What determines government spending multipliers?

Giancarlo Corsetti (Cambridge University), André Meier (IMF),
Gernot Müller (University of Bonn)

Economic Policy Seminar, Bruegel, Brussels, June 22 2012

The view expressed in this presentation are those of the authors and do not necessarily represent those of the IMF or IMF policy

Introduction

What is the size of "the" fiscal multiplier?

Multiplier differs with specific features of the model such as expectations formation, price stickiness, preferences (Romer/Bernstein, Cogan/Cwik/Taylor/Wieland, Uhlig, Bilbiie, Monacelli/Perotti, Hall...)

In addition, however, economic theory suggests that multiplier depends on various features of the economy

- Exchange rate regime
- State of public finances
- State of banking and financial system

The issue

Quest for "the" multiplier doomed to fail, to the extent that determinants of multiplier vary with economic environment

Standard time-series techniques inadequate:

- Need flexible econometric approach to accommodate variations in structural features of the economy and policy regimes, both across countries and over time

This paper: empirical exploration of determinants of government spending multipliers

- Identification strategy compatible with limitations in the availability of good quality data

In this paper

Annual data for 17 OECD countries 1975–2008

Two step approach

- Step 1
  Estimate systematic behavior of government spending (goods and services) and identify exogenous innovations, ie, policy shocks
- Step 2
  Estimate effects of policy shocks in different economic environments (interacting shocks with dummy variables)

Results from Step 1. Systematic policy

In line with earlier studies (eg Galí/Perotti 2003)

- No clear cyclical pattern
- Negative feedback from high debt: government spending adjusts downward in response to high debt

A notable new result

- Spending is systematically cut during financial crisis in several countries

Results from Step 2. Effect of exogenous spending increase (1% of GDP) differs across environment

If flexible exchange rates, no fiscal strain or financial crisis (baseline)

- no impact effect on output, negative effects on consumption and investment;
- interest rate falls, real depreciation.

If pegged exchange rates

- positive output response on impact;
- interest rate rises, real appreciation.

If weak public finances

- negative output response on impact.

If economy experiences financial crisis

- output and consumption rise by 2 percentage points on impact, interest rate rises.

Robustness

Definition of environment

- Alternative dating of crises;
- Higher debt/deficit thresholds identifying fiscal stress.

Specification of first and second step

- No time lags in spending implementation in crisis years;
- Data in growth rates versus level.

Sample

- Extend the sample to 1960, exclude the global crisis years 2007-8;
- Exclude the US;
- Exclude countries for which spending is systematically cut during crises.

Related empirical literature

Two-step approach first adopted by Perotti 1999 (spending multipliers are lower if debt and deficits are high) and then by Tagkalakis 2008 (private consumption responds more in recessions than in expansions).

Different from our study, these works only control for (and analyse) one conditional factor at a time (either size of debt/deficit or cycle).

Same is true for two influential recent studies:

- the regime-switching VAR model adopted by Auerbach and Gorodnichenko 2011:
  multiplier effects are higher during recessions in the US.
- the panel analysis by Ilzetzki/Mendoza/Vegh 2011, who estimate VARs on appropriately defined subsets of 45 countries X 10 years of observations in their sample, to account for exchange rate regime, openness and debt:
  fiscal policy stimulates output under a peg/ in relatively closed economies, but not under a float / in very open economies.

Plan

Theoretical considerations

Empirical strategy

Data

Results

Conclusions

THEORETICAL CONSIDERATIONS

Abstracting from international dimension and assuming away fiscal and financial strain (in all respects), predictions for government spending multiplier on output differ widely across model classes. Examples

- Neoclassical model (Baxter/King 1993): -0.5 (distortionary taxes and balanced budget) to 0.6 (lump-sum taxes)
- New Keynesian (Linnemann/Schabert 2003): 0.75

Within each class of models, predictions vary a lot with the economic and policy environment (see ie, Woodford 2011).

International dimension: exchange rate regime

The textbook version of the Mundell-Fleming model

- Sizeable multiplier under peg
- 100 percent crowding out under float

But deeper message: equilibrium multipliers depend on monetary accommodation (see Dornbusch 1980).

In New Keynesian models difference across regimes is less sharp

- Under a float: monetary policy may be quite accommodative; monetary and fiscal interactions over medium-term horizons matter (CMM 2011).
- Under a peg, long run PPP implies that a short-run rise of inflation must be offset by long-run fall of inflation: real rates are low in the short run but high over longer horizon (CKM 2011).

State of public finances

Neoclassical model with trigger points (Bertola/Drazen 1993):

- co-movement of government spending and consumption depends on level of debt

Perotti 1999 allows for demand effects, but also obtains non-linearity;

- good times (low debt): positive co-movement; bad times (high debt): negative co-movement

Crisis

Macro model arguably still work in progress.

Some common references

- Higher fraction of rule-of-thumb agents raises multiplier (Galí/López-Salido/Vallés 2007): interpretation as lack of access to capital markets
- Zero lower bound (Christiano/Eichenbaum/Rebelo 2011, Erceg/Lindé 2010)
- Unemployment crisis in a liquidity trap, and hysteresis, Pontus Rendahl 2012

EMPIRICAL STRATEGY

Need flexible approach to account for various dimensions simultaneously

Two-step strategy

- First step: obtain spending shocks as residuals in estimated country-specific spending rule
- Second step: fixed-effect panel regression to estimates effects on macro variables of interest

Identification

Focus on government consumption: on average 21.5 percent of GDP.

- Virtually no cyclical component, no direct link to productivity.

Identification: no contemporaneous two-way interdependence between spending and economic activity

- Spending predetermined since significant time lags between budget formulation and execution;
- Automatic stabilizers mostly through tax and transfers.

Annual data

Frequency mostly dictated by availability of good quality data

Does a "Blanchard-Perotti" identification strategy work at this frequency?

- Studies comparing results with quarterly/annual frequency for countries with high quality data: no difference detected;
- Under some circumstances (crises) time lags may be shortened — but our methodology helps accounting for this;
- Timing of budget process;
- Annual data do alleviate the anticipation problem discussed by Ramey (2011), and Mountford and Uhlig (2009).

First step: estimating shocks to government spending

$$
\begin{aligned}
g_{t,i} &= \phi_i + \eta_i trend_t + \beta_{i,1} g_{t-1,i} + \beta_{i,2} g_{t-2,i} + \gamma_{i,1} y_{t-1,i} + \gamma_{i,2} y_{t-2,i} \\
&+ \theta_i cli_{t-1,i} + \delta_i b_{t-1,i} + \rho_{i,1} fc_{t-1,i} + \rho_{i,2} strain_{t-1,i} + \rho_{i,3} peg_{t-1,i} \\
&+ \varepsilon_{t,i}
\end{aligned}
$$

$g_{i,t}$: government consumption, log per capita

$y_{i,t-1}$: lagged output, log per capita

$cli_{i,t-1}$: lagged value of a composite leading indicator

$b_{i,t-1}$: beginning-of-period debt stock, expressed as a share of GDP

$fc_{i,t-1}$: dummy variable indicating a financial crisis, lagged

$peg_{i,t-1}$: dummy variable indicating exchange rate regime, lagged

$strain_{i,t-1}$: dummy variable indicating fiscal stress, lagged

Second step: estimating multipliers

$$
\begin{aligned}
x_{t,i} &= \alpha_i + \mu_i trend_t + \chi_i x_{t-1,i} \\
&+ \sigma_1 \widehat{\varepsilon}_{t,i} + \sigma_2 \widehat{\varepsilon}_{t-1,i} + \sigma_3 \widehat{\varepsilon}_{t-2,i} + \sigma_4 \widehat{\varepsilon}_{t-3,i} \\
&+ \kappa_1 \left(\widehat{\varepsilon}_{t,i} d_{t,i}\right) + \kappa_2 \left(\widehat{\varepsilon}_{t-1,i} d_{t-1,i}\right) + \kappa_3 \left(\widehat{\varepsilon}_{t-2,i} d_{t-2,i}\right) + \kappa_4 \left(\widehat{\varepsilon}_{t-3,i} d_{t-3,i}\right) \\
&+ \lambda_1 d_{t,i} + \lambda_2 d_{t-1,i} + \lambda_3 d_{t-2,i} + \lambda_4 d_{t-3,i} + u_{t,i}
\end{aligned}
$$

$x_{t,i}$: macro variable of interest (Y,C,I,NX/GDP,RER,G)

$d_{t,i}$: dummy variable indicating a particular feature of the economic environment in a particular year

DATA
Sources and definitions

Government spending	Log of real per capita government consumption	OECD Economic Outlook Database: volume of final government consumption expenditure (CGV); OECD Analytic Database: population size (POP).
GDP	Log of per capita GDP	OECD Economic Outlook Database: value of gross domestic product (GDP), GDP deflator (PGDP); OECD Analytic Database: population size (POP).
CLI	Composite leading indicator	OECD Monthly Economic Indicators database: CLI amplitude-adjusted; normalized by subracting 100, and dividing by 100.
Public debt	General government gross debt (in percent of GDP)	Primary source: IMF World Economic Outlook: General government gross debt (GGD), nominal GDP (NGDP); where unavailable: OECD Analytic Database: General government gross financial liabilities as a percentage of GDP (GGFLQ).
Private consumption	Log per capita real private consumption	OECD Economic Outlook Database: volume of final private consumption expenditure (CPV); OECD Analytic Database: population size (POP).
Private investment	Log per capita real fixed investment	OECD Economic Outlook Database: volume of private total fixed capital formation (IPV); OECD Analytic Database: population size (POP).
Trade balance	Ratio of net exports to GDP	IMF World Economic Outlook: exports of goods and services at current prices (NX), imports of goods and services at current prices (NM), nominal GDP (NGDP).
REER	CPI-based real effective exchange rate (in percent)	OECD Monthly Economic Indicators Database (CCRETT01.IXOB).

Composition of final sample (baseline)

Australia	1992-2008
Austria	1978-2008
Belgium	1978-2008
Canada	1978-2001, 2007-08
Denmark	1978-2008
Finland	1989-91, 1998-2008
France	1982-2008
Ireland	1983-2008
Italy	1980-1991, 1998-2008
Japan	1978-2008
Netherlands	1978-2008
Norway	1978-2008
Portugal	1990-2008
Spain	1984-2008
Sweden	1978-2008
UK	1978-1989,1997-2008
USA	1983-2008
Total no. of observations:	444

Peg: Ilzetzki/Reinhart/Rogoff 2008 categories "no separate legal tender" to "de facto crawling band"

Austria, 1978-2008
Belgium, 1978-2008
Canada, 1978-2001
Denmark, 1978-2008
Finland, 1989-91, 1998-2008
France, 1982-2008
Ireland, 1983-2008
Italy, 1983-91, 1998-2008
Netherlands, 1978-2008
Portugal, 1990-2008
Spain, 1984-2008
Sweden, 1978-92

Fiscal strain: lagged public debt exceeds 100 percent and/or lagged government net borrowing exceeds 6 percent of GDP

Belgium, 1978-2003
Canada, 1983-87, 1992-97
Denmark, 1982-84
France, 1994
Ireland, 1983-89
Italy, 1980-91, 1998-2008
Japan, 1997-2008
Netherlands, 1983, 1996
Portugal, 1991-92, 1994-95, 2006
Spain, 1986-87, 1994-96
Sweden, 1983, 1993-96

Financial crisis: Reinhart/Rogoff 2008 and Reinhart 2010

Australia, 1992
Austria, 2008
Belgium, 2008
Canada, 1983-85
Denmark, 1987-92, 2008
Finland, 1991
France, 1994-95
Ireland, 2007-08
Italy, 1990-91, 2008
Japan, 1992-97
Netherlands, 2008
Norway, 1988-93
Spain, 1984-85, 2008
Sweden, 1991-94
United Kingdom, 2007-08
United States, 1984-91, 2007-08
(1982-84, 1988-1991 (López-Salido/Nelson 2010), 2007-08)

RESULTS
Estimated rules in the first step

	g(-1)	g(-2)	y(-1)	y(-2)	CLI (-1)	strain	crisis	peg	debt
Australia	-0.210	-0.315	0.159	0.240	0.055	.	0.000	.	-0.139 *
Austria	1.344 ***	-0.507 ***	-0.320 **	0.245	0.020	.	.	.	0.009
Belgium	0.554 ***	0.194	0.056	-0.103	-0.054	0.014	.	.	-0.041 ***
Canada	0.916 ***	-0.004	0.190	-0.069	-0.141 *	-0.016	0.015	0.001	-0.020
Denmark	1.007 ***	-0.084	-0.024	-0.111	0.076	-0.015	-0.010	.	-0.005
Finland	1.060 **	-0.432	0.431 *	-0.077	-0.020	0.012	0.000	.	0.082
France	0.610 ***	0.277	0.085	0.092	-0.089	-0.008	0.000	.	-0.071 *
Ireland	0.709 ***	-0.075	0.002	-0.008	0.466 **	-0.011	-0.046 *	.	-0.188 **
Italy	1.099 ***	-0.235	0.299	0.013	-0.008	.	-0.015	-0.006	-0.070 *
Japan	0.620 ***	0.205	-0.519 ***	0.602 ***	0.059	-0.009	-0.018 **	-0.002	-0.010
Netherlands	0.784 ***	-0.210	-0.154	-0.050	0.114	-0.019	.	.	-0.026
Norway	1.015 ***	-0.305 *	0.147	-0.043	0.035	.	0.014 *	.	-0.011
Portugal	-0.075	0.148	1.192 **	-0.387	-0.180	0.024	.	.	-0.136
Spain	0.533 **	0.161	0.458	-0.336	0.018	0.003	-0.054 ***	.	-0.090 **
Sweden	0.768 ***	0.065	-0.154	-0.168	0.054	-0.014 *	-0.007	0.033 *	-0.042
UK	0.980 ***	-0.147	0.050	0.168	-0.168	0.005	0.011	-0.017	0.005
USA	0.998 ***	-0.257 *	0.240 **	-0.286 **	-0.155 **	.	0.023 ***	-0.003	-0.069 **

Results for first step

In line with the literature: no clear cyclical pattern for spending.

For most countries, debt accummulation leads to adjustment in spending.

Spending is systematically cut at time of crisis.

- Make room for saving the banks?
- Traditional policy model to deal with crises: budget contraction, usually matched by high interest rates to defend the currency.

Results for first step: diagnostics

	F-test of joint significance (p-value)	R squared	Arellano-Bond test of autocorrelation (p-value)
Australia	0,00	0,999	0,28
Austria	0,00	0,998	0,56
Belgium	0,00	0,994	0,11
Canada	0,00	0,984	0,38
Denmark	0,00	0,993	0,97
Finland	0,00	0,986	0,74
France	0,00	0,998	0,43
Ireland	0,00	0,996	0,42
Italy	0,00	0,995	0,95
Japan	0,00	0,999	0,34
Netherlands	0,00	0,994	0,08
Norway	0,00	0,998	0,07
Portugal	0,00	0,992	0,35
Spain	0,00	0,999	0,19
Sweden	0,00	0,990	0,44
UK	0,00	0,992	0,28
USA	0,00	0,994	0,42

Summary statistics for estimated government spending shocks (percent)

No. of observations	444
Mean	0,04
Median	0,00
Standard deviation	1,02
Minimum	-3,57
Maximum	5,16
Correlation with simple growth rate of government spending	0,64

Five largest negative and positive shocks:

Portugal, 1993	-3,57
Netherlands, 1984	-3,33
Netherland, 2005	-3,18
Norway, 1988	-2,97
Spain, 1988	-2,67
Portugal, 1991	2,60
Portugal, 2005	2,68
Denmark, 1993	2,85
Ireland, 1986	3,83
Netherlands, 2006	5,16

Second step

Simulate impulse response functions on basis of second stage regression for a period of six years after shock.

Normalize shock to one percent of GDP and scale variables so that responses are expressed in output units.

Variables of interest: output, consumption, investment, net exports, real exchange rate, interest rate and inflation.

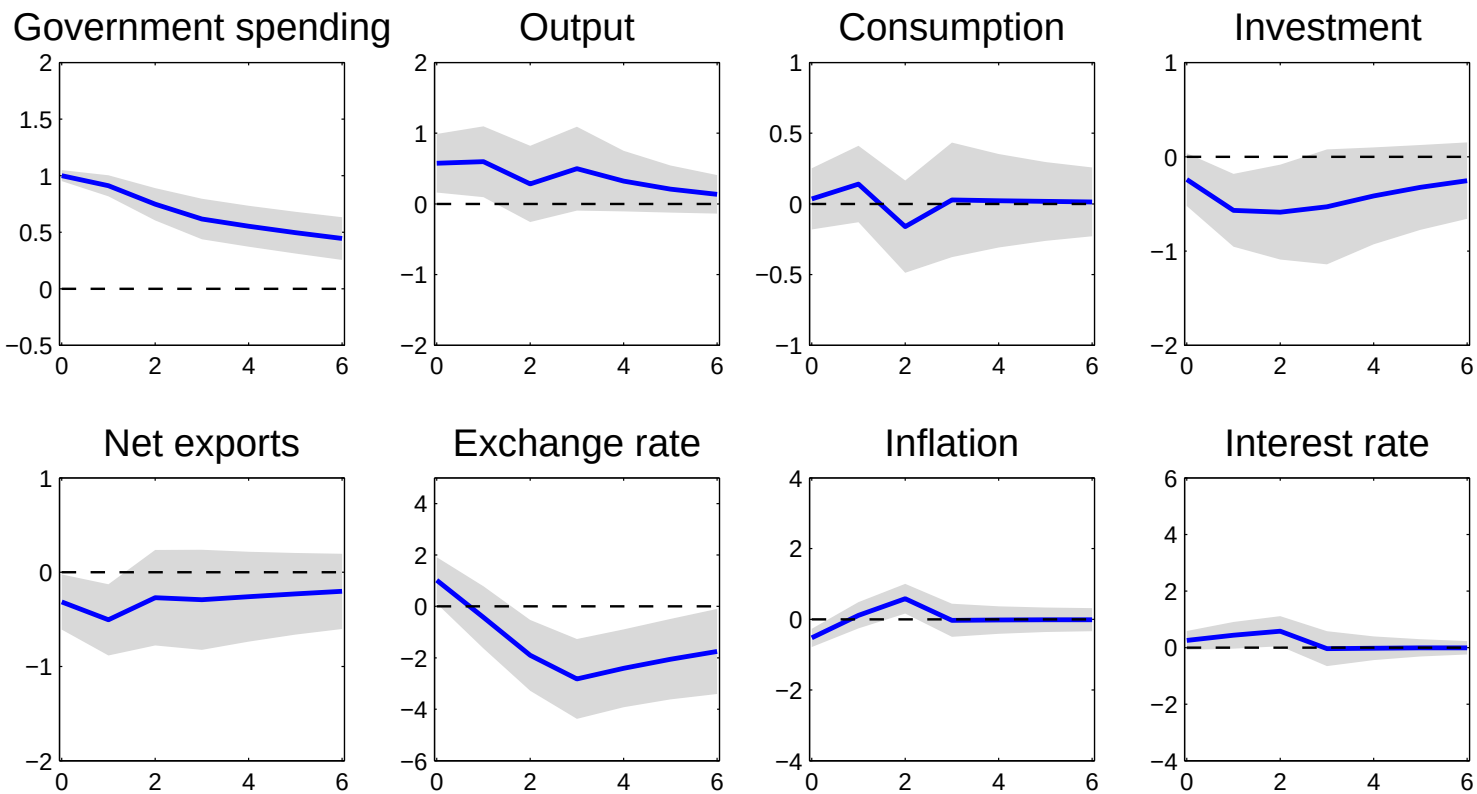
- To start with, for comparison with literature, we show an unconditional estimate of the model, assuming no dummies in first step;
- We then show conditional estimates (all dummies) with extensive robustness.

Unconditional estimate of the model

Omitting all dummies we run a standard panel VAR, capturing **average transmission** across different economic environments.

- Moderate output multipliers;
- Crowding out of investment, no consumption response;
- Current account deterioration on impact, real appreciation followed by depreciation;
- Fiscal-monetary mix: short-term interest rate mildly contractionary;
- Puzzling short-lived fall in inflation (documented by the literature).

Results for the unconditional estimates



Accounting for variations in economic environment

Results for the baseline economy with floating exchange rate in good times confirm findings in the literature.

Contrast results for baseline with departures from baseline:

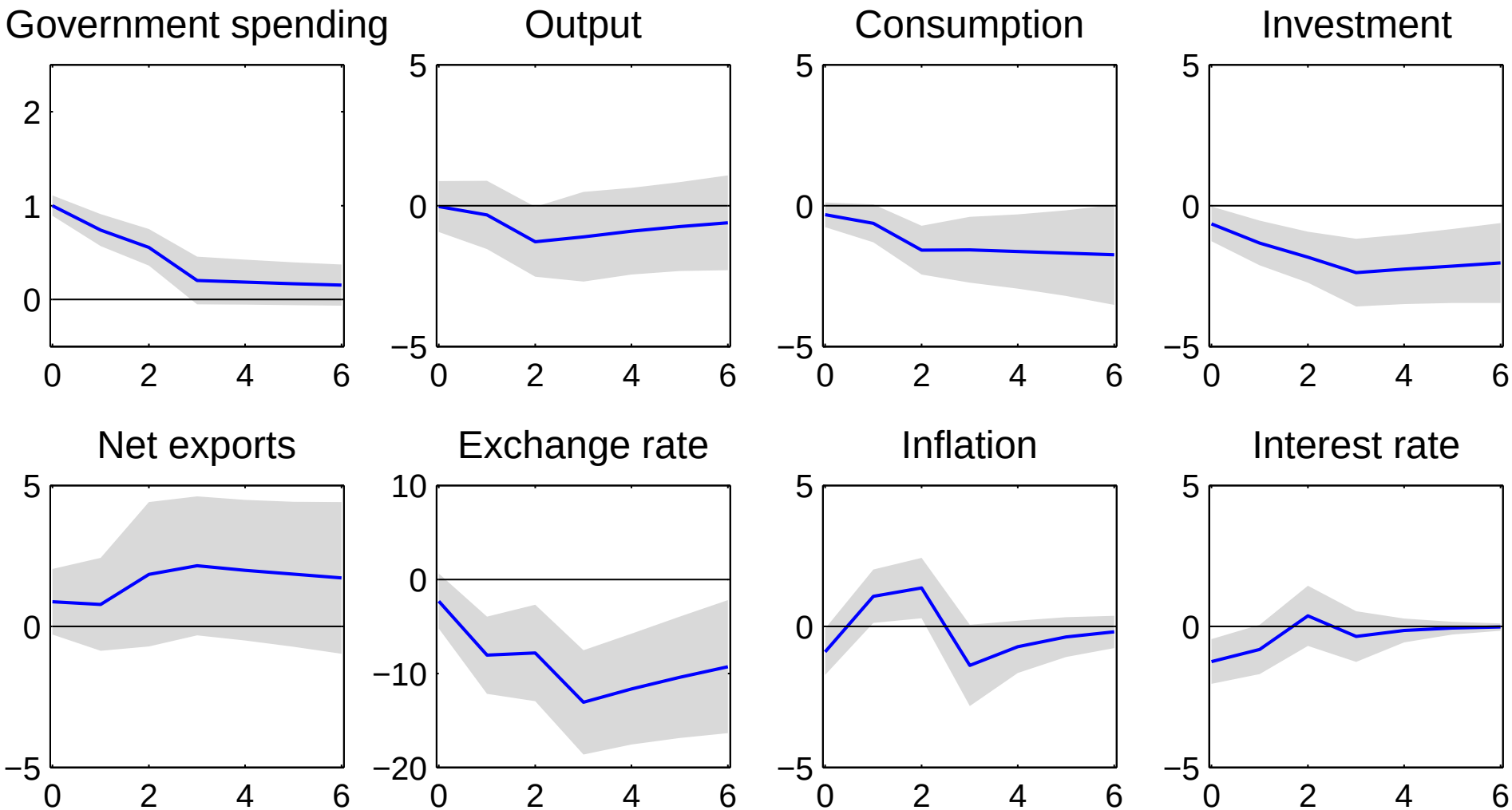
- Currency peg
- Weak public finances
- Financial crisis

Baseline scenario

Floating exchange rate in good times (no fiscal/financial stress)

- No positive output effects: crowding out of C and I
- Current account surplus, real depreciation
- Policy mix: fall in interest rate

Baseline scenario

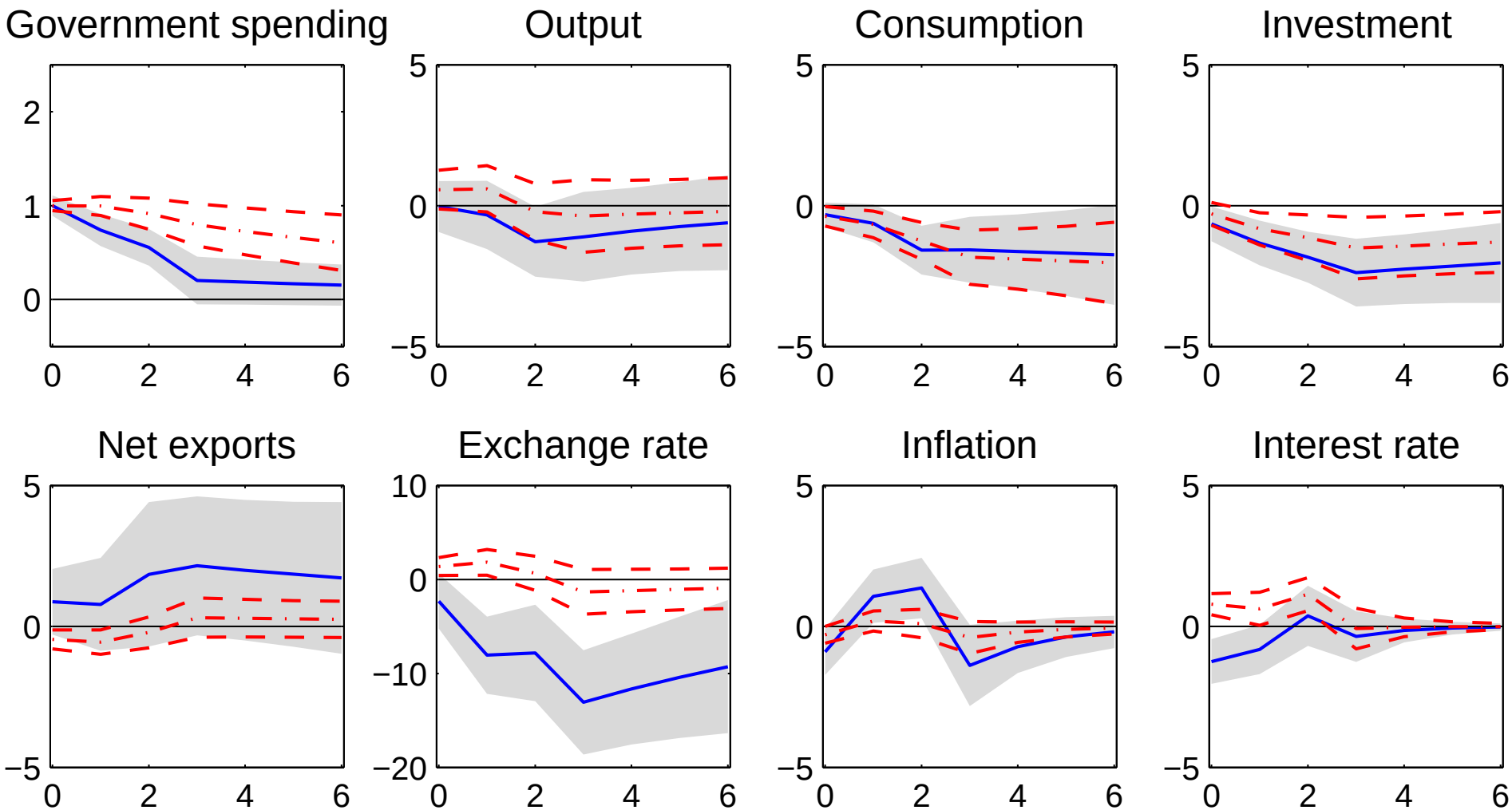


Baseline scenario vs peg

Peg in good times

- More persistent spending, larger effect on output, lower crowding out of Investment
- External deficit, real appreciation
- Policy mix: rise in interest rate

Baseline scenario vs peg

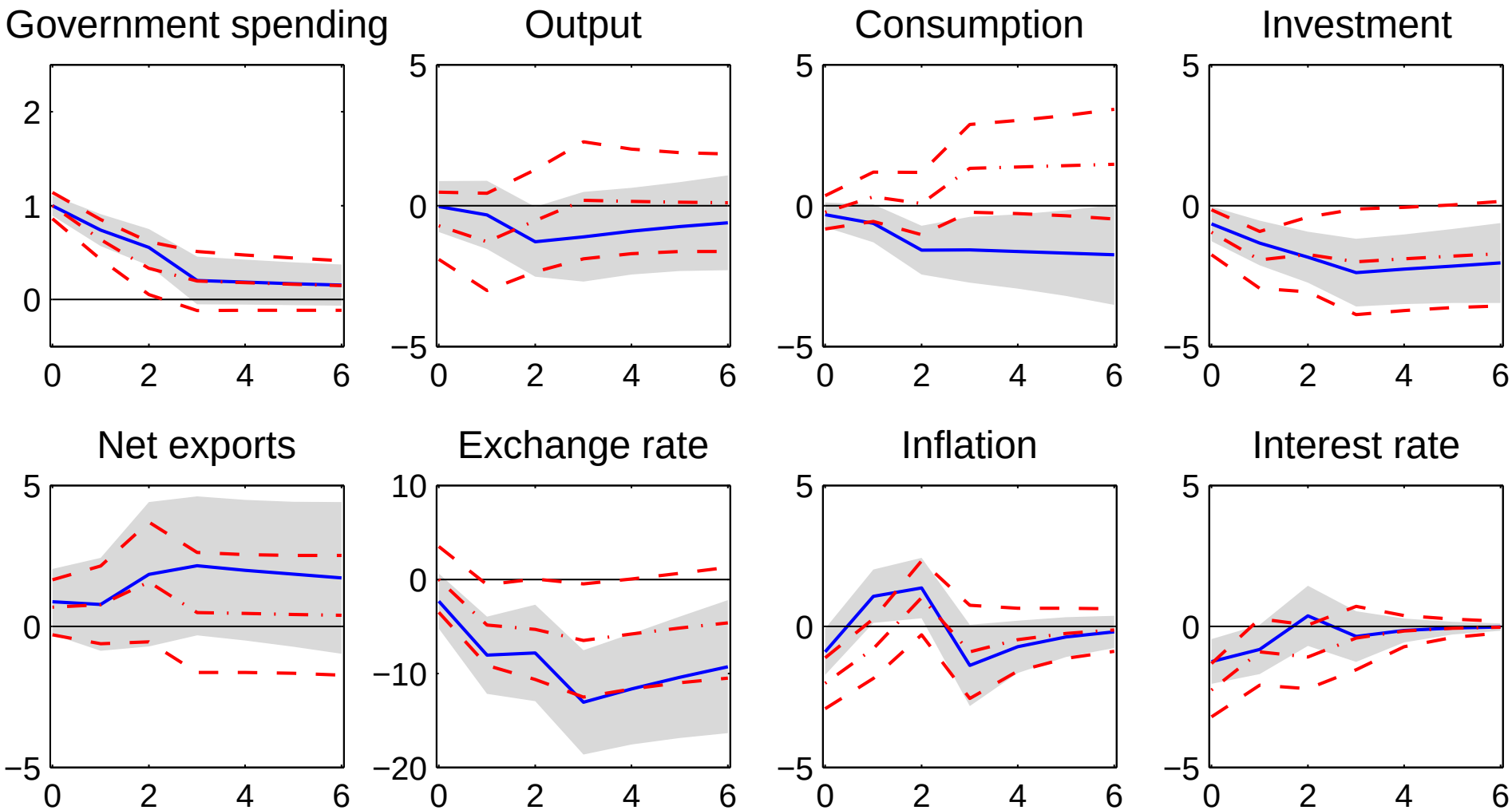


Baseline scenario vs weak public finances

Weak public finances in non-crisis times

- Negative response of output, but puzzling point-estimate of medium-term response of C
- Moderate differences in I and NX
- but size of debt and deficit inefficient proxy for fiscal strain

Baseline scenario vs fiscal strain

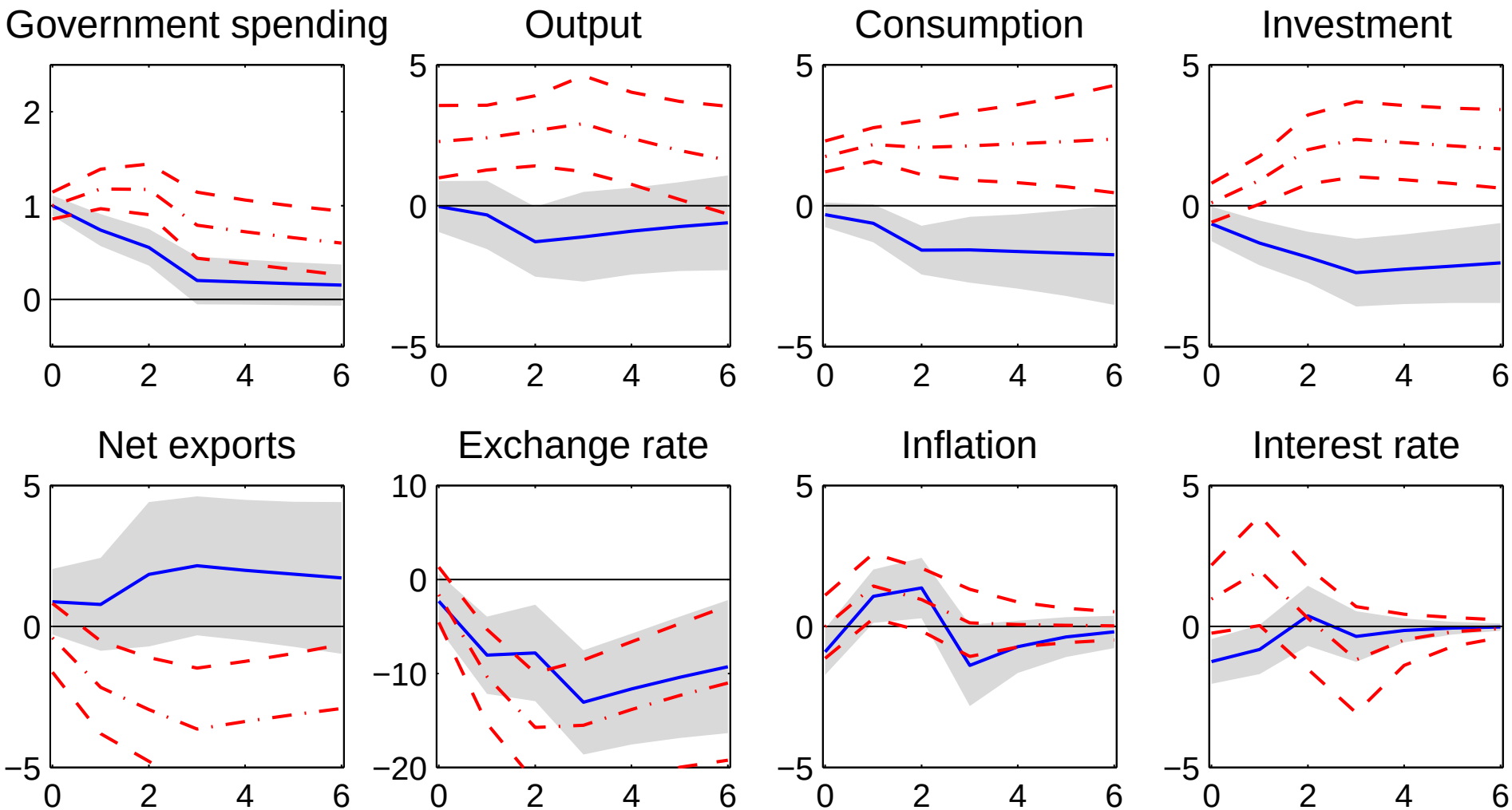


Baseline scenario vs financial crisis

Stronger results

- Response of output and C is twice as much. Response of I strengthens over time
- Current account worsens, real depreciation
- Policy mix: interest rate rises

Baseline scenario vs financial crisis



Output multipliers for baseline specification

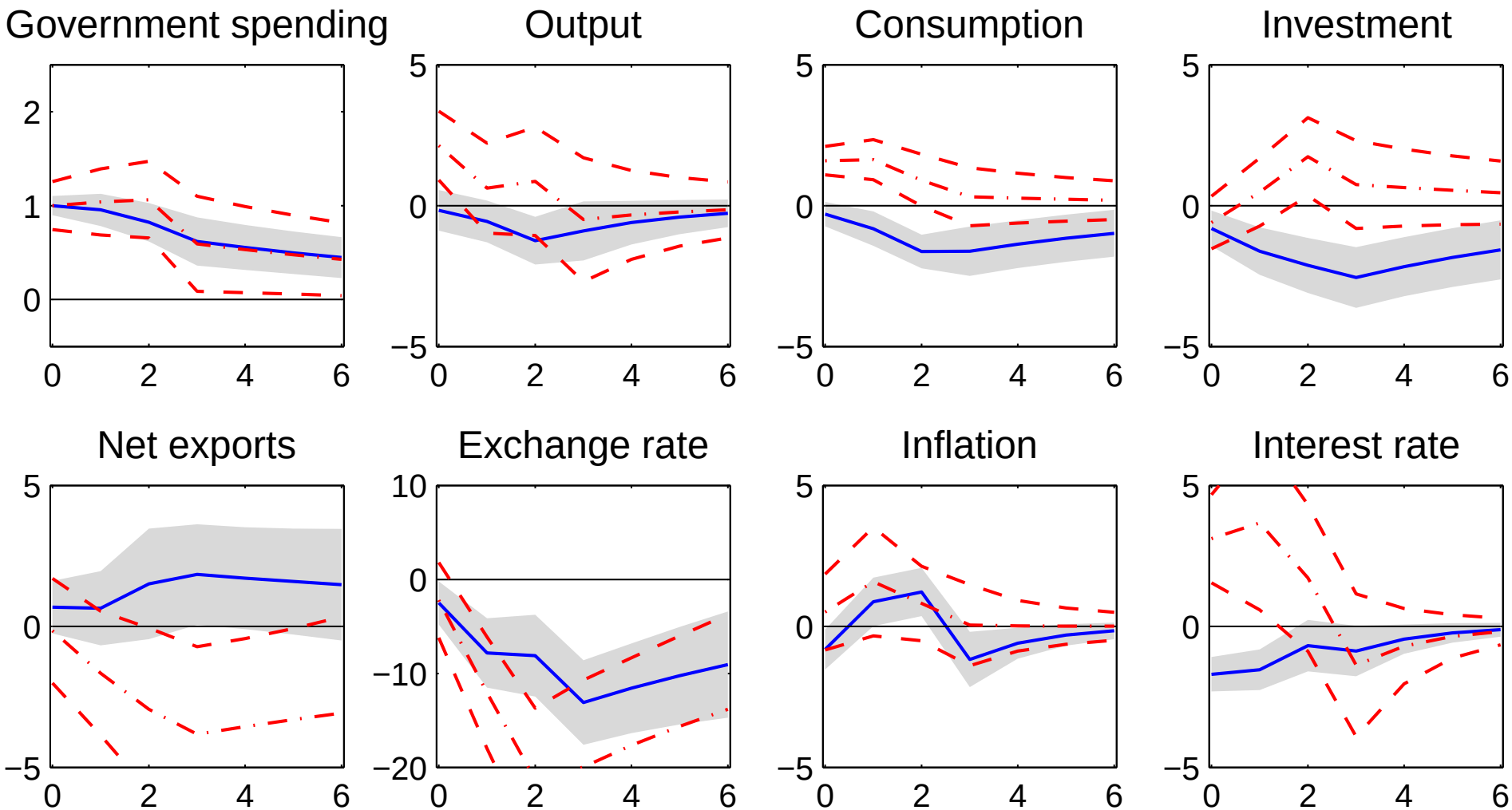
	Impact	Maximum	Cumulative ($\sum Y_t / \sum G_t$)		
	Y_0 / G_0	$\max Y / G_0$	year: 2	4	6
Baseline	−0.0	−0.0	−0.2	−1.1	−1.5
Currency Peg	0.6	0.6	0.6	0.2	0.0
Weak Public Finances	−0.7	0.2	−1.2	−1.1	−0.8
Financial crisis	2.3	2.9	2.2	2.5	2.6

How does the multiplier vary with the severity of a financial crisis?

We condition the analysis on the so-called big five, plus the current crisis

- Same strong effects on impact, but less persistent over time: cumulative multipliers are small
- Sharper effects under a peg and weak public finances

Baseline vs severe financial crisis



Output multipliers (severe financial crisis)

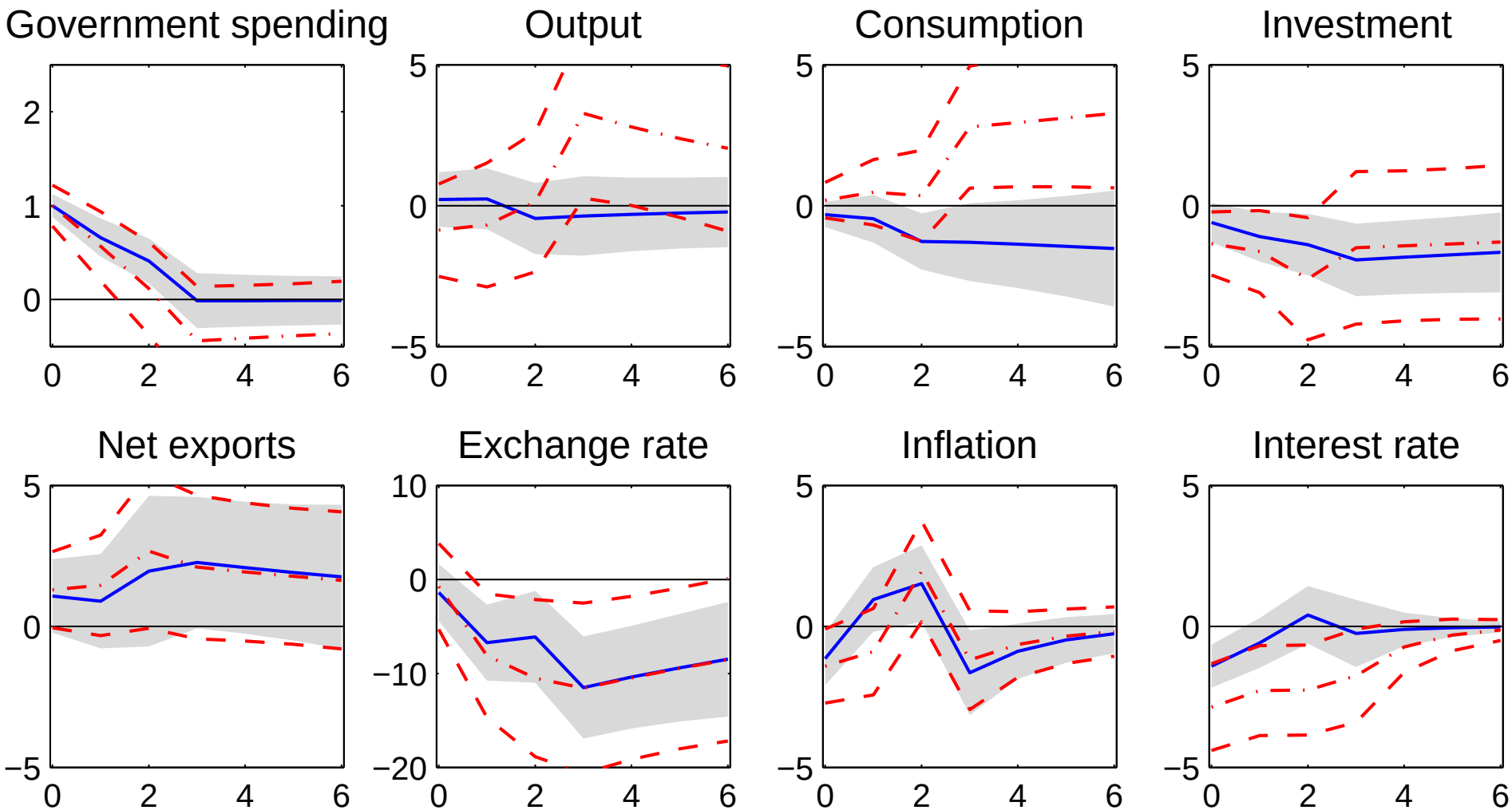
	Impact	Maximum	Cumulative ($\sum Y_t / \sum G_t$)		
	Y_0 / G_0	$\max Y / G_0$	year: 2	4	6
Baseline	−0.2	−0.2	−0.4	−0.8	−0.9
Currency Peg	1.0	1.1	1.1	0.8	0.7
Weak Public Finances	−1.2	0.1	−1.6	1.2	−0.9
Financial crisis	2.1	2.1	1.4	0.8	0.5

Sensitivity analysis: dummy definition for weak public finances

Narrow definitions of weak public finances: lagged debt $>$ 120 percent or deficit $>$ 7 percent

- Similar results for baseline and financial crises
- Output effects under peg vanish

Baseline vs weak public finances (narrow definition)



Sensitivity analysis: specification of first step

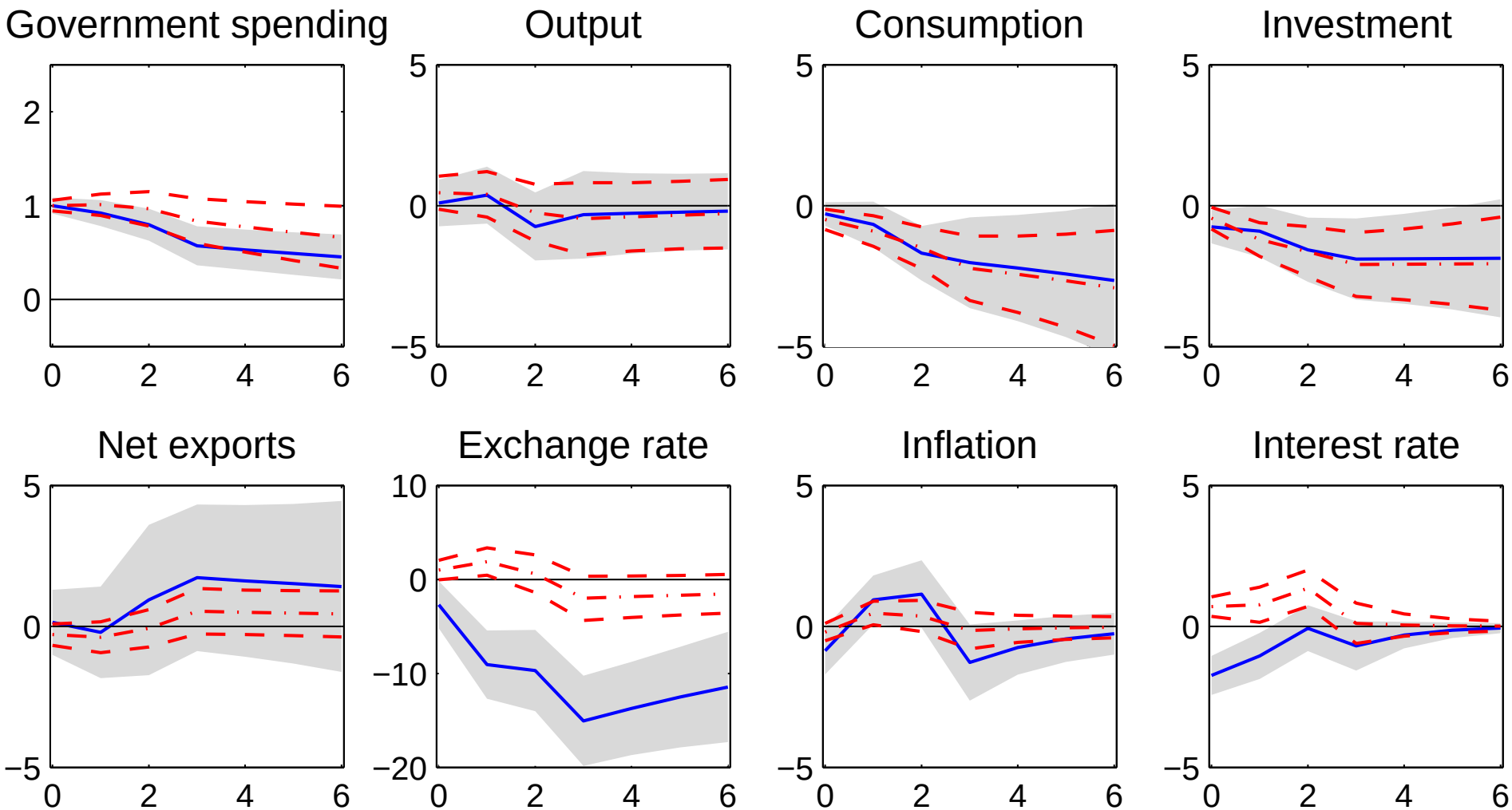
Contemporaneous value of crisis dummy in first step

- Way to account for shorter decision and implementation lags under special circumstances: in a crisis, spending response is treated as systematic
- In a crisis, impact response is again large, but cumulative multipliers fall
- All other results similar.

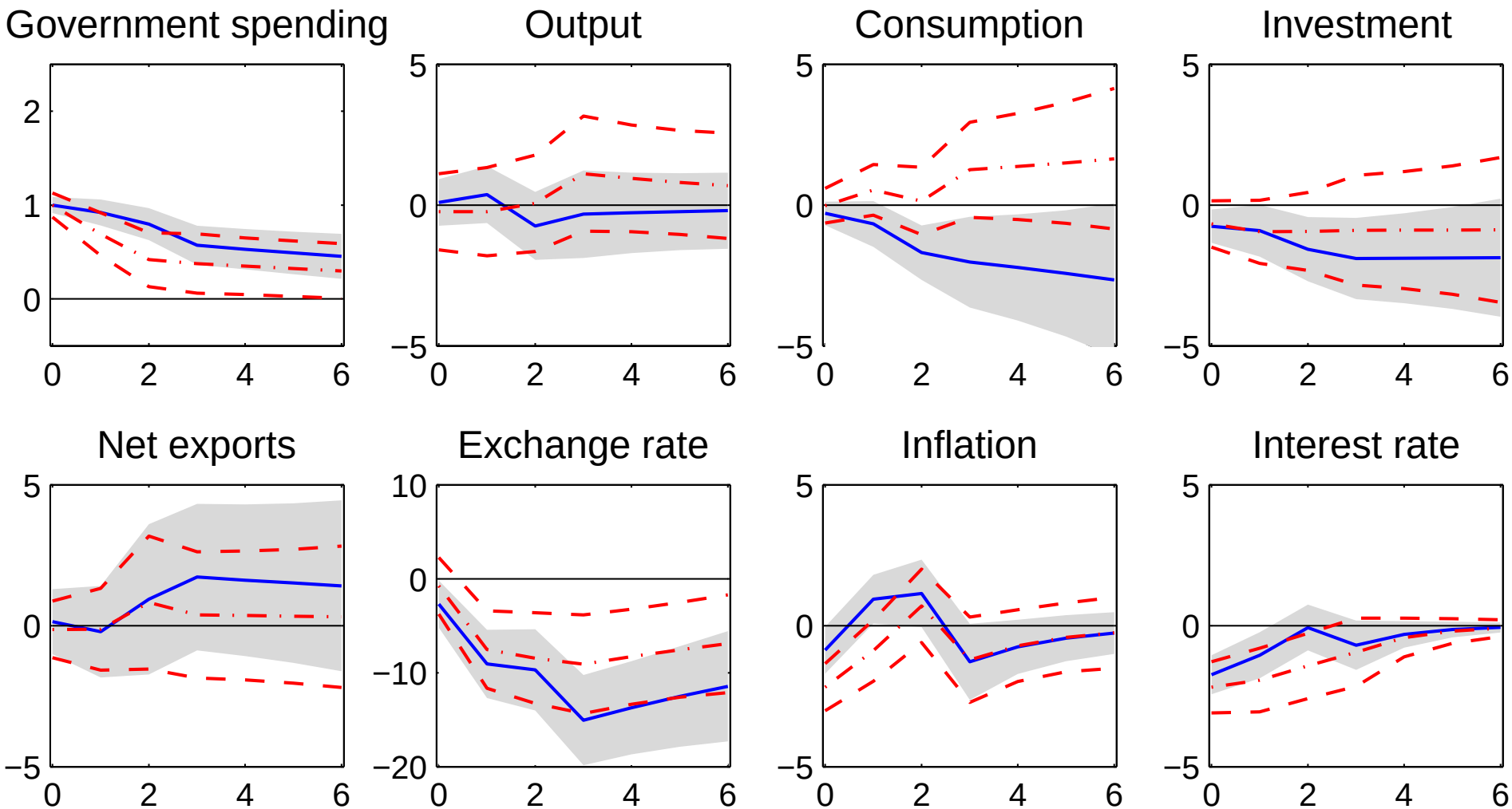
Specification of both steps in growth rates rather than levels

- Sharper results for pegs
- More persistent effects under crises

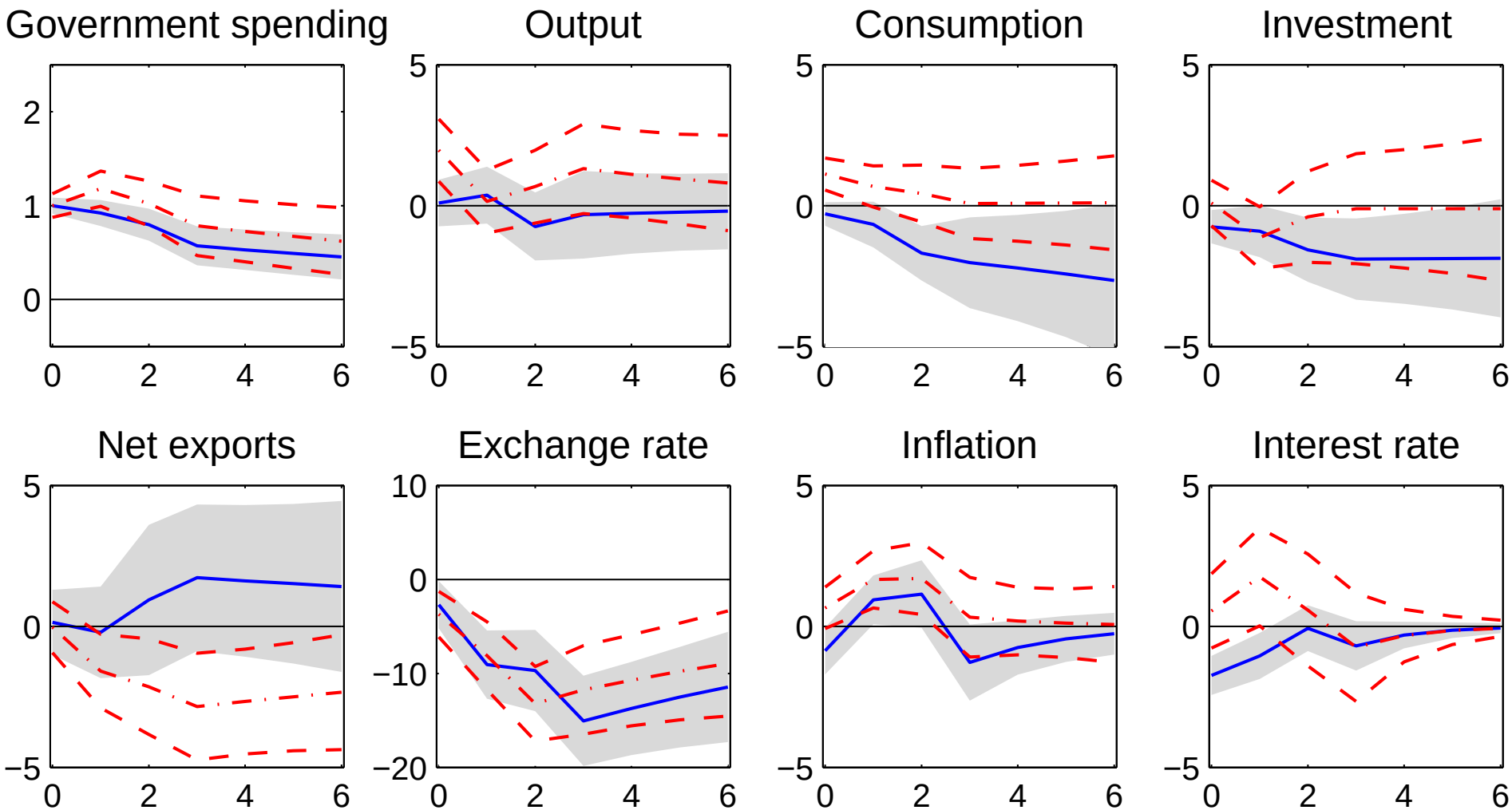
Baseline scenario vs peg (Contemp. dummy)



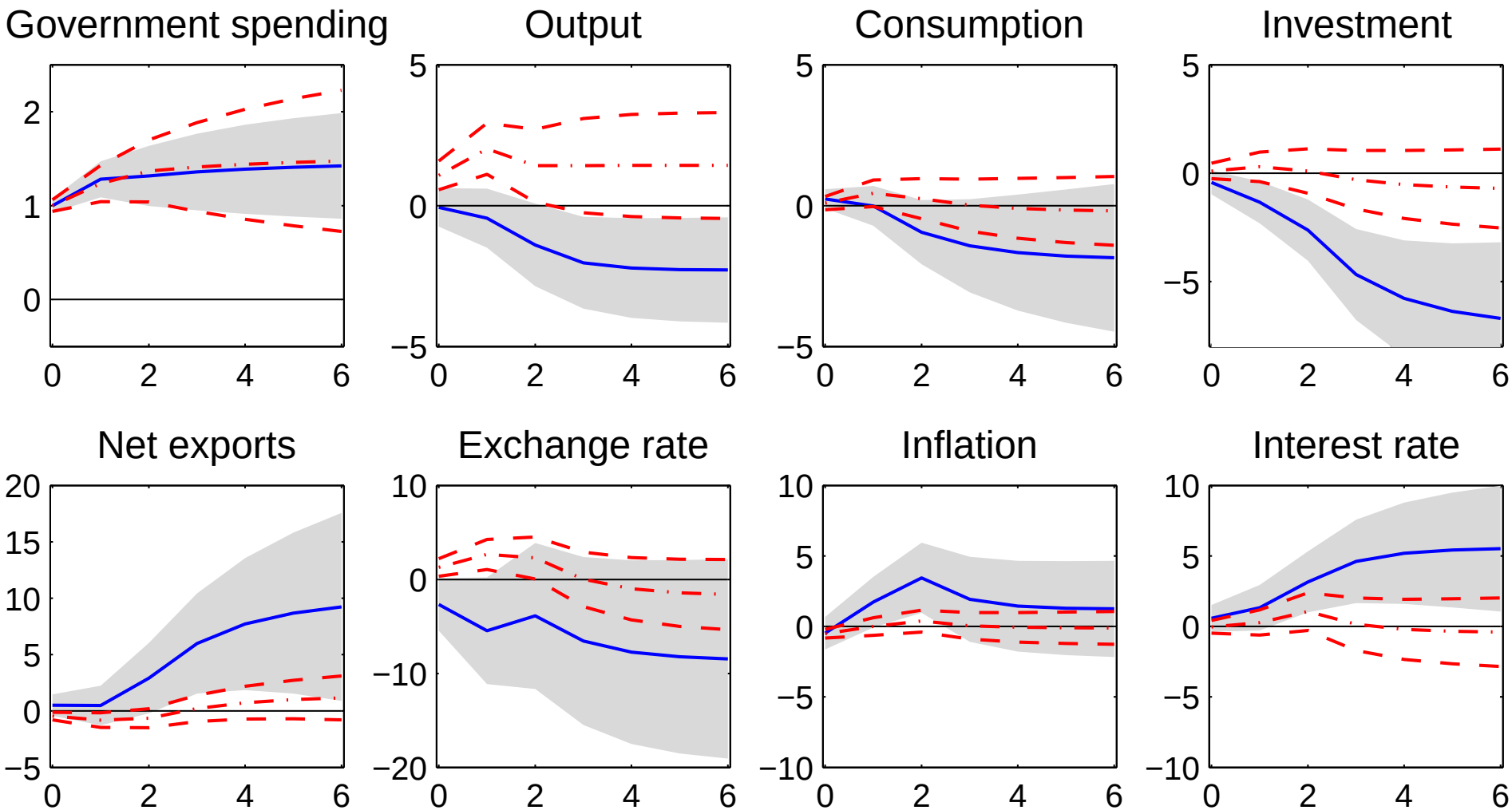
Baseline scenario vs weak public finances (Contemp. dummy)



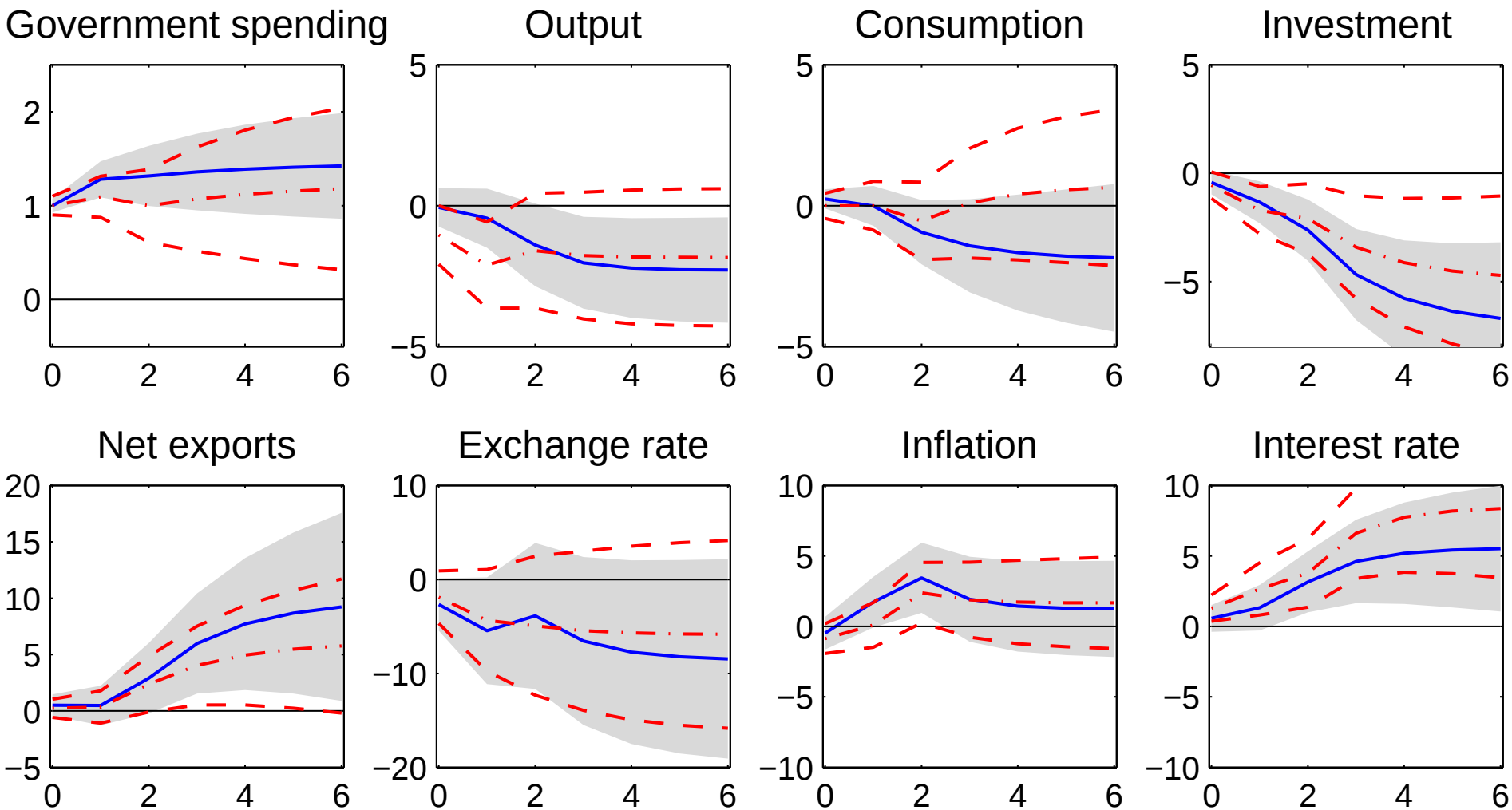
Baseline scenario vs financial crisis (Contemp. dummy)



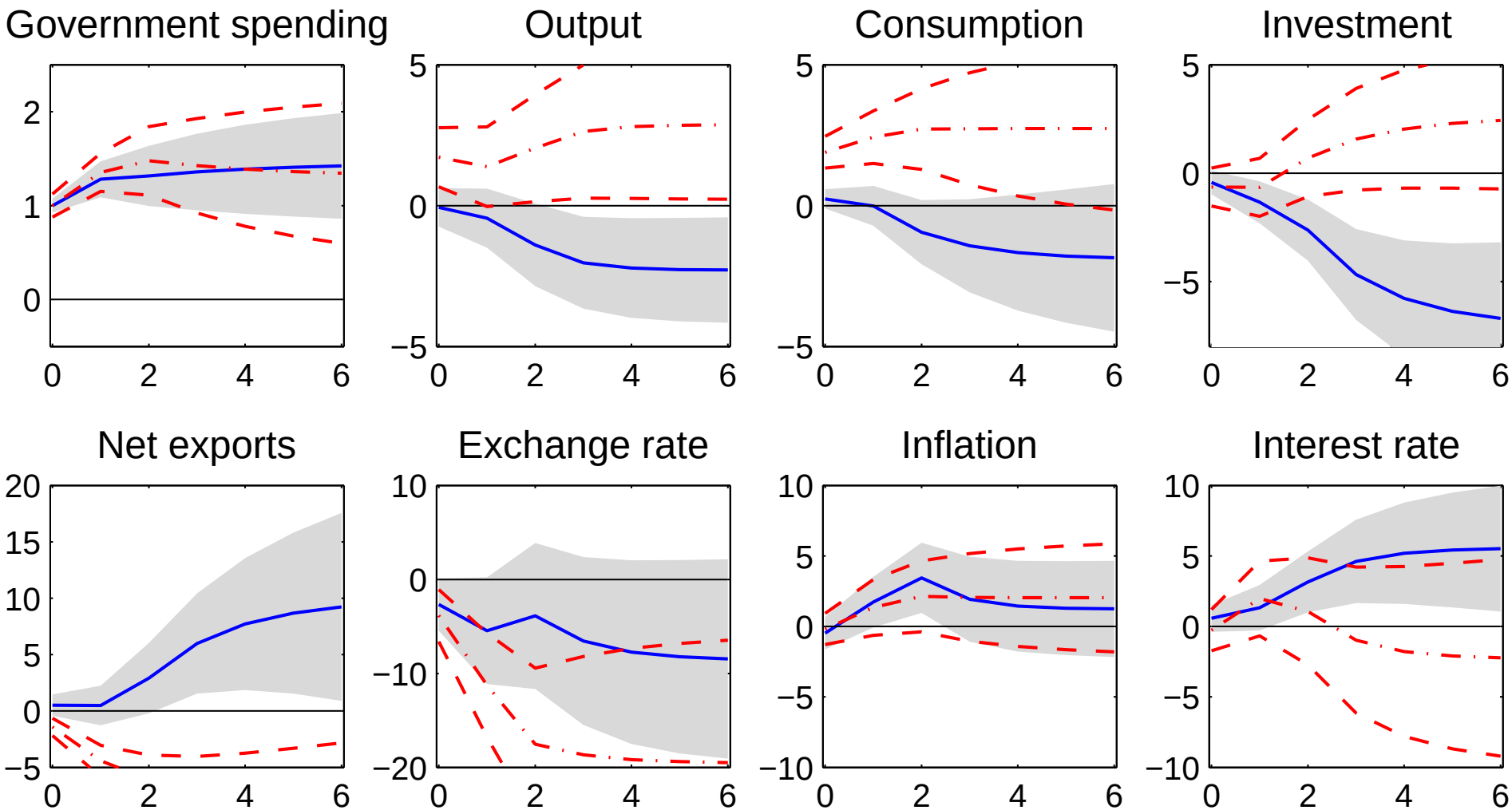
Baseline scenario vs peg (growth rates)



Baseline scenario vs weak public finances (growth rates)



Baseline scenario vs financial crisis (growth rates)

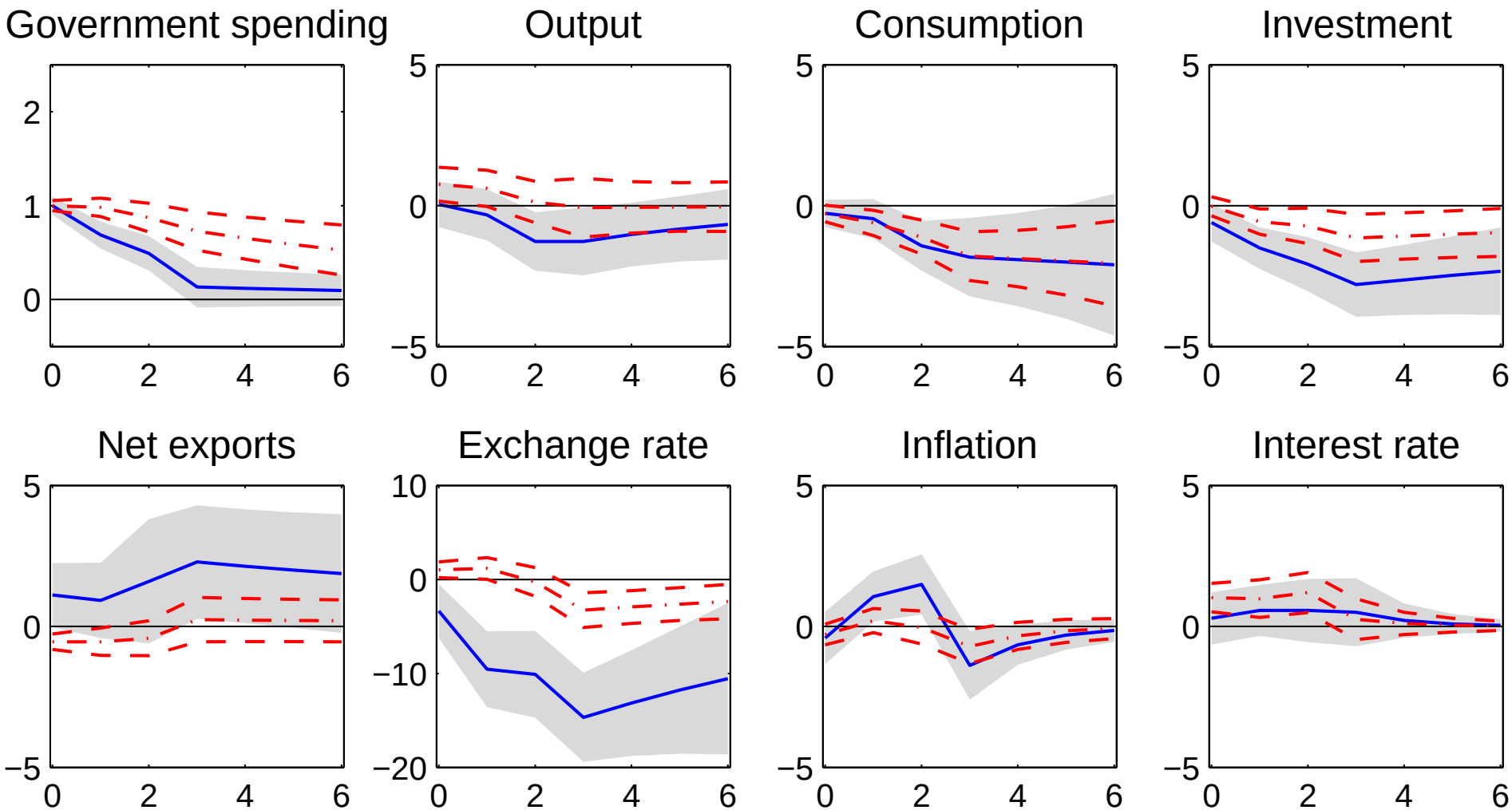


Sensitivity analysis: Sample

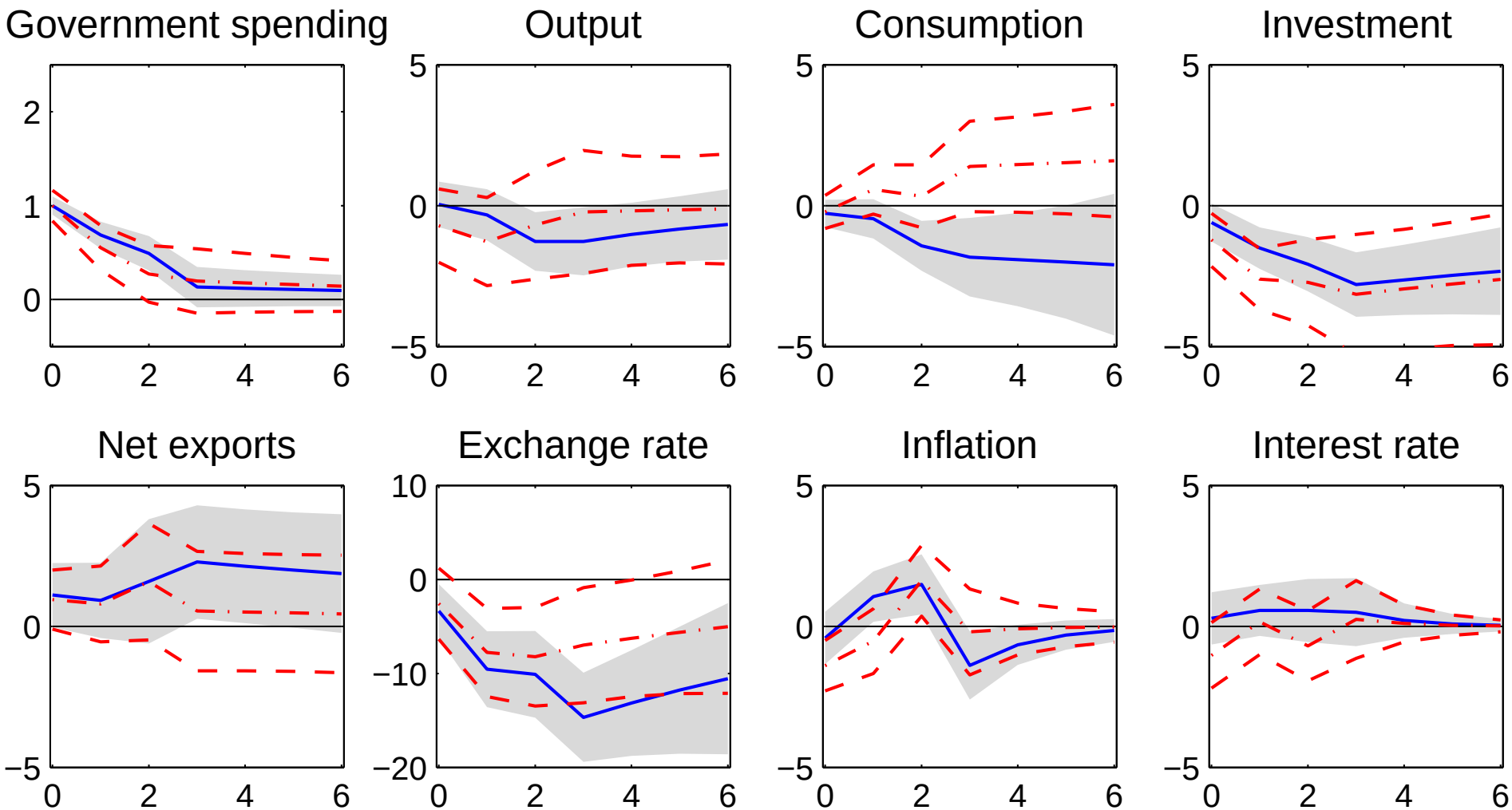
Checks

- Extend the sample to 1960
- Exclude global crisis (2007–2008)
- Exclude the US

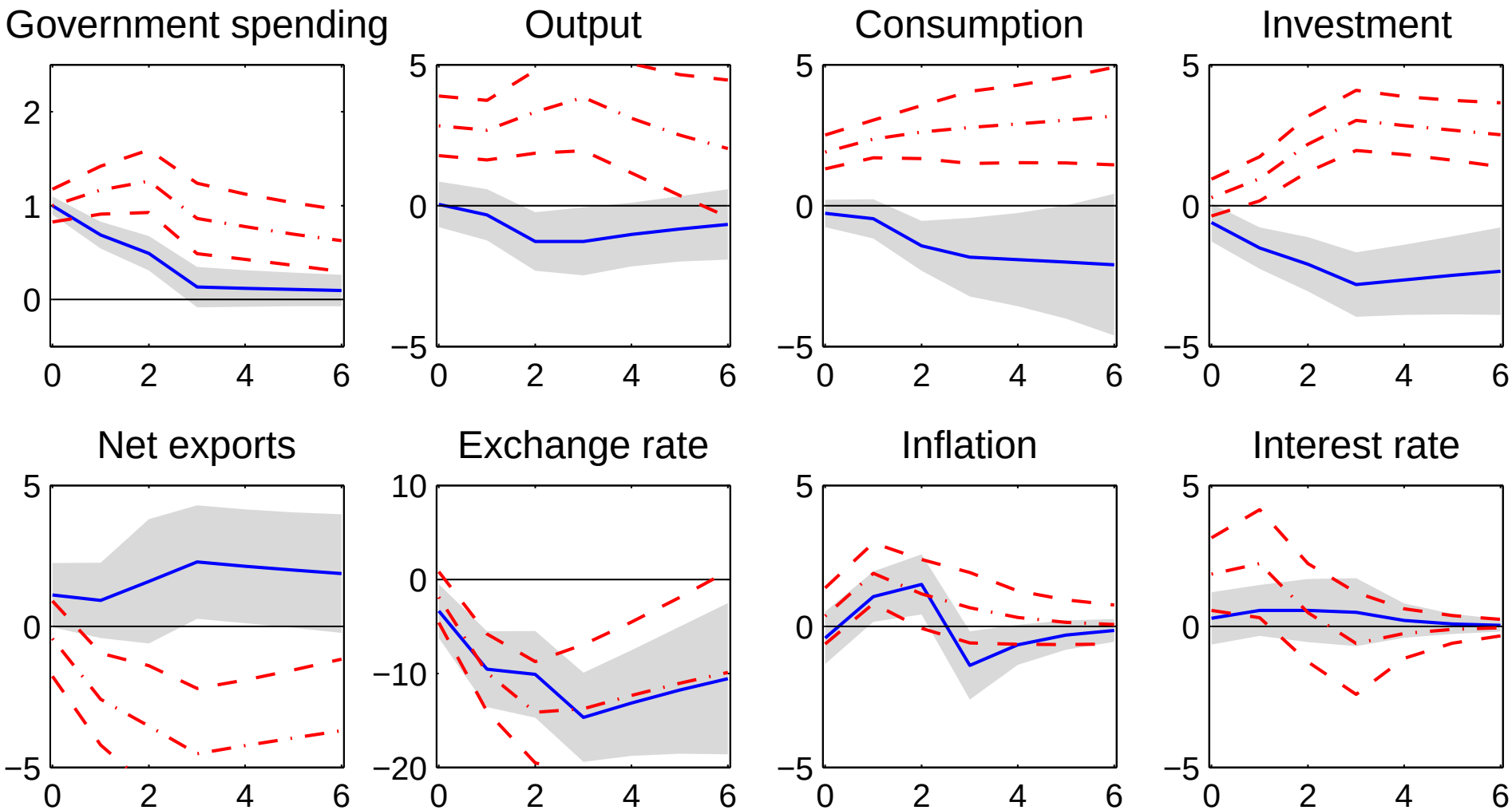
Baseline vs peg (1960–2008)



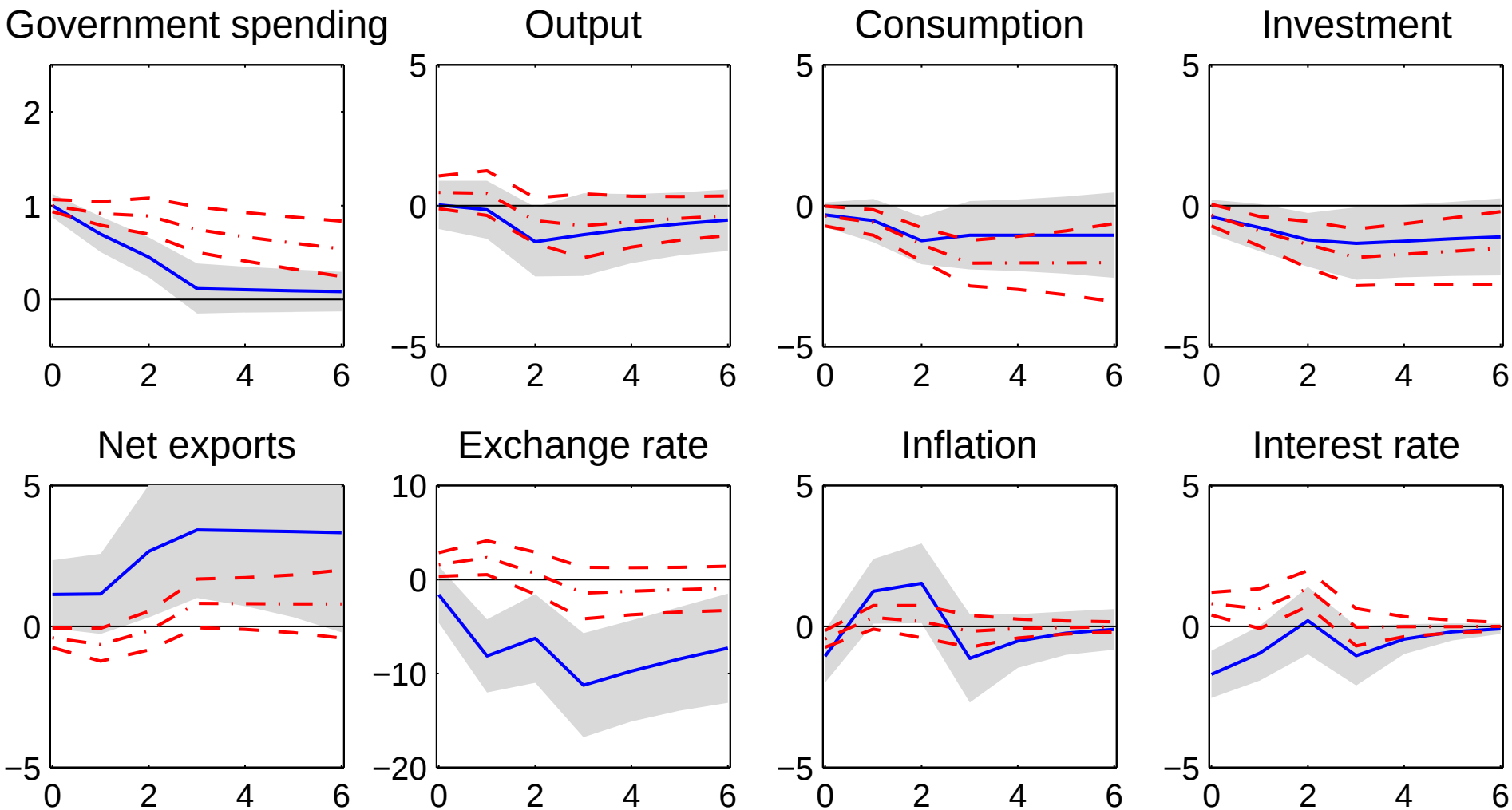
Baseline vs weak public finances (1960–2008)



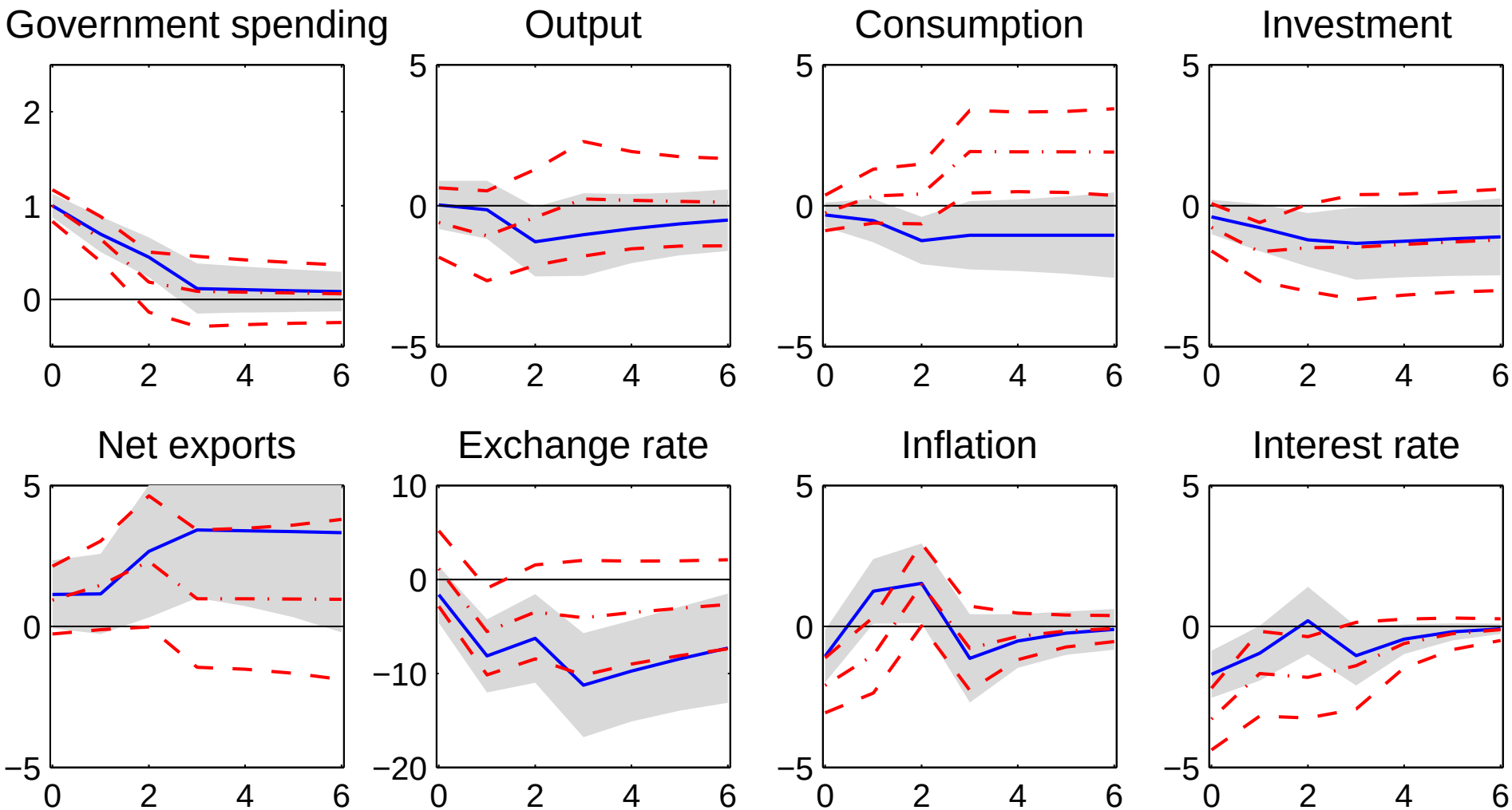
Baseline vs financial crisis (1960–2008)



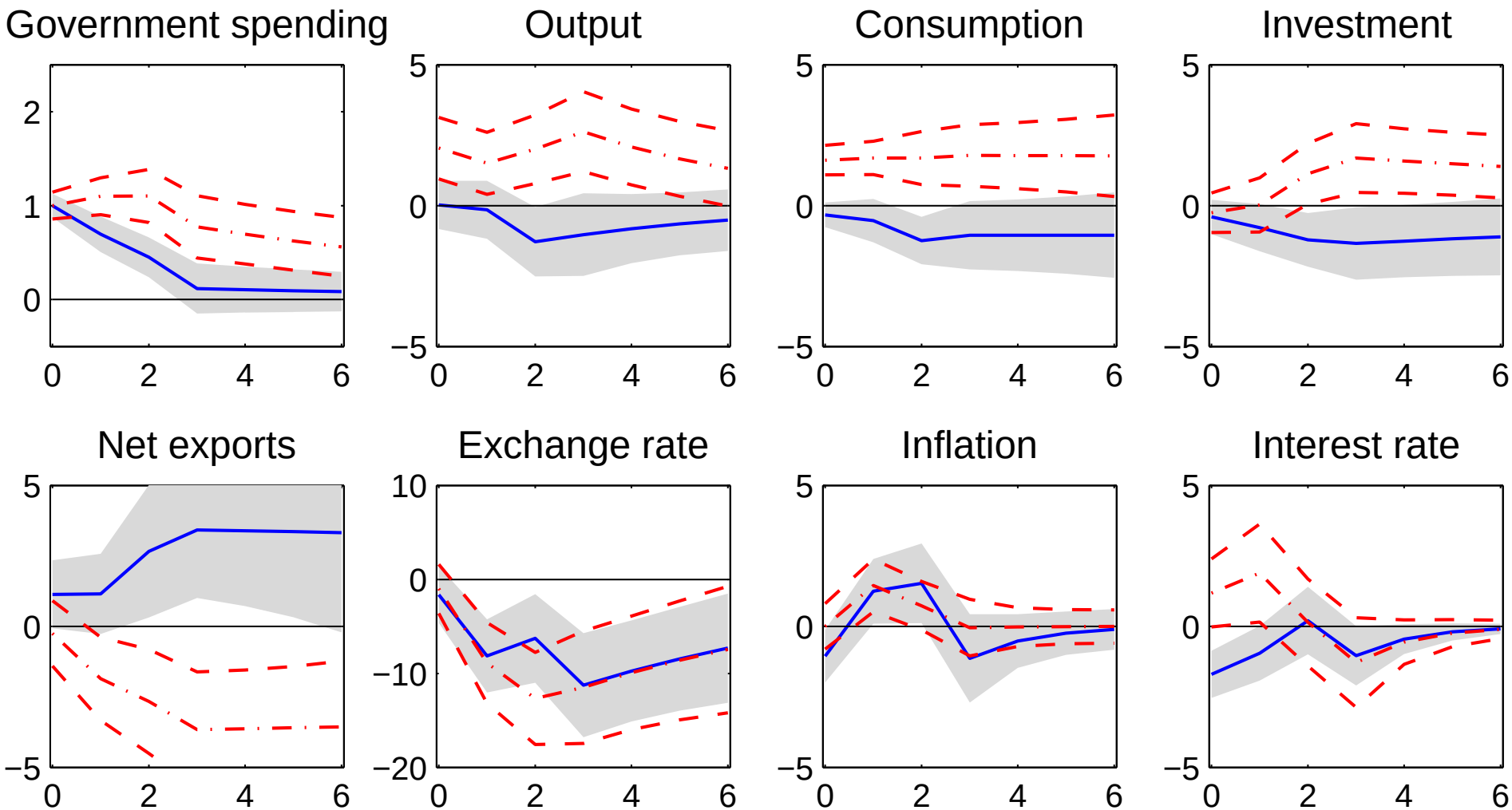
Baseline vs peg (w/o 2007–08)



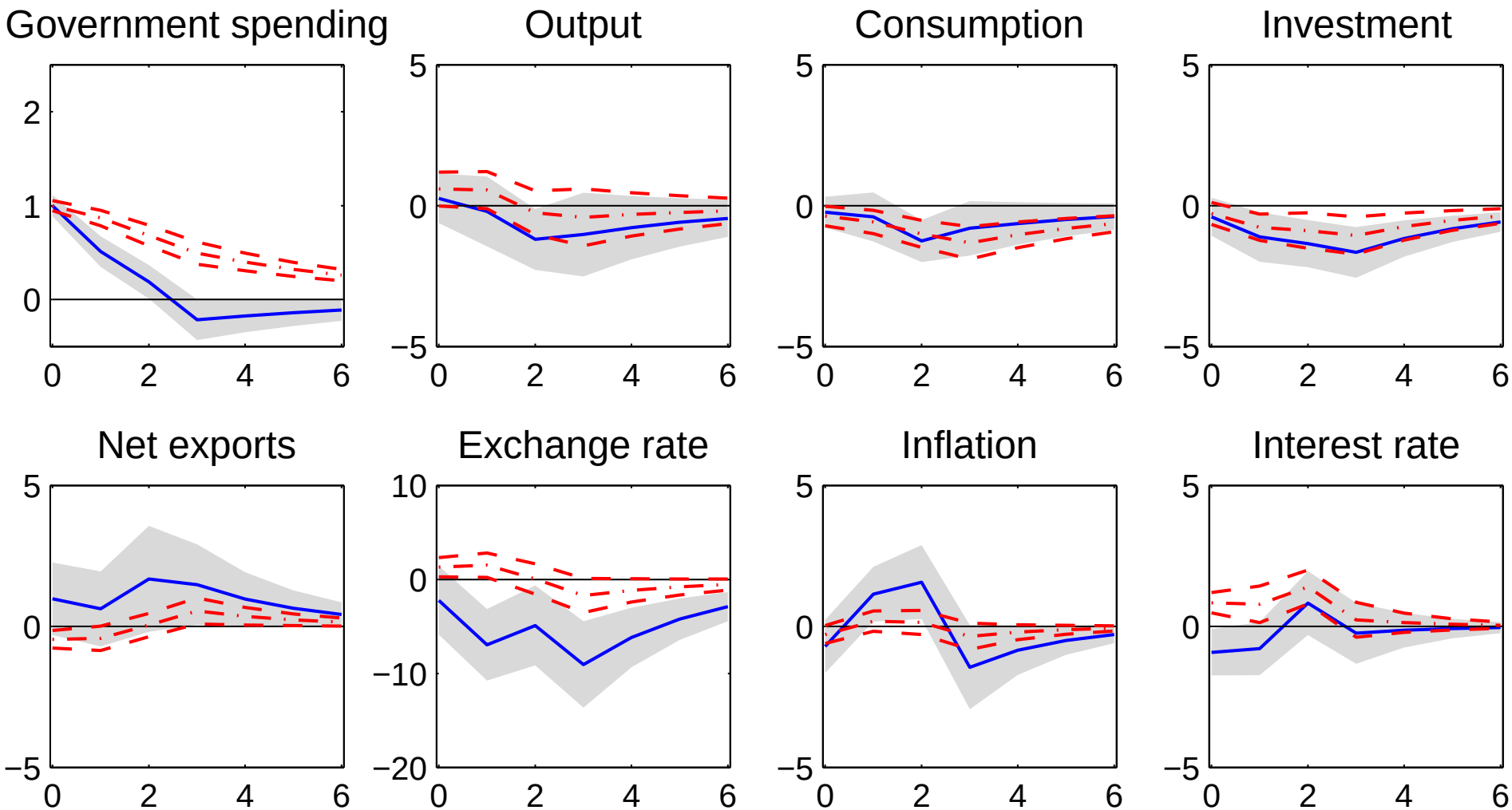
Baseline vs weak public finances (w/o 2007–08)



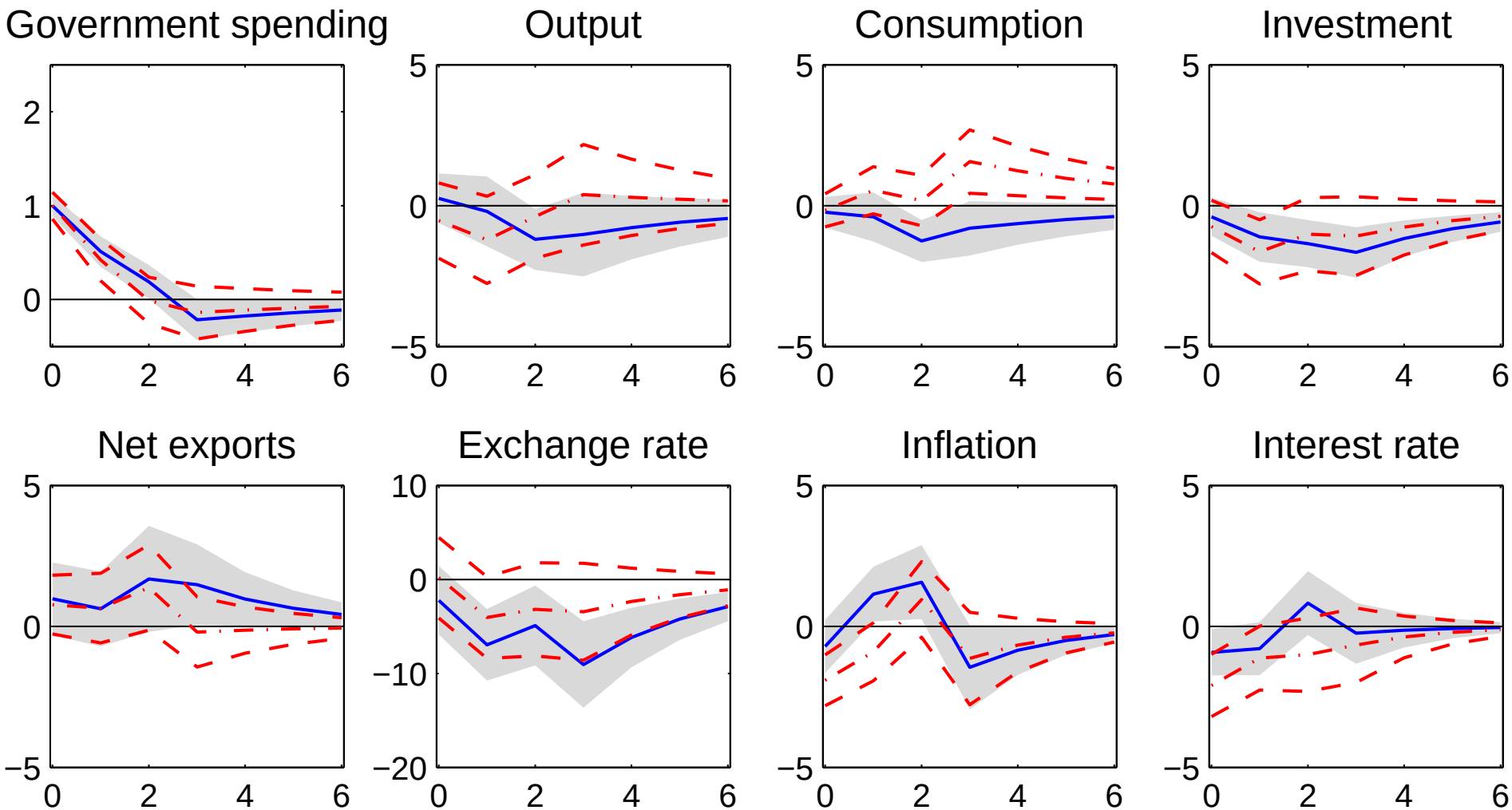
Baseline vs financial crisis (w/o 2007–08)



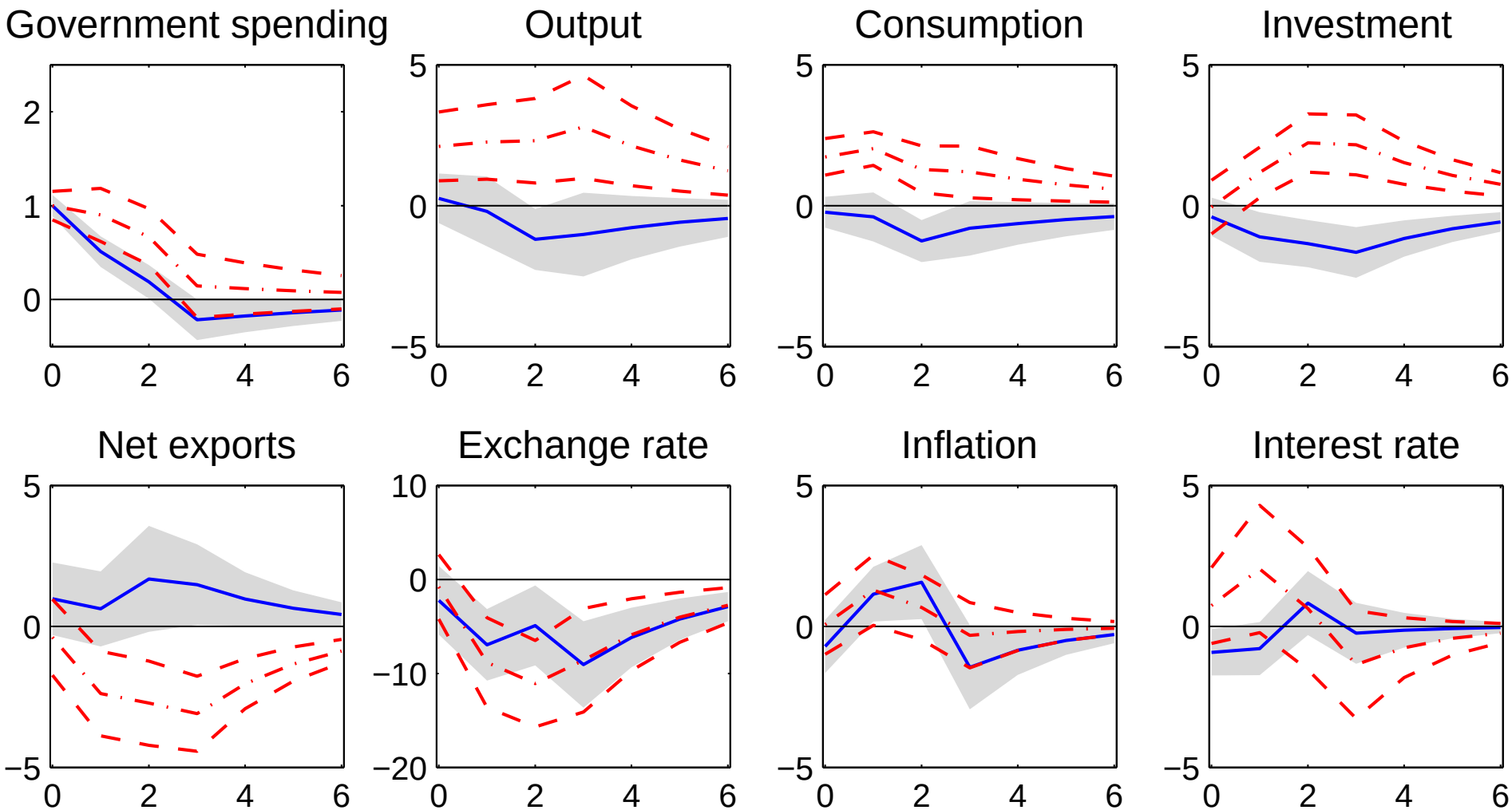
Baseline scenario vs peg (w/o US)



Baseline scenario vs weak public finances (w/o US)



Baseline scenario vs financial crisis (w/o US)



Conclusions

Effects of government spending depend on circumstances that vary across countries and time.

In this paper we have proposed a methodology building on an identification strategy that is compatible with limitations in the availability of good quality data.

- Certain caveats remain (discussed extensively in the paper);
- Evidence appears to support theory along several dimensions.

There is no such thing as *the* multiplier

Multipliers are

- Small (≈ 0) in normal times (no crisis, independent monetary policy)
- Larger (or at least not smaller) if currency peg
- Sizeable on impact at times of financial crisis
- Robust results shed light on puzzling evidence in the literature: real depreciation/appreciation linked to exchange rate regime and hence to policy mix

Appendix A. A note on identification

Government spending shock = innovation in spending within the year, in the spirit of Blanchard/Perotti 2002, but

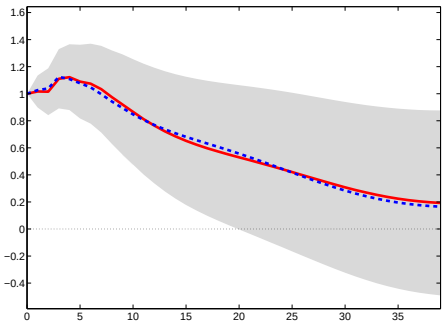
- Good quality data
- Fit timing of budget process
- Less prone to anticipation effects (Beetsma/Giuliodori/Klaasen 2006, 2008 and Bénétrix/Lane 2009)

Born/Müller 2012 estimate VAR on quarterly US data 1954–2007

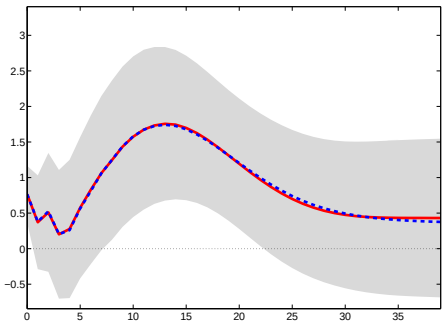
- Compare impulse responses of unrestricted model to those of model restricted so that spending does not response systematically to economy within the year (restriction not rejected by the data)
- Compare annualized response of unrestricted model to those obtained for VAR model estimated on annual data

Appendix A. Results for quarterly and annual US data 1954–2007

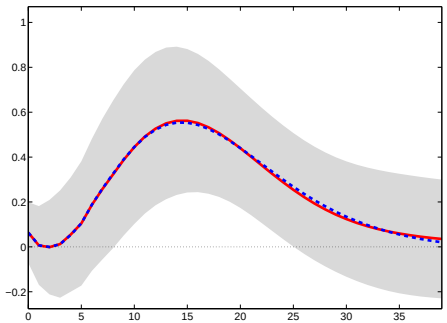
Government spending

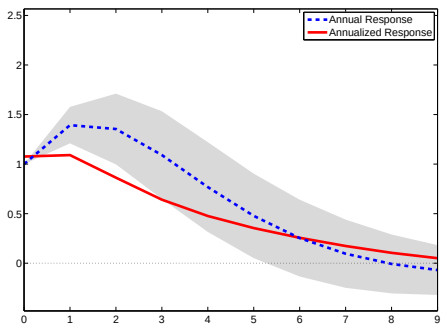


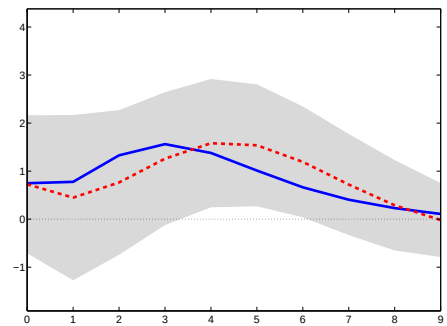
Output

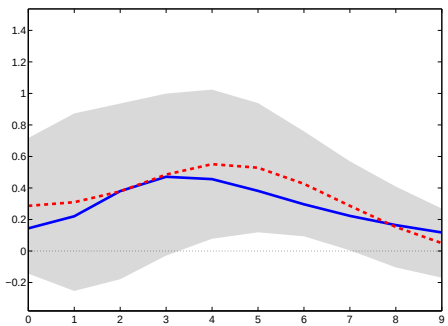


Consumption









Appendix B. Blanchard Perotti and Ramey compared: Results of Corsetti/Meier/Müller 2011

Estimate on quarterly U.S. data for 1983–2007

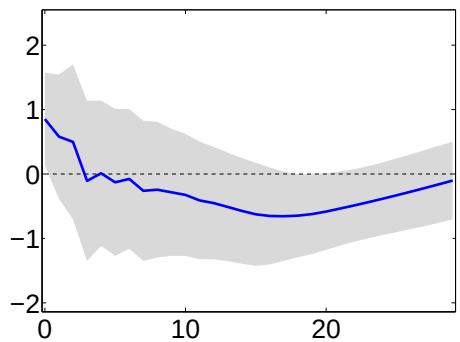
Seven variables: government spending, output, private consumption, long-term real interest rate, real exchange rate, inflation, public debt

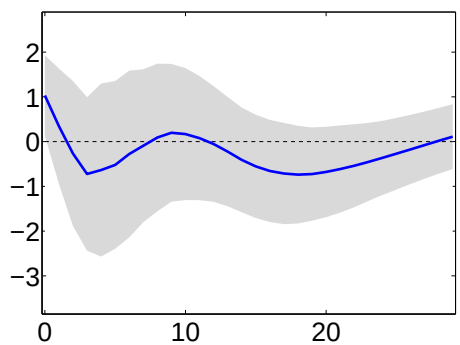
Identification

- Blanchard-Perotti: government spending predetermined
- Ramey: compute spending news survey of professional forecasters
- Similar results when estimated on same sample

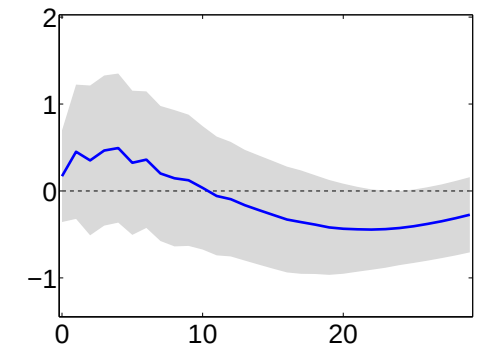
Appendix B. Adjustment to government spending shock; identification: Blanchard-Perotti (top) and Ramey (bottom)

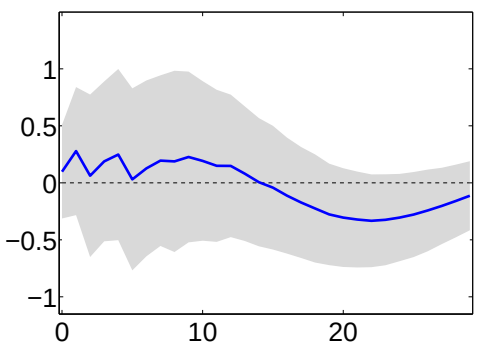
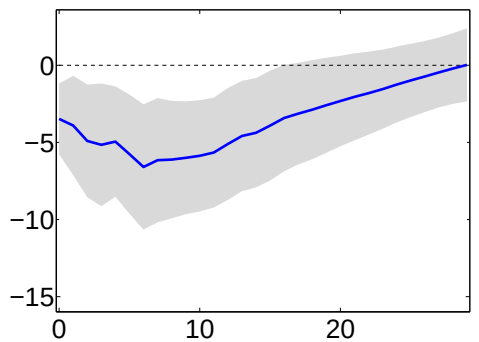
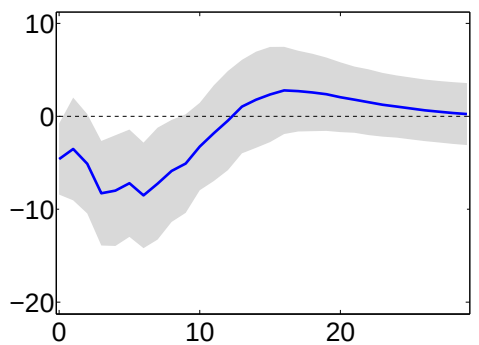
Output





Consumption





REER