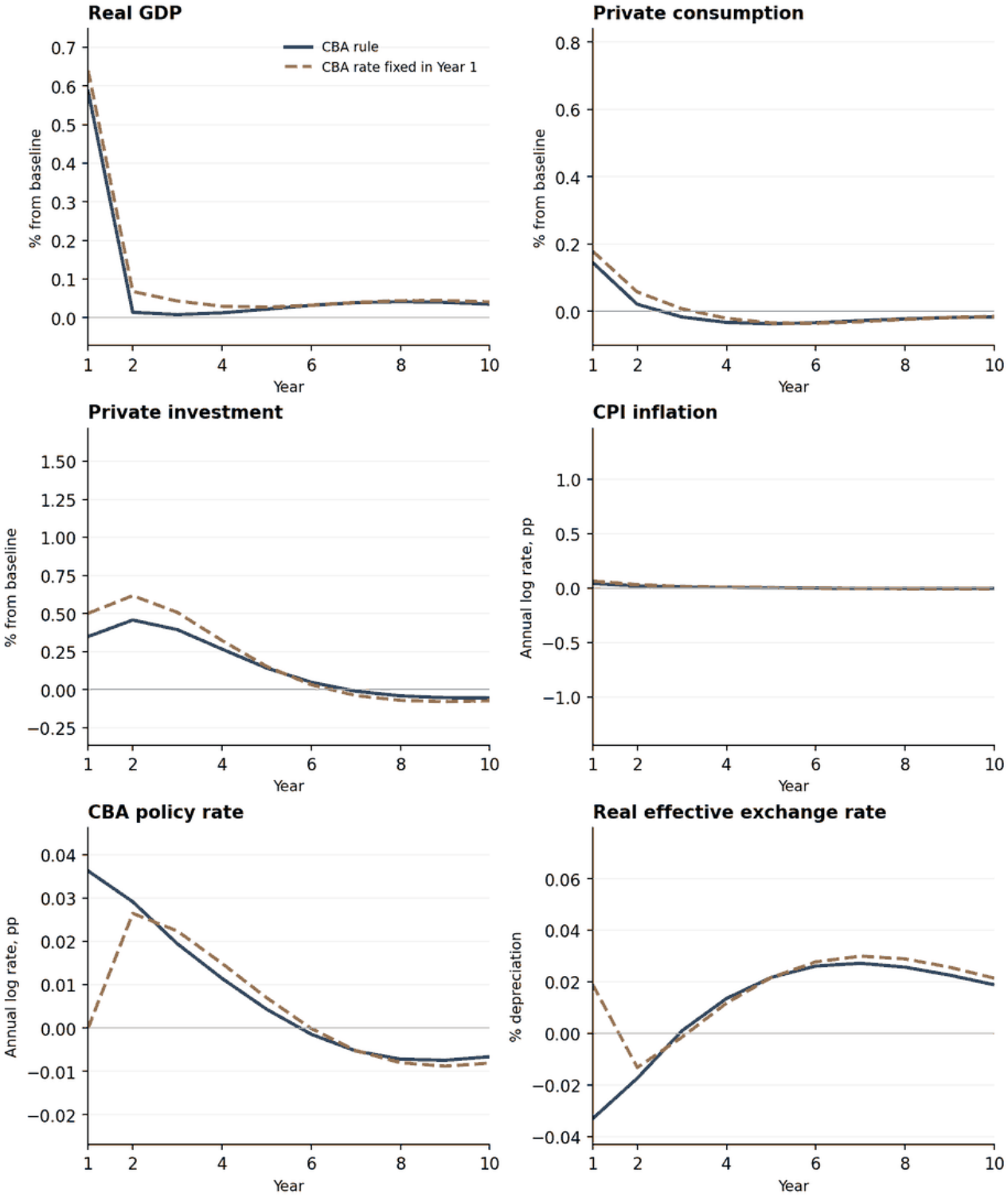
4. Ranked fiscal effects: Year 2

Instrument ordering follows the Year-1 GDP response under the CBA rule, highest to lowest. Ordering and axis scales are retained across the two years and the CPI panels.



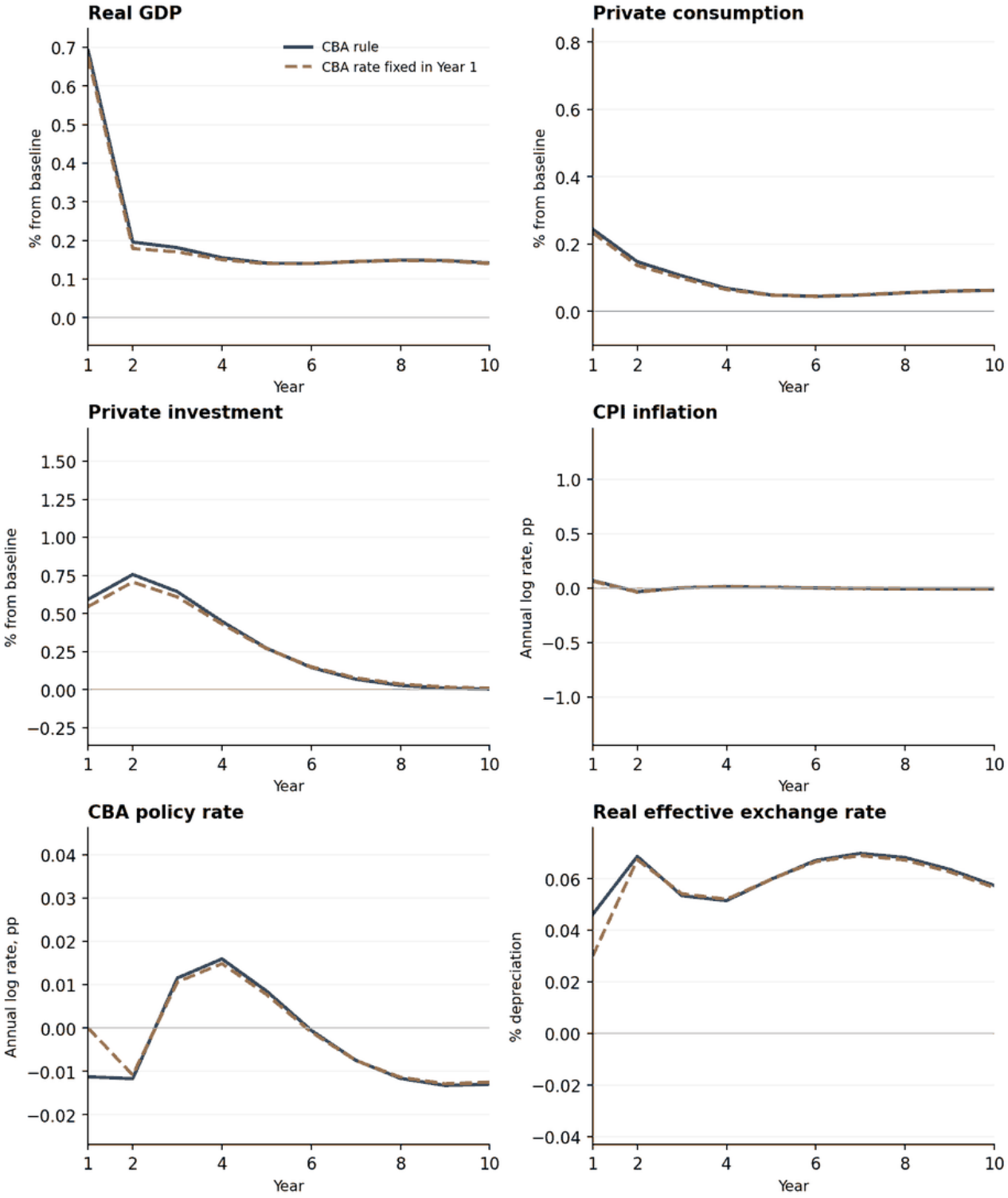
5.1 Government consumption

One-year expansion equal to 1% of Armenia's initial GDP. Solid: source CBA rule. Dashed: CBA rate fixed in Year 1. Scales are held constant by variable across all seven fiscal-shock pages.



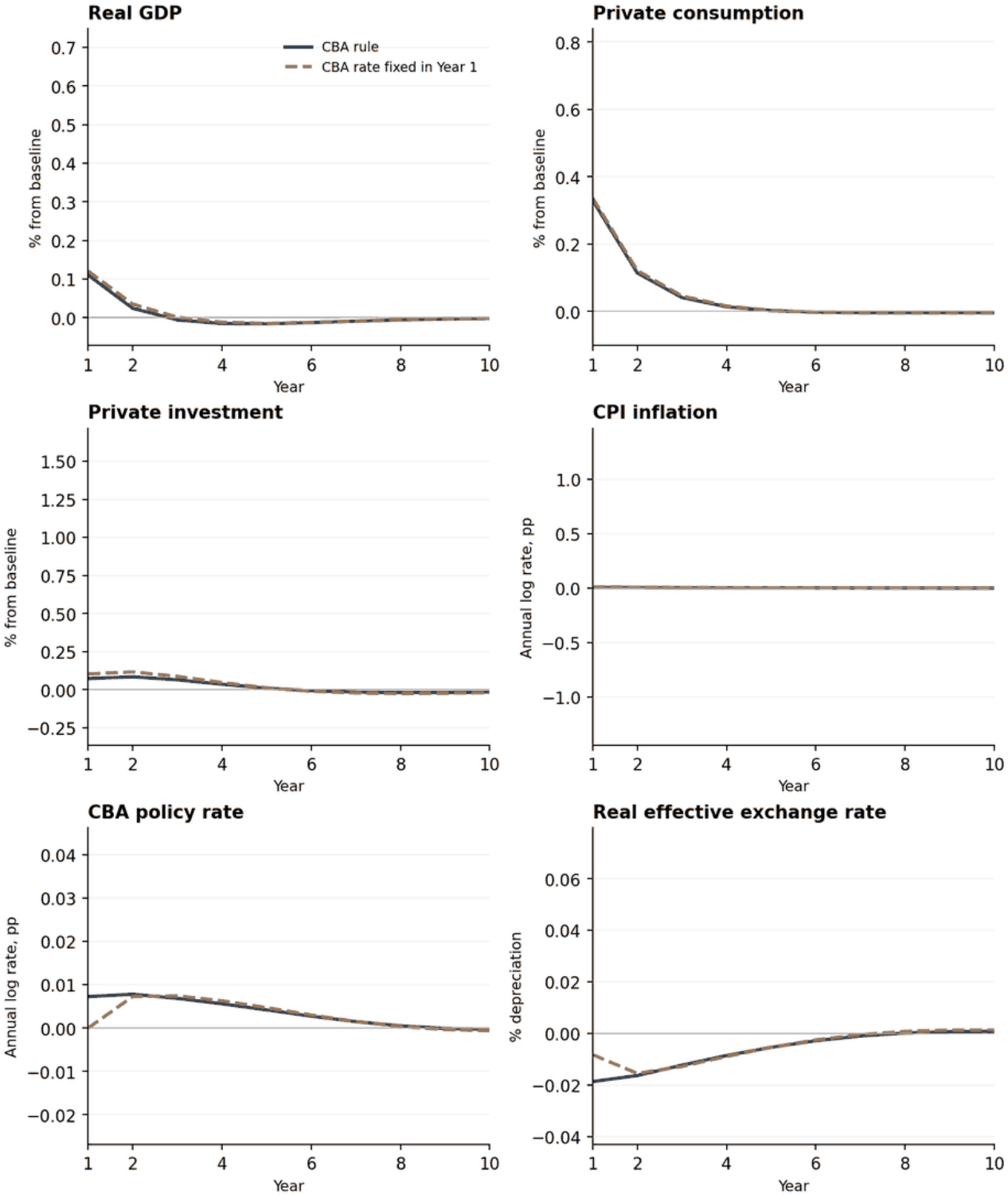
5.2 Government investment

One-year expansion equal to 1% of Armenia's initial GDP. Solid: source CBA rule. Dashed: CBA rate fixed in Year 1. Scales are held constant by variable across all seven fiscal-shock pages.



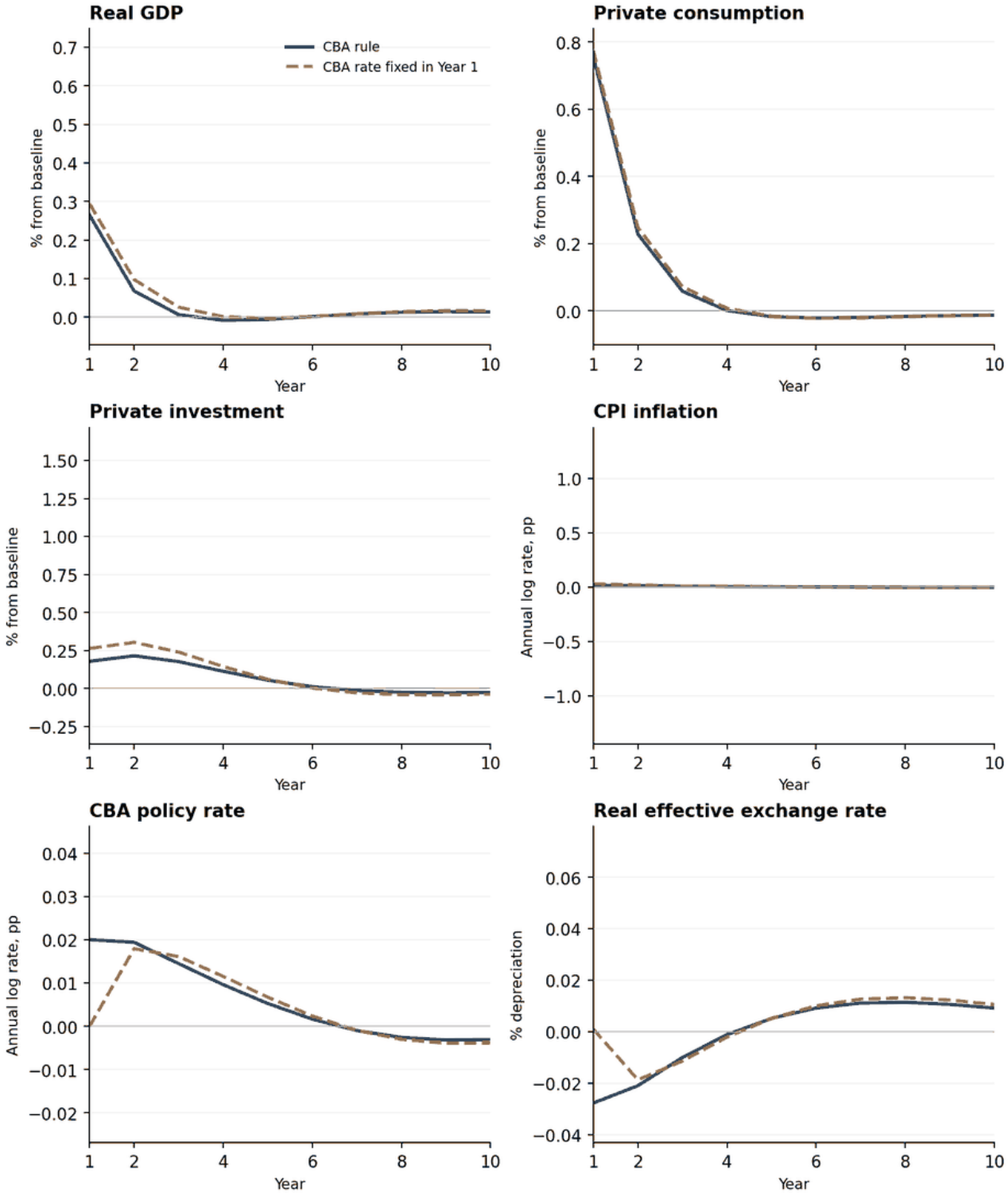
5.3 General transfers

One-year expansion equal to 1% of Armenia's initial GDP. Solid: source CBA rule. Dashed: CBA rate fixed in Year 1. Scales are held constant by variable across all seven fiscal-shock pages.



5.4 Targeted transfers

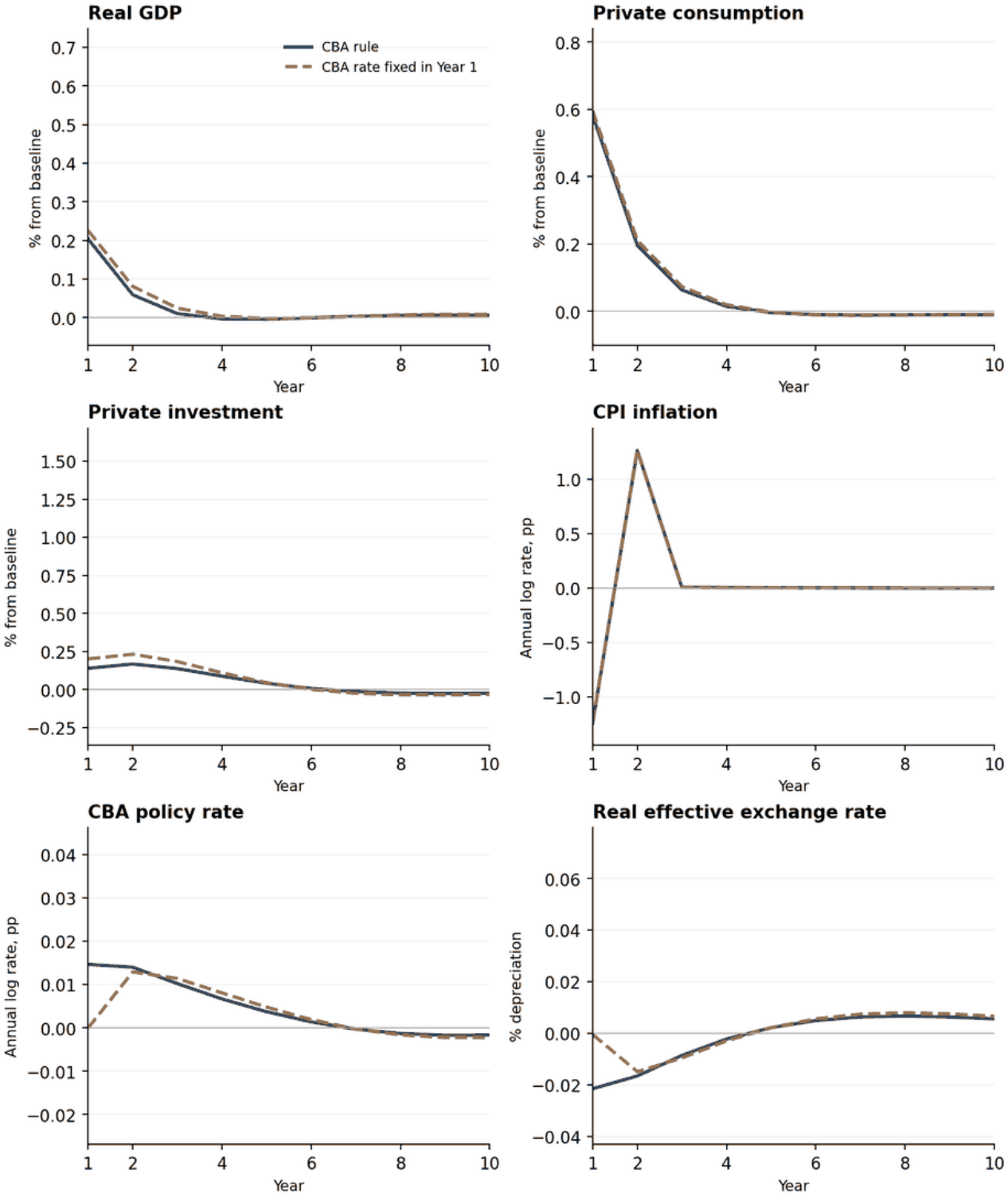
One-year expansion equal to 1% of Armenia's initial GDP. Solid: source CBA rule. Dashed: CBA rate fixed in Year 1. Scales are held constant by variable across all seven fiscal-shock pages.



5.5 VAT reduction

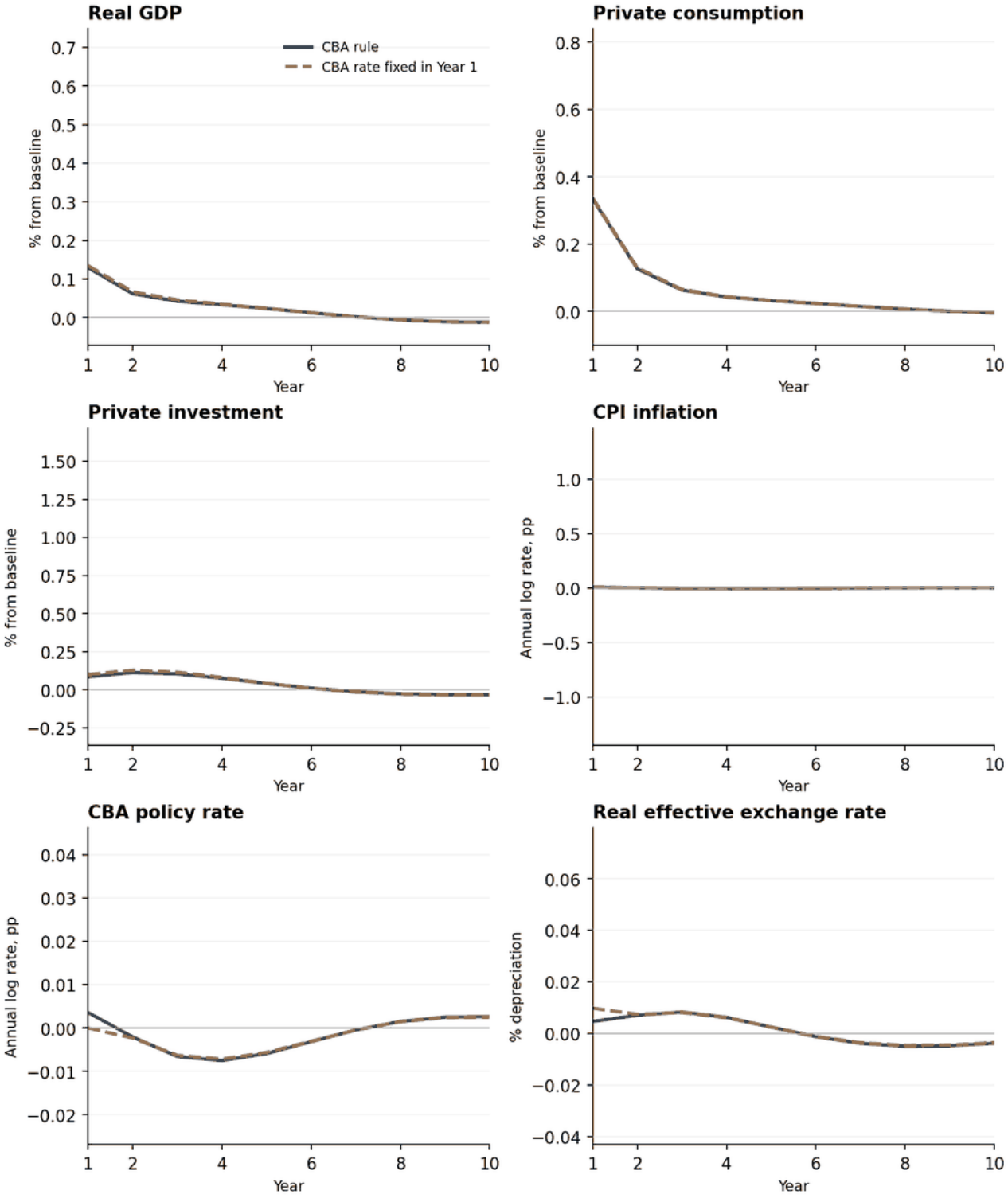
One-year expansion equal to 1% of Armenia's initial GDP. Solid: source CBA rule. Dashed: CBA rate fixed in Year 1. Scales are held constant by variable across all seven fiscal-shock pages.

The VAT cut has a direct effect on tax-inclusive headline CPI. The inherited policy rule responds to the model core-inflation measure, so a decline in headline CPI does not by itself imply monetary easing.



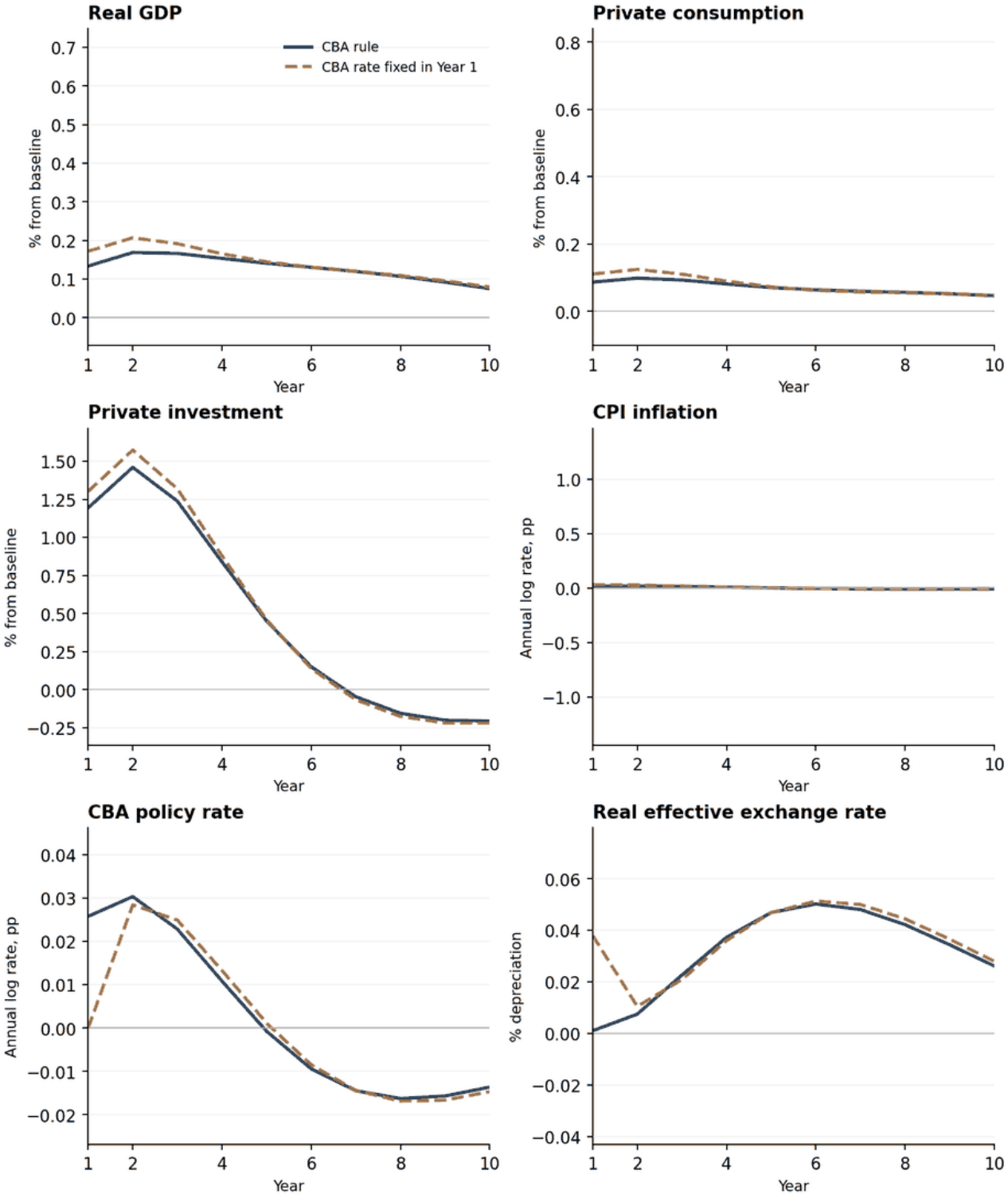
5.6 Labor income tax reduction

One-year expansion equal to 1% of Armenia's initial GDP. Solid: source CBA rule. Dashed: CBA rate fixed in Year 1. Scales are held constant by variable across all seven fiscal-shock pages.



5.7 Capital income tax reduction

One-year expansion equal to 1% of Armenia's initial GDP. Solid: source CBA rule. Dashed: CBA rate fixed in Year 1. Scales are held constant by variable across all seven fiscal-shock pages.

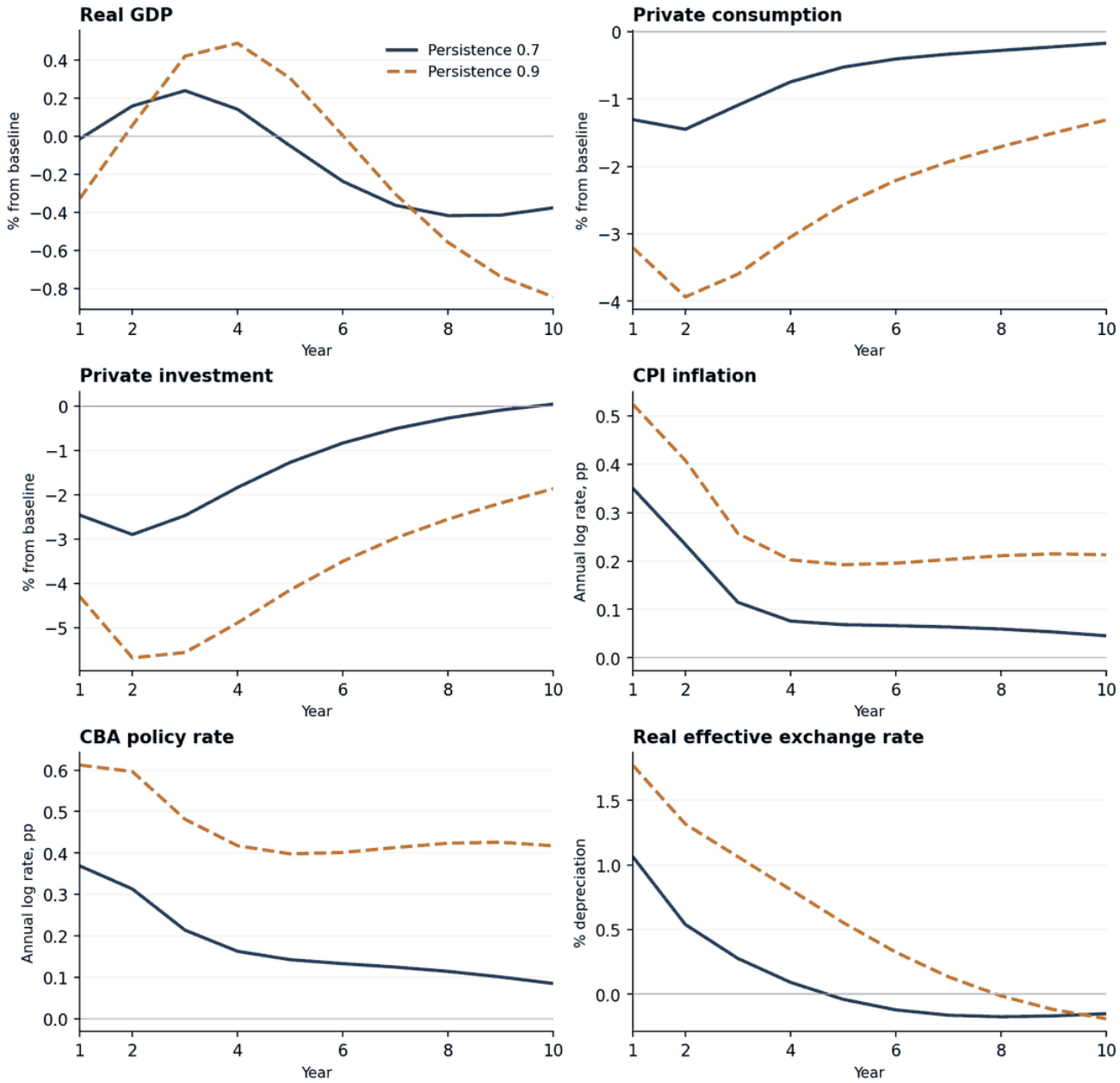


6. Armenia country risk: persistence matters

GBPREM, the government-risk component, rises by 100 basis points on impact. The inherited CGBFX coefficient of 0.66 adds 66 bp to the FX-premium component, so the combined UIP risk premium rises by 166 bp. The two lines compare persistence 0.7 and 0.9 under the source CBA rule.

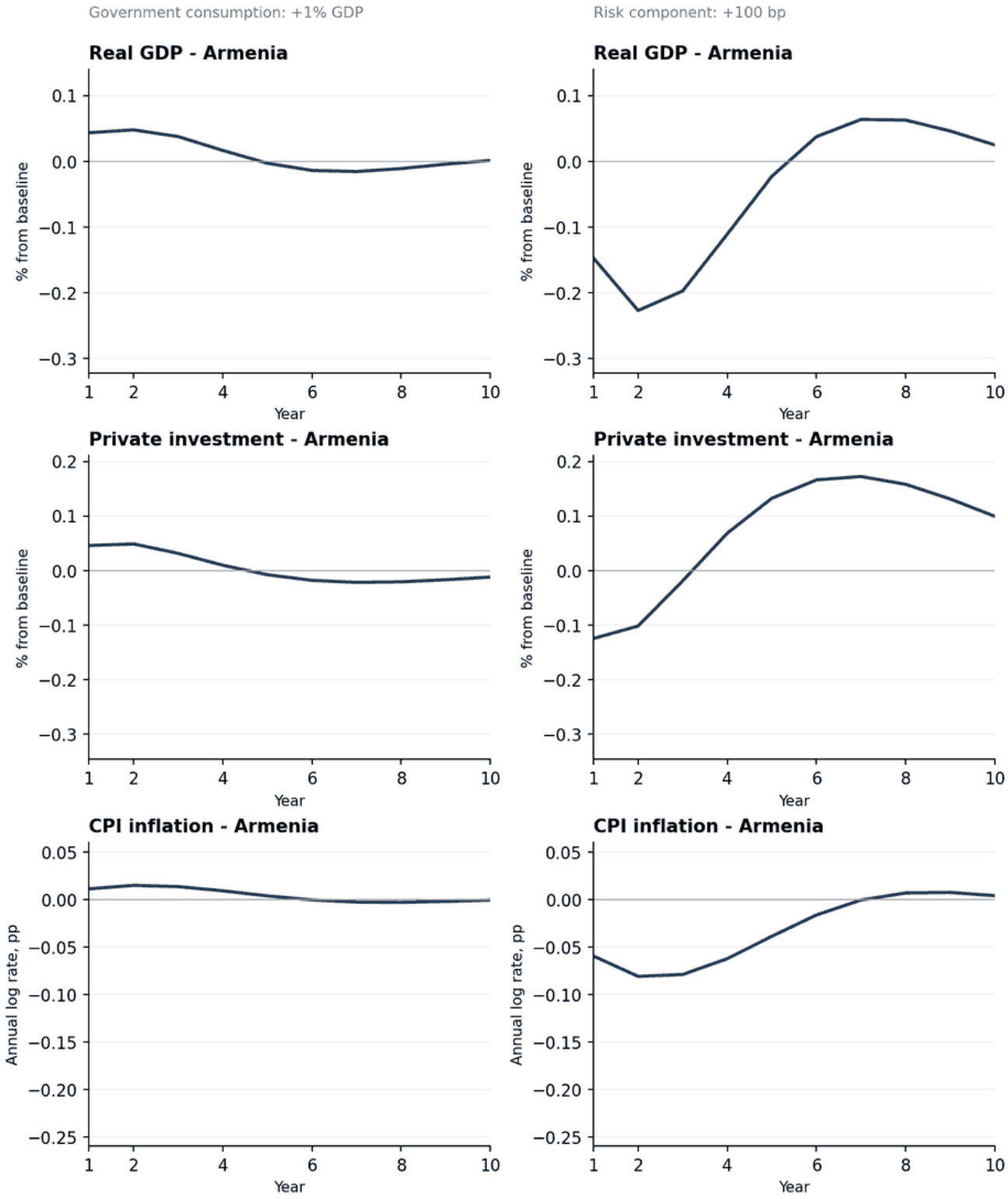
Persistence	GDP Y1: rule	GDP Y1: fixed	Consumption Y1: rule	Investment Y1: rule
0.7	-0.01	0.53	-1.30	-2.46
0.9	-0.33	0.58	-3.20	-4.30

The fixed-rate counterfactual allows stronger exchange-rate and export adjustment. First-year GDP can rise while consumption and private investment contract. A shock normalized to a 100 bp combined UIP premium would scale these first-order responses by 1/1.66.



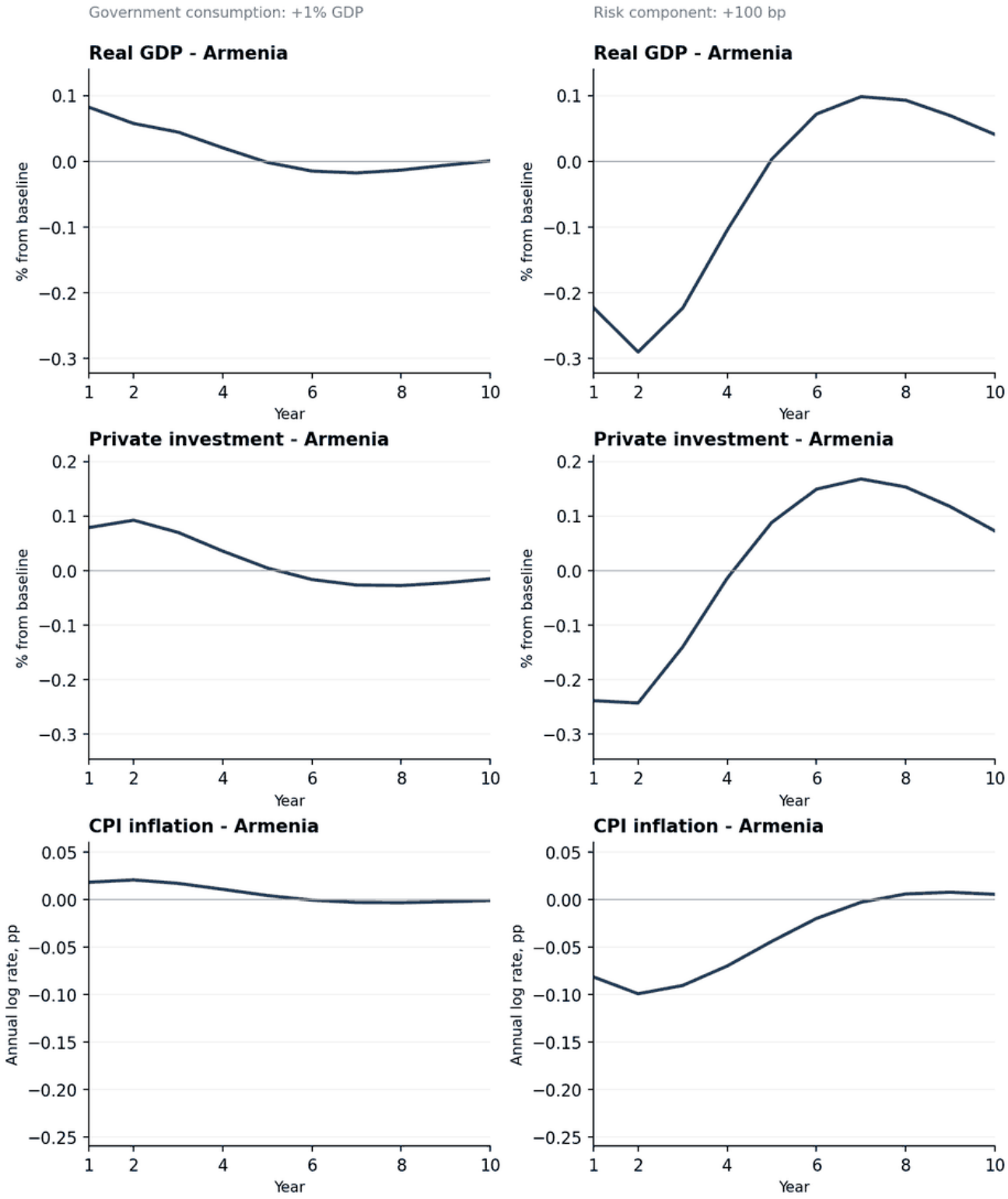
7.1 Spillovers from United States

All panels show Armenia. Left: one-year government consumption +1% of the origin region's GDP. Right: origin government-risk component +100 bp, persistence 0.7. Each country follows its source monetary rule; the dram floats. Row scales match between the two experiments.



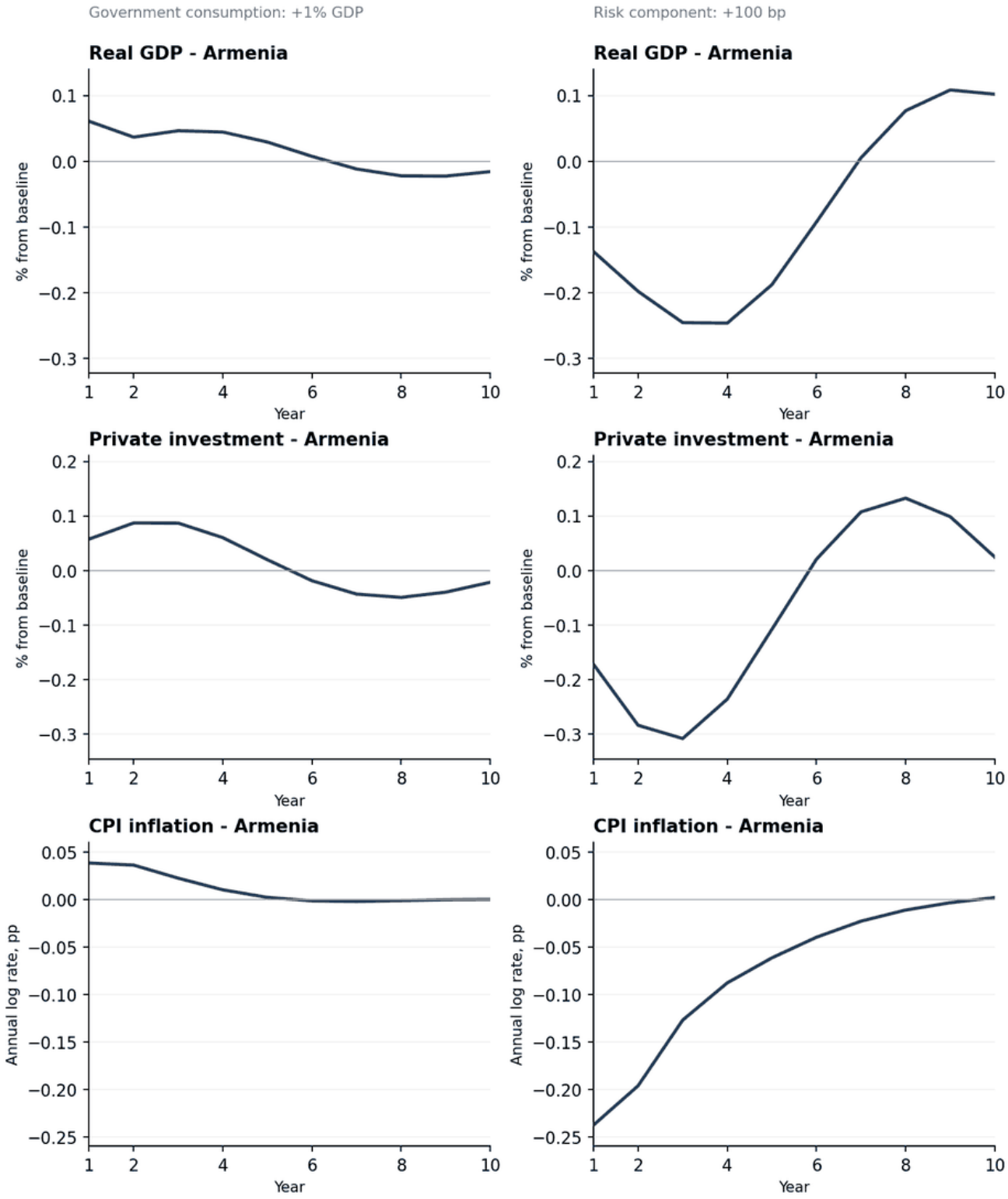
7.2 Spillovers from Euro area

All panels show Armenia. Left: one-year government consumption +1% of the origin region's GDP. Right: origin government-risk component +100 bp, persistence 0.7. Each country follows its source monetary rule; the dram floats. Row scales match between the two experiments.



7.3 Spillovers from Russia

All panels show Armenia. Left: one-year government consumption +1% of the origin region's GDP. Right: origin government-risk component +100 bp, persistence 0.7. Each country follows its source monetary rule; the dram floats. Row scales match between the two experiments.



8. Evidence, assumptions and next extensions

This is a numerically solved research calibration with explicitly provisional empirical elements. The five-region equilibrium and its linear shock responses are new results. Earlier Germany outputs and cached derivatives were excluded. A source-consistent steady state is necessary for simulation, but it cannot validate an unobserved parameter or close an empirical data gap.

Most useful next extensions. Replace EU27 proxies with exact EA20 bilateral goods and services flows, distinguish re-exports in Armenia, and estimate use-category partner shares. Add measured Russia-Armenia remittances and energy-price exposure before interpreting the model as a complete account of Russia's importance. Refine Russian fiscal coverage and composition; replace the euro-area quarterly ratio proxies and provisional openness split with a consistent annual dataset. Test alternative policy rules, risk persistence and financial-accelerator settings before using the results for decisions.

Current Armenia model. Armenia_GIMF3_current.zip, 5 November 2026; README, country_data.json and repaired_state.txt.

Earlier five-region build. GIMF4_Armenia_Russia_5R_WORKING_v15.zip, 4 October 2026. Used for equations and input provenance; unfinished states and Germany outputs were not treated as Armenia evidence.

CBA inflation target. https://www.cba.am/en/mpmain

IMF Armenia fiscal reference.
https://www.imf.org/-/media/Files/Publications/CR/2025/English/1armea2025001-print-pdf.ashx

Eurostat: 2024Q4 expenditure ratios.
https://ec.europa.eu/eurostat/web/products-euro-indicators/w/2-07032025-ap

Eurostat: revised 2024 EA20 debt.
https://ec.europa.eu/eurostat/en/web/products-euro-indicators/w/2-21102026-ap

ECB: 2024 international investment position.
https://www.ecb.europa.eu/press/stats/bop/2025/html/ecb.bq250404~3a3bb7d212.en.html

Russian fiscal-resource cross-check. Gaidar Institute, Russian Economy in 2025, table of 2024-25 enlarged-government accounts. https://www.iep.ru/files/text/trends/2025/Engl_RosEcon_2025_WEB.pdf

Russian tax-only cross-check. Federal Tax Service, 26 February 2025.
https://www.nalog.gov.ru/rn77/news/activities_fts/15841044/

Structural references. Kumhof, Laxton, Muir and Mursula (2010), IMF WP/10/34; Anderson et al. (2013), IMF WP/13/55.

ARMENIA | THREE FINANCIAL SHOCKS

Model responses around the calibrated steady state | 6 November 2026

1 Country risk premium

+100 basis points on impact; AR(1) persistence 0.70.

2 External finance premium

Borrower-riskiness shocks in both sectors, scaled so the initial-debt-weighted financing premium rises 100 bp on impact; riskiness persistence 0.60.
Sector premiums and their later paths are endogenous.

3 Capital / net-worth destruction (NWKSHK)

One-year exogenous loss valued at 10% of initial sector net worth, in each sector. This changes depreciation and destroys productive capital. The endogenous net-worth response can differ from 10%. It is not a household wealth shock.

Policy and interpretation

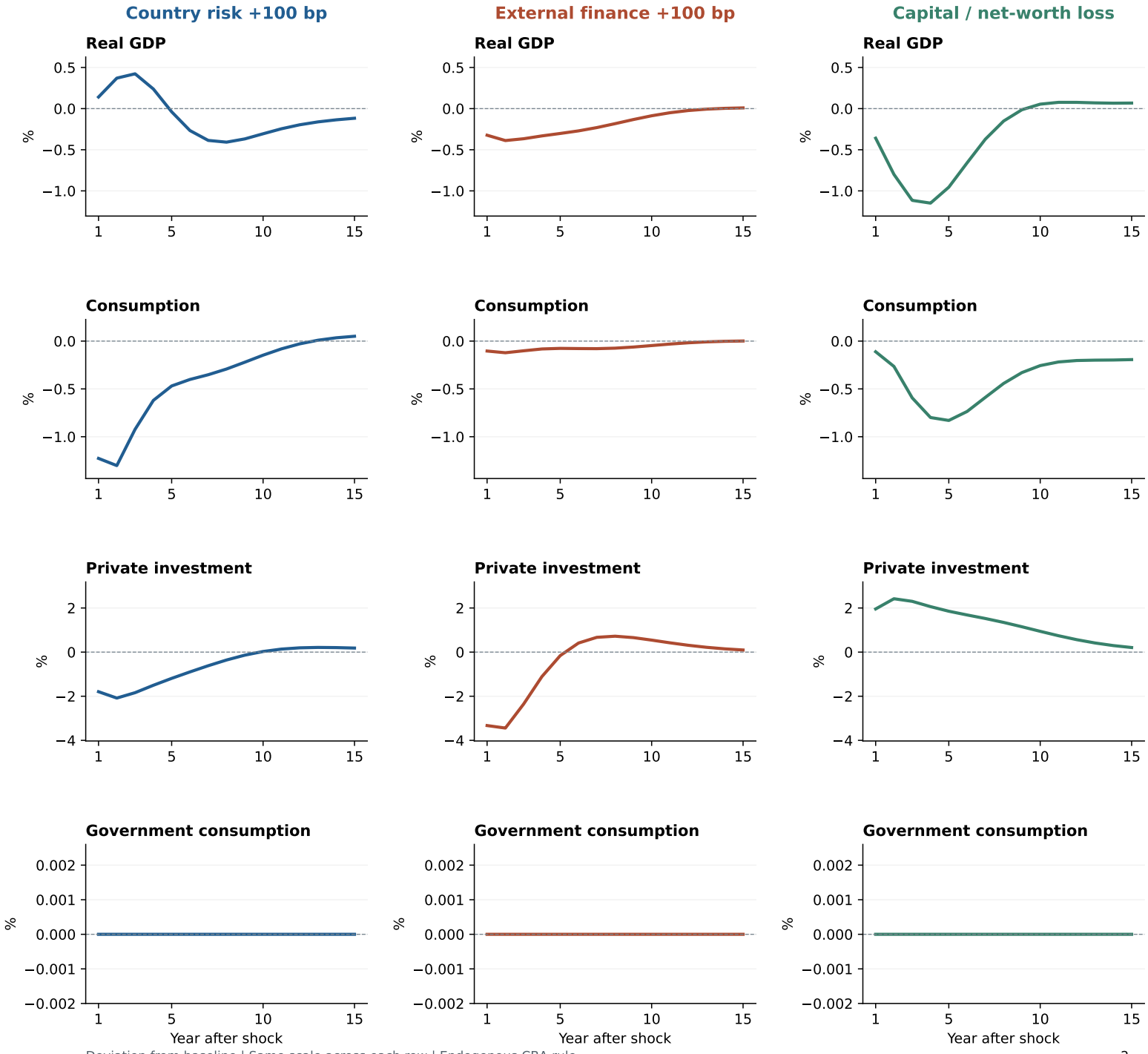
CBA inflation-targeting rule responds; floating dram; existing fiscal rule retained.
R1 United States, R2 Armenia, R3 rest of world. Shocks originate only in Armenia.
Years are years after the shock. Percent changes and percentage points (pp) are deviations from the no-shock baseline; these are simulations, not forecasts.

Numerical checks

First-order perfect-foresight solutions, 100-year horizon; checked against 60 years.
Steady-state and linear dynamic equation residuals are below 1e-8.
Equal plotting scales across shocks for each variable; dashed line marks zero.

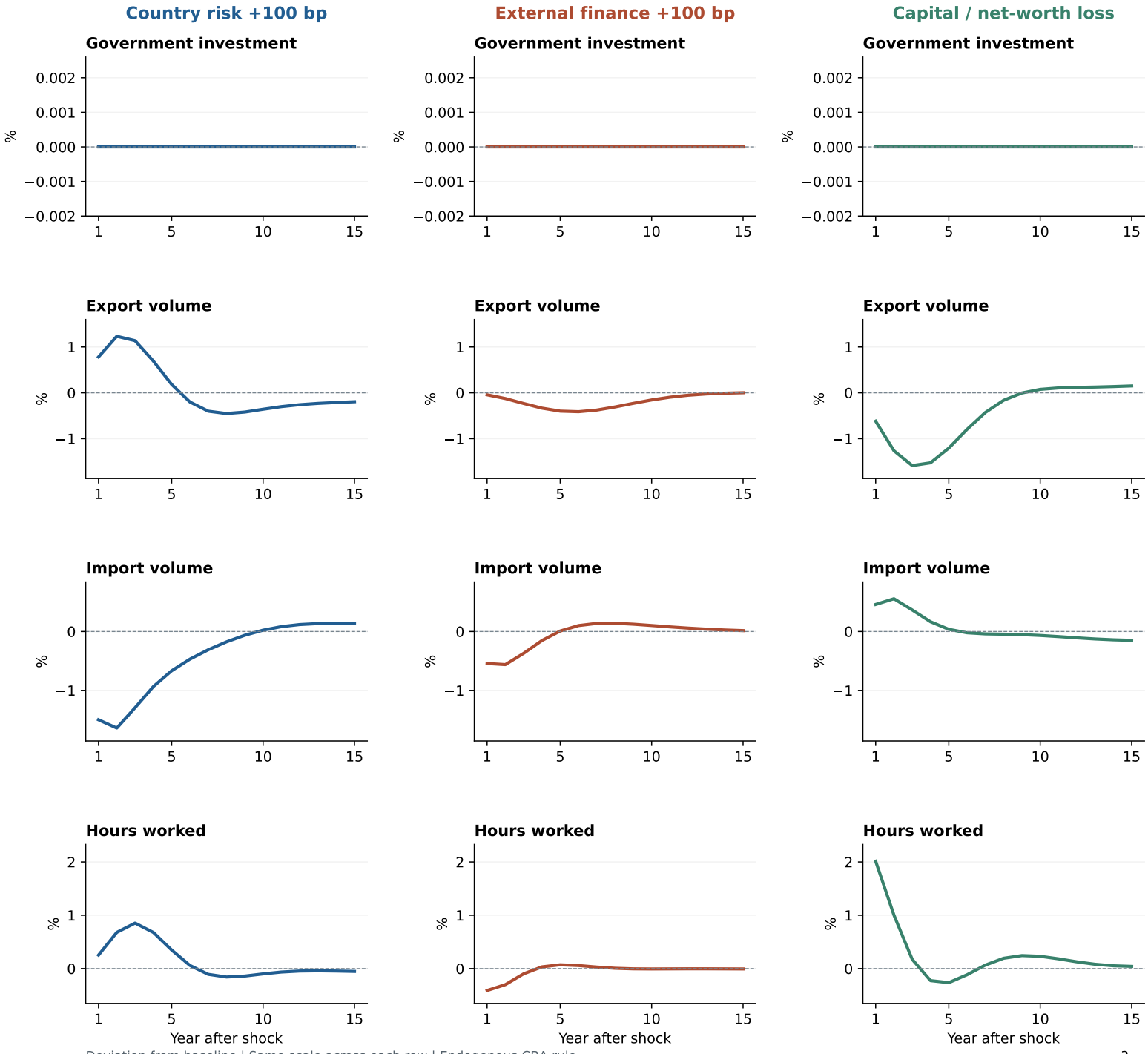
Source: supplied Armenia_GIMF3_current model, including its exchange-rate pass-through calibration.

Armenia | Demand and output



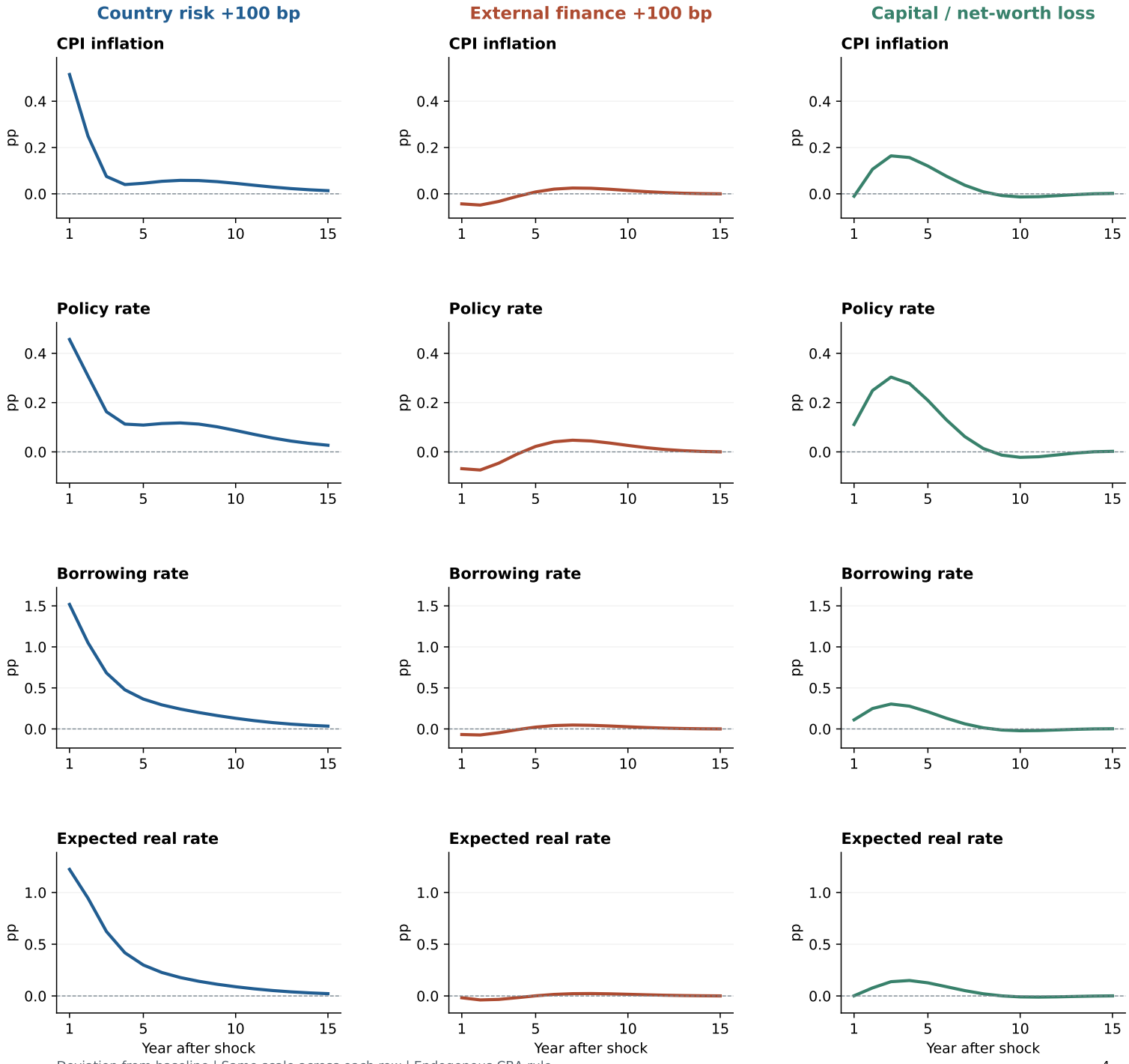
Deviation from baseline | Same scale across each row | Endogenous CBA rule

Armenia | Demand and output



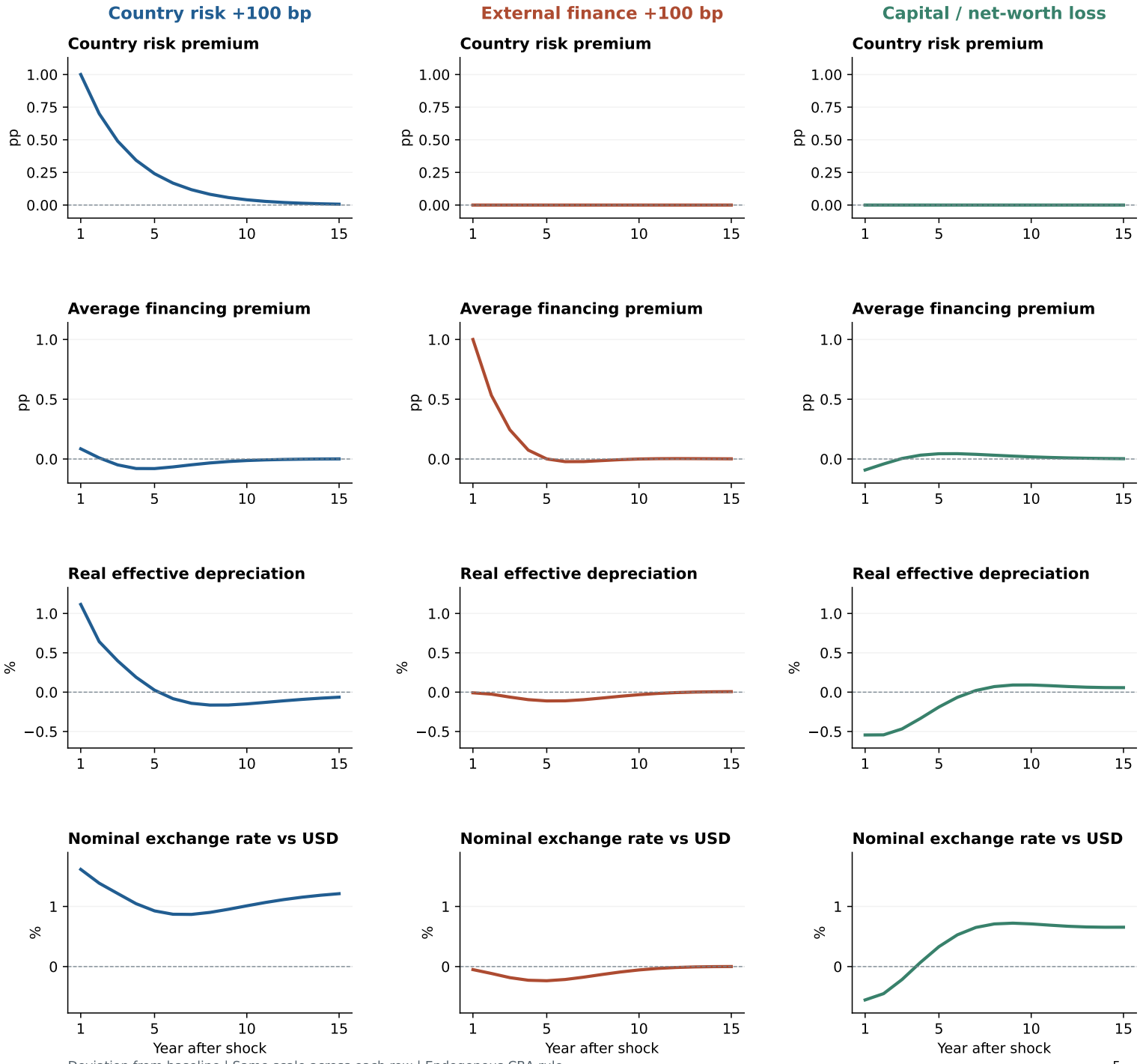
Deviation from baseline | Same scale across each row | Endogenous CBA rule

Armenia | Prices, interest rates and exchange rates



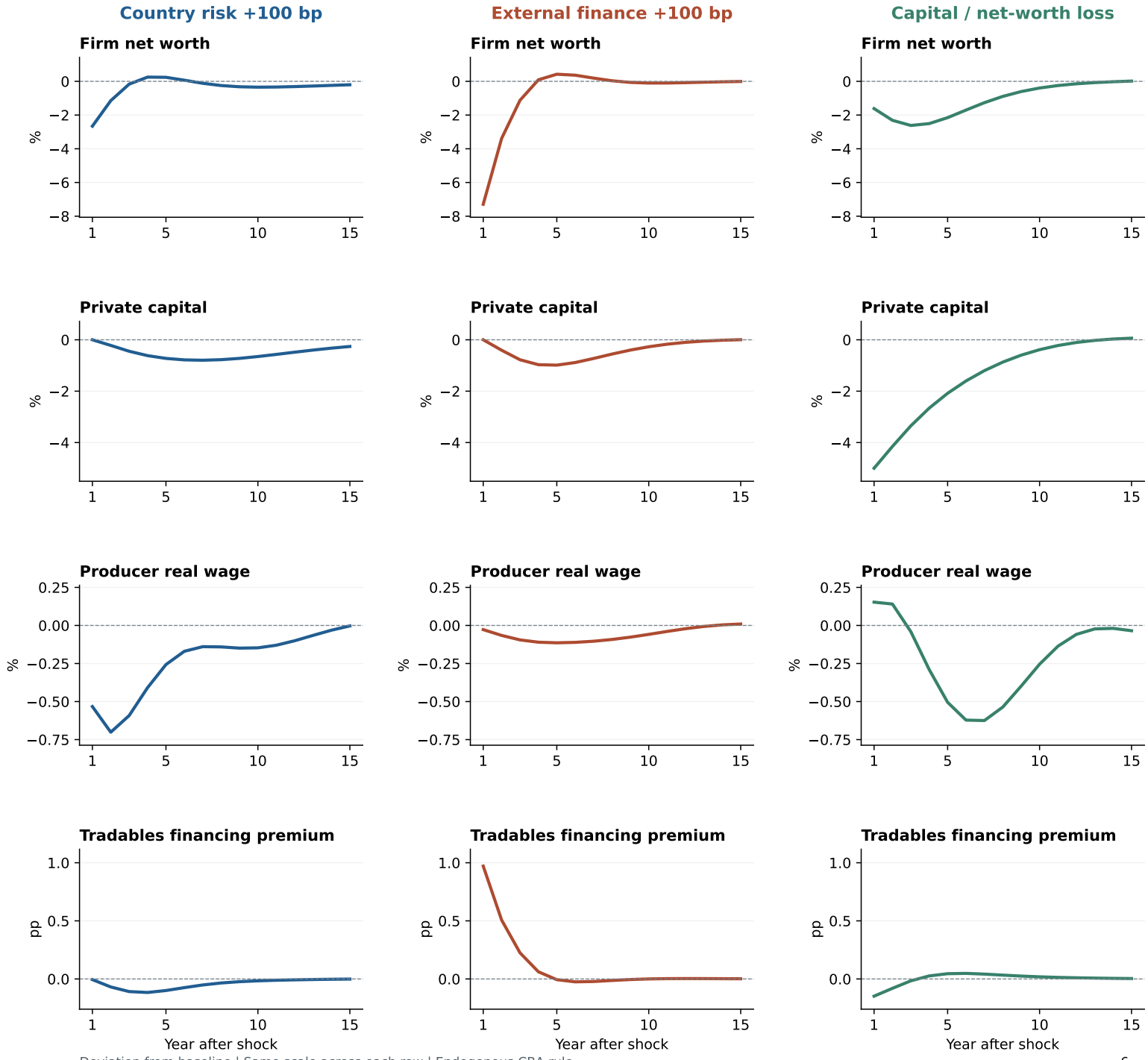
Deviation from baseline | Same scale across each row | Endogenous CBA rule

Armenia | Prices, interest rates and exchange rates



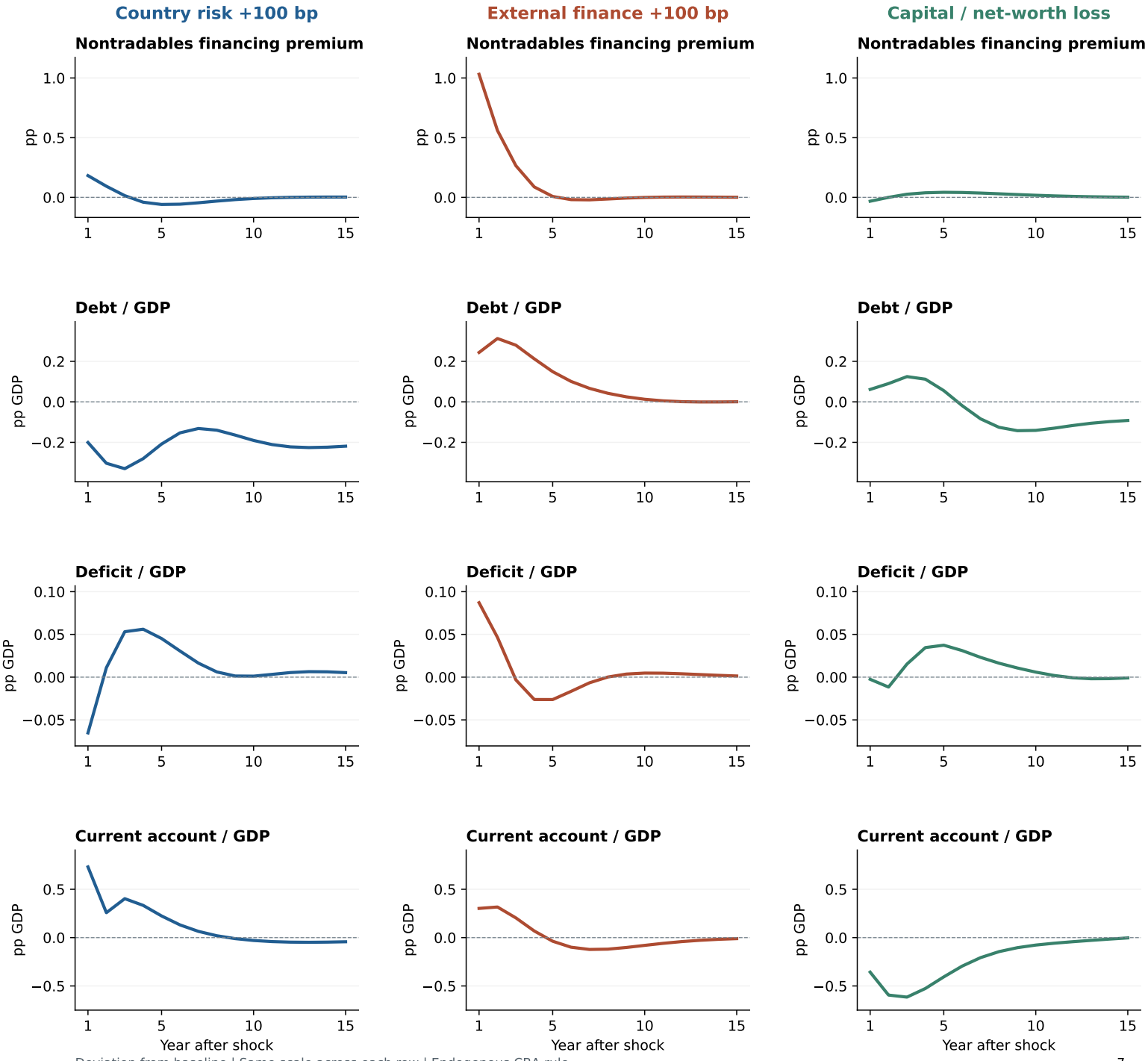
Deviation from baseline | Same scale across each row | Endogenous CBA rule

Armenia | Balance sheets, income and external accounts



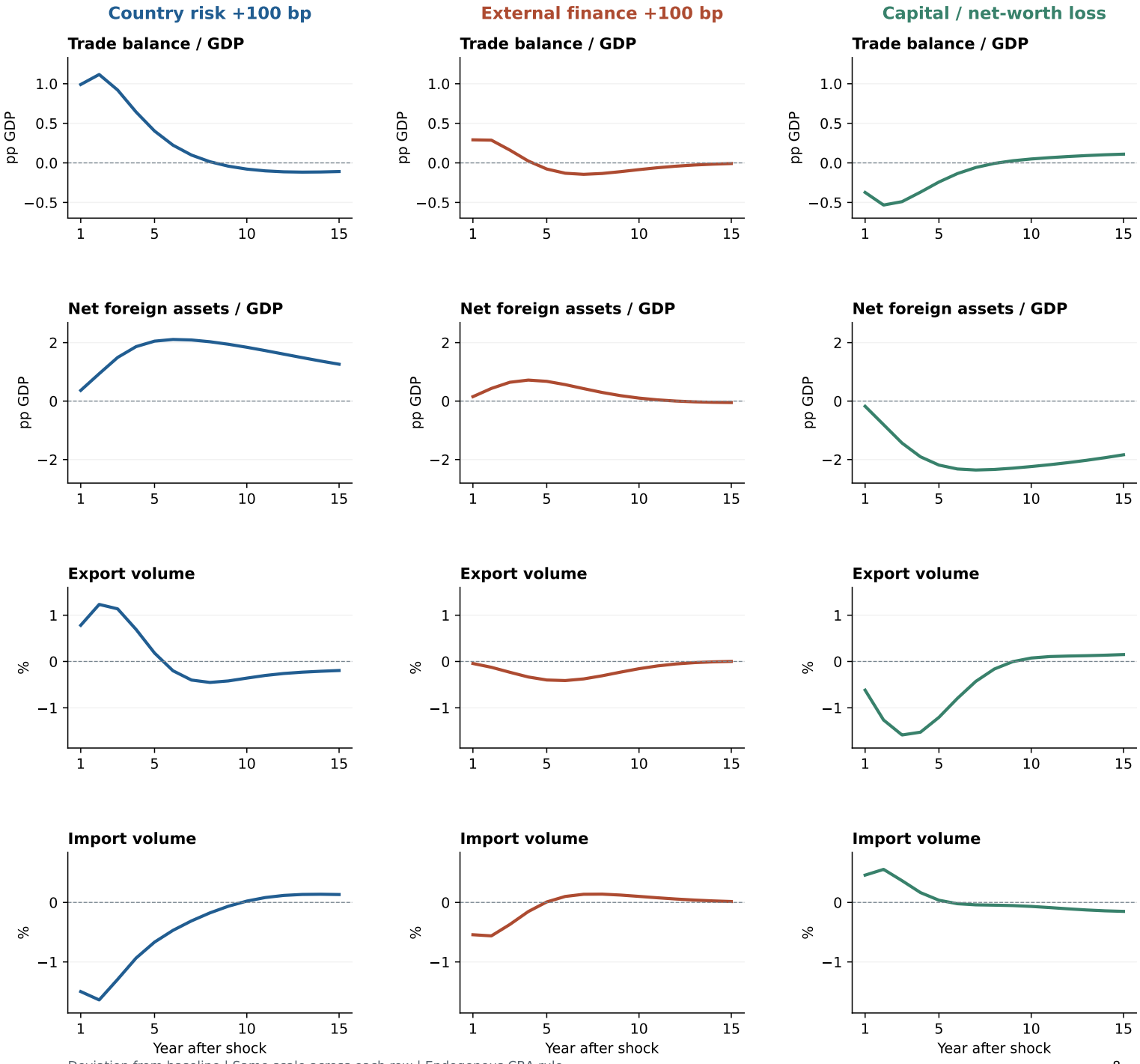
Deviation from baseline | Same scale across each row | Endogenous CBA rule

Armenia | Balance sheets, income and external accounts



Deviation from baseline | Same scale across each row | Endogenous CBA rule

Armenia | Balance sheets, income and external accounts



Deviation from baseline | Same scale across each row | Endogenous CBA rule

Armenia | Reading the first-year responses

Variable	Country risk	External finance	Capital loss
Real GDP (%)	0.14	-0.32	-0.36
Consumption (%)	-1.23	-0.10	-0.11
Private investment (%)	-1.79	-3.33	1.96
Export volume (%)	0.78	-0.04	-0.62
Import volume (%)	-1.50	-0.54	0.46
CPI inflation (pp)	0.52	-0.04	-0.01
Hours worked (%)	0.25	-0.41	2.01
Firm net worth (%)	-2.66	-7.29	-1.62
Private capital (%)	0.00	0.00	-5.00

Country risk: domestic private spending falls, but depreciation and stronger net exports initially offset that decline in the model. The GDP response turns negative later.

External finance: higher borrower riskiness weakens firm net worth and investment, reducing GDP and inflation initially. The CBA cuts its policy rate.

Capital loss: productive capital falls 5.00% on impact; investment rises as firms rebuild. The 10% shock is a direct loss scaled by initial net worth, not a 10% net-worth outcome.

These mechanisms are conditional on the inherited Armenia calibration and policy closure.