Government Debt, Interest Rates, and Optimal Policy

A medium-sized, open-economy, fiscal DSGE model of South Africa

Hylton Hollander

Stellenbosch University

hylton@sun.ac.za

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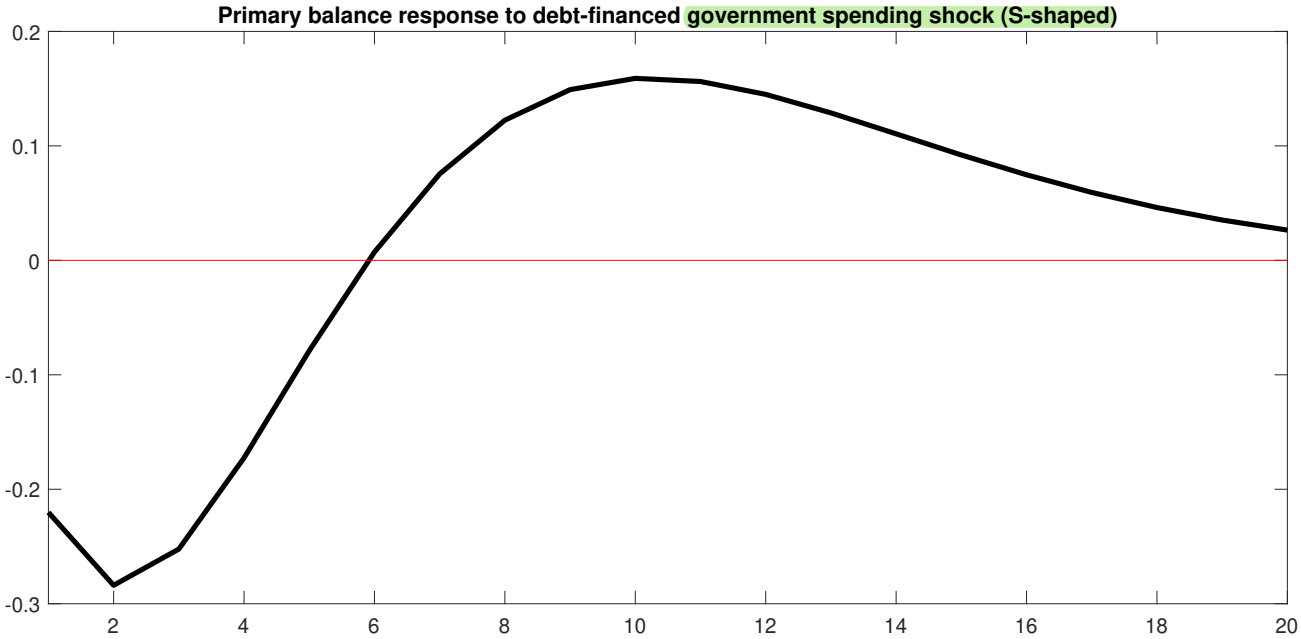
Overview

1. Motivation & Aims
   - fiscal sustainability and sovereign debt risk
   - government debt and interest rates
   - optimal policy and policy coordination
2. Contribution to the literature
3. Model economy & Main findings
4. Results
   - debt-financed fiscal stimulus and the transmission mechanisms
   - fiscal sustainability, monetary policy, and optimal policy
   - debt stabilisation and social relief after COVID-19
5. Concluding remarks
   - modelling issues
6. Appendix

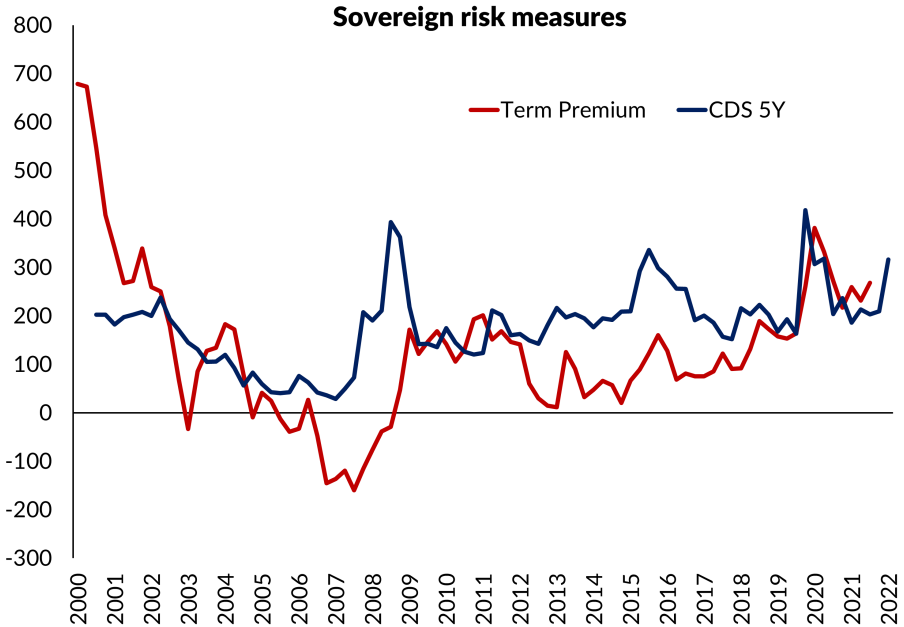
Motivation: fiscal sustainability and sovereign debt risk

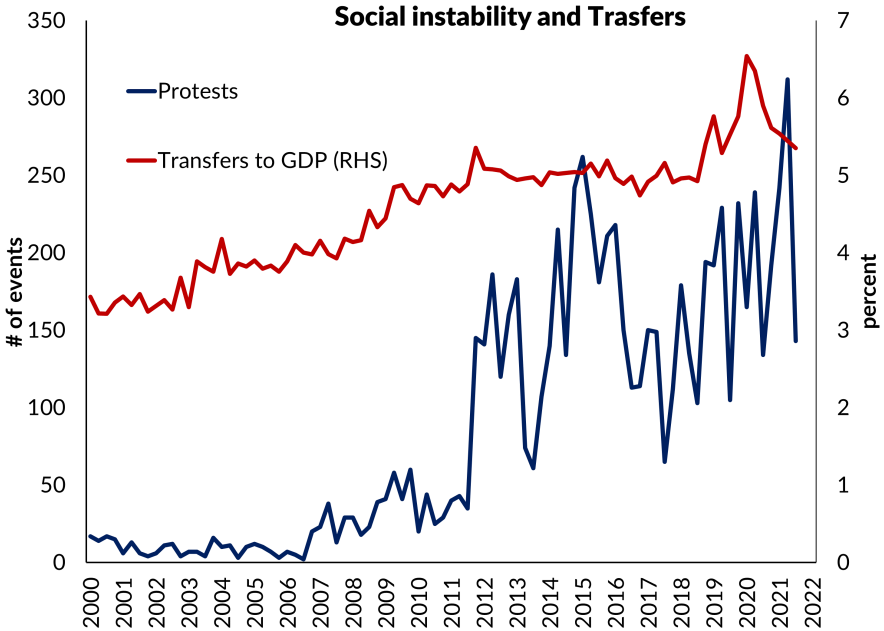


In search of the "right [s-shaped] surplus" response ...

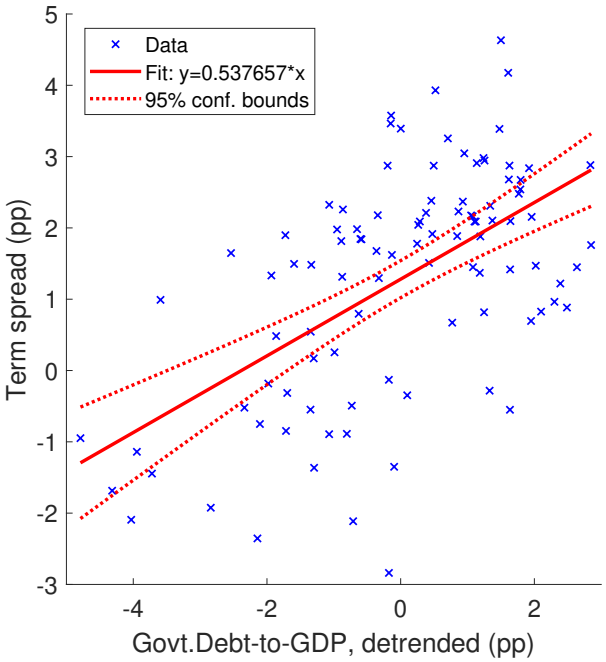
- academia: Calitz et al. (2014); Burger and Calitz (2019); Calitz (2020)
- markets: 5-11% probability of default within next 5 years (CDS spreads, 2020-2022)
- policymakers: sovereign debt crisis by 2024 (Mboweni, 2020)

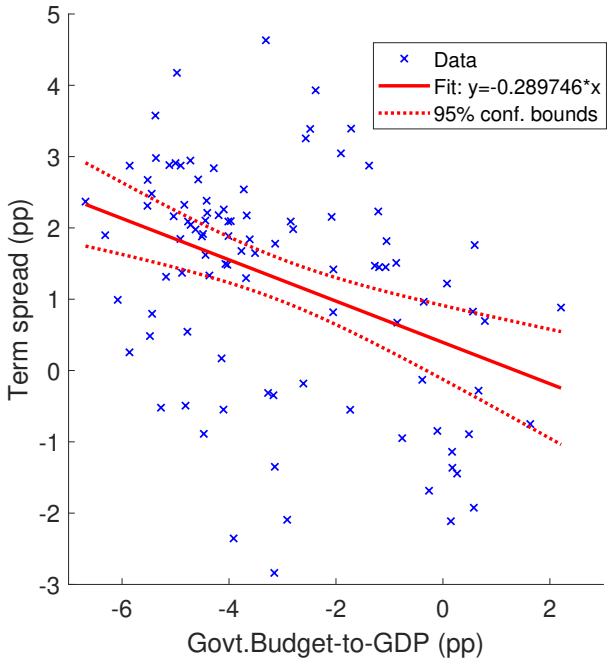
Motivation: fiscal sustainability and sovereign debt risk





Motivation: government debt and interest rates





- reduced-form measures estimate the average effect of changes in debt or deficits—a proxy for debt-financed fiscal stimulus (DFFS).
- expenditure or tax revenue?
- a key transmission mechanism for fiscal multipliers (Ganelli and Rankin, 2020) and fiscal sustainability (Fourie and Burger, 2003; Calitz et al., 2013)

Motivation: optimal policy and policy coordination

South African Reserve Bank

> *For government to continue providing the necessary social and economic services while achieving fiscal sustainability, the growth in debt-service costs needs to be contained as a top priority, primarily through debt-containing measures* — *June 2021 Quarterly Bulletin*

- government borrowing rate $r >$ economic growth rate g
- South Africa runs a primary fiscal deficit $pb < pb^{sus}$
- fiscal policy has been time inconsistent: "fiscal rules" (link *target* to *outcome*)
- As a result, debt is rising without limit. Fiscal consolidation is urgent.

Aims for the study

Aims **I**

1. What is the effect of disaggregated debt-financed revenue and expenditure shocks on interest rates?
2. How important are the transmission mechanisms: crowding in/out, risk premium, and fiscal-monetary policy interaction?
3. What is the effect of interest rate shocks on government debt: monetary policy (domestic and foreign), risk premium, and credit ratings? (Appendix)

Aims **II**

1. What is the least cost way of achieving consolidation?
2. How does one coordinate between fiscal and monetary policy?

Aims **III**

1. How can we best achieve debt stabilisation and social stability after COVID-19? (Preliminary and time-dependant)

Contribution to the literature I

I. The effect of DFFS on interest rates in a DSGE model

- Difficulty in identifying fiscal policy shocks is well-documented in the literature (Engen and Hubbard, 2004; Ramey, 2019; Gamber and Seliski, 2019; Kemp, 2020)
- Empirical evidence on the effect of government debt on interest rates in South Africa is very limited (Fedderke, 2020)
- SA literature predominantly focused on:
  - the effect of government debt on growth,
  - the effect of interest rates on the macroeconomy, and
  - the spillover effects of credit ratings or sovereign risk.

  (e.g., Peter and Grandes, 2005; Fedderke, 2020; Mothibi, 2019; Mhlaba and Phiri, 2019; Soobyah and Steenkamp, 2020b,a)

Contribution to the literature II

II. Optimal policy for fiscal sustainability

- There is a substantial literature on fiscal sustainability
- But not much on optimal policy in a DSGE model. A big reason for this follows from **I**
- Evaluate policy options by explicitly incorporating welfare loss
- Include coordination with monetary policy

III. The macroeconomics of extending the social grant system in South Africa

- Debt stabilization and social relief after COVID-19 (Preliminary)

Model economy: the effect of debt-financed fiscal stimulus

Theoretically, DFFS programs directly stimulate aggregate demand through government expenditure or tax cuts, but their effectiveness is highly dependent on:

- direct crowding-out of private sector expenditure (Afonso and Sousa, 2012; Traum and Yang, 2015; Kemp, 2020; Kemp and Hollander, 2020),
- spillover effects to the private sector through higher interest rates (risk premium) (Peter and Grandes, 2005; De Bruyckere et al., 2013; Augustin et al., 2018), and
- the interaction between fiscal policy and monetary policy (Ascari and Rankin, 2013; Ramey, 2019; Ganelli and Rankin, 2020).

Model economy

The new-Keynesian open-economy fiscal DSGE model based on Kemp and Hollander (2020) is well-suited to answer the above aims:

- Includes a non-trivial role for fiscal policy: consumption, investment, transfers, labour income tax, capital tax, consumption tax.
- Sticky prices for all goods: domestic, foreign, imports, exports
- Sticky wages for Ricardian and non-Ricardian households
- Rational, forward-looking, and optimizing households and firms
- Households have access to domestic and foreign bonds

Estimate with SA data and run counterfactual simulations:

- 20 observable variables; 21 exogenous shocks
- The six fiscal policy variables are estimated by six fiscal reaction functions that respond to output and debt.

Main findings I

I. The effect of debt-financed fiscal stimulus in a DSGE Model

- Reduced-form estimates provide quantitatively similar results to the net effect of DFFS on real yields (Appendix)
- But for fiscal policy analysis, there are non-negligible differences in the responses of households, firms, and the monetary authority (and the risk premium) to each disaggregated fiscal policy shock.
- Notably, an investment-driven DFFS, as opposed to government consumption, produces far more favourable fiscal sustainability outcomes.
- Fiscal "revenue cuts" are contractionary.[1]

[1] To ensure a stable and predictable stream of tax revenue over the business cycle, the accuracy and credibility of official projections is crucial (e.g., Calitz et al., 2016).

Main findings I & II

I. The transmission mechanisms

- The endogenous responses of the risk premium (long rate) and monetary policy (short rate) have sizeable influences on the dynamic effects of DFFS.
- Crowding out can be important for government consumption spending, but not a significant channel.

II.The effect of interest rates on debt

- Monetary policy shocks contribute 12% of the variance of government debt-to-GDP
- Risk premium shocks in the long-term rate contribute 7%
- Credit rating shocks are $\approx$ 50% larger than non-ratings-related risk premium shocks (Appendix)

Main findings II

II. Optimal policy for fiscal sustainability

- Government expenditure need not be counter-cyclical, but it must be subordinate to fiscal sustainability (debt level)
- Monetary policy is sub-optimal because of a preference for interest rate smoothing, but the gains from allowing greater policy rate variation are marginal
- Independent optimal fiscal policy and optimal monetary policy coincides with optimal policy coordination.
- There is a trade-off between long-run debt stabilization (hard) and short-term fiscal sustainability (soft)

Results: debt-financed fiscal expenditure

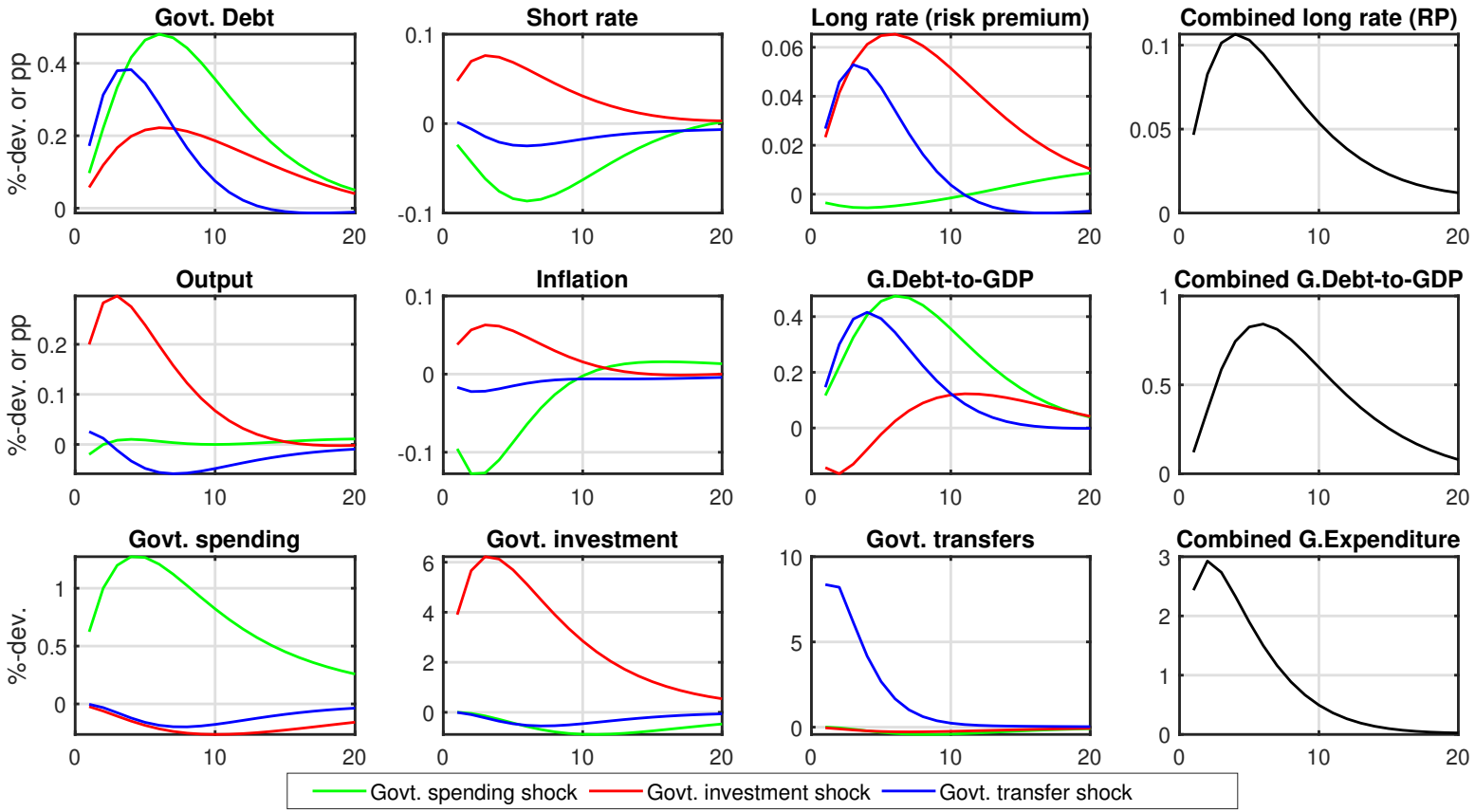


Figure: IRFs for government expenditure shocks.

Results: debt-financed fiscal revenue shortfalls

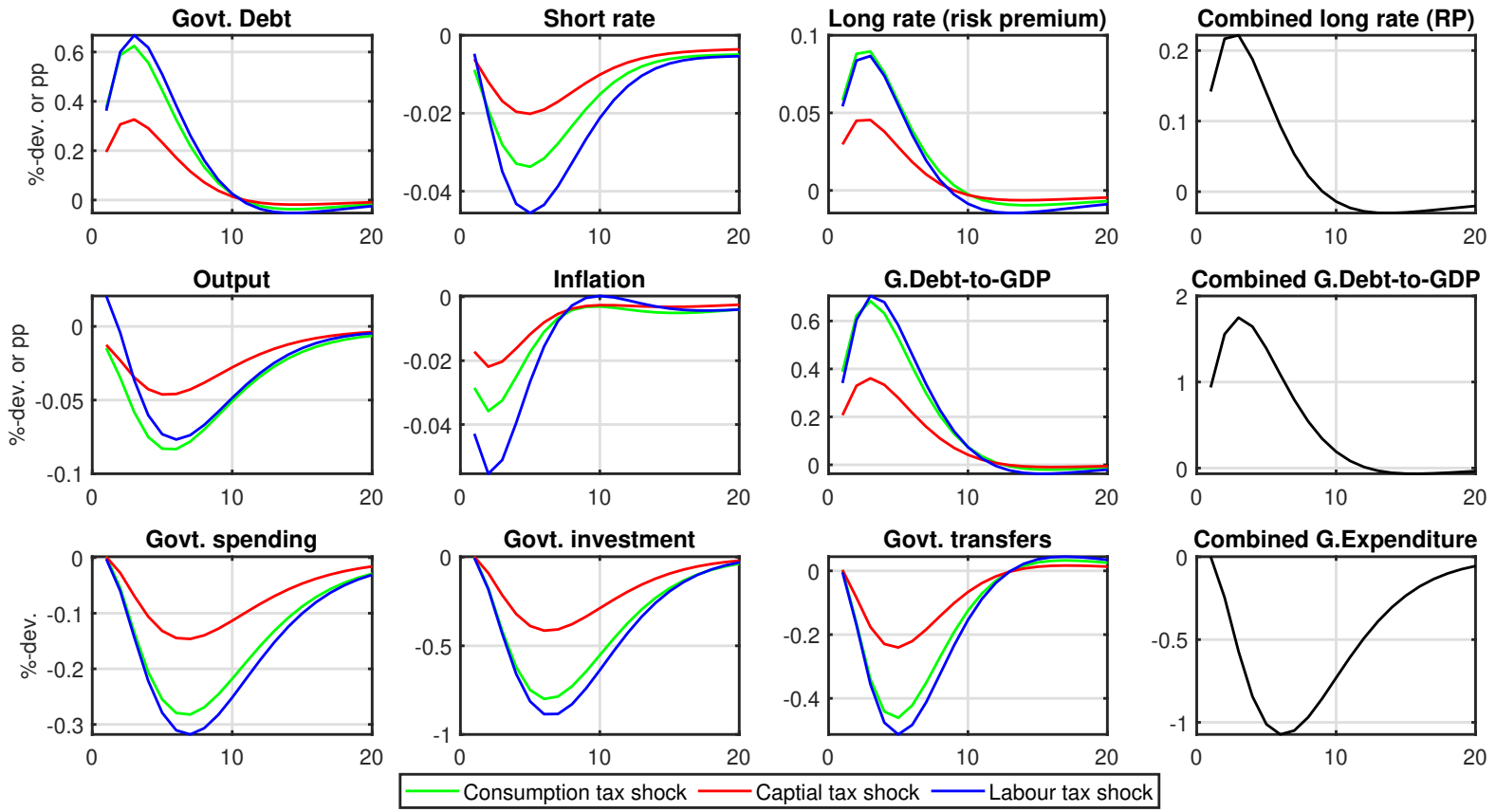


Figure: IRFs for government tax revenue shocks.

The transmission mechanisms: risk premium

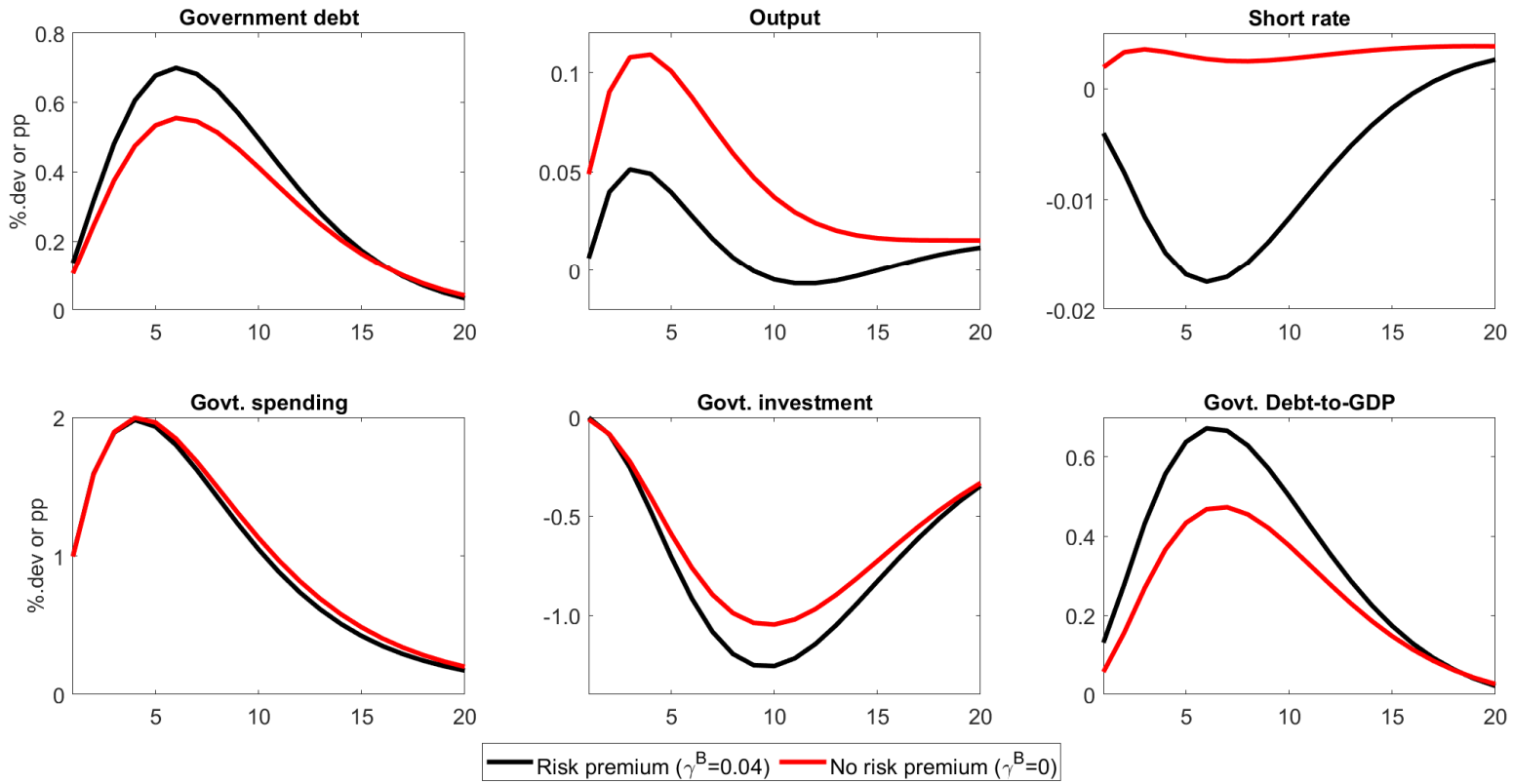


Figure: Government consumption with and without risk premium response

$$r_t^{(10y)} = r_t^{(3m)} + \underbrace{\gamma^B(b_t - y_t) + \varepsilon_t^{RP}}_{\text{risk premium } (RP_t)},$$

The transmission mechanisms: risk premium

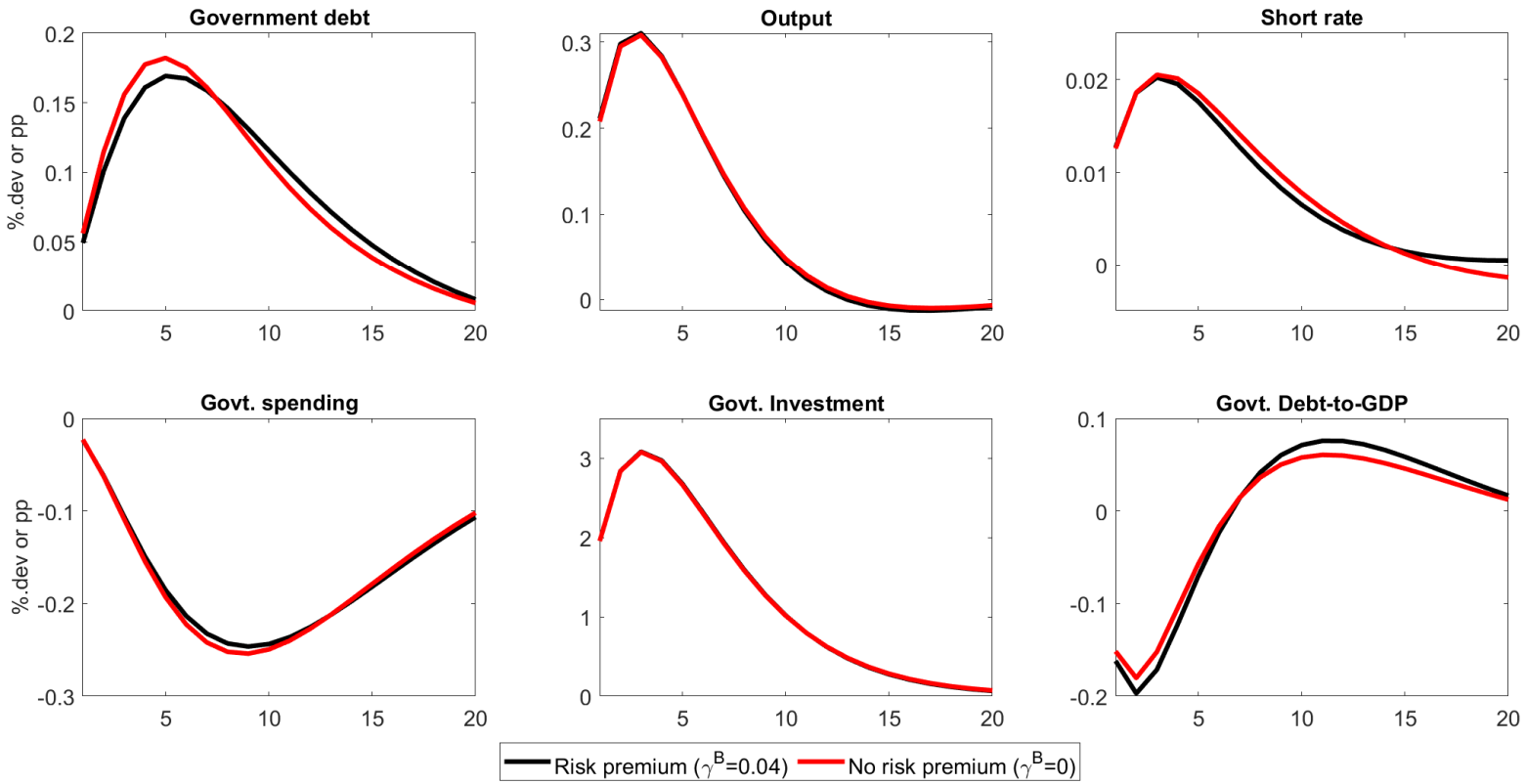


Figure: Government investment with and without risk premium response

$$r_t^{(10y)} = r_t^{(3m)} + \underbrace{\gamma^B (b_t - y_t) + \varepsilon_t^{RP}}_{\text{risk premium } (RP_t)},$$

The transmission mechanisms: monetary policy

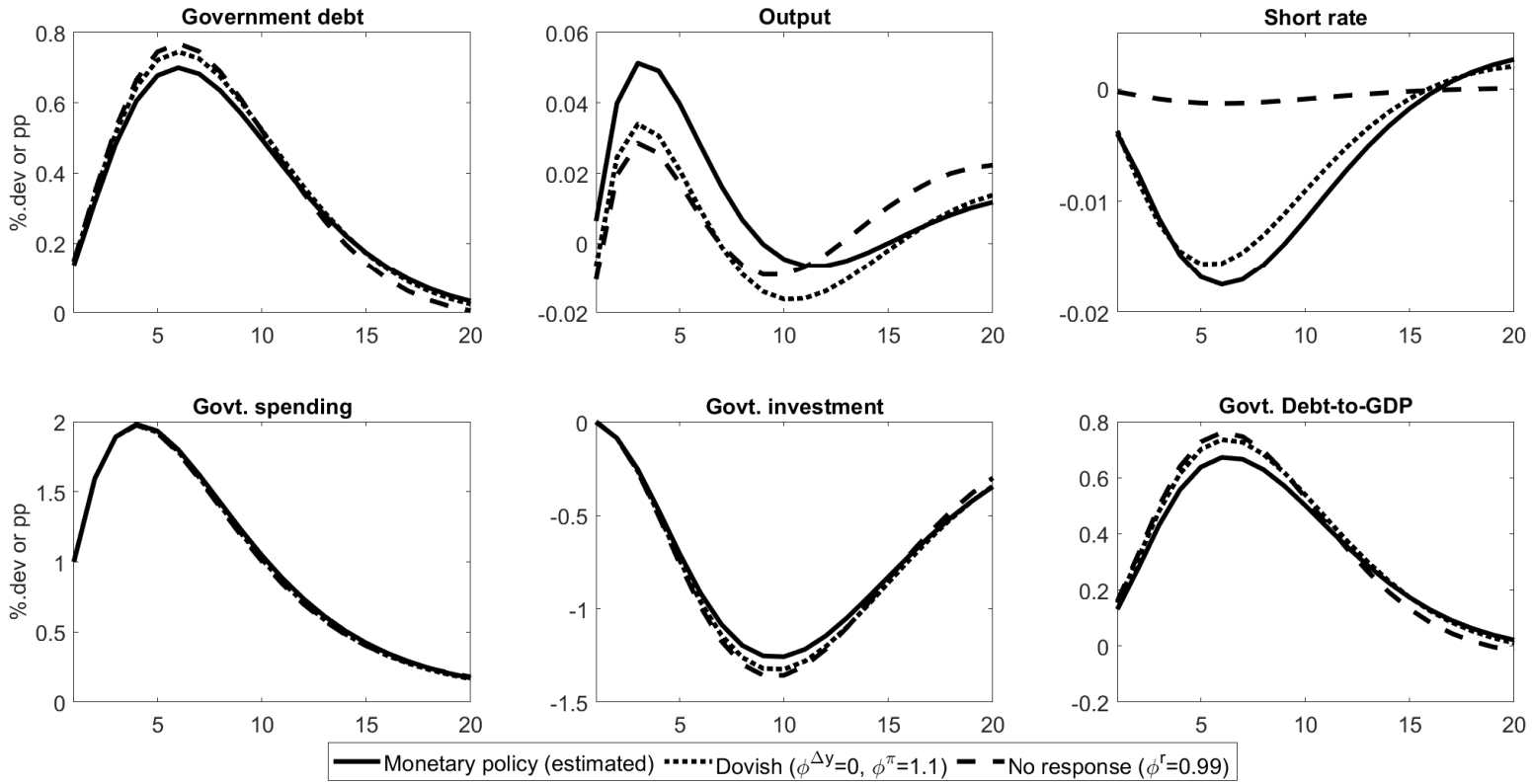


Figure: Government consumption with degrees of monetary policy responses

$$r_t^{(3m)} = \phi_R r_{t-1}^{(3m)} + (1-\phi_R)\left(\phi_\pi \pi_{C,t} + \phi_{\Delta y}\Delta y_t\right) + \eta_t^R \ ,$$

The transmission mechanisms: monetary policy

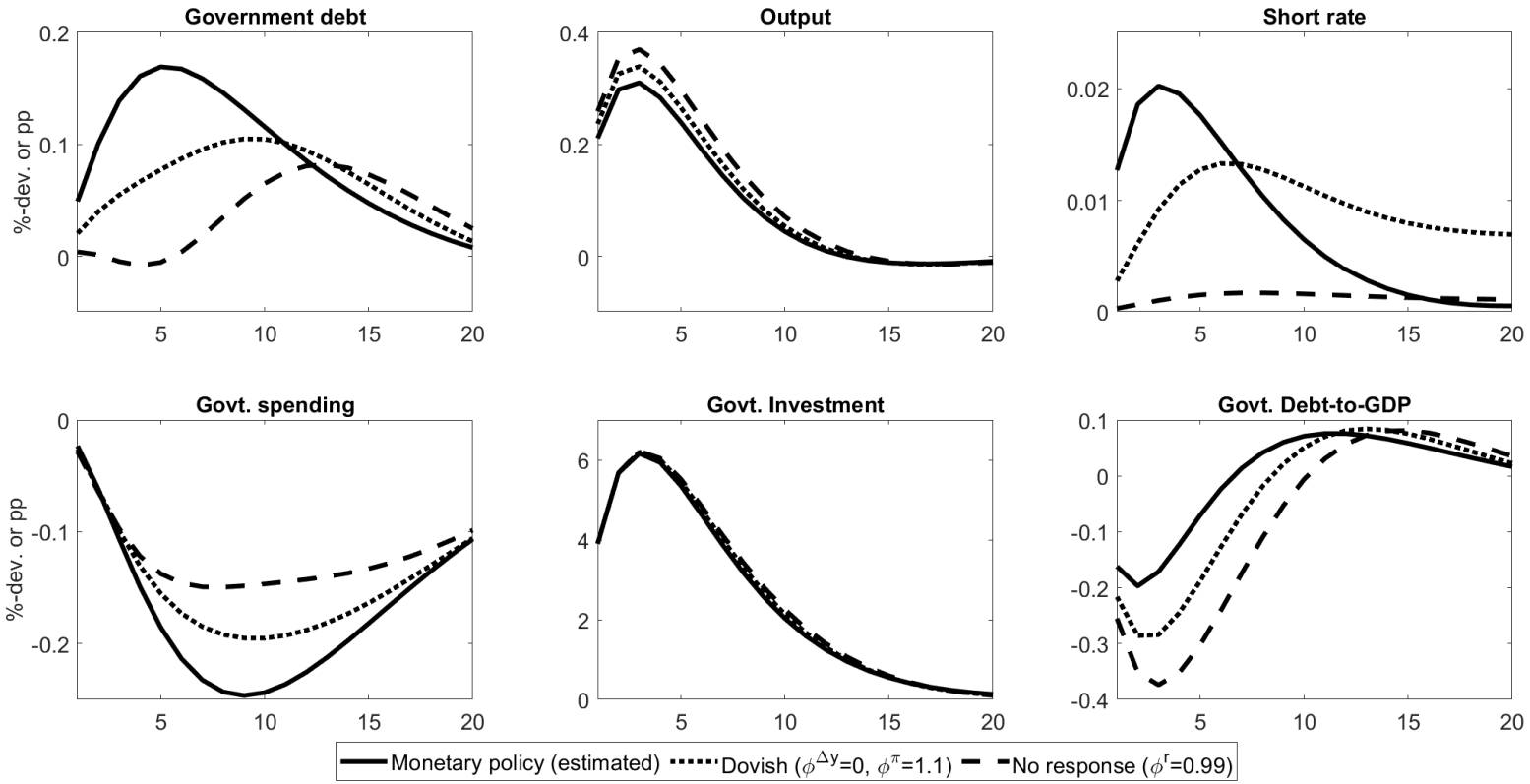


Figure: Government investment with degrees of monetary policy responses

$$r_t^{(3m)} = \phi_R r_{t-1}^{(3m)} + (1-\phi_R)\left(\phi_\pi \pi_{C,t} + \phi_{\Delta y}\Delta y_t\right) + \eta_t^R \ ,$$

The transmission mechanisms: crowding-in/-out

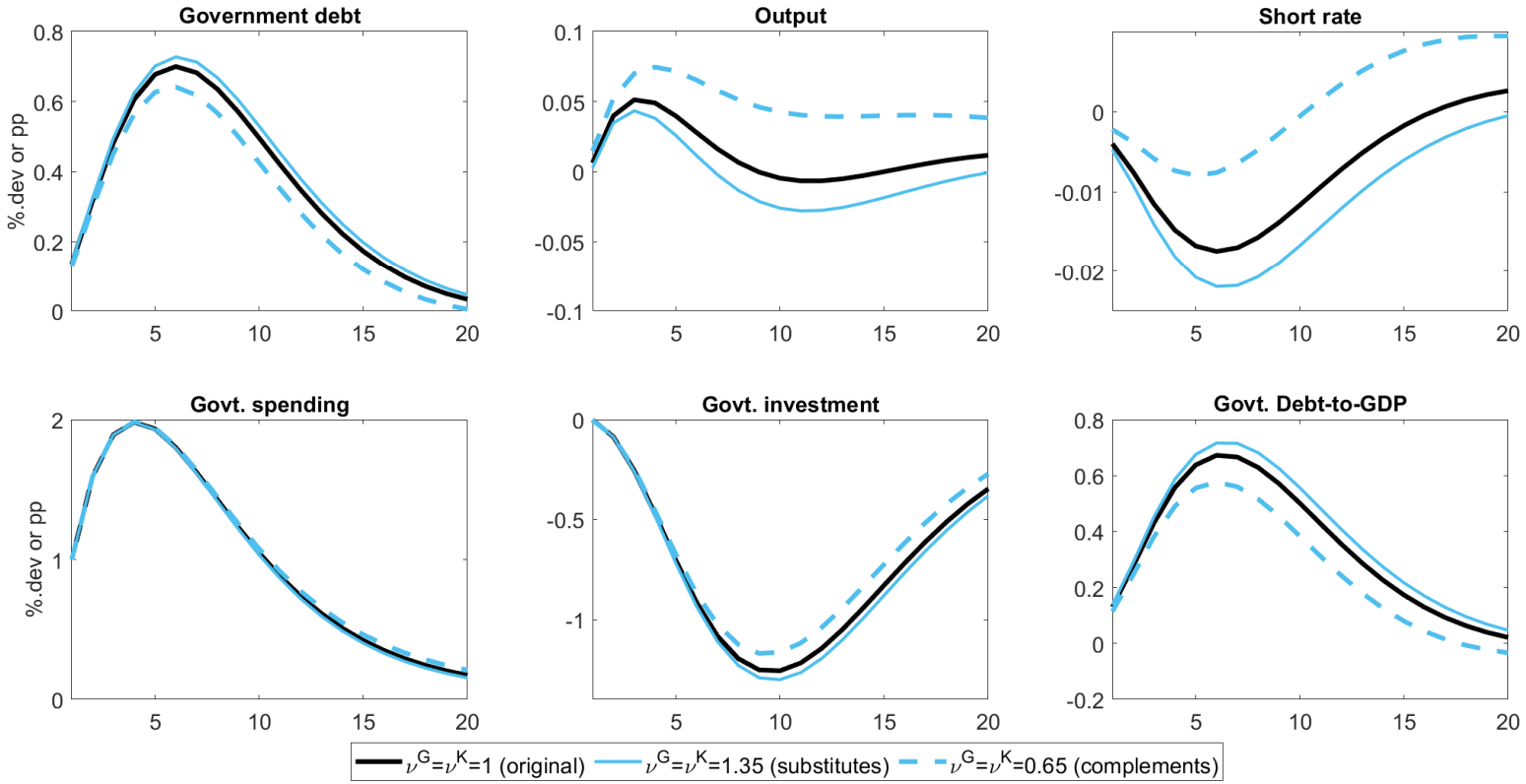


Figure: Government spending with crowding-in and crowding-out

$$\tilde{C}_{h,t} = \left(\alpha_G^{\frac{1}{\nu_G}} \left(C_{h,t} \right)^{\frac{\nu_G - 1}{\nu_G}} + (1 - \alpha_G)^{\frac{1}{\nu_G}} \left(G_t \right)^{\frac{\nu_G - 1}{\nu_G}} \right)^{\frac{\nu_G}{\nu_G - 1}},$$

The transmission mechanisms: crowding-in/-out

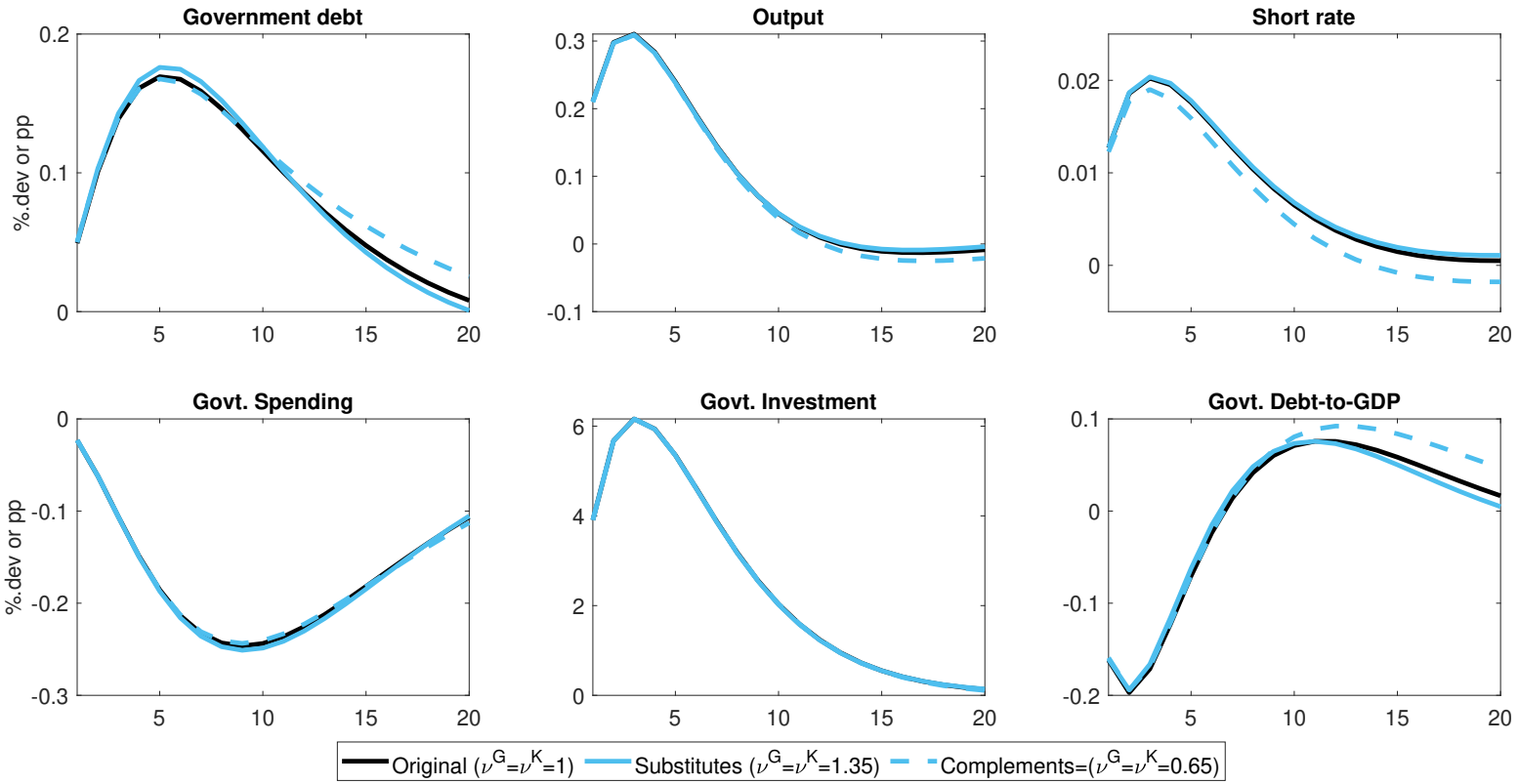
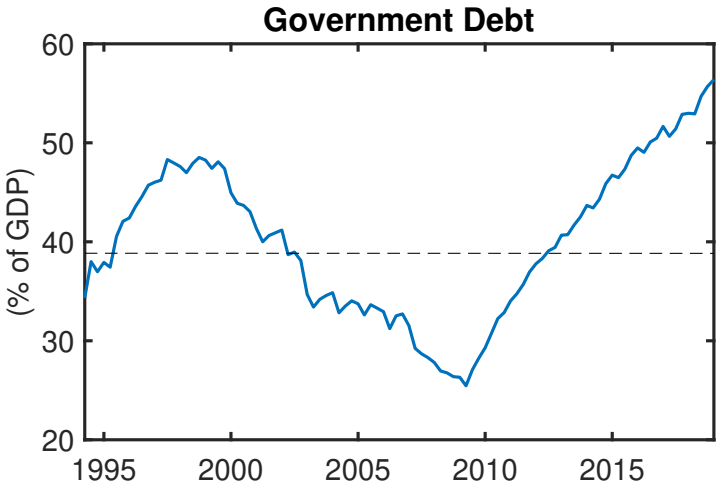
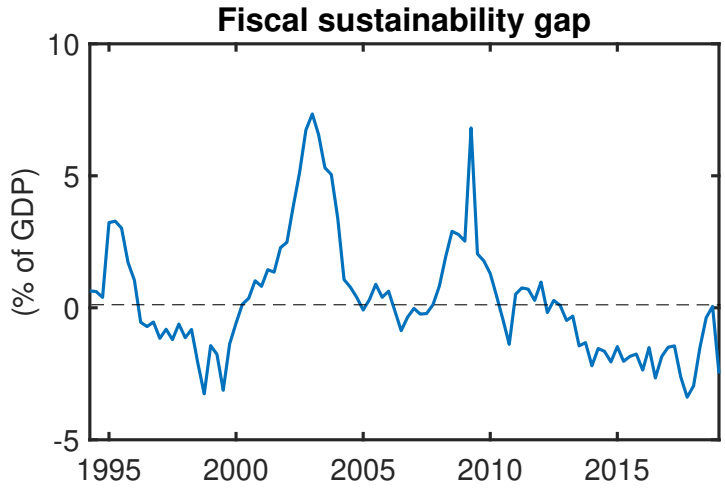


Figure: Government investment with crowding-in and crowding-out

$$\tilde{K}_{f,t} = \left(\alpha_K^{\frac{1}{\nu_K}} \left(K^s_{f,t} \right)^{\frac{\nu_K - 1}{\nu_K}} + (1 - \alpha_K)^{\frac{1}{\nu_K}} \left(K_{G,t} \right)^{\frac{\nu_K - 1}{\nu_K}} \right)^{\frac{\nu_K}{\nu_K - 1}}$$

Two measures for fiscal sustainability





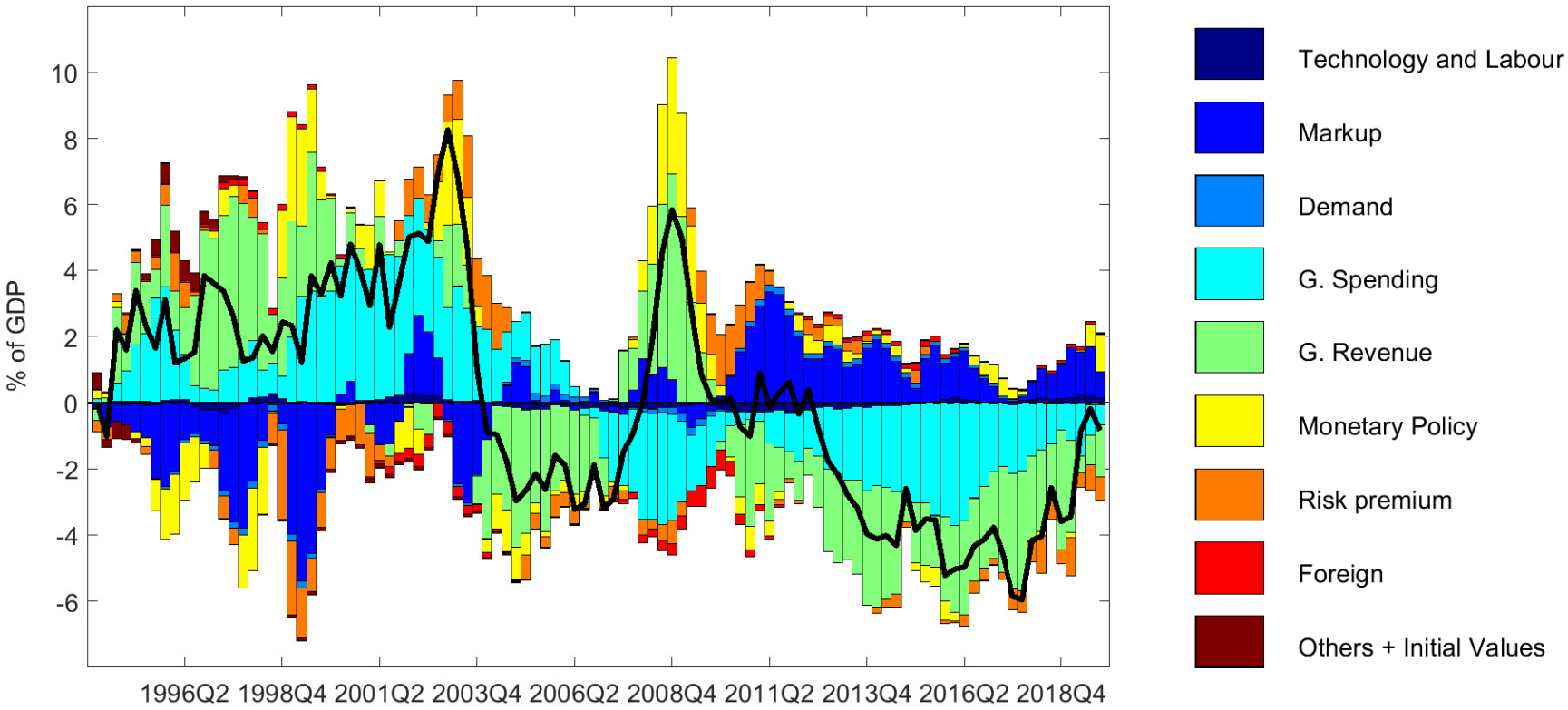
Sustainable fiscal policy:[2]

1. the public debt-to-GDP ratio remains stable over the medium- to long-run.
2. If the real interest rate exceeds the real economic growth rate, fiscal sustainability requires government to maintain a primary surplus.

$$pb^{sus} = (r - g) \cdot b_{-1} \quad | \quad pb^{sus*} = (r^* - g^*) \cdot b_0$$
$$pb^{gap} = pb - pb^{sus} \quad \Rightarrow \quad \Delta b = 0$$

[2] Buiter et al. (1985), Blanchard et al. (1991),Fourie and Burger (2003)

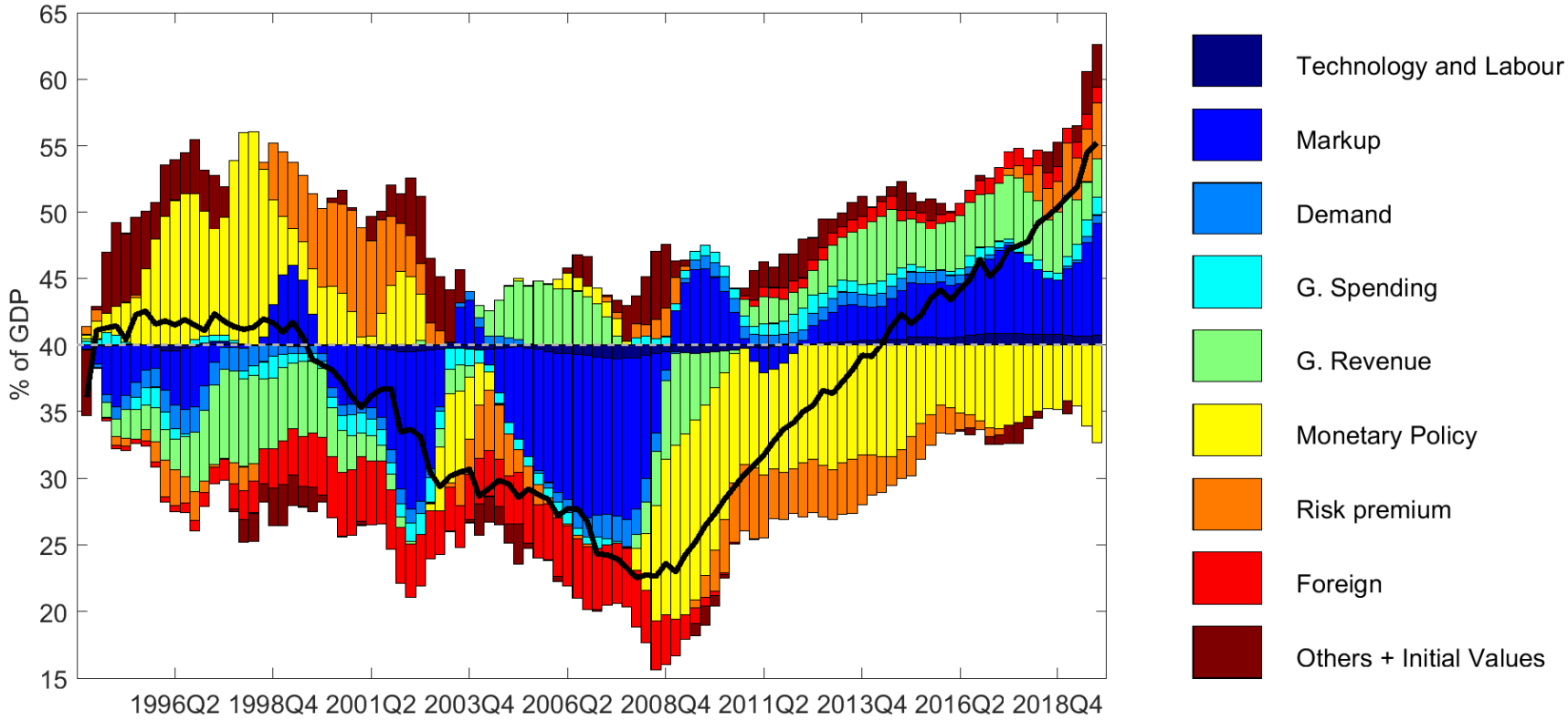
Fiscal sustainability and monetary policy



FEVD:

- Monetary policy shocks contribute 6%
- Risk premium shocks contribute 6%

Government debt-to-GDP and monetary policy



FEVD:

- Monetary policy shocks contribute 12%
- Risk premium shocks contribute 6%

Optimal policy: the loss function

The success of policy can be measured by its ability to minimize instability in the target variables—a loss function:

$$\min \mathcal{L}_t = y_t^2 + \Theta_{\mathbb{X}}.\mathbb{X}_t^2 \ ,$$

where the welfare loss ($\mathcal{L}$) is an increasing function of deviations to output (y_t) and one or more variables in the vector $\mathbb{X}$. $\Theta_{\mathbb{X}}$ is a vector of weights corresponding to the policy target variables.

- Fiscal policy: output and debt (b) or output and the fiscal sustainability gap (pb^{gap})
- Monetary policy: output and inflation (π)
- $\Theta_{\mathbb{X}}$ also controls for instability in the policy instrument.

Optimal policy: optimal simple rules

The fiscal instruments (government consumption and investment expenditure) follow simple feedback rules:

$$g_t = \phi_G g_{t-1} - \theta_{g,y} y_t - \theta_{g,b} b_t + \varepsilon_t^g$$

$$i_{g,t} = \phi_{i_g} i_{g,t-1} - \theta_{i_g,y} y_t - \theta_{i_g,b} b_t + \varepsilon_t^{i_g}$$

And monetary policy follows a Taylor-type reaction function:

$$r_t = \phi_r r_{t-1} + (1-\phi_r)\left(\pi_t^* + \phi_\pi \left(\pi_t - \pi_t^*\right) + \phi_{\Delta y}(y_t - y_{t-1})\right) + \varepsilon_t^r \quad (1)$$

Policymakers must choose θ's and ϕ's to minimize $\mathcal{L}_t \to 0$

Optimal fiscal policy.

Weights on policy variables: $y, pb^{sus} = 1$

	Weights on policy instruments			
	$g, iG = 1$	$g, iG = 0.5$	$g, iG = 0$	
Parameters	*Optimal values*			*Estimated*
$\theta_{g,y}$	0.11	0.10	0.03	0.11
$\theta_{g,b}$	0.09	0.11	0.32	0.18
$\theta_{iG,y}$	0.45	0.44	0.19	0.20
$\theta_{iG,b}$	0.19	0.20	0.58	0.57
Obj.Func:	2.79	1.59	0.30	
$\theta_{iG,y}$	0.42	0.42	0.19	0.20
$\theta_{iG,b}$	0.20	0.20	1.00	0.57
Obj.Func:	2.53	1.44	0.32	

Optimal monetary policy.

Weights on policy variables: y, $\pi^C = 1$ (top); y, $pb^{sus} = 1$ (bottom)

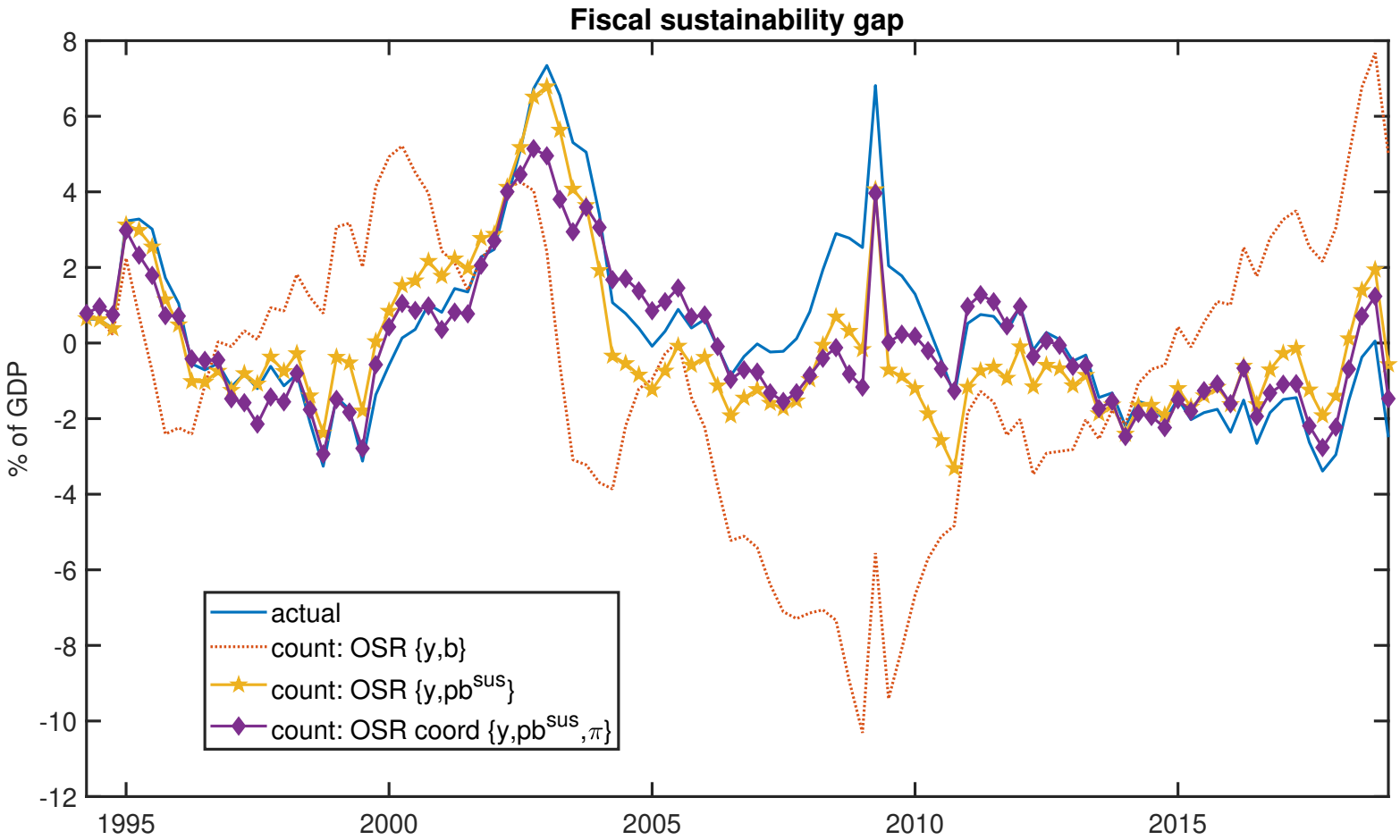
	Weights on policy instrument			
	$r = 1$	$r = 0.5$	$r = 0$	
Parameters	*Optimal values*			*Estimated*
ϕ_π	3.15	3.33	3.59	1.57
$\phi_{\Delta y}$	0.98	1.06	1.18	0.39
Obj.Func:	0.13	0.13	0.12	
	Weights on policy goal			
	$\pi^C = 1$	$\pi^C = 0.5$	$\pi^C = 0$	
ϕ_π	2.97	3.04	3.13	1.57
$\phi_{\Delta y}$	1.01	1.05	1.10	0.39
Obj.Func:	0.29	0.28	0.28	

Optimal policy coordination

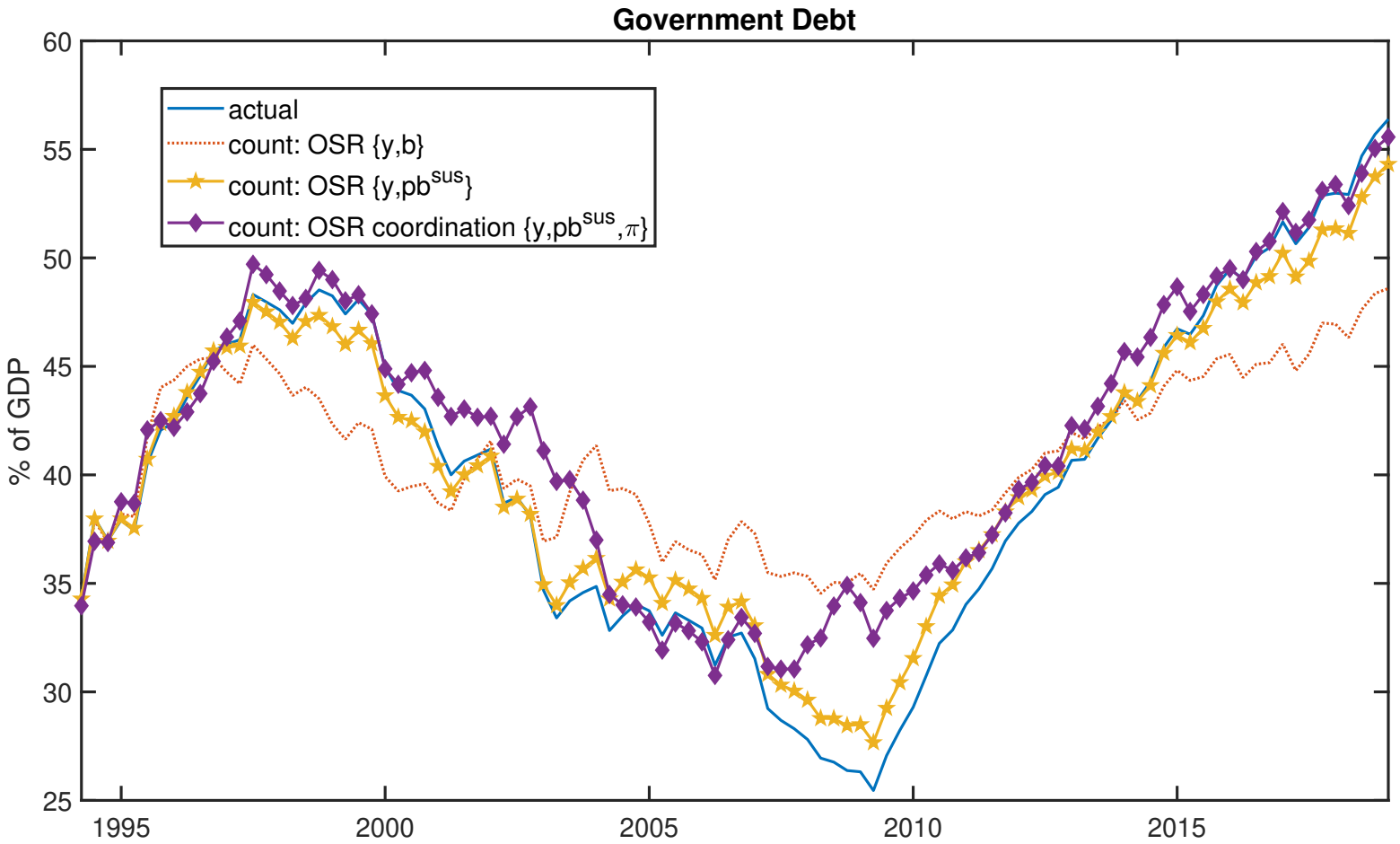
Weights on policy variables: y, pb^{sus}, $\pi^C = 1$

	Weights on policy instrument(s)				
	$iG,\ r = 1$	$iG,\ r = 0.5$	$iG,\ r = 0$	$iG = 0$	
Parameters		*Optimal values*			*Est.*
$\theta_{iG,y}$	0.42	0.42	0.19	-0.41	0.20
$\theta_{iG,b}$	0.20	0.20	1.03	1.85	0.57
ϕ_π	1.62	1.63	3.35	-	1.57
$\phi_{\Delta y}$	0.42	0.43	1.21	-	0.39
Obj.Func:	2.54	1.44	0.27	0.76	

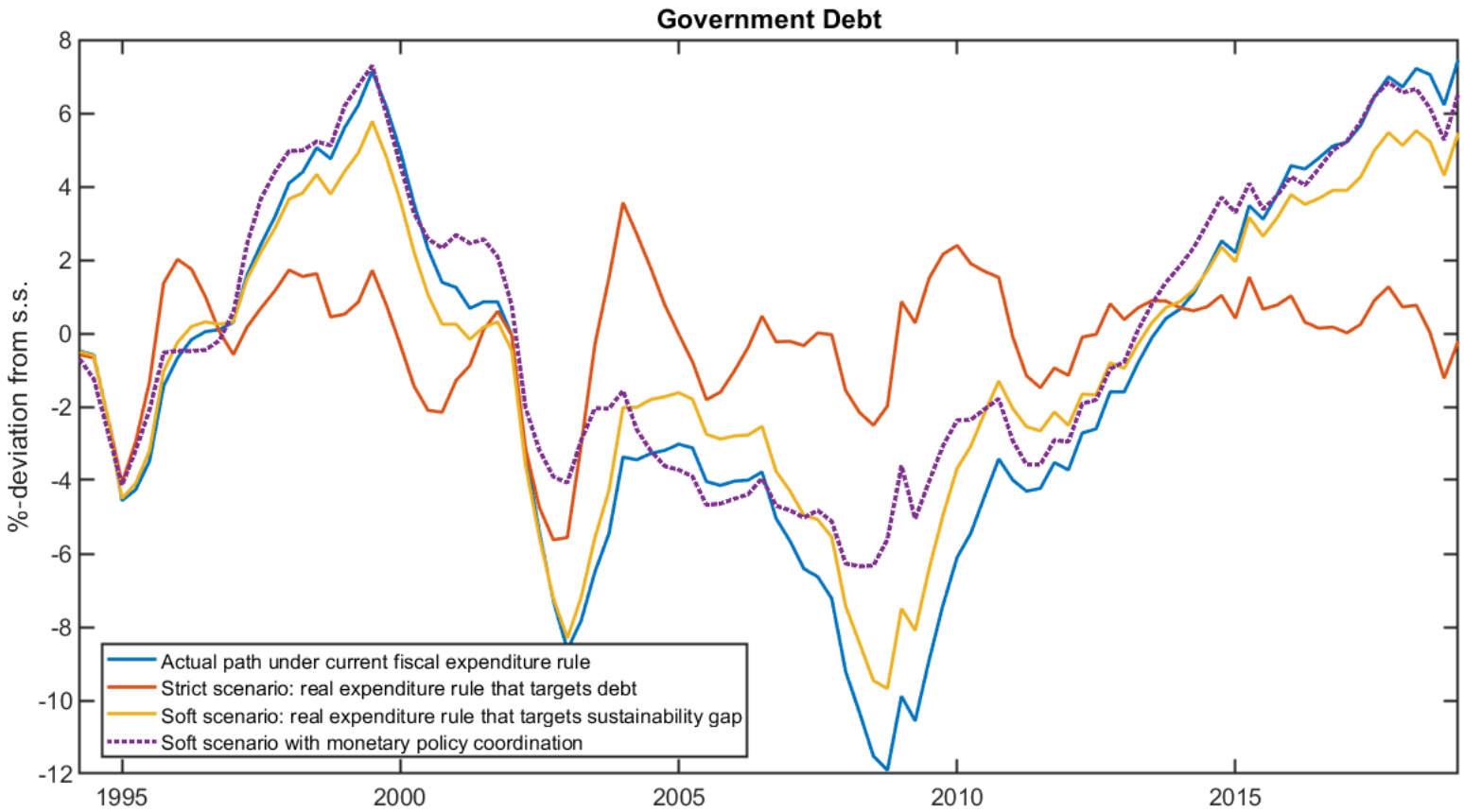
Counterfactual simulations: fiscal sustainability



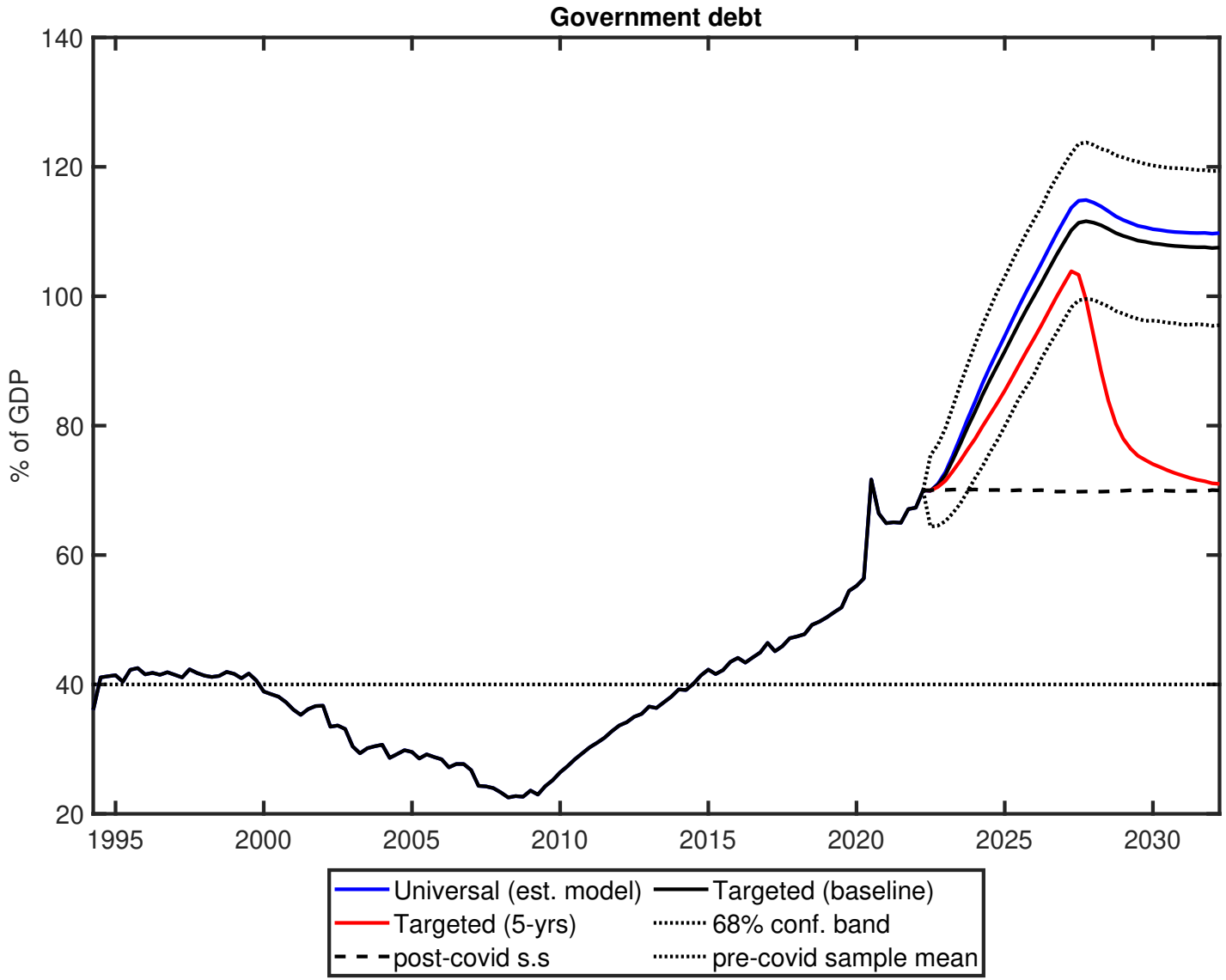
Counterfactual simulations: debt-to-GDP stabilization



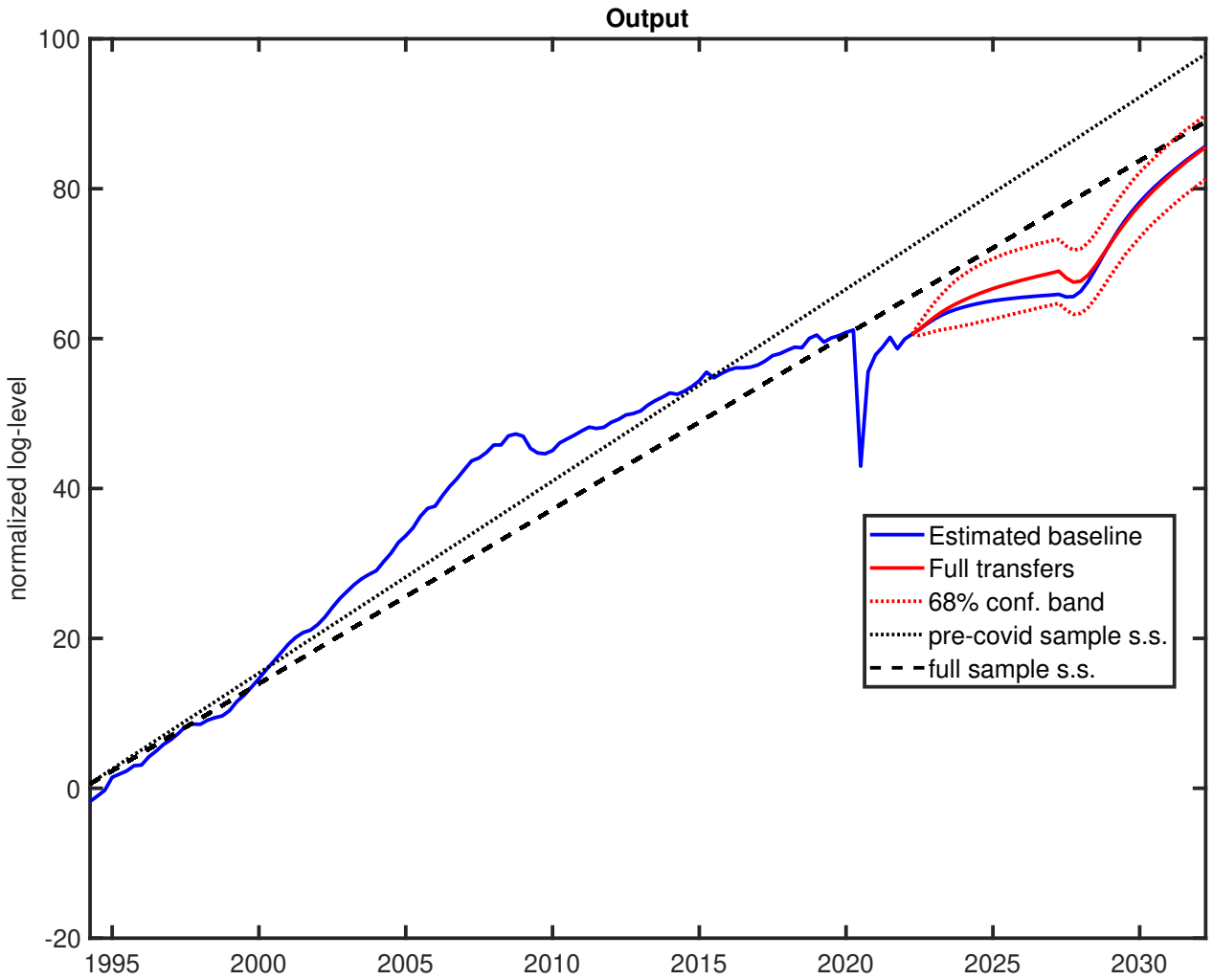
Counterfactual simulations: Government debt



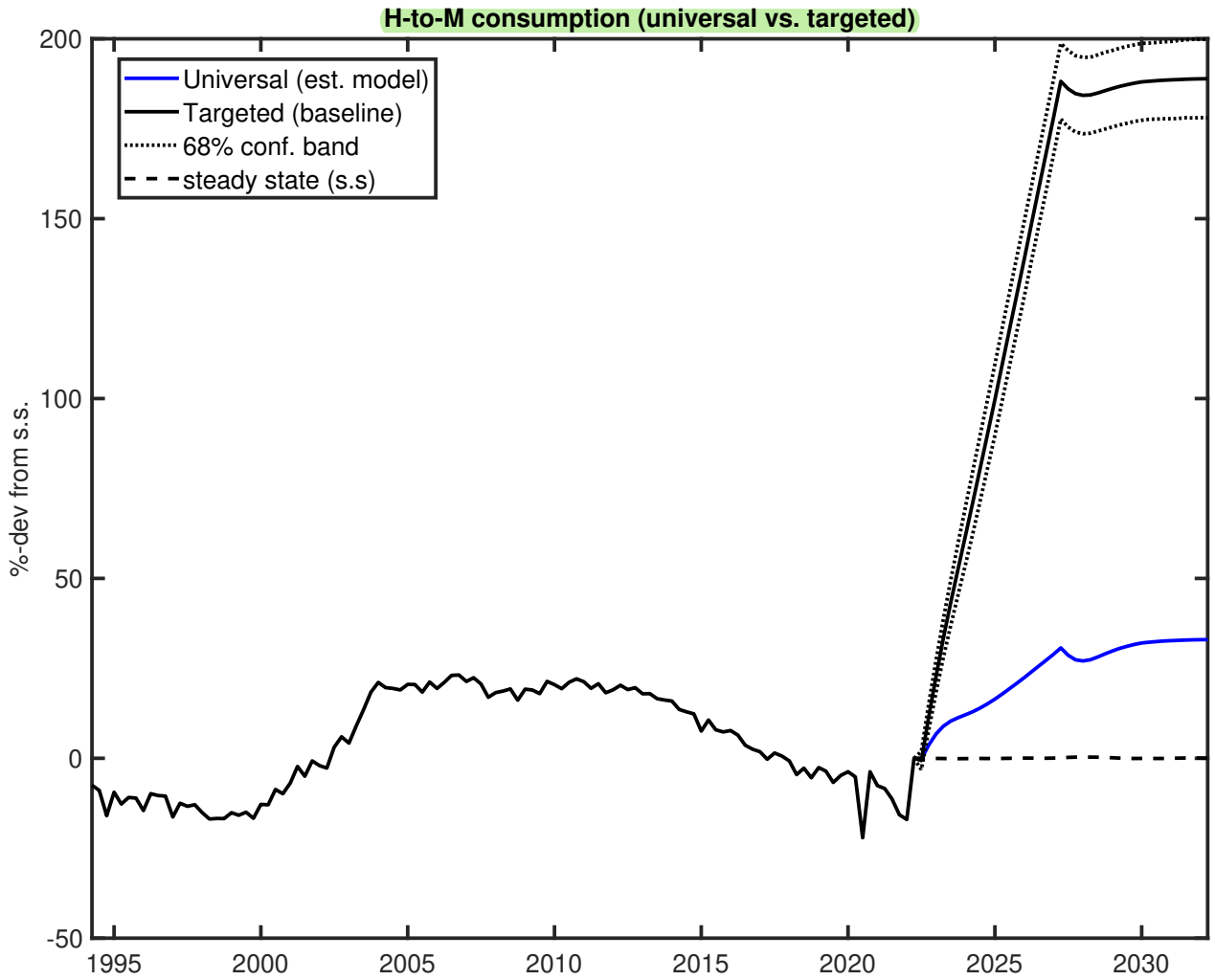
COVID-19, social relief, and debt stabilisation



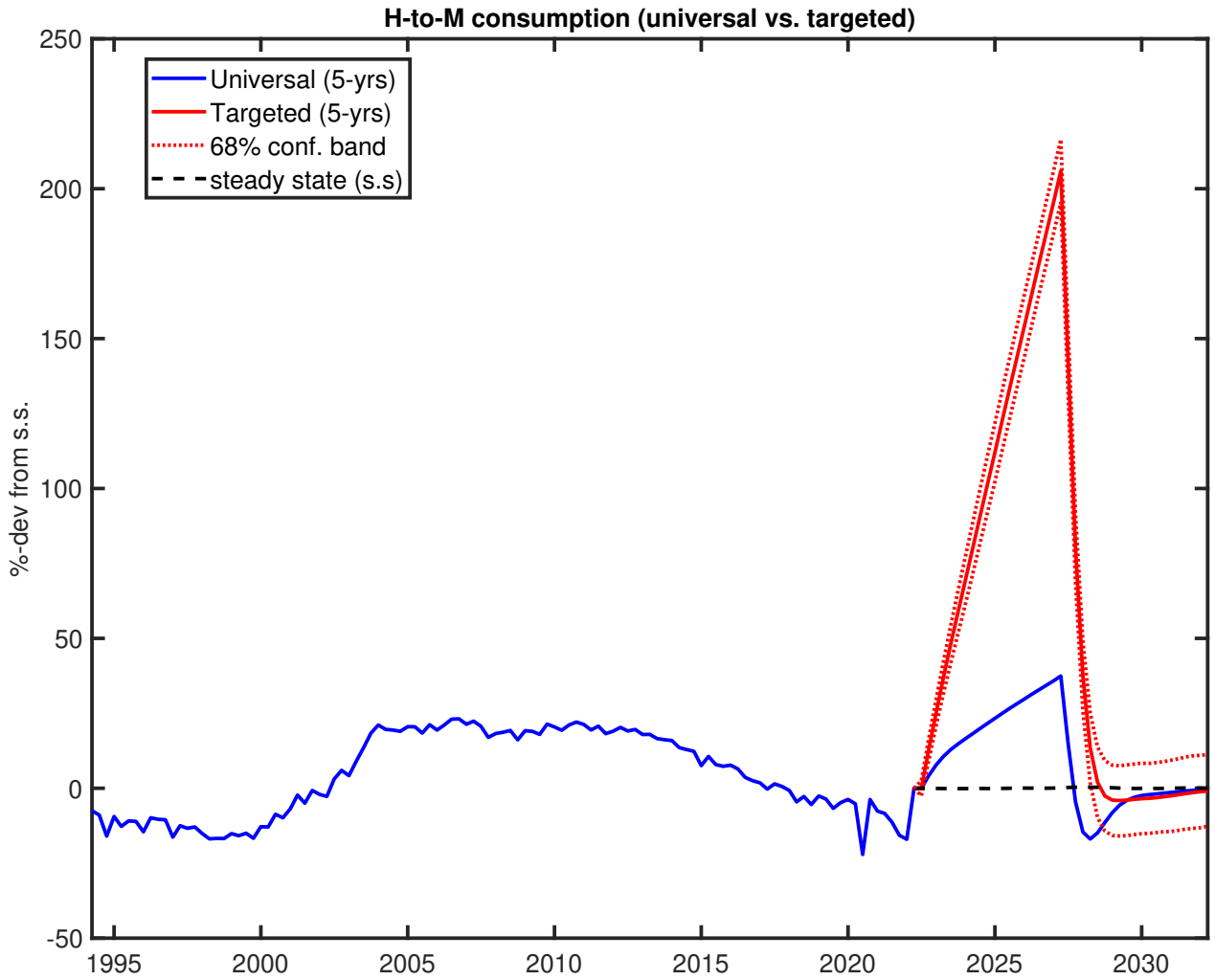
COVID-19, social relief, and debt stabilisation



COVID-19, social relief, and debt stabilisation



COVID-19, social relief, and debt stabilisation



Implications?

Implications I

- As in the current environment, an investment-driven DFFS could reduce the government debt-to-GDP ratio in periods of economic slack, when monetary policy would typically be more accommodative.

Implications II

- Policy coordination is achievable without loss of credibility or a mandate change.
- A strong preference for policy rate smoothing means that MP is "sub-optimal", but the potential gains for inflation stability appear marginal.
- Fiscal policy needs to balance short- versus long-term fiscal sustainability.

Implications?

- The extent of forecast (e.g., "fiscal projection") errors and the "assumed" long-run steady-state are crucially important for policy decision-making and credibility. (Applies to monetary policy as well)
- The response of debt and interest rates to credit rating changes suggest that further downgrades could offset any gains from the current stance of monetary policy.
- If fiscal policy remains unsustainable a negative feedback loop between increasing debt servicing costs (through a higher risk premium) and rapid debt accumulation may push the country into a sovereign debt crisis and economic distress.

Modelling issues

- Identification sensitivity: data, shocks, and model specification
- Identification of foreign shocks and monetary policy shocks
- The zero lower bound (ZLB)
- Measurement errors in the model and bringing the data to the model
- Fit-for-purpose: forecasting vs. policy analysis

Appendix: observable variables

Observable variables used for Bayesian estimation of the model

- Fiscal: consumption, investment, transfers, income tax (personal and corporate), transfers
- Domestic: output, consumption, investment, employment, inflation, real wages, short-term interest rate, import inflation, export inflation, government debt-to-GDP, and the inflation target.
- Foreign: output, inflation, and the short-term interest rate. All are weighted-average series from South Africa's main trading partners.

Sample periods: 1994Q1−2019Q4 & 1994Q1−2021Q4

Appendix: implied long rate

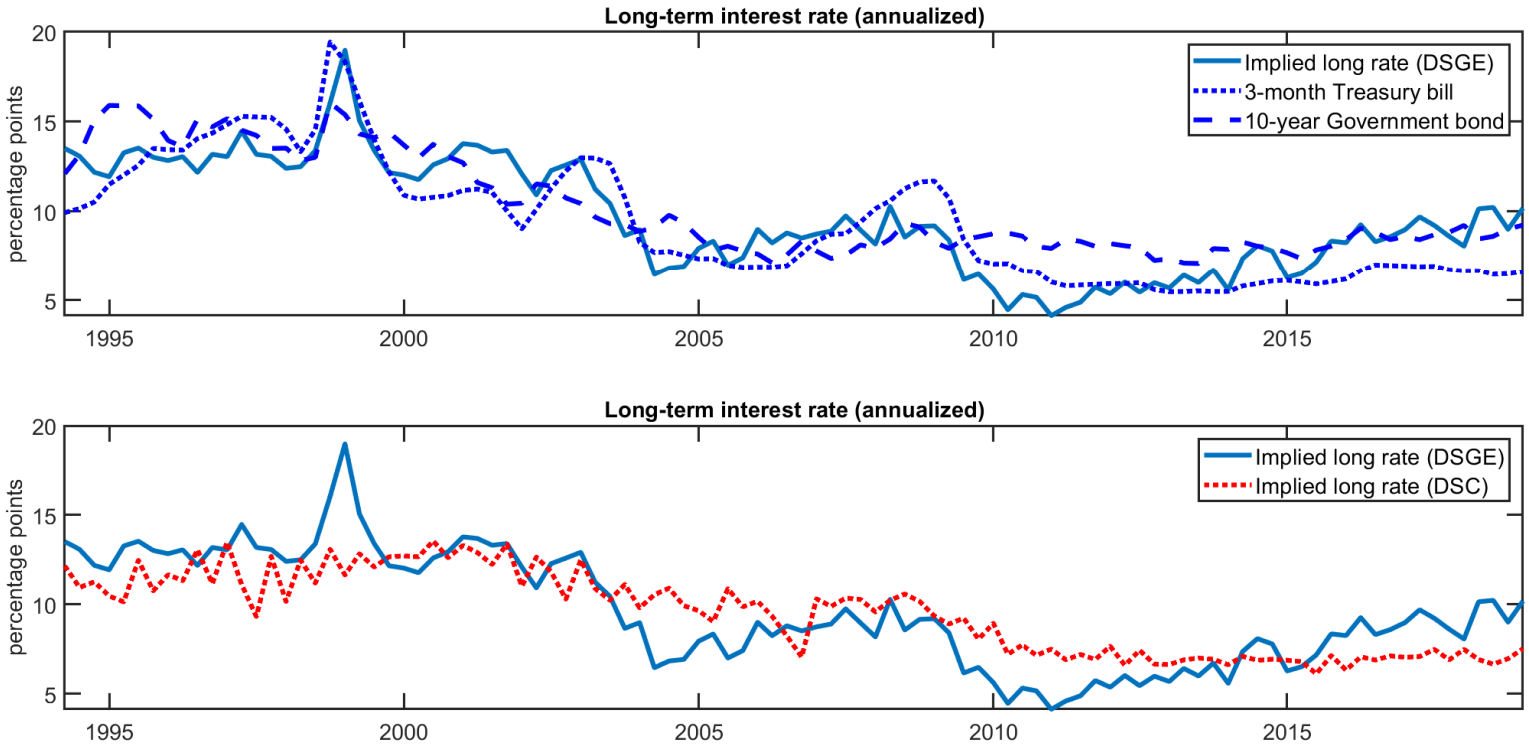
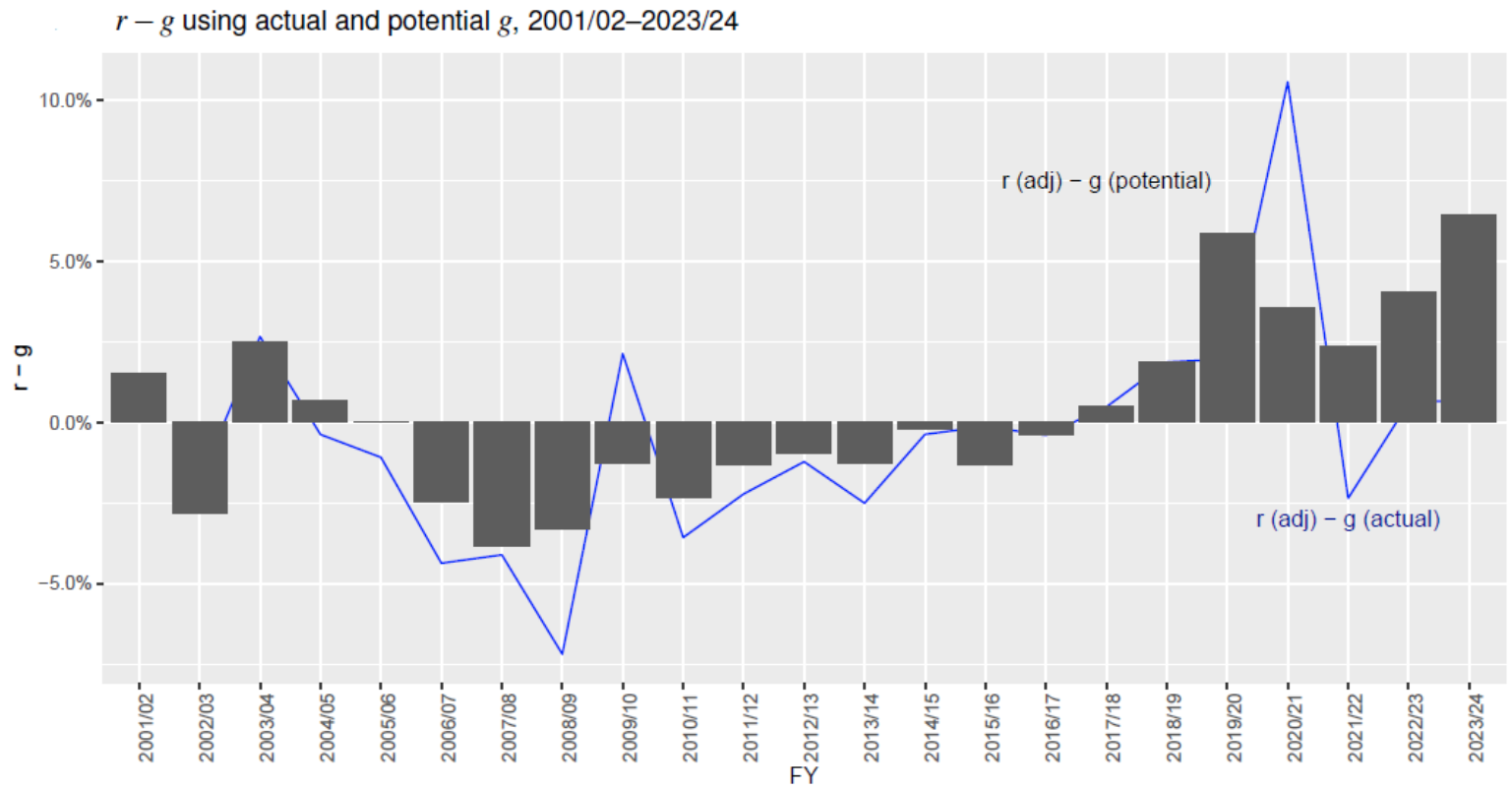


Figure: Long rate: Implied vs Actual

Appendix: $r - g$



Note: the figure presents estimates of $r - g$ using r^{adj} and two estimates of g—a 'long-run' potential measure from Fedderke and Mengisteab (2017) and the annual growth rates. Using the actual growth rate of g in 2021/22 and 2022/23 leads to $r < g$, but these are one-off changes to a post-COVID economic recovery and terms of trade shock. The long-run measure is arguably more appropriate for long-run fiscal analysis.

Source: authors' compilation based on National Treasury data.

Appendix: sensitivity of interest rates to government debt

Table: Sensitivity of interest rates to government debt-to-GDP (SIGD)

	Combined basis points	G.Spending basis points	G.Investment basis points	G.Transfers basis points
$SIGD_0$				
$i^{(10y)}$	88	7	-46	36
$i^{(3m)}$	21	2	-53	1
$r^{(10y)}$	155	105	-25	51
RP	120	70	-15	49
$SIGD_{max}$				
$i^{(10y)}$	13	2	53	13
$i^{(3m)}$	3	0.4	62	0.4
$r^{(10y)}$	22	26	29	18
RP	17	17	17	17

Note: $i^{(10y)}$ is the implied long rate based on the short-term interest rate response and the endogenous response of the risk premium to the debt-to-GDP ratio. $r^{(10y)}$ is the inflation-adjusted long rate. RP is the risk premium.

Appendix: sensitivity of interest rates to government debt

Table: Sensitivity of interest rates to government debt-to-GDP (SIGD)

	Combined basis points	VAT basis points	CIT basis points	PIT basis points
$SIGD_0$				
$i^{(10y)}$	24	23	22	25
$i^{(3m)}$	-1	-1	-2	-1
$r^{(10y)}$	35	32	32	41
RP	32	30	30	36
$SIGD_{max}$				
$i^{(10y)}$	13	13	13	12
$i^{(3m)}$	-1	-1	-1	-1
$r^{(10y)}$	19	18	19	20
RP	17	17	17	17

Note: $i^{(10y)}$ is the implied long rate based on the short-term interest rate response and the endogenous response of the risk premium to the debt-to-GDP ratio. $r^{(10y)}$ is the inflation-adjusted long rate. RP is the risk premium.

Appendix: the effect of interest rates

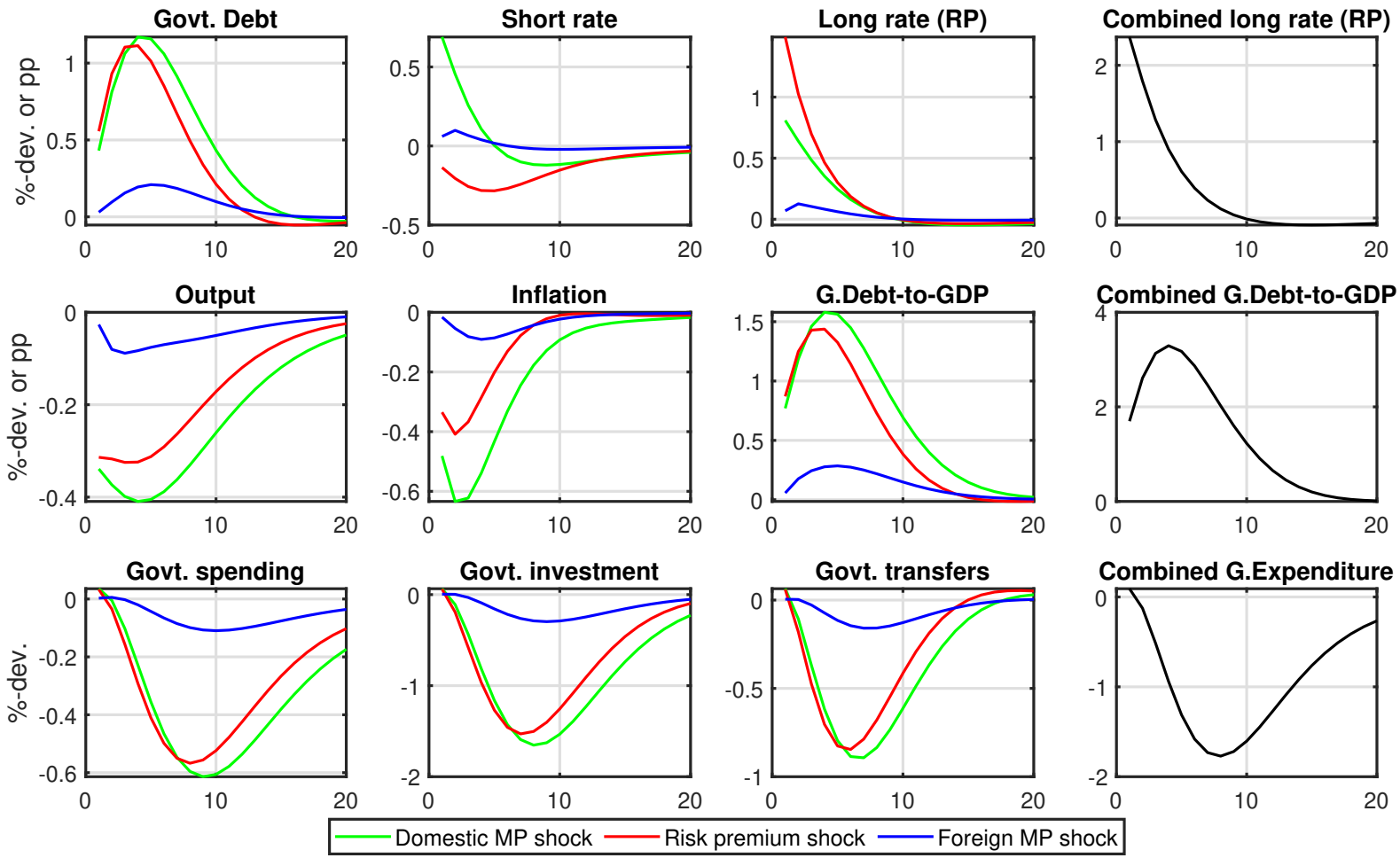


Figure: IRFs for interest rate shocks

Appendix: credit Rating Changes (Fitch)

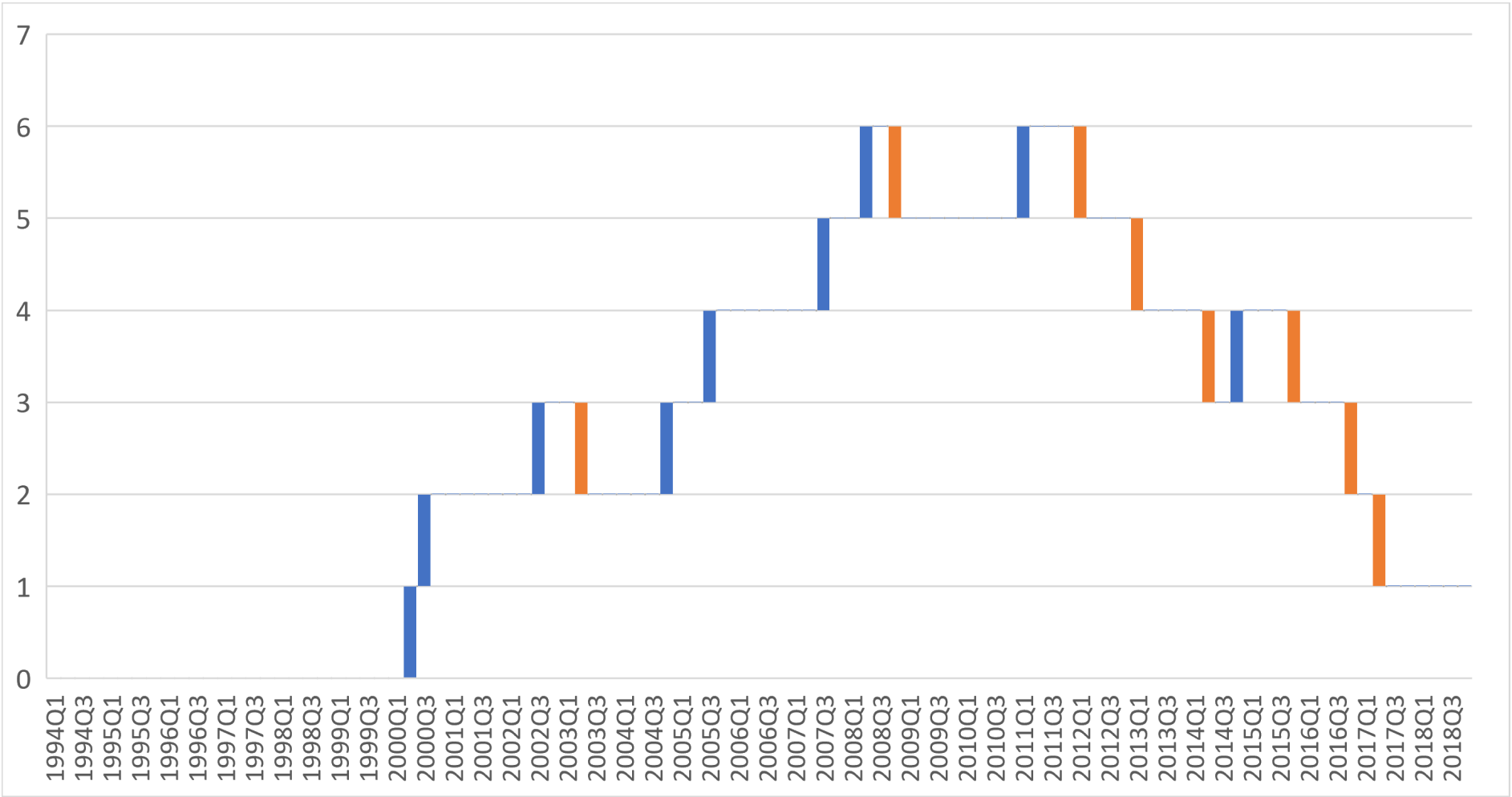


Figure: Credit Rating Changes (Fitch)

Appendix: the effect of credit ratings

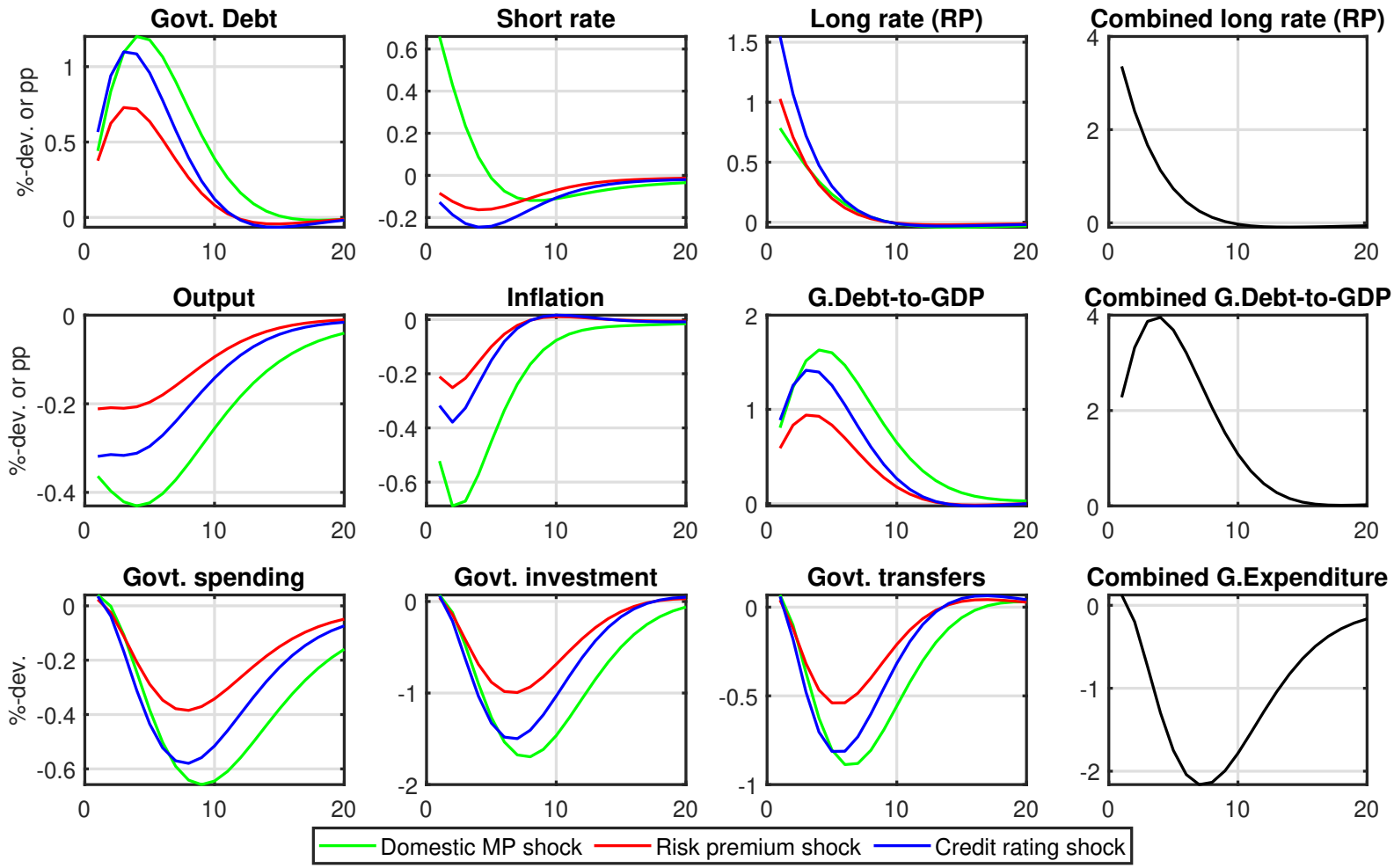
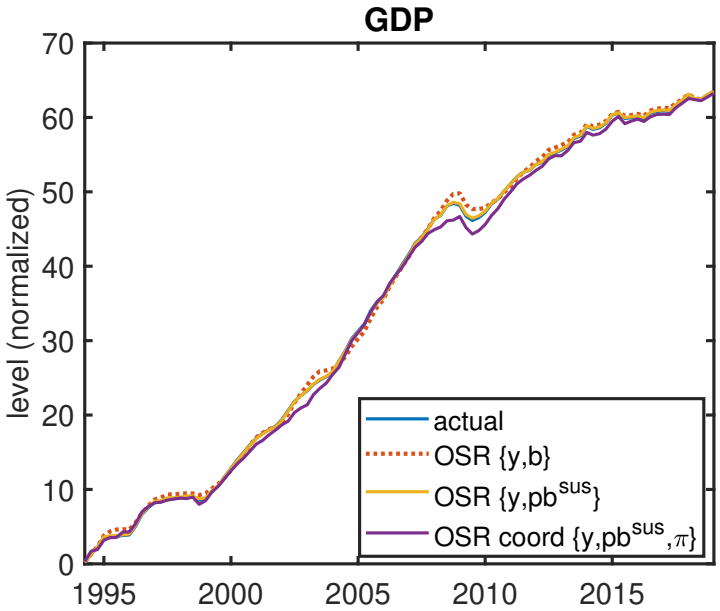
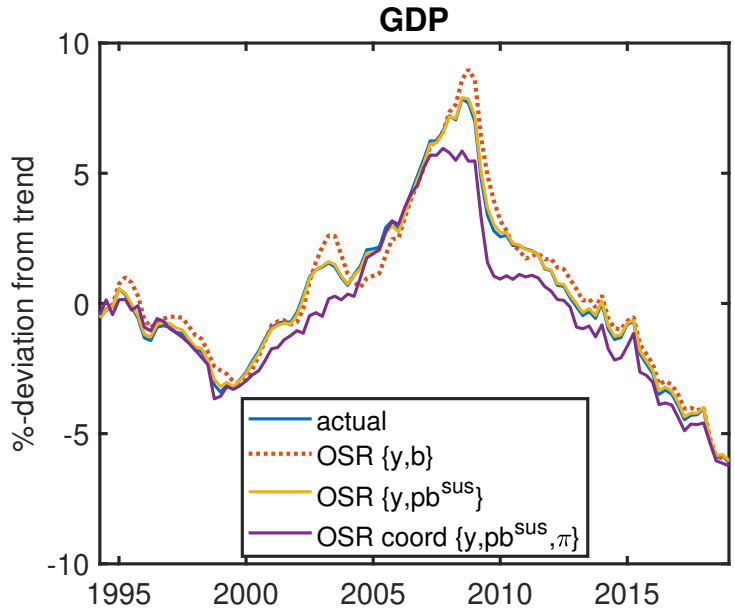


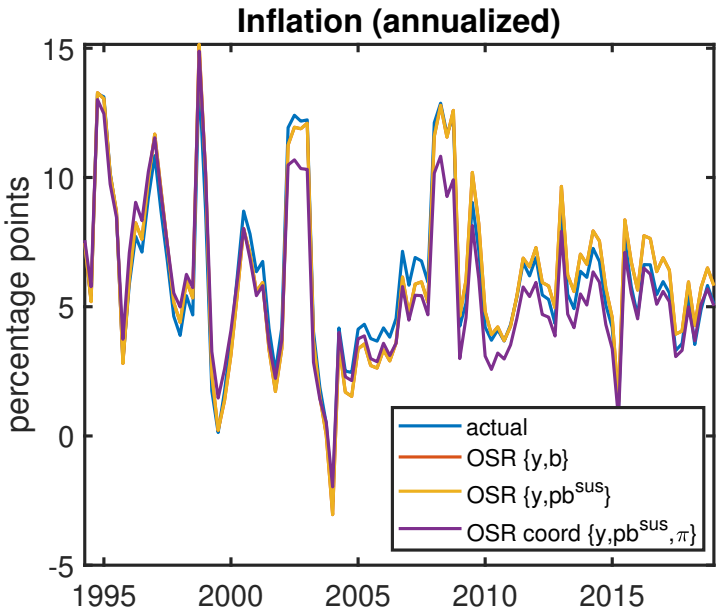
Figure: IRFs for interest rate and credit rating shocks

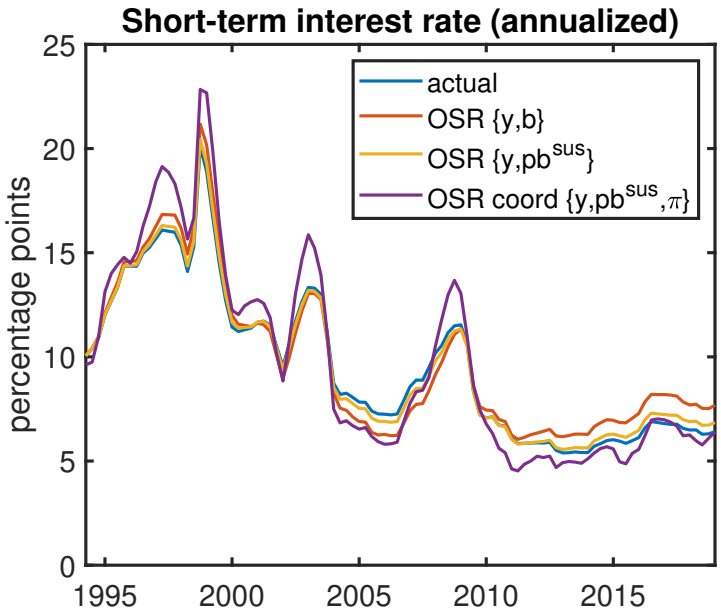
Appendix: counterfactual simulations: output (GDP)





Appendix: counterfactual simulations: inflation and the short-term (policy) rate





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