

# What determines government spending multipliers?

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- ▶ Exchange rate regime

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- ▶ Exchange rate regime
- ▶ State of public finances

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- ▶ Exchange rate regime
- ▶ State of public finances
- ▶ State of banking system

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Need flexible econometric approach to accommodate variations

# Our approach

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- ▶ Estimate systematic behavior of government spending (goods and services) and identify exogenous innovations, ie, policy shocks
- ▶ Estimate effect of policy shocks controlling for economic environments on the basis of a dummy variable approach

# Results on systematic policy

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



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Spending is systematically cut during financial crisis in several countries

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An economy with flexible exchange rates, no fiscal strain, no financial crisis (baseline scenario): virtually no effect on output, consumption, and net exports; investment declines, real depreciation

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If economy experiences financial crisis: output and consumption rise by 2 percentage points for extended period

## Related empirical literature

Our two-step approach similar to Perotti 1999, who finds that government spending crowds out consumption in fiscally bad times



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Barro/Redlick 2009 report a defense spending multiplier of around 0.7 (1) at the median unemployment rate (unemployment rate equal to 12 percent)

Ilzetzki/Mendoza/Vegh 2009 consider 45 countries, estimate panel VARs distinguishing income level, size of foreign debt, exchange rate regime, and openness: fiscal policy does not stimulate output under floating exchange rate and in very open economies, but under peg and in relatively closed economies

# Plan

Theoretical considerations

Empirical strategy

Data

Results

Conclusions

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



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Within given class of models, predictions depend a lot on economic environment...

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New Keynesian model: effect of exchange rate regime on multipliers less clear cut, as monetary policy may be quite accommodative under float

# State of public finances

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co-movement of government spending and consumption depends on  
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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

# Banking/financial crisis

Fraction of rule-of-thumb agents raises multiplier  
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Zero lower bound (Christiano/Eichenbaum/Rebelo 2009, Erceg/Lindé 2010)

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Use two step strategy instead

## First step: fiscal rule

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

$g_{i,t}$ : 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

$$\begin{aligned}x_{t,i} &= \alpha_i + \mu_i \text{trend}_t + \chi x_{t-1,i} \\ &+ \sigma_1 \hat{\varepsilon}_{t,i} + \sigma_2 \hat{\varepsilon}_{t-1,i} + \sigma_3 \hat{\varepsilon}_{t-2,i} + \sigma_4 \hat{\varepsilon}_{t-3,i} \\ &+ \kappa_1 (\hat{\varepsilon}_{t,i} d_{t,i}) + \kappa_2 (\hat{\varepsilon}_{t-1,i} d_{t-1,i}) + \kappa_3 (\hat{\varepsilon}_{t-2,i} d_{t-2,i}) + \kappa_4 (\hat{\varepsilon}_{t-3,i} d_{t-3,i}) \\ &+ \lambda_1 d_{t,i} + \lambda_2 d_{t-1,i} + \lambda_3 d_{t-2,i} + \lambda_4 d_{t-3,i} + u_{t,i}\end{aligned}$$

$x_{t,i}$ : macroeconomic variable of interest

$d_{t,i}$ : 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 subtracting 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

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 for first step: estimated rules

	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
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

# 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	Five largest negative and positive shocks:	
Mean	0,04	Portugal, 1993	-3,57
		Netherlands, 1984	-3,33
Median	0,00	Netherland, 2005	-3,18
		Norway, 1988	-2,97
Standard deviation	1,02	Spain, 1988	-2,67
		Portugal, 1991	2,60
Minimum	-3,57	Portugal, 2005	2,68
		Denmark, 1993	2,85
Maximum	5,16	Ireland, 1986	3,83
		Netherlands, 2006	5,16
Correlation with simple growth rate of government spending	0,64		

## Results for second step

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

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

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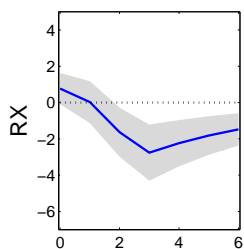
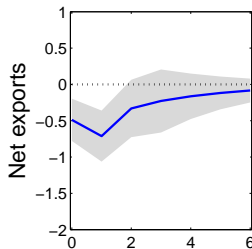
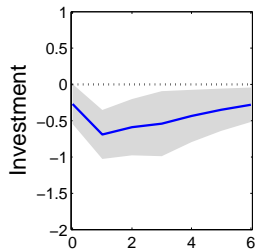
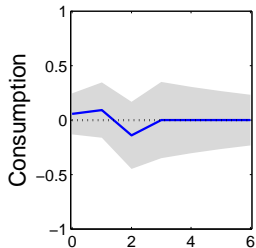
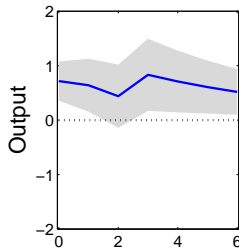
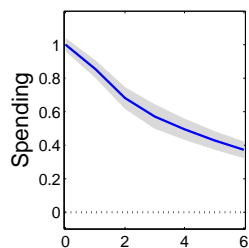
Simulate impulse response functions on basis of second stage regression for a period of six years after shock

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For comparison with literature: unconditional results (obtained assuming no dummies in first step)

## Results for second step: unconditional



## Results for second step: accounting for variations in economic environment

Baseline scenario: economy with floating exchange rate in good times

## Results for second step: accounting for variations in economic environment

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Contrast results for baseline with departures from baseline

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- ▶ Peg

## Results for second step: accounting for variations in economic environment

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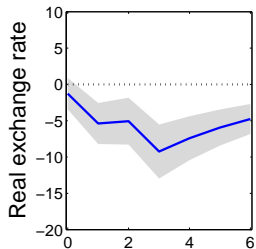
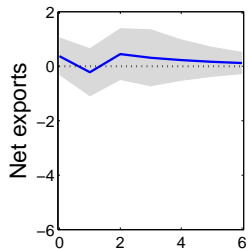
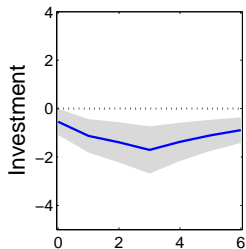
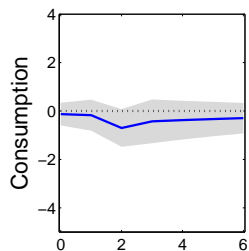
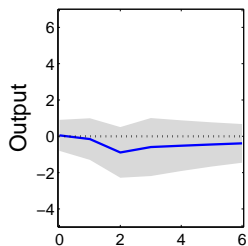
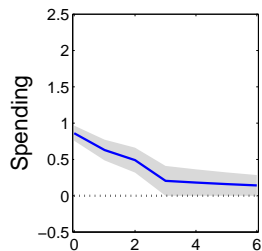
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Contrast results for baseline with departures from baseline

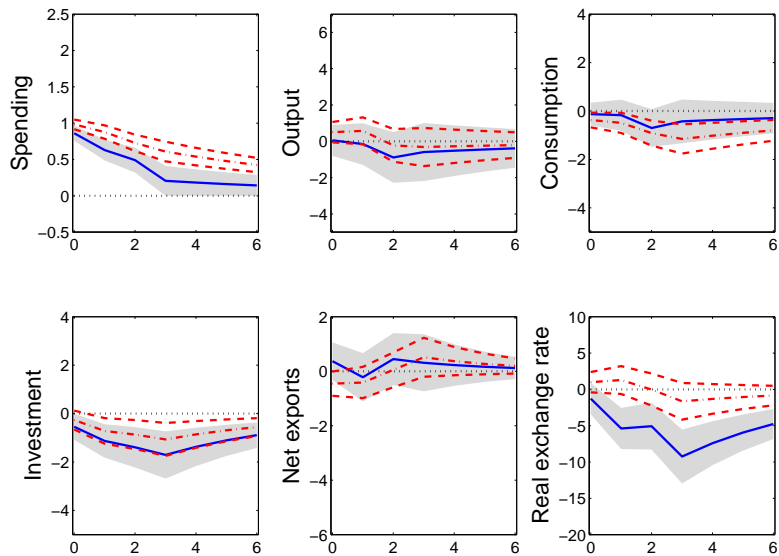
- ▶ Peg
- ▶ Fiscal strain
- ▶ Financial crisis



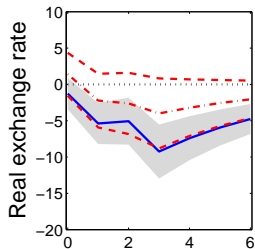
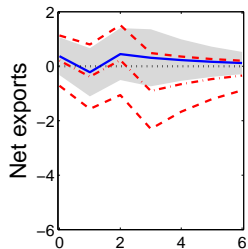
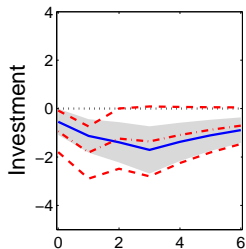
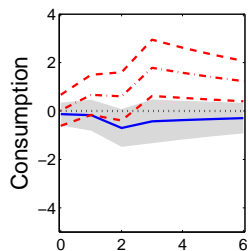
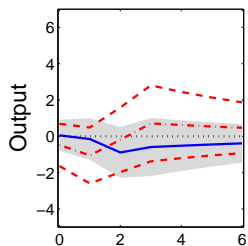
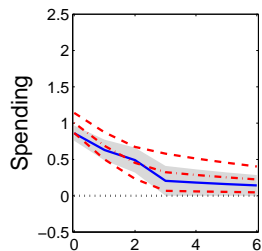
# Baseline scenario



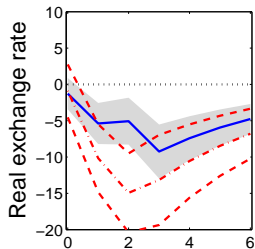
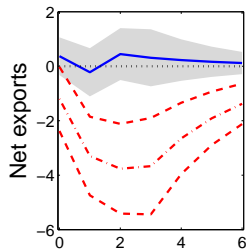
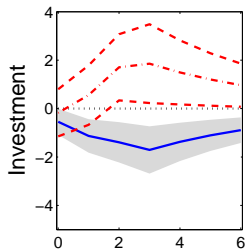
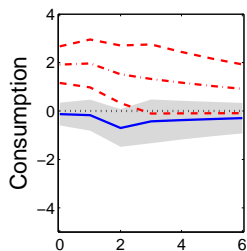
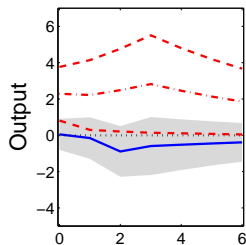
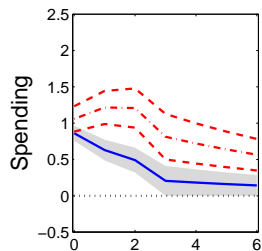
# Baseline scenario vs peg



# Baseline scenario vs **fiscal strain**



# Baseline scenario vs financial crisis



# Sensitivity analysis I: definition of dummy variables

Financial crisis

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## Financial crisis

- ▶ Narrow definition: big 5 and current

# Sensitivity analysis I: definition of dummy variables

## Financial crisis

- ▶ Narrow definition: big 5 and current
- ▶ Alternative definition for US following López-Salido/Nelson 2010

# Sensitivity analysis I: definition of dummy variables

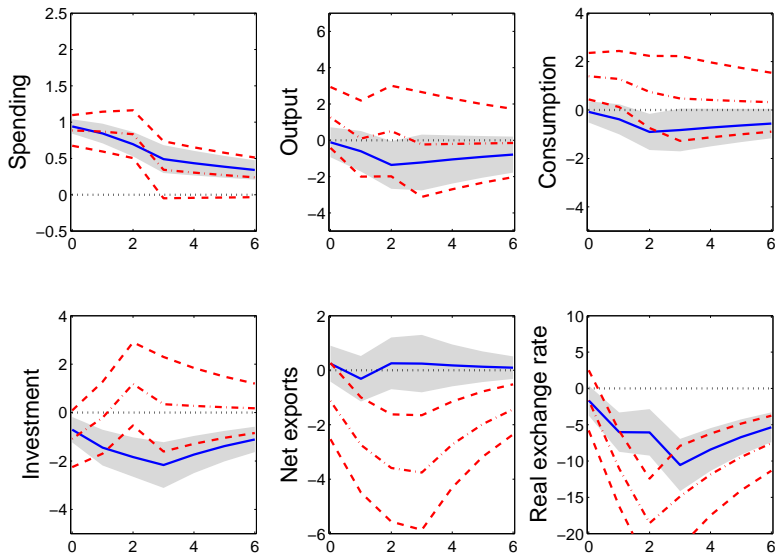
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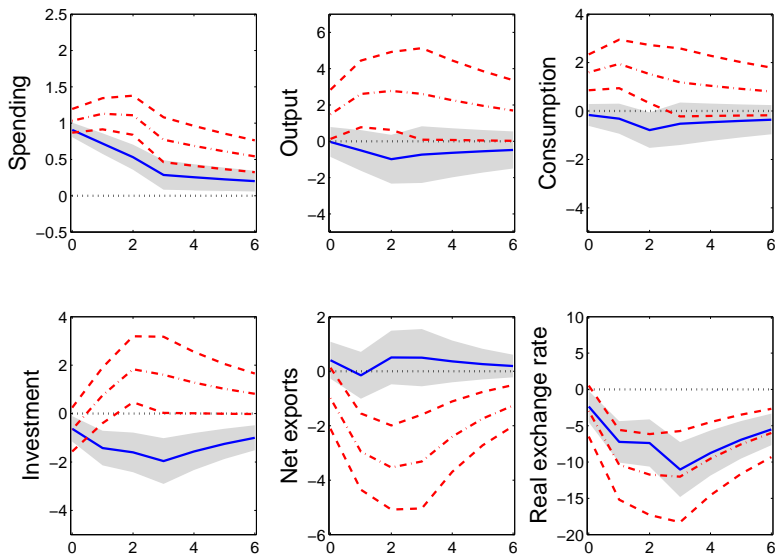
Narrow definitions of fiscal stress: lagged debt  $> 120$  percent or deficit  $> 7$  percent



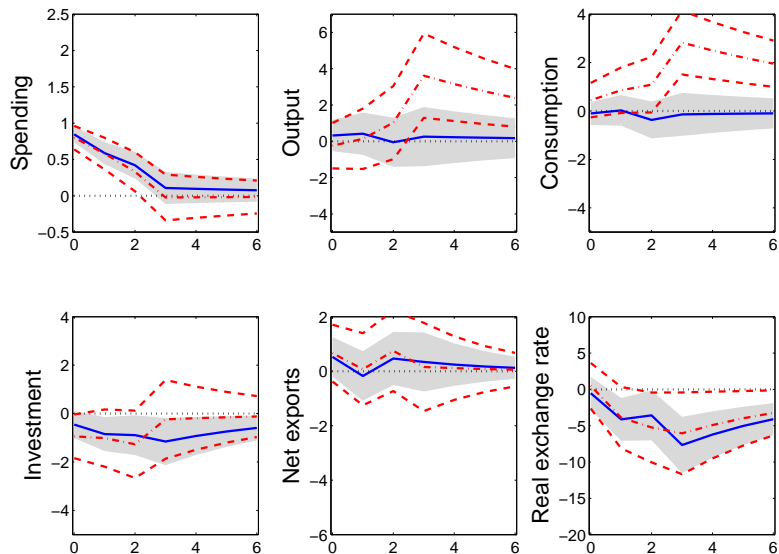
# Baseline vs financial crisis (narrow definition)



# Baseline vs financial crisis (López-Salido/Nelson)



# Baseline vs fiscal strain (narrow definition)



# Sensitivity analysis II: specification of first step

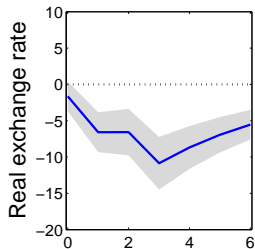
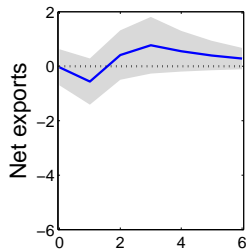
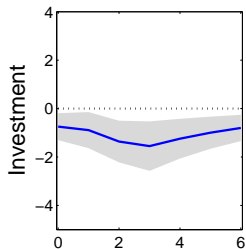
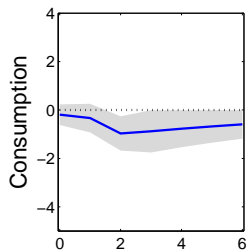
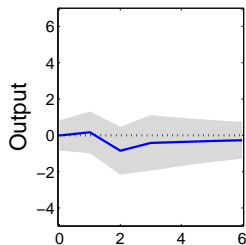
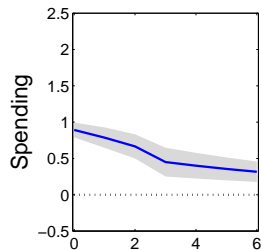
Contemporaneous value of crisis dummy in first step

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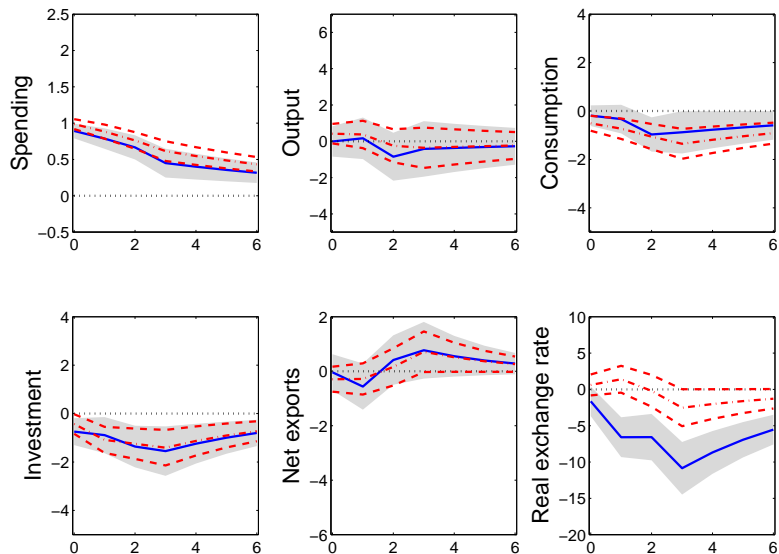
Contemporaneous value of crisis dummy in first step

Specification of both steps in growth rates rather than levels

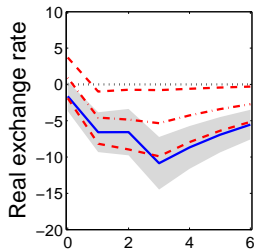
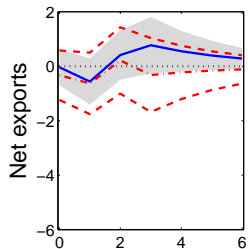
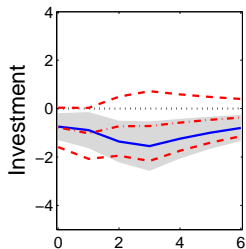
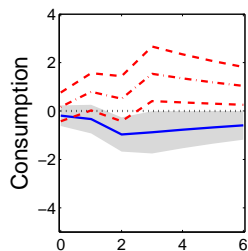
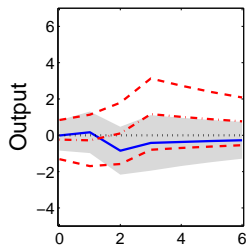
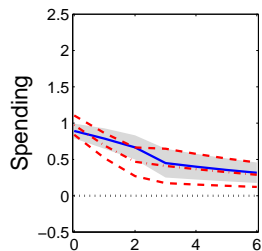
# Baseline scenario



# Baseline scenario vs peg

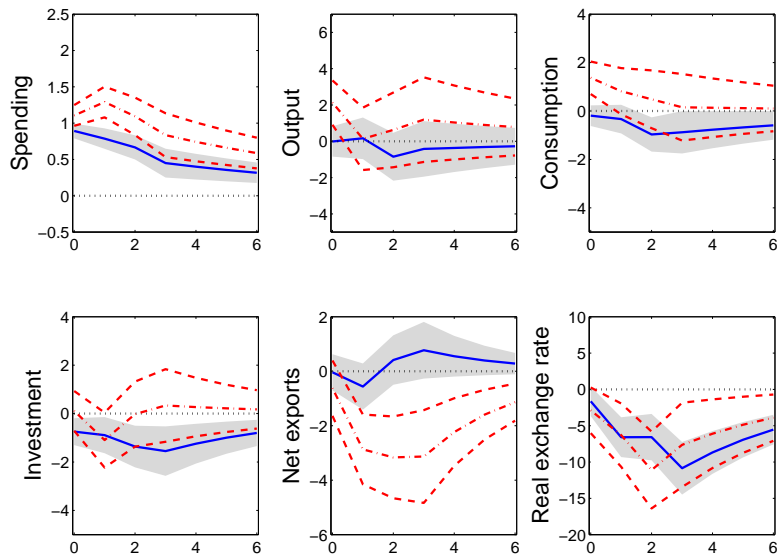


# Baseline scenario vs **fiscal strain**

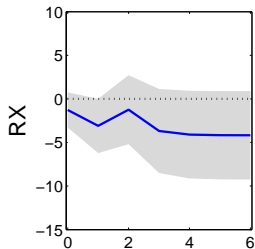
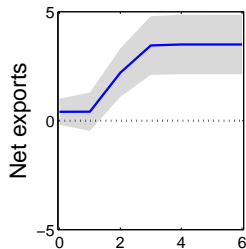
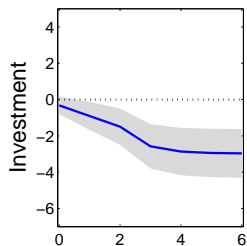
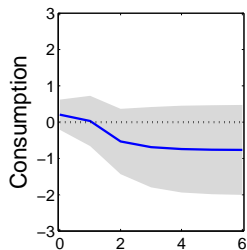
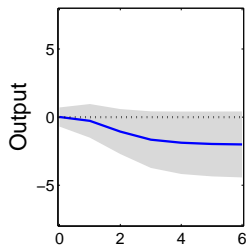
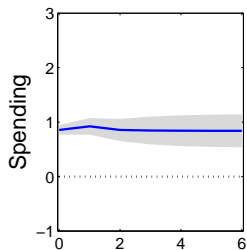




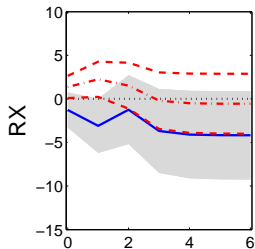
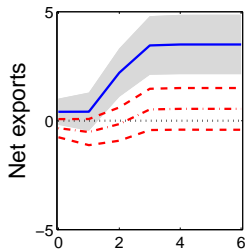
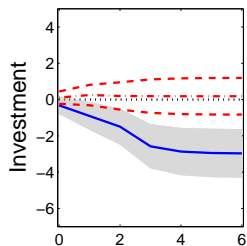
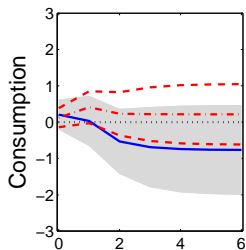
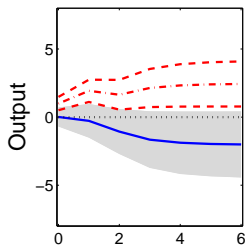
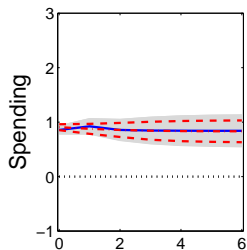
# Baseline scenario vs financial crisis



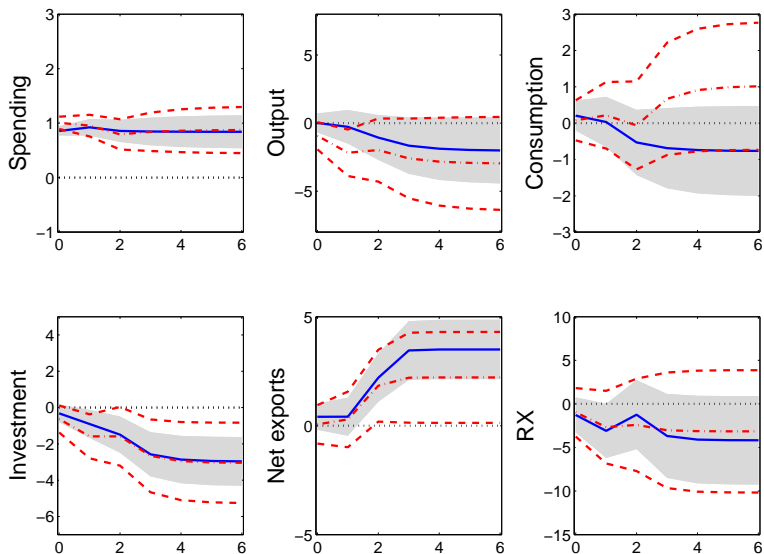
# Growth rates: baseline scenario



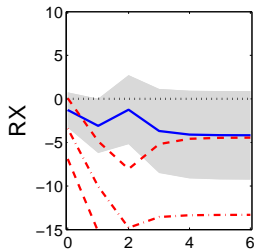
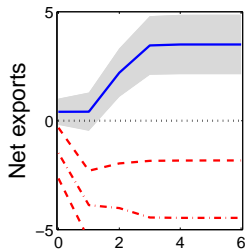
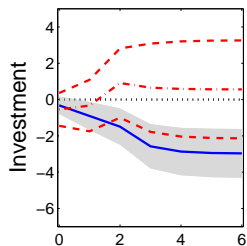
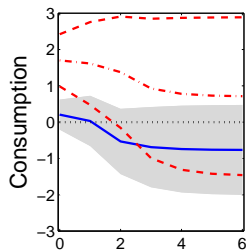
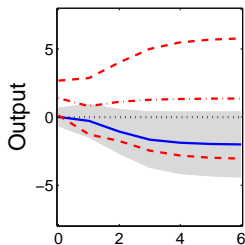
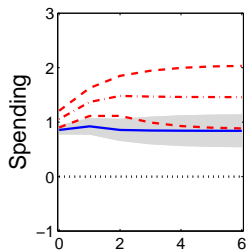
# Growth rates: baseline scenario vs peg



# Growth rates: baseline scenario vs **fiscal strain**



# Growth rates: baseline scenario vs financial crisis



# Conclusions

Effects of government spending vary across countries and time

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Fiscal and monetary interaction crucial for adjustment to fiscal shocks



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Multipliers sizeable at times of financial crisis

# A remark on identification

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

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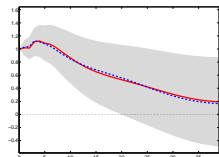
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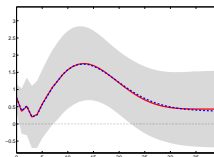
- ▶ Compare impulse responses of unrestricted model to those of model restricted so that spending does not response systematically to economy within the year (restriction not rejected by the data)
- ▶ Compare annualized response of unrestricted model to those obtained for VAR model estimated on annual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

# Results for quarterly and annual US data 1954–2007

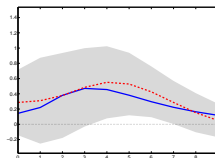
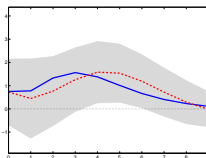
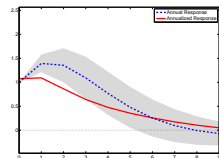
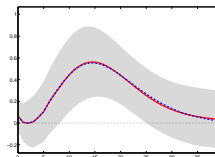
## Government Spending



## Output



## Consumption



# Results of Corsetti/Meier/Müller 2009

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

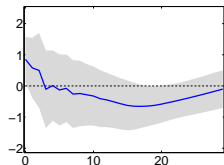
Seven variables: government spending, output, private consumption, long-term real interest rate, real exchange rate, inflation, public debt

## Identification

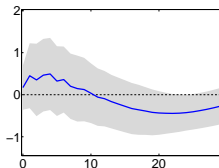
- ▶ Blanchard-Perotti: government spending predetermined
- ▶ Ramey: compute spending news survey of professional forecasters

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

Output



Consumption



REER

