Exchange rate regimes and fiscal multipliers

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Fiscal Policy in the Aftermath of the Financial Crisis
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1. Introduction

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If so, how strongly?

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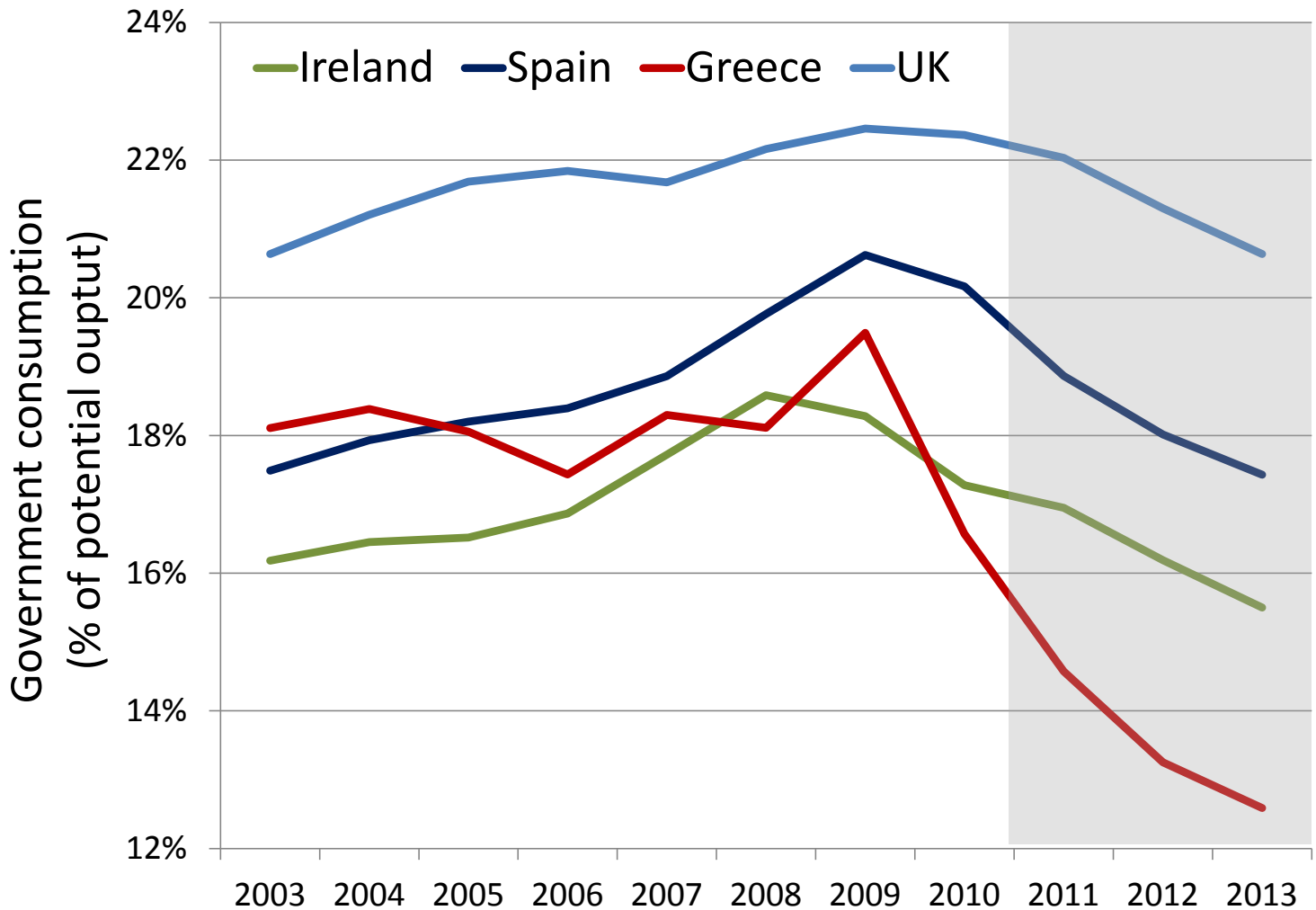
Fiscal stimulus in response to financial crisis 2009

- American Recovery and Reinvestment Act: 787 billion USD
- European Economic Recovery Plan: about 2 percent of GDP

Issue remains vital in the aftermath of the crisis



Exchange rate regime impacts multiplier

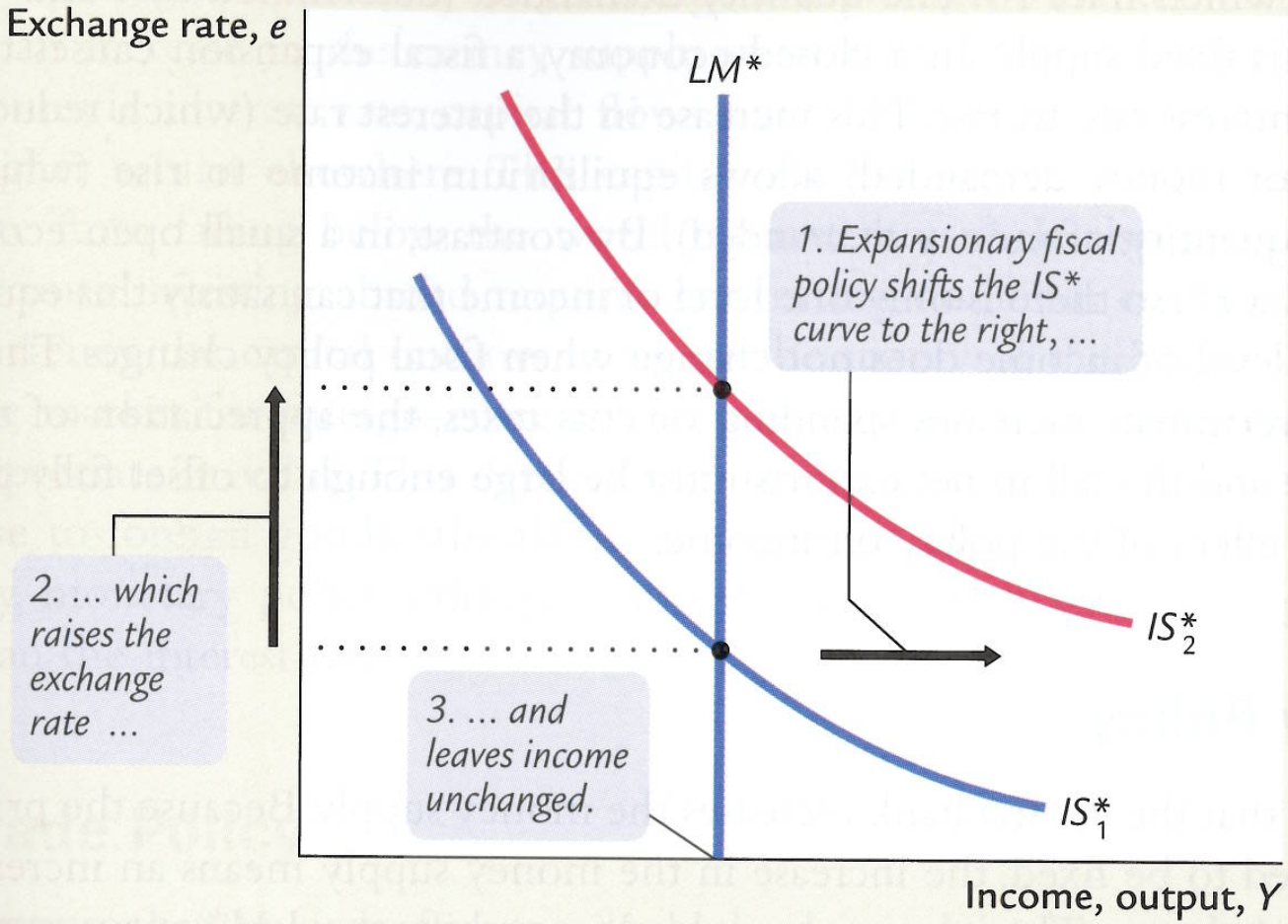
General insight: monetary policy matters for multiplier (Woodford 2011, Christiano/Eichenbaum/Rebelo 2011, Davig/Leeper 2011)

Mundell-Fleming model: public spending raises income and demand for domestic currency

- Peg: monetary policy accommodates demand, **multiplier** $>> 1$
- Float: real appreciation crowds out net exports, **multiplier** $= 0$

Textbook treatment (Mankiw "Macroeconomics")

FIGURE 12-4



A Fiscal Expansion Under Floating Exchange Rates An increase in government purchases or a decrease in taxes shifts the *IS** curve to the right. This raises the exchange rate but has no effect on income.

Evidence in support of MF-Model

Estimates of multiplier in monetary union larger than "consensus" estimate of $0.5 - 1$

- US-states: 1.5 (Nakamura/Steinsson 2011)
- Italian Provinces: 1.2 (Acconcia/Corsetti/Simonelli 2011)

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Ilzetzki/Mendoza/Végh 2011: estimate panel VAR for 44 countries, Blanchard-Perotti identification

- Float: 0
- Peg: 1.65 under peg (long-run)

Yet behavior of trade variables in response to higher government spending doesn't square with MF account

Ilzetzki/Mendoza/Végh find "weak evidence" for MF channel

- Very short-lived exchange rate appreciation under float
- No significant movement of net exports

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Studies for US (and Canada, UK, Australia) find no evidence for real appreciation and/or (large) trade deficit

- Robust across identification schemes: Kim/Roubini 2008, Monacelli/Perotti 2010, Enders/Müller/Scholl 2011, Corsetti/Meier/Müller 2012

This paper

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    - Short-run multiplier under peg 1.2, under float 0.75
    - No evidence for MF transmission

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1. New time-series evidence using unique data set, which allows to control for anticipation
   - Short-run multiplier under peg 1.2, under float 0.75
   - No evidence for MF transmission
2. New Keynesian small open economy model
   - Can account for fiscal transmission under both exchange rate regimes
   - Monetary policy is key, but transmission channel differs relative to MF

2. Vector autoregression (VAR)

Bi-annual VAR model estimated on panel of OECD countries (1985:2–2011:1): effects of unanticipated shocks to government spending

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Identification assumption: government spending predetermined

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- With bi-annual observations more restrictive than Blanchard/Perotti 2002, but not too restrictive (Born/Müller 2012)

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Changes in government spending may be anticipated (Ramey 2011, Mountford/Uhlig 2009, Leeper/Walker/Yang 2011)

- Include OECD forecast for spending growth in VAR

VAR model with spending forecast

Vector of endogenous variables

$$x_{i,t} = \begin{bmatrix} g_{i,t} & fc_{i,t}^{t+1} & y_{i,t} & r_{i,t} & rx_{i,t} & nx_{i,t} \end{bmatrix}'$$

Reduced-form VAR model

$$x_{i,t} = \mu_i + \sum_{k=1}^{K} C_k x_{i,t-k} + u_{i,t},$$

- Consider also country-specific time trends and country fixed effects
- Structural shocks: $w_t = \Omega u_t$, with $E w_t w_t' = I$

Anticipation as a source of non-invertibility

Shocks of structural model cannot be recovered from VAR

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Generic state-space representation of general equilibrium model

$$z_{t+1} = Az_t + Bw_{t+1} \quad (1)$$
$$x_{t+1} = Cz_t + Dw_{t+1} \quad (2)$$

- Rearranging: $\left[1 - (A - BD^{-1}C)L\right] z_{t+1} = BD^{-1}x_{t+1}$
- If eigenvalues of $(A - BD^{-1}C)$ smaller than 1, state can be written as function of past observables; obtain VAR(∞) (Poor-man's invertibility condition of Fernández-Villaverde et al 2007)

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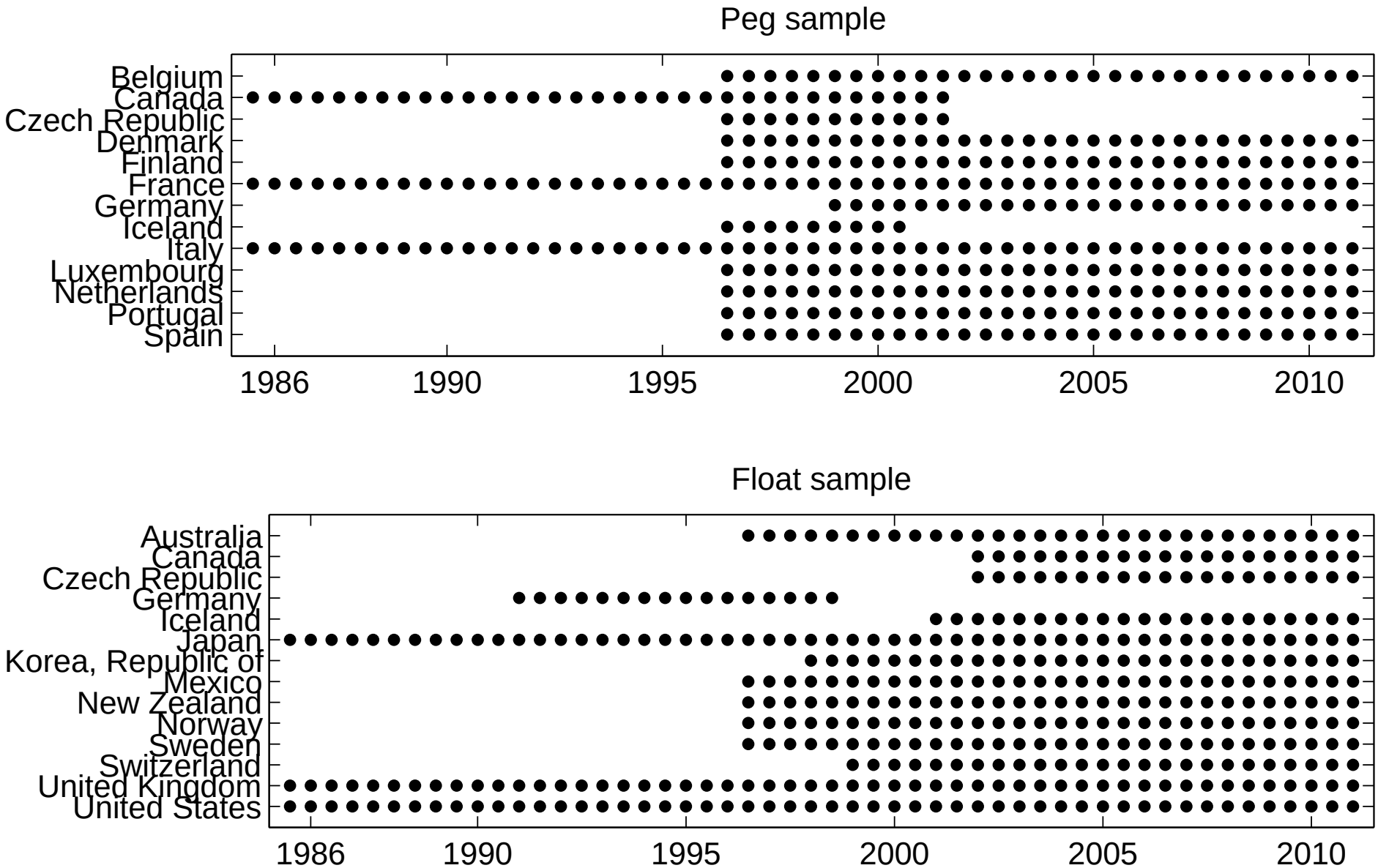
New Keynesian open economy model: **if there is anticipation of government spending shocks, invertibility only if fc_t^{t+1} in x_t**

Classification of Ilzetzki/Reinhart/Rogoff 2008

	1.	No separate legal tender
	2.	Pre announced peg or currency board arrangement
P	3.	Pre announced horizontal band that is narrower than or equal to +/-2%
E	4.	De facto peg
G	5.	Pre announced crawling peg
	6.	Pre announced crawling band that is narrower than or equal to +/-2%
	7.	De facto crawling peg
	8.	De facto crawling band that is narrower than or equal to +/-2%
	9.	Pre announced crawling band that is wider than or equal to +/-2%
F	10.	De facto crawling band that is narrower than or equal to +/-5%
L	11.	Moving band that is narrower than or equal to +/-2%
O	12.	Managed floating
A	13.	Freely floating
T	14.	Freely falling
	15.	Dual market in which parallel market data is missing


Peg sample
Belgium
Canada
Czech Republic
Denmark
Finland
France
Germany
Iceland
Italy
Luxembourg
Netherlands
Portugal
Spain
1986
1990
1995
2000
2005
2010
Float sample
Australia
Canada
Czech Republic
Germany
Iceland
Japan
Korea, Republic of
Mexico
New Zealand
Norway
Sweden
Switzerland
United Kingdom
United States
1986
1990
1995
2000
2005
2010

Results for baseline specification

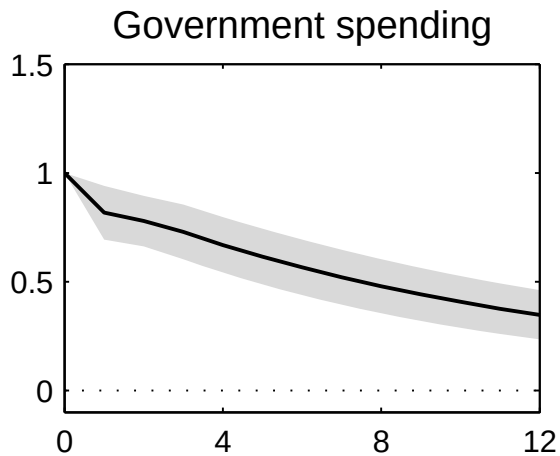
Exogenous increase in government spending by one percent of GDP

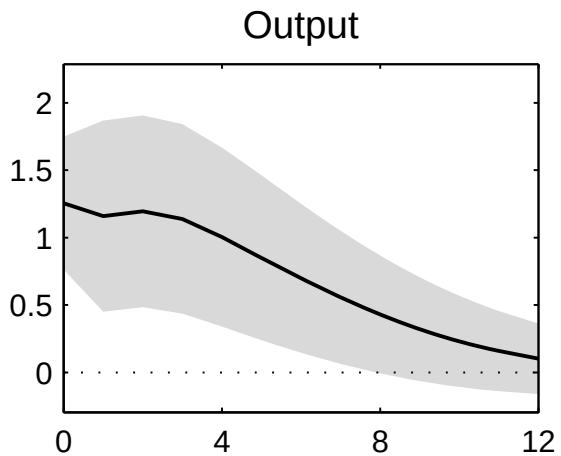
Compute impulse responses for 12 half years

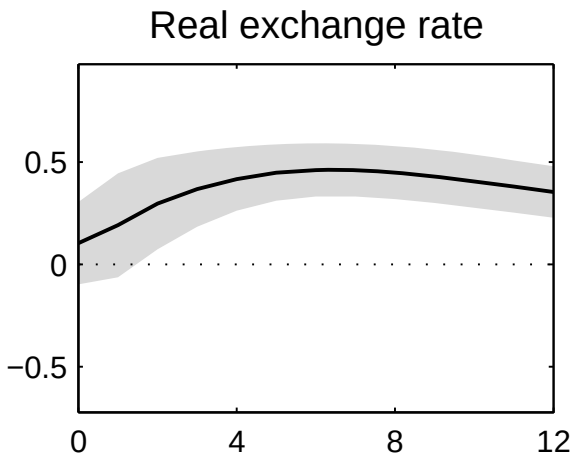
Report 90 percent confidence bounds

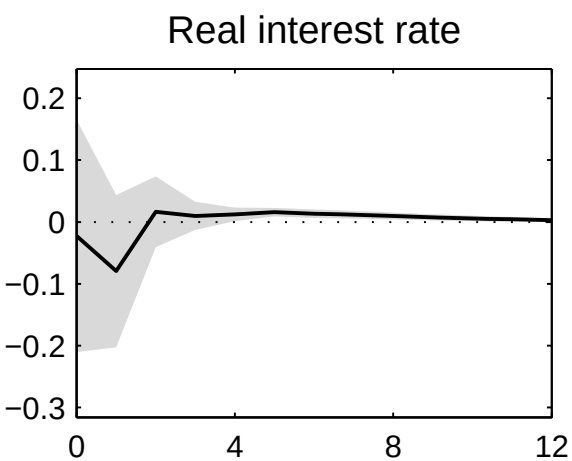
Compare results for peg and float

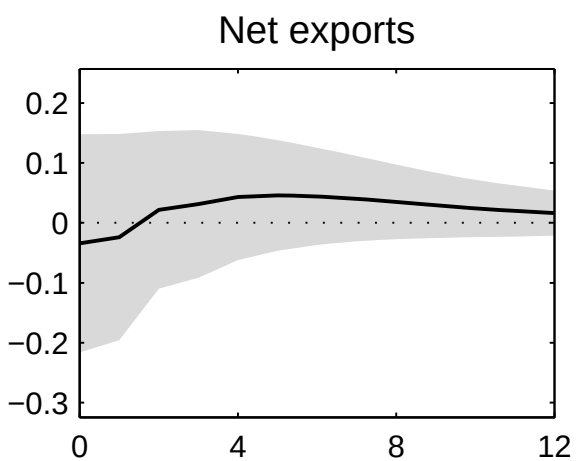
Results for baseline model: peg



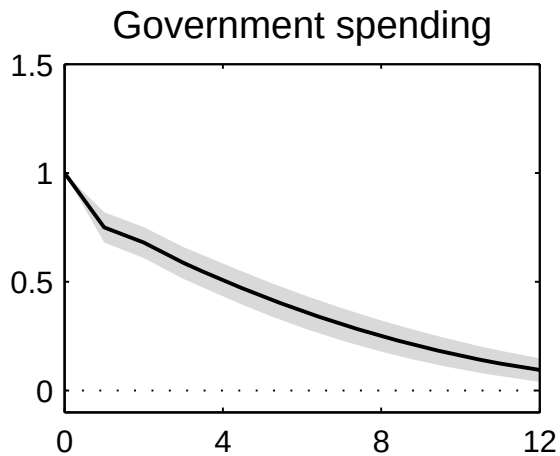


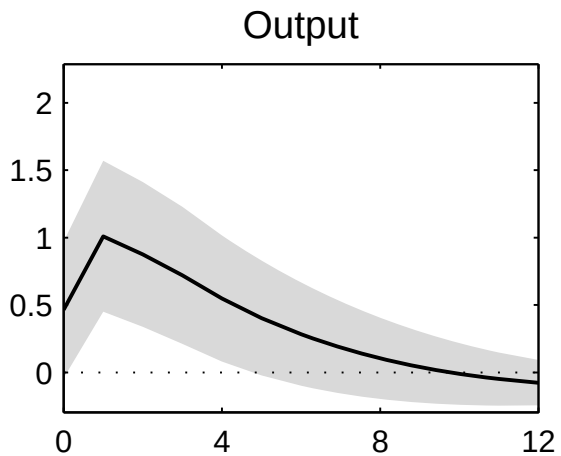


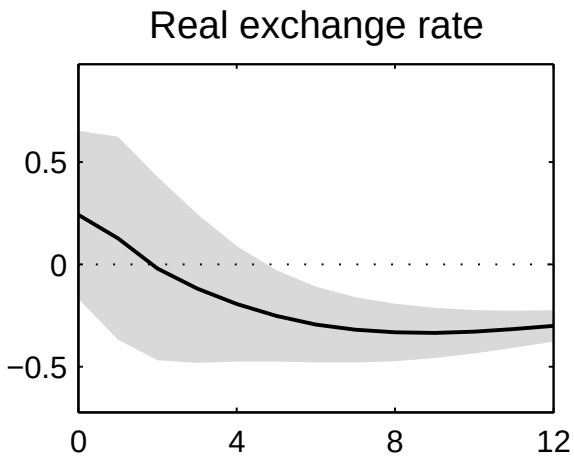


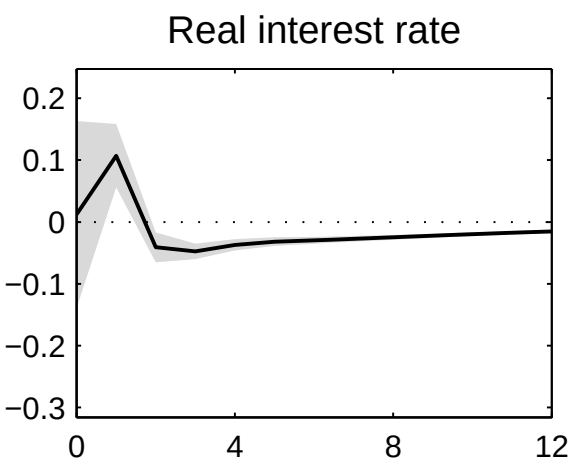


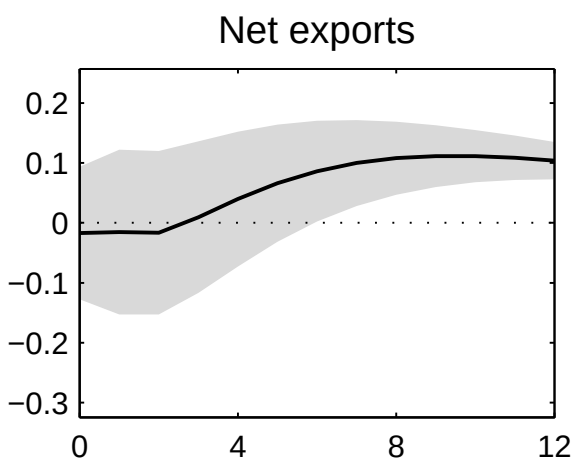
Results for baseline model: float



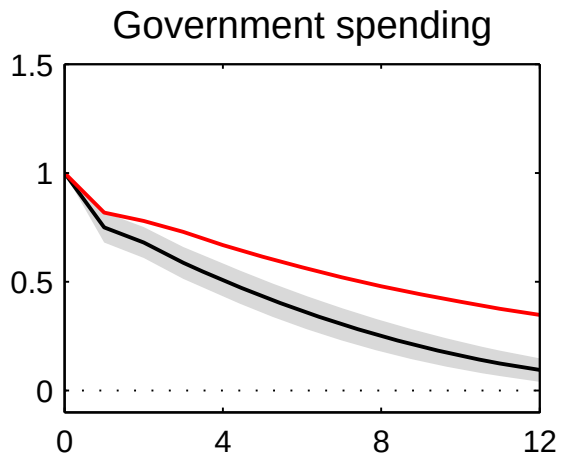


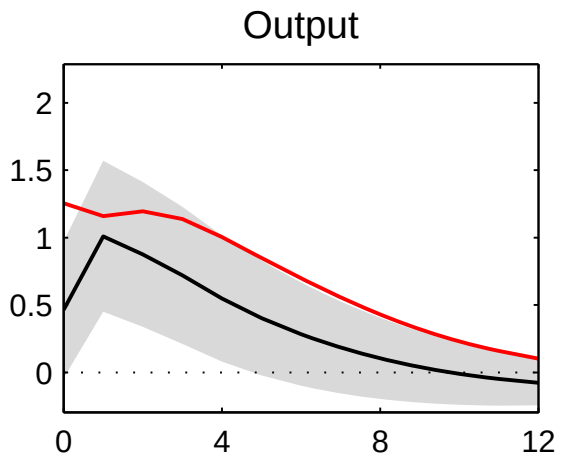


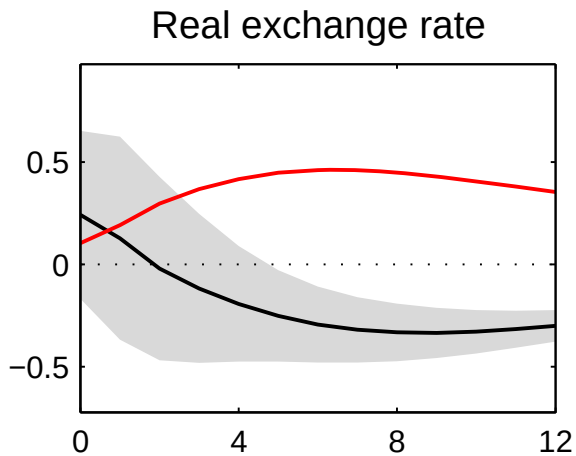


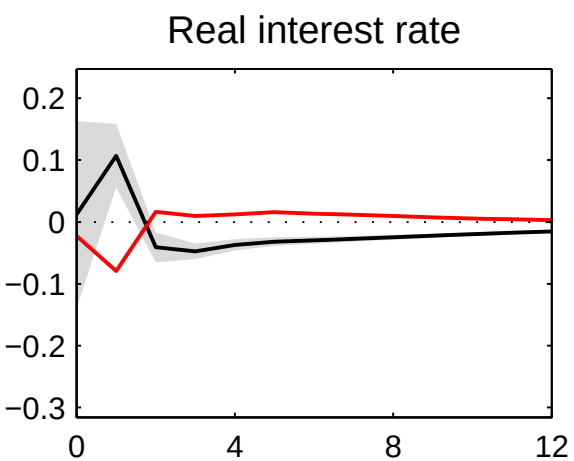


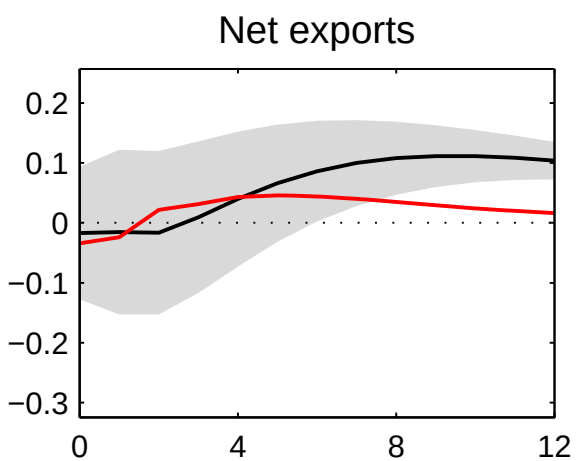
Results for baseline model: float vs peg











Variable	Horizon	Peg	Float	Peg - Float
Output	1	1.26	0.46	0.79
		(0.25)	(0.26)	(0.37)
	3	1.19	0.88	0.32
		(0.36)	(0.27)	(0.47)
	5	1.00	0.55	0.46
		(0.34)	(0.24)	(0.42)
Real exchange rate	1	0.10	0.24	−0.14
		(0.10)	(0.21)	(0.23)
	3	0.30	−0.02	0.32
		(0.11)	(0.23)	(0.26)
	5	0.42	−0.19	0.61
		(0.08)	(0.14)	(0.17)
Real interest rate	1	−0.02	0.01	−0.03
		(0.10)	(0.08)	(0.12)
	3	0.02	−0.04	0.06
		(0.03)	(0.01)	(0.03)
	5	0.01	−0.04	0.05
		(0.01)	(0.00)	(0.01)
Net exports	1	−0.03	−0.02	−0.02
		(0.09)	(0.06)	(0.10)
	3	0.02	−0.02	0.04
		(0.07)	(0.07)	(0.10)
	5	0.04	0.04	0.00
		(0.05)	(0.06)	(0.08)

Sensitivity analysis

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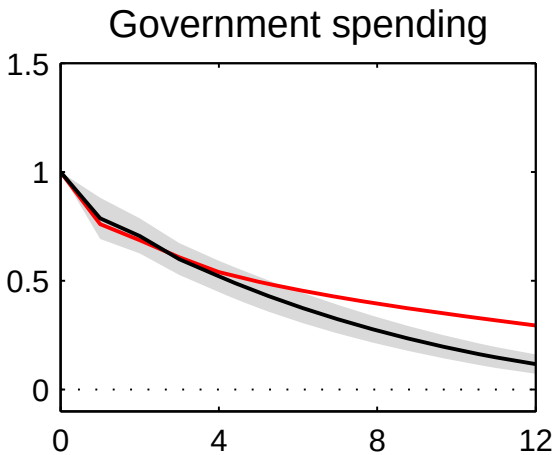
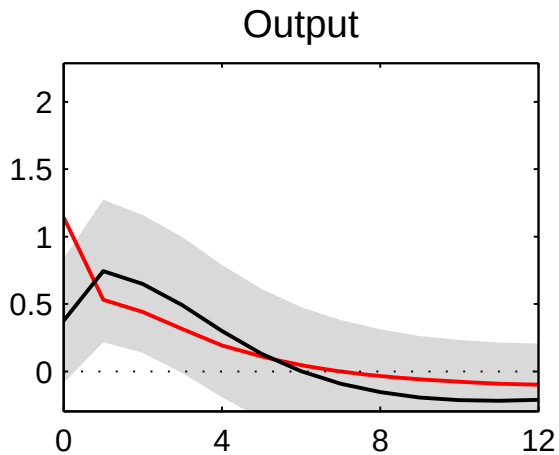
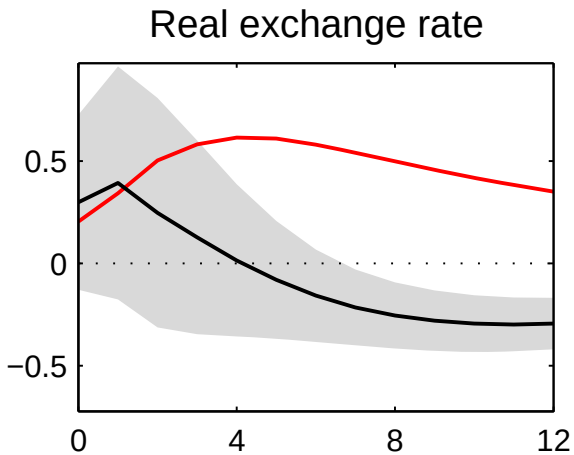
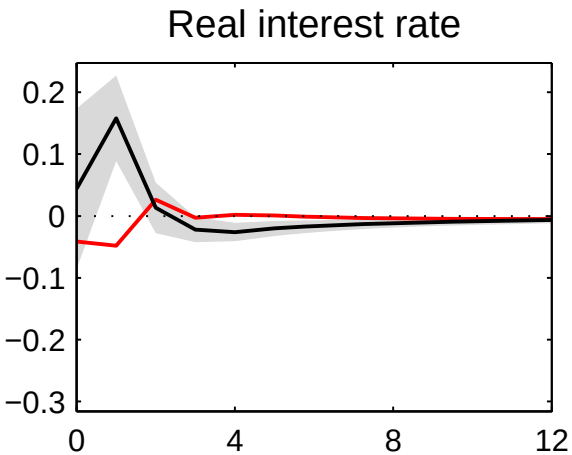
Results are robust.

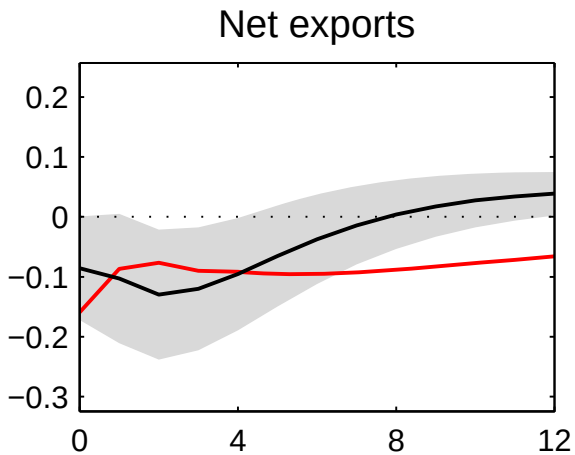
Pre-crisis sample: peg vs float



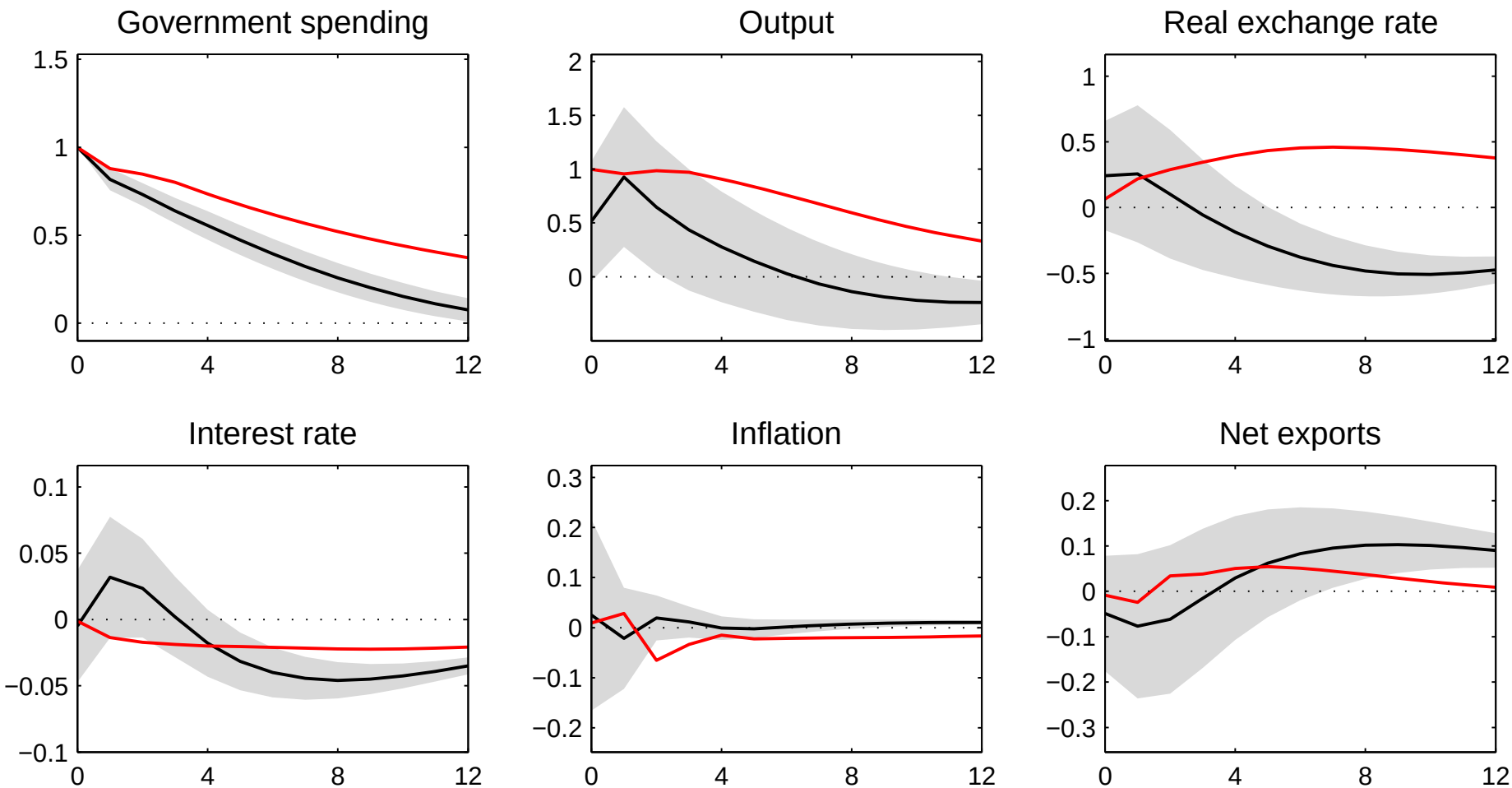




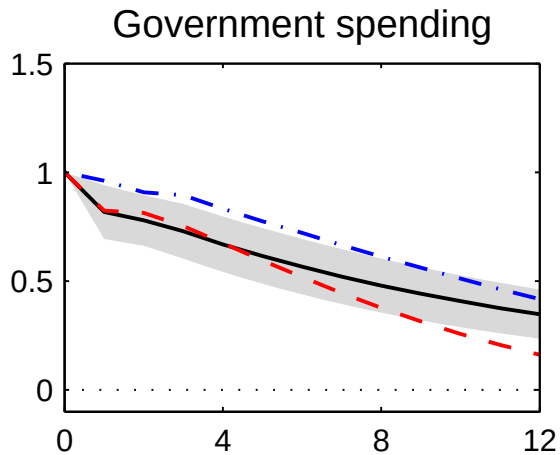


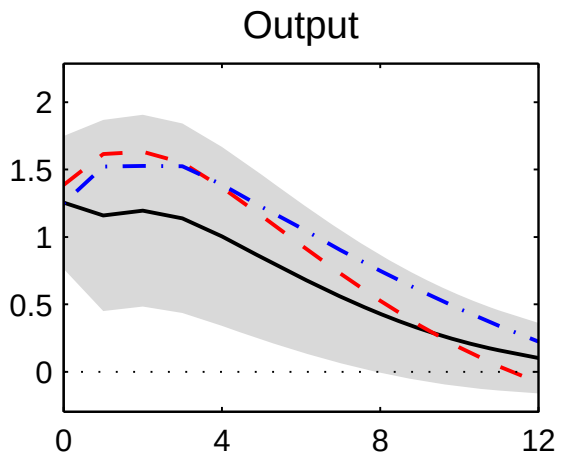


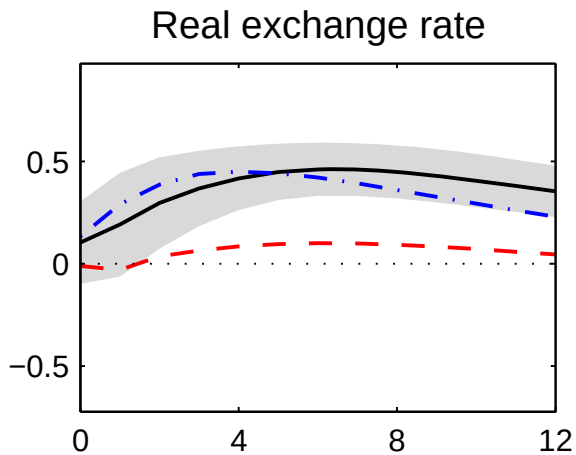
Nominal rate specification: peg vs float

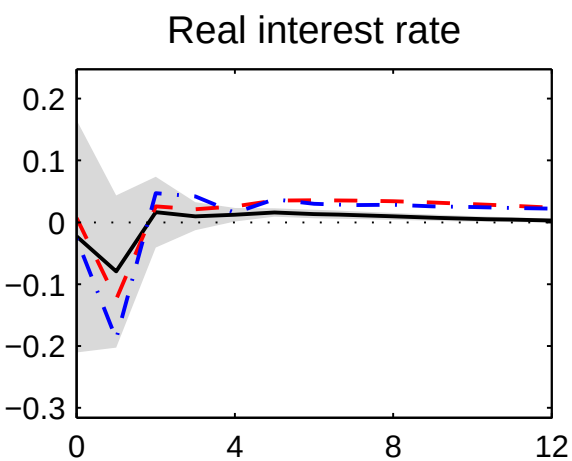


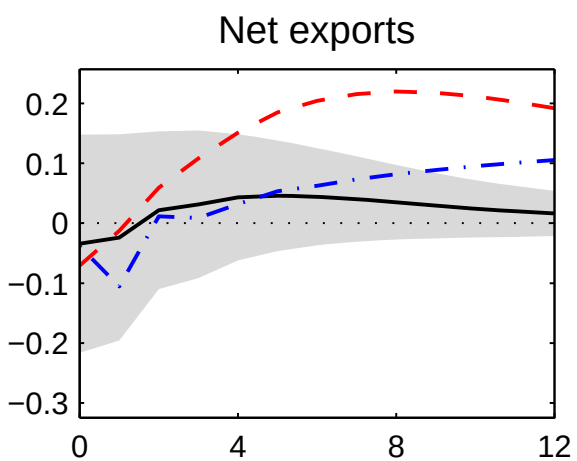
Alternative definition of peg: baseline vs tighter peg and EA countries











3. Small open economy model

New Keynesian economy (akin to Galí/Monacelli 2005)

- Imperfectly competitive firms produce country-specific varieties
- Pricing in producer currency, infrequent price adjustment
- Fraction of households (λ) without access to asset market (similar to Galí/López-Salido/Vallés 2007)

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Policies

- Exogenous government spending financed by debt and lump-sum taxes
- Monetary policy sets short-term interest rate to stabilize inflation or to fix exchange rate

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Small open economy: fiscal policy does not affect "rest of the world" or "rest of monetary union"

Final goods and price indices

$$C_t = \left[\begin{array}{c} (1-\omega)^{\frac{1}{\sigma}} \left(\left[\int_0^1 Y_{H,t}(j)^{\frac{\epsilon-1}{\epsilon}} dj \right]^{\frac{\epsilon}{\epsilon-1}} \right)^{\frac{\sigma-1}{\sigma}} \\ +\omega^{\frac{1}{\sigma}} \left(\left[\int_0^1 Y_{F,t}(j)^{\frac{\epsilon-1}{\epsilon}} dj \right]^{\frac{\epsilon}{\epsilon-1}} \right)^{\frac{\sigma-1}{\sigma}} \end{array} \right]^{\frac{\sigma}{\sigma-1}}$$

Price indices

$$P_t = \left[(1-\omega) P_{H,t}^{1-\sigma} + \omega P_{F,t}^{1-\sigma} \right]^{\frac{1}{1-\sigma}}$$

$$P_{H,t} = \left(\int_0^1 P_{H,t}(j)^{1-\epsilon} di \right)^{\frac{1}{1-\epsilon}} \qquad P_{F,t} = \left(\int_0^1 P_{F,t}(j)^{1-\epsilon} di \right)^{\frac{1}{1-\epsilon}}$$

Real exchange rate

$$Q_t = \frac{P_t \mathrm{E}_t}{P_t^*}$$

Firm's problem

If allowed, adjust $P_{H,t}(j)$ so as to

$$\max E_t \sum_{k=0}^{\infty} \xi^k \Lambda_{t,t+k} Y_{t,t+k}(j) \left(P_{H,t}(j) - \Omega_{t,t+k}\right)$$

Subject to demand function

$$\begin{aligned} Y_{t,t+k}(j) &= \left(\frac{P_{H,t}(j)}{P_{H,t+k}}\right)^{-\epsilon} Y_{t+k} \\ Y_t &= (1-\omega)\left(\frac{P_{H,t}}{P_t}\right)^{-\sigma} C_t + \omega\left(\frac{P_{H,t}}{P_t^*}\right)^{-\sigma} C_t^* + G_t \end{aligned}$$

And production function: $Y_t(j) = H_t(j)$

Household problem

Asset holders ($1-\lambda$-fraction of population) solve

$$\max E_t \sum_{k=0}^{\infty} \beta^k \left(\frac{C_{A,t+k}^{1-\gamma}}{1-\gamma} - \frac{H_{A,t+k}^{1+\varphi}}{1+\varphi} \right)$$

subject to

$$E_t \left\{ \rho_{t,t+1} \Xi_{t+1} \right\} - \Xi_t + P_t C_{A,t} = W_t N_{A,t} - T_t + \Upsilon_t$$

Non-asset holders (λ-fraction of population)

$$\max \left[\frac{C_{N,t}^{1-\gamma}}{1-\gamma} - \frac{H_{N,t}^{1+\varphi}}{1+\varphi} \right] \quad \text{s.t. } P_t C_{N,t} = W_t H_{N,t} - T_t$$

Fiscal policy

- Government consumption determined exogenously

$$G_t = (1-\rho)G + \rho G_{t-1} + \varepsilon_t$$

- Government budget constraint and tax rule:

$$R_t^{-1} D_{t+1} = D_t + P_{H,t} G_t - T_t, \quad T_t = \psi D_t$$

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Monetary policy

- Floating exchange rate

$$\log(R_t) = \log(R) + \phi_\pi (\Pi_{H,t} - \Pi_H)$$

- Fixed exchange rate

$$\log(R_t) = \log(R_t^*) + \phi_E \log(E_t / E), \text{ with } \phi_E > 0$$

Model simulation

Focus on log-linear approximation of equilibrium (around zero-inflation, zero-debt steady state)

- Analytical solutions for floating exchange rate and $\lambda = 0$
- Focus on numerical solution

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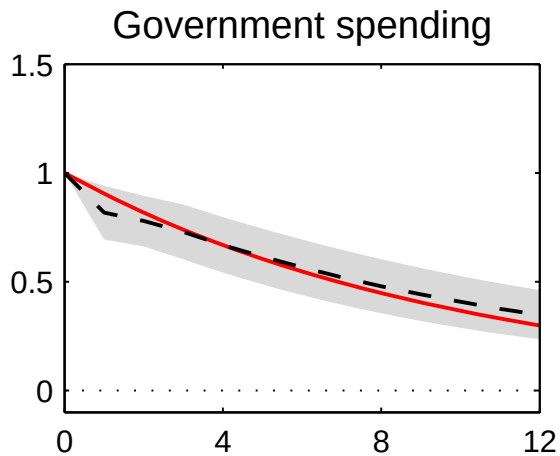
Calibration strategy

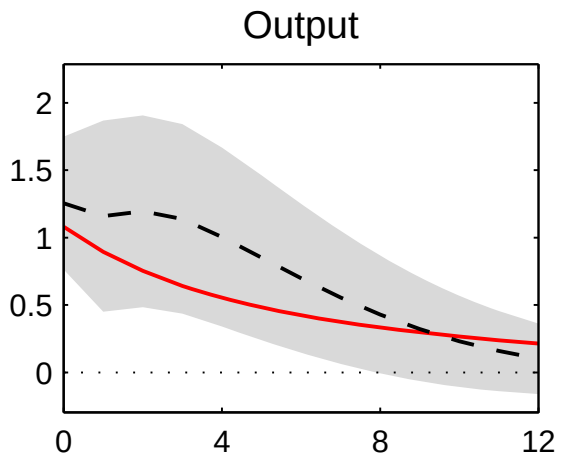
- Assign parameter values while matching impulse response functions (first 3.5 years after shock) **under peg**
- Assess model performance (informally) considering impulse responses **under float**

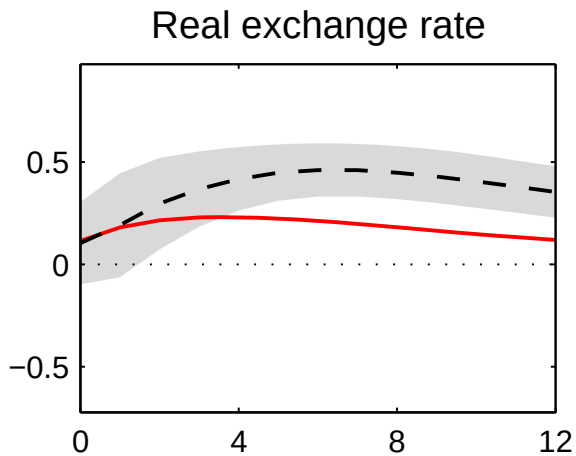
Model parameters

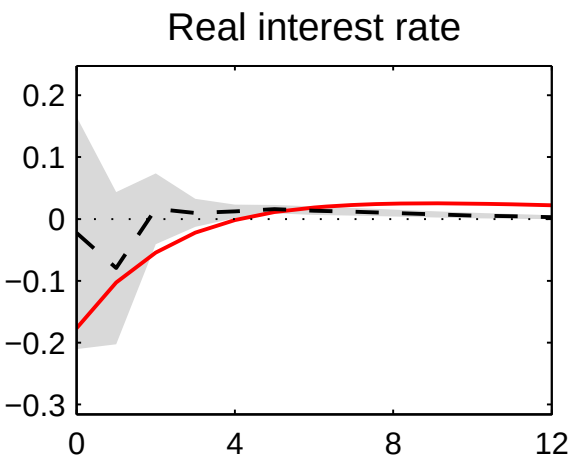
Pre-set values		
Discount factor (steady state)		$\beta = 0.98$
Risk aversion		$\gamma = 1$
Import share		$\omega = .35$
Government-consumption share (steady state)		$G/Y = 0.2$
Taylor-rule coefficient (float)		$\phi_\pi = 1.5$
Tax-rule coefficient		$\psi = 0.021$
Obtained by matching spending response		
Persistence spending peg	$\rho = 0.90$	(0.02)
Persistence spending float	$\rho = 0.84$	(0.03)
Matching IRF under peg		
Fraction of prices kept unchanged	$\xi = 0.75$	(0.05)
Trade-price elasticity	$\sigma = 0.45$	(0.40)
Constrained households	$\lambda = 0.32$	(0.39)
Inverse Frisch elasticity	$\varphi = 0.62$	(0.56)

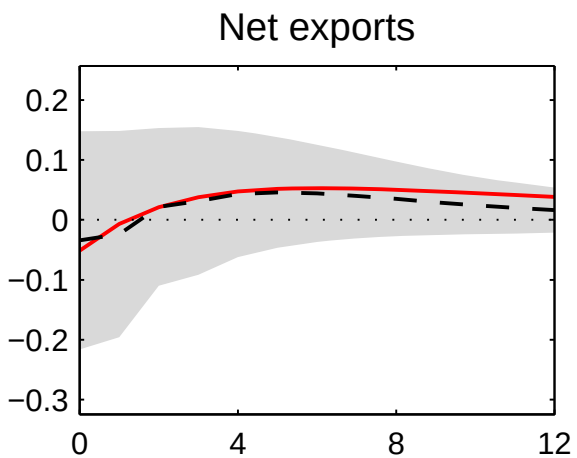
Effects of spending shock under peg: model vs VAR



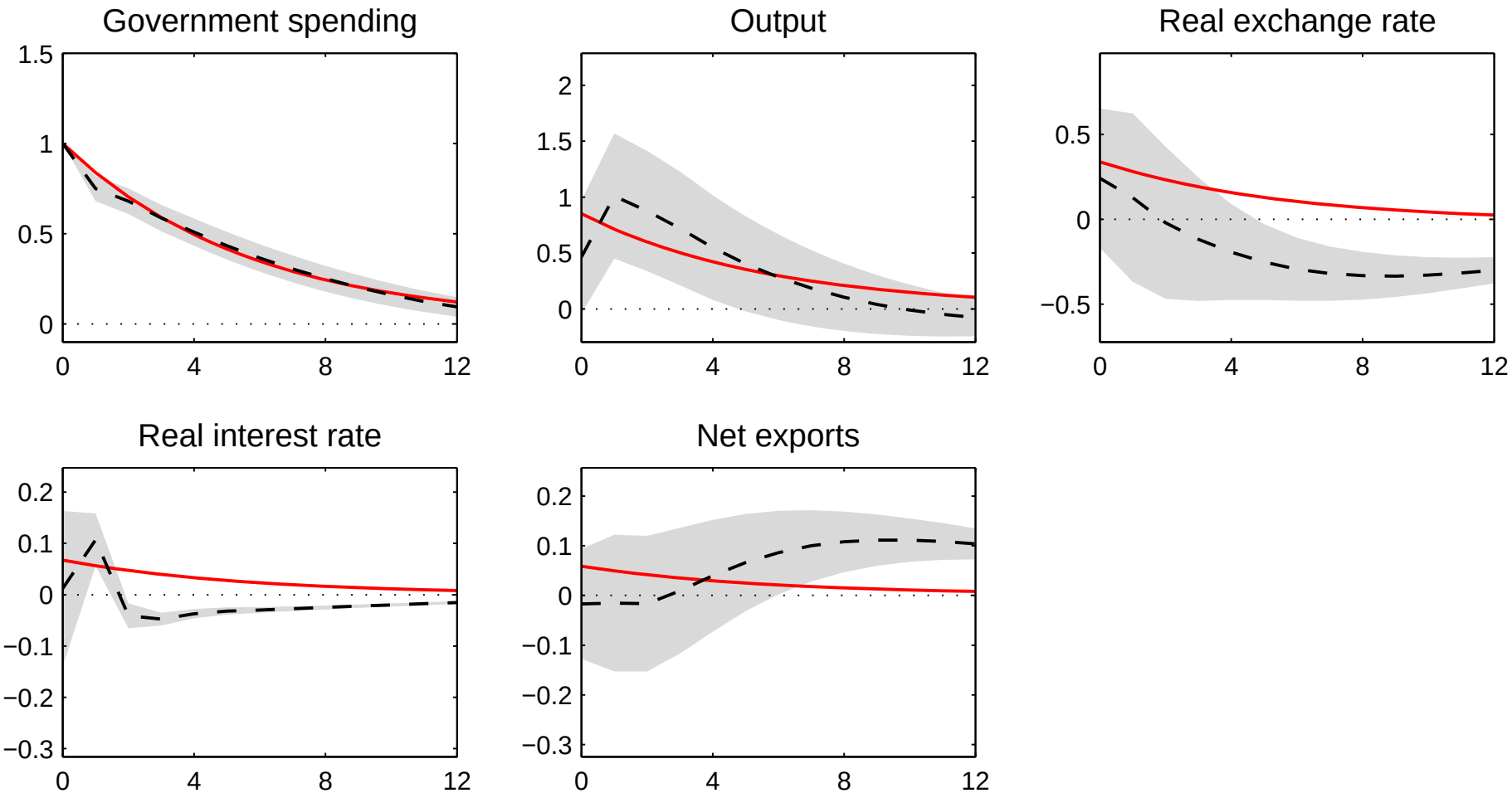








Effects of spending shock under float: model vs VAR



Given empirical success, use model to address the following questions

Why is the multiplier fairly small under peg?

- Intertemporal optimization implies declining expenditure of asset holders: PPP ensures that long-term rate rises with inflation

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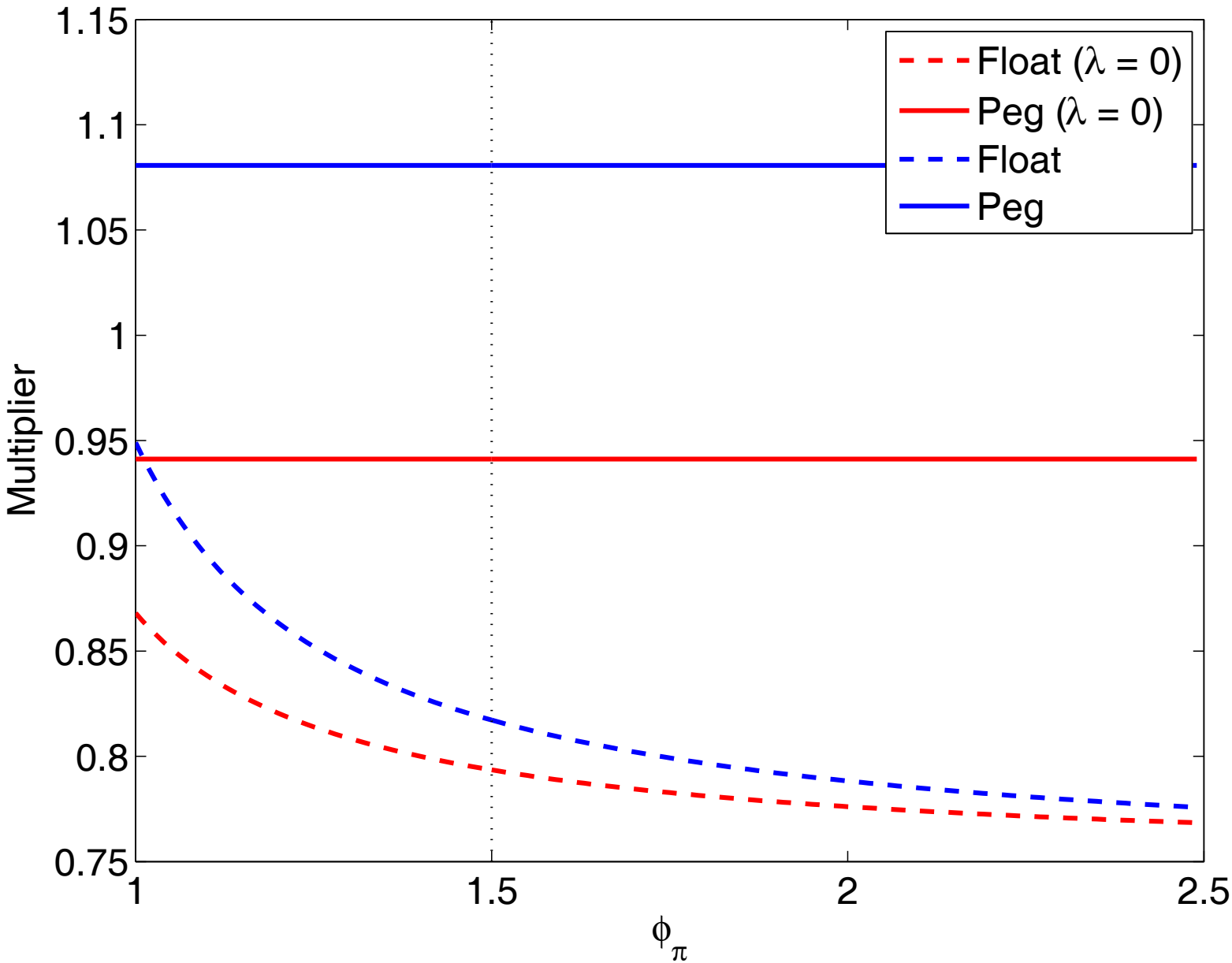
Why is there no crowding out of net exports?

- Trade price elasticity is low

Multiplier: the role of λ and ϕ_π



5. Conclusions

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Variant of NK-model in line with VAR evidence

- Monetary policy accommodative under float
- Multiplier exceeds unity under peg only if $\lambda > 0$

Fiscal policy in (the European) monetary union

Potentially important stabilization tool

- Evidence for cross-country spillovers (Beetsma/Guiliodri/Klaasen 2006)

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- Multiplier considerably smaller in the presence of sovereign risk (Corsetti/Kuester/Meier/Müller 2012)
- Not self defeating (assuming plausible output-elasticity of government budget)