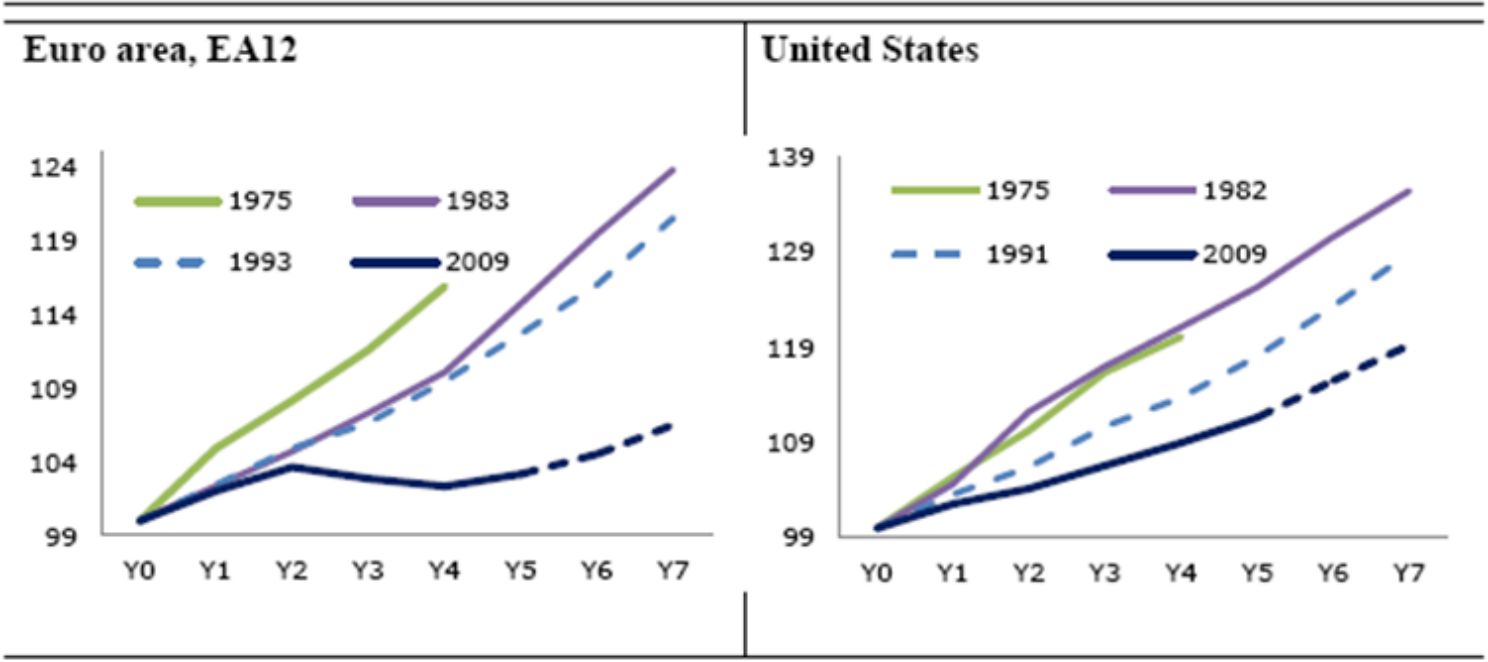
The Post-Crisis Slump in the Euro Area and the US: Evidence from an Estimated Three Region DSGE Model

Robert Kollmann (ECARES-ULB and CEPR)
Beatrice Pataracchia (European Commission, Joint Research Centre)
Rafal Raciborski (European Commission, DG ECFIN)
Marco Ratto (European Commission, Joint Research Centre)
Werner Roeger (European Commission, DG ECFIN)
Lukas Vogel (European Commission, DG ECFIN)

Recoveries after major recessions, real GDP (Y0=100)



Note: Y0 marks the year of the cyclical trough as measured by ECFIN's output gap estimate. For the recovery after 2009, Y6 and Y7 are based on the Winter Forecast. EA 12 comprises of BE, DE, IE, EL, ES, FR, IT, LU, NL, AT, PT, FI.

Source: Priftis, Roeger & in't Veld (2015)

Different views about sources of long slump

- Restrictive fiscal policy ('austerity'): see, e.g., International Monetary Fund (2012), De Grauwe (2014) and Stiglitz (2015).
- Household deleveraging: e.g., Rogoff (2015)
- Financial constraints for investors:
  - Mostly seen as EA problem, more rapid and aggressive non-conventional central bank policy the US.
  - EA banks rebuilt their capital much more gradually than US banks, after the crisis (OECD (2014)).
  - EA bank balance sheets weakened by sovereign debt crisis (Acharya et al. (2014), Kalemli-Özcan et al. (2015)).
- Rigidities in product and labor markets:
  - Slowing down sectoral redeployment and the adoption of new technologies (e.g., Fernald (2015)).

The contribution of this paper

- Quantify the importance of alternative hypotheses using a standard *estimated* DSGE model (1999q1-2014q4).

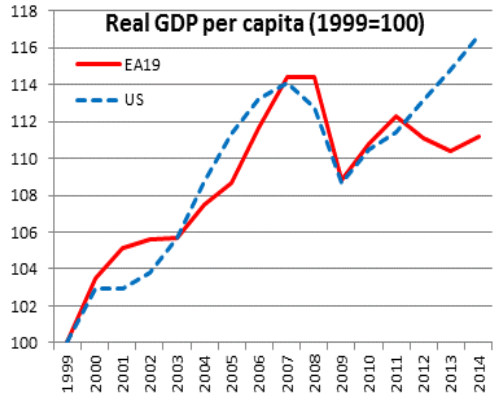
- Explain the post-crisis divergence between the EA and the US (controlling for RoW) => jointly model EA-US-RoW.

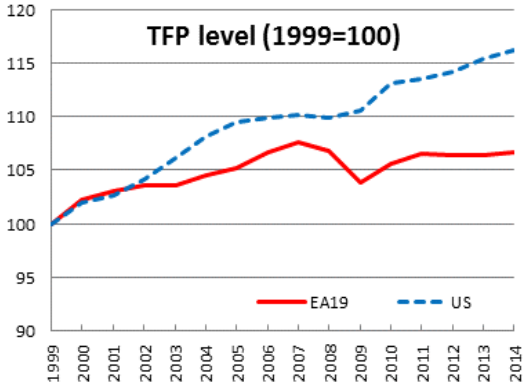
The EA and US have the same structure, but parameters are allowed to differ across the blocks.

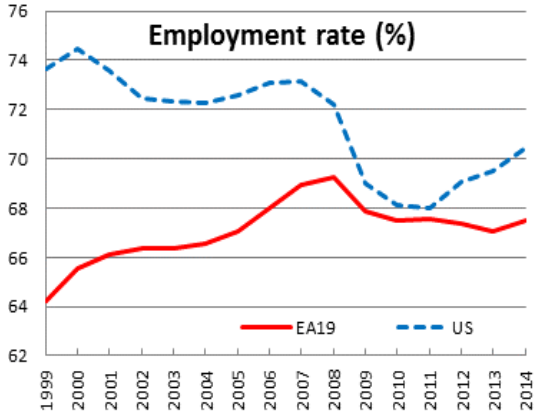
So far, little empirical model-based research on the EA post-crisis slump.

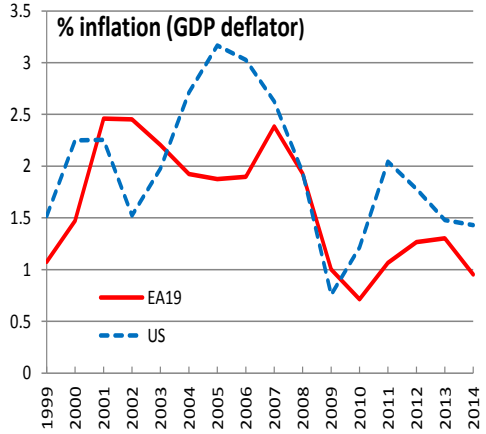
Studies on the post-crisis dynamics in the US, using estimated closed economy DSGE; see Christiano, Eichenbaum and Trabandt (2015) and Del Negro, Giannoni and Schorfeide(2015).

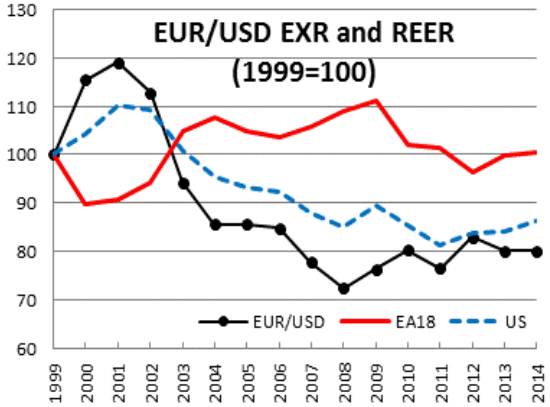
Facts

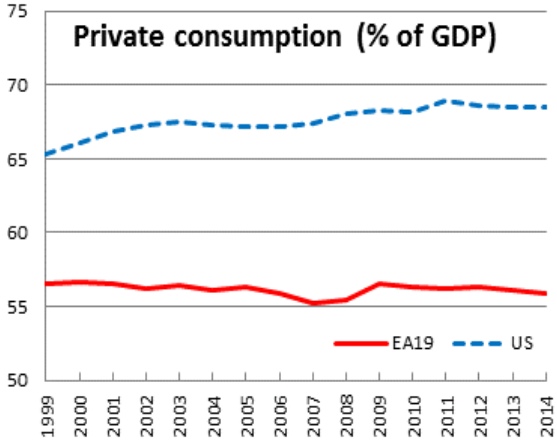

Real GDP per capita (1999=100)
EA19
US

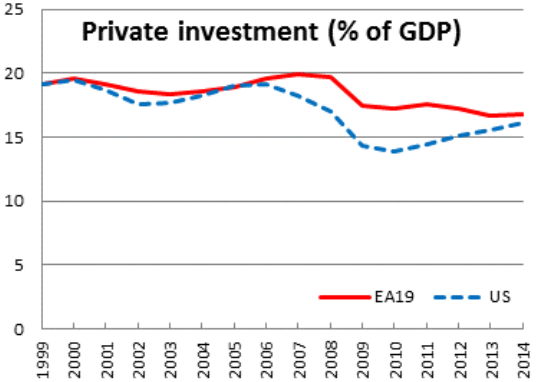

TFP level (1999=100)
EA19
US

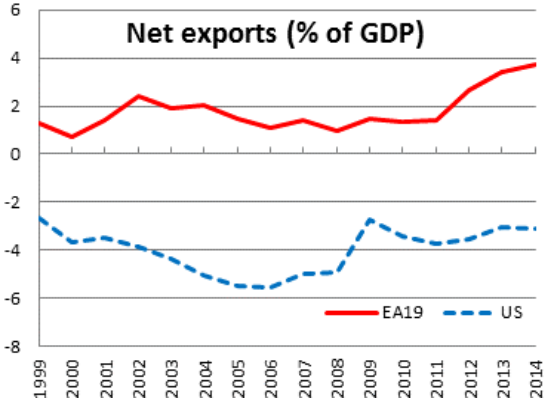

Employment rate (%)
EA19
US


% inflation (GDP deflator)
EA19
US


EUR/USD EXR and REER
(1999=100)
EUR/USD
EA18
US


Private consumption (% of GDP)
EA19
US


Private investment (% of GDP)
EA19
US


Net exports (% of GDP)
EA19
US

Summary

Persistent EA slump reflects a combination of adverse supply *and* demand shocks: negative TFP growth shock and adverse shock to capital investment

We concur with Christiano et al. (2015) that financial shocks were the key driver of the Great Recession in the US.

But EA and US differ:

- US risk premium shock less persistent
- Stronger savings response in US
- Persistent TFP decline in EA
- 2009: pro-cyclical mark up in EA vs. counter-cyclical mark up in US
- Differences in wage and price adjustment=>wage share responds differently

Like Fratto and Uhlig (2015) and Lindé et al. (2015) we find that the zero-lower-bound (ZLB) was not a significant constraint for US and EA monetary policy during the Great Recession. However, the ZLB binds for EA at the end of the sample.

Model description

- The EA and US blocks assume constrained and unconstrained households, firms and a government. EA and US households provide labor services to firms.

- There is a monopolistically competitive sector producing differentiated goods in the EA and the US that uses domestic labor and capital.
- Total Output in EA and US is produced by combining the domestic differentiated goods bundle with energy input.

- Sticky nominal intermediate good prices and wages.
- EA and US wages are set by monopolistic trade unions.

- Governments levy distortionary taxes and issue debt. Public expenditure responds to government balance.
- Monetary policy with Taylor rule.

- Domestic and foreign goods are imperfect substitutes.
- Nearly perfect international capital mobility across countries (up to a risk premium which depends on the net foreign asset position of the country), plus a stochastic exchange risk premium.

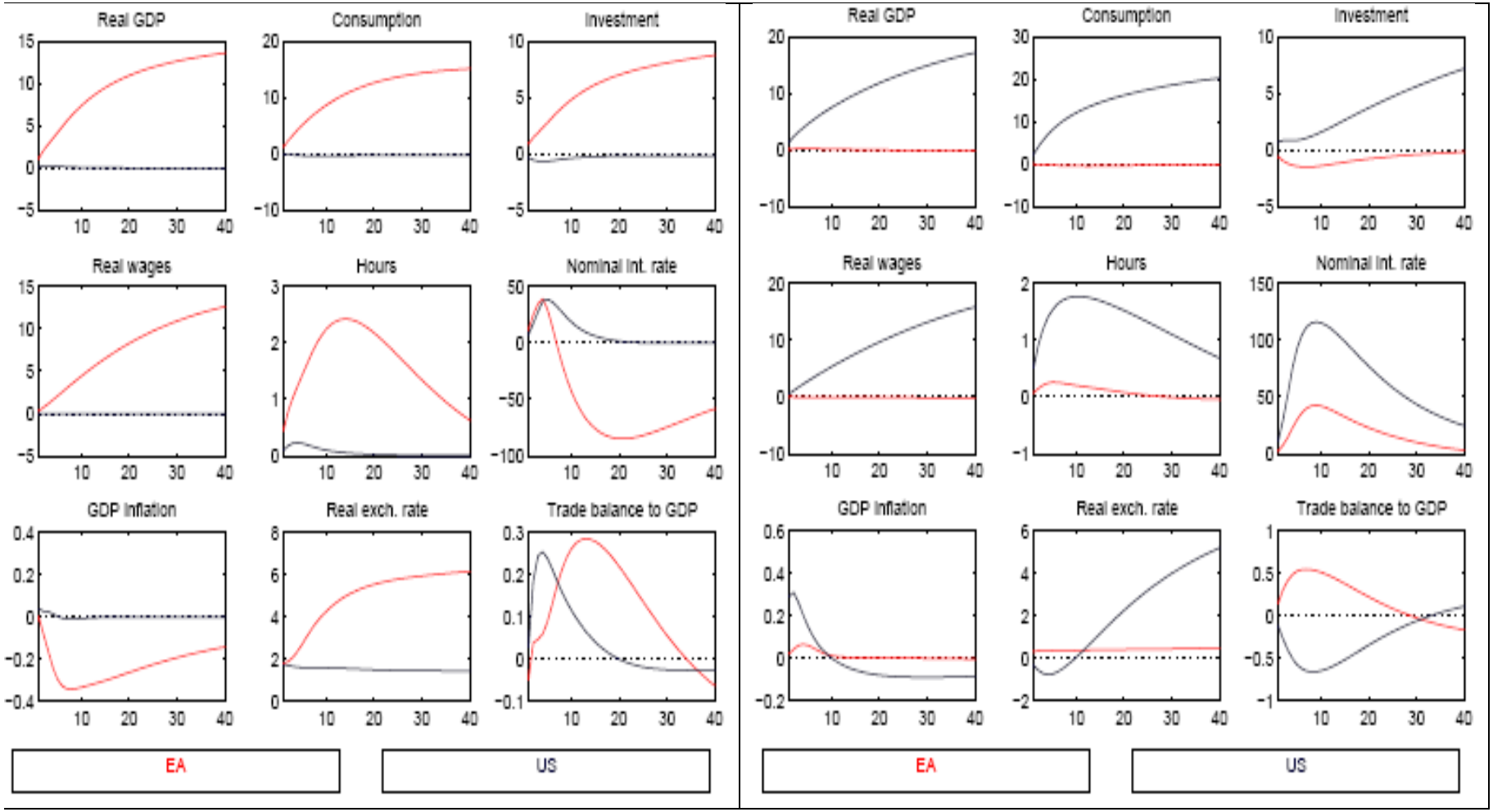
Table 1. Prior and posterior distributions of key estimated model parameters

		Posteriors				Priors		
		EA		US				
		Mode (1)	Std (2)	Mode (3)	Std (4)	Distribution (5)	Mean (6)	Std (7)
Preferences								
Consumption habit	η_C	0.89	0.03	0.85	0.03	Beta	0.5	0.2
Labour habit	η_L	0.39	0.22	0.86	0.08	Beta	0.5	0.2
Risk aversion	σ	1.41	0.17	1.39	0.17	Gamma	1.5	0.2
Labor supply	κ	2.31	0.45	2.14	0.41	Gamma	2.5	0.5
Import price elasticity	ν	4.11	0.43	4.26	0.45	Gamma	2	1
Import source elasticity	ν_1	0.60	0.22	0.16	0.07	Gamma	2	1
Oil demand elasticity	ν_O	0.33	0.02	0.33	0.03	Beta	0.5	0.08
Nominal and real frictions								
NLC household share	s^r	0.66	0.05	0.75	0.02	Beta	0.65	0.05
Price adj. cost	γ_P	28.6	6.64	62.2	14.8	Gamma	60	40
Forward-looking prices	sfp	0.54	0.04	0.77	0.05	Beta	0.5	0.1
Import price rigidity	ρ_{PM}	0.24	0.10	0.19	0.10	Beta	2	0.8
Nominal wage adj. cost	γ_W	4.84	1.33	2.94	0.83	Gamma	5	2
Forward-looking wages	sfw	0.52	0.10	0.51	0.11	Beta	0.5	0.1
Real wage rigidity	ρ_w	0.96	0.01	0.96	0.01	Beta	0.5	0.2
Import demand inertia	ρ_M	0.33	0.06	0.45	0.05	Beta	0.7	0.1
Oil demand inertia	ρ_O	0.26	0.08	0.19	0.05	Beta	0.7	0.1
Labour adj. cost	γ_L	4.69	1.01	12.1	3.60	Gamma	60	40
Capital adj. cost	γ_K	41.8	22.6	51.9	22.2	Gamma	60	40
Investment adj. cost	γ_I	91.2	31.5	49.2	21.3	Gamma	60	40
Capacity util. adj. cost	γ_{UC}	0.04	0.02	0.07	0.02	Gamma	0.1	0.04
Monetary policy								
Interest persistence	ρ_R	0.87	0.02	0.85	0.03	Beta	0.7	0.12
Response to inflation	$\tau_{R,\pi}$	2.37	0.37	2.09	0.31	Beta	2	0.4
Response to GDP	$\tau_{R,y}$	0.02	0.01	0.02	0.00	Beta	0.5	0.2
Fiscal policy								
Transfer persistence	ρ_T	0.97	0.01	0.97	0.01	Beta	0.7	0.1
Response to deficit	$\tau_{T,d}$	0.01	0.00	0.01	0.00	Beta	0.03	0.008
Response to debt	$\tau_{T,b}$	0.00	0.00	0.00	0.00	Beta	0.001	0.001
Consumption persistence	ρ_{GC}	0.95	0.01	0.95	0.02	Beta	0.7	0.1
Investment persistence	ρ_{IG}	0.83	0.05	0.92	0.02	Beta	0.7	0.1

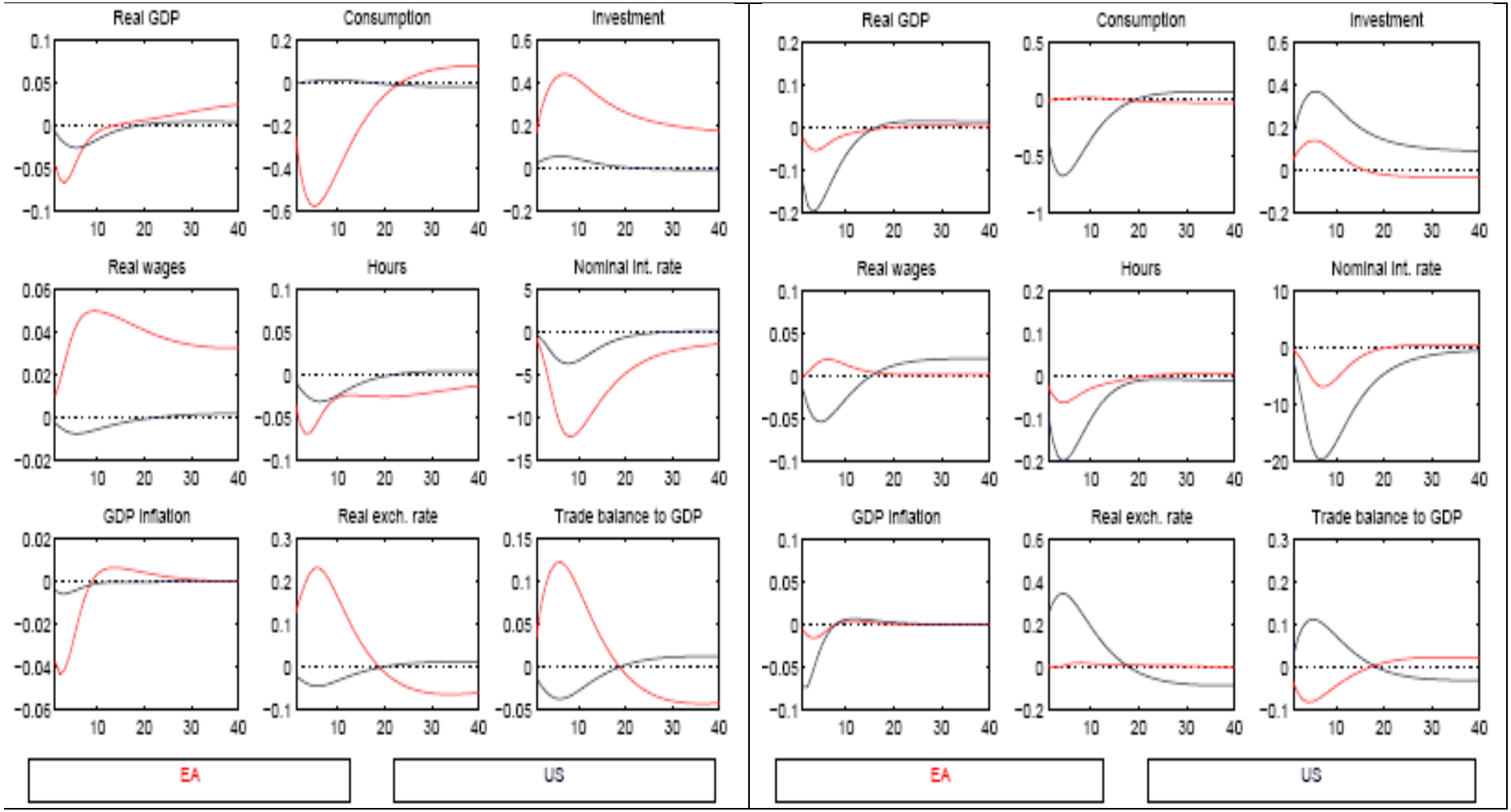
Dynamic effects of shocks: IRFs

Which facts can individual shocks explain?

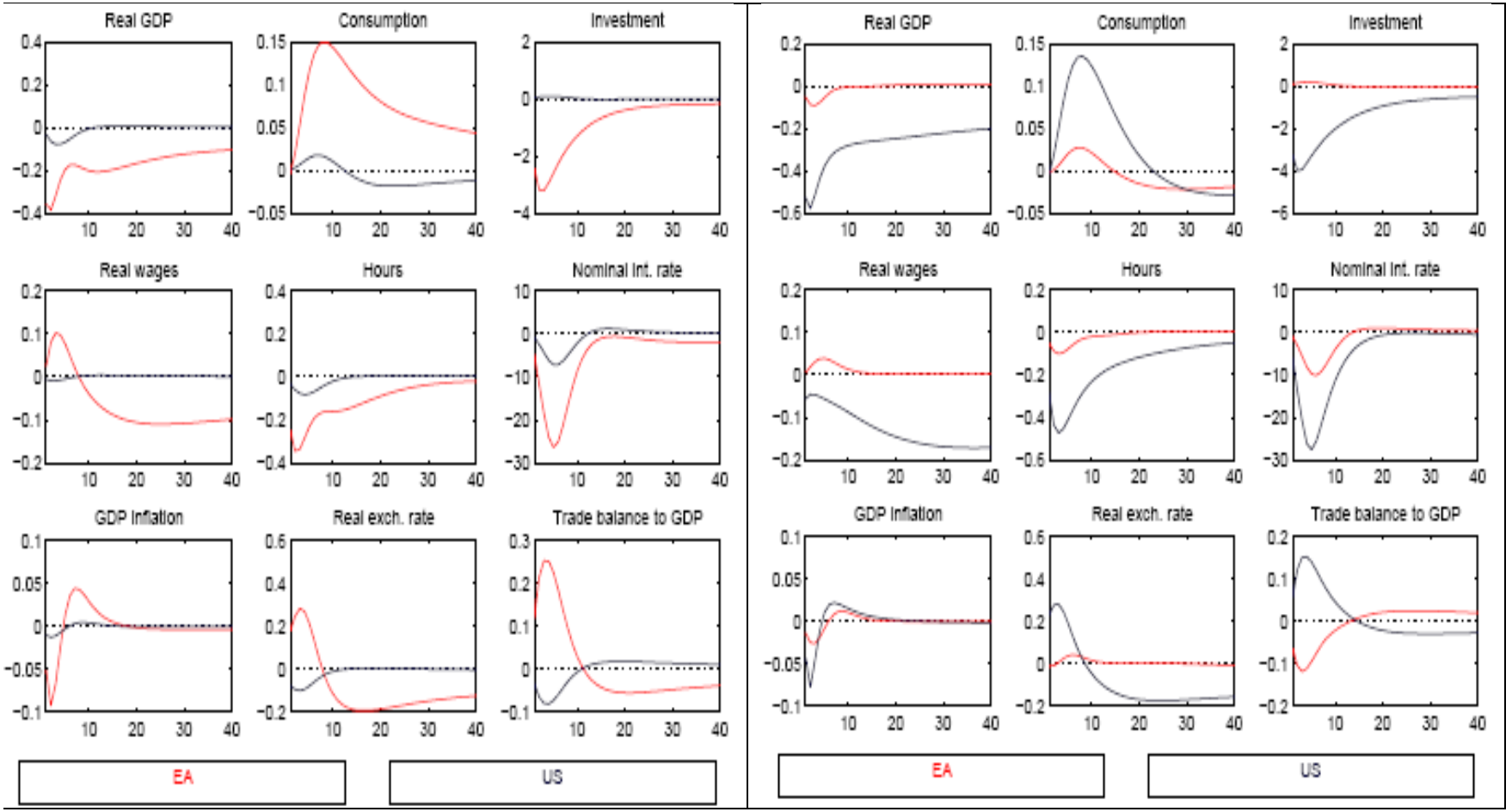
TFP shock


Real GDP
Consumption
Investment
Real wages
Hours
Nominal int. rate
GDP inflation
Real exch. rate
Trade balance to GDP
EA
US
Real GDP
Consumption
Investment
Real wages
Hours
Nominal int. rate
GDP inflation
Real exch. rate
Trade balance to GDP
EA
US

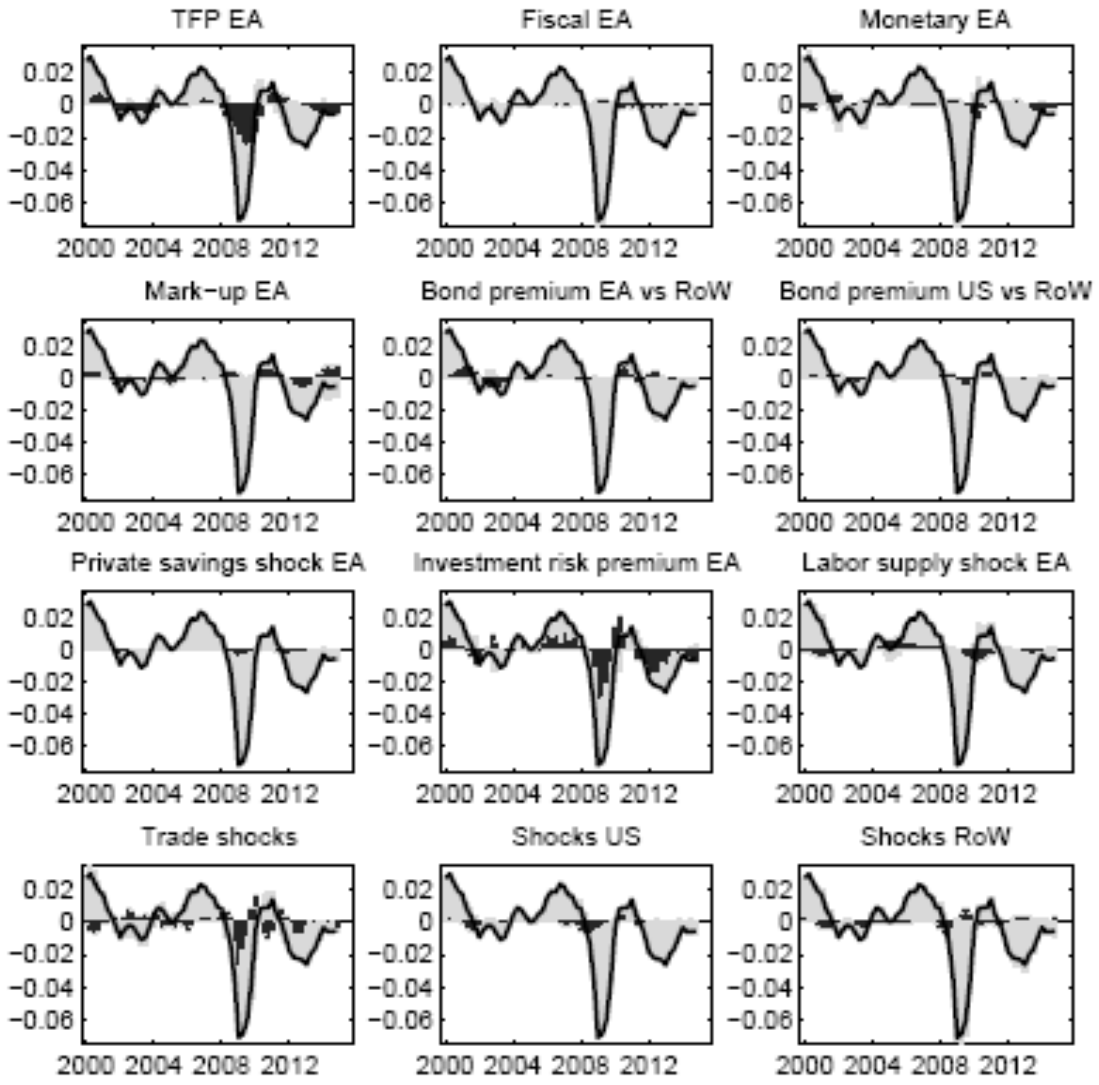
Saving shock



Investment risk premium



Historical Decompositions of real GDP growth rate in EA



Investment boom before crisis

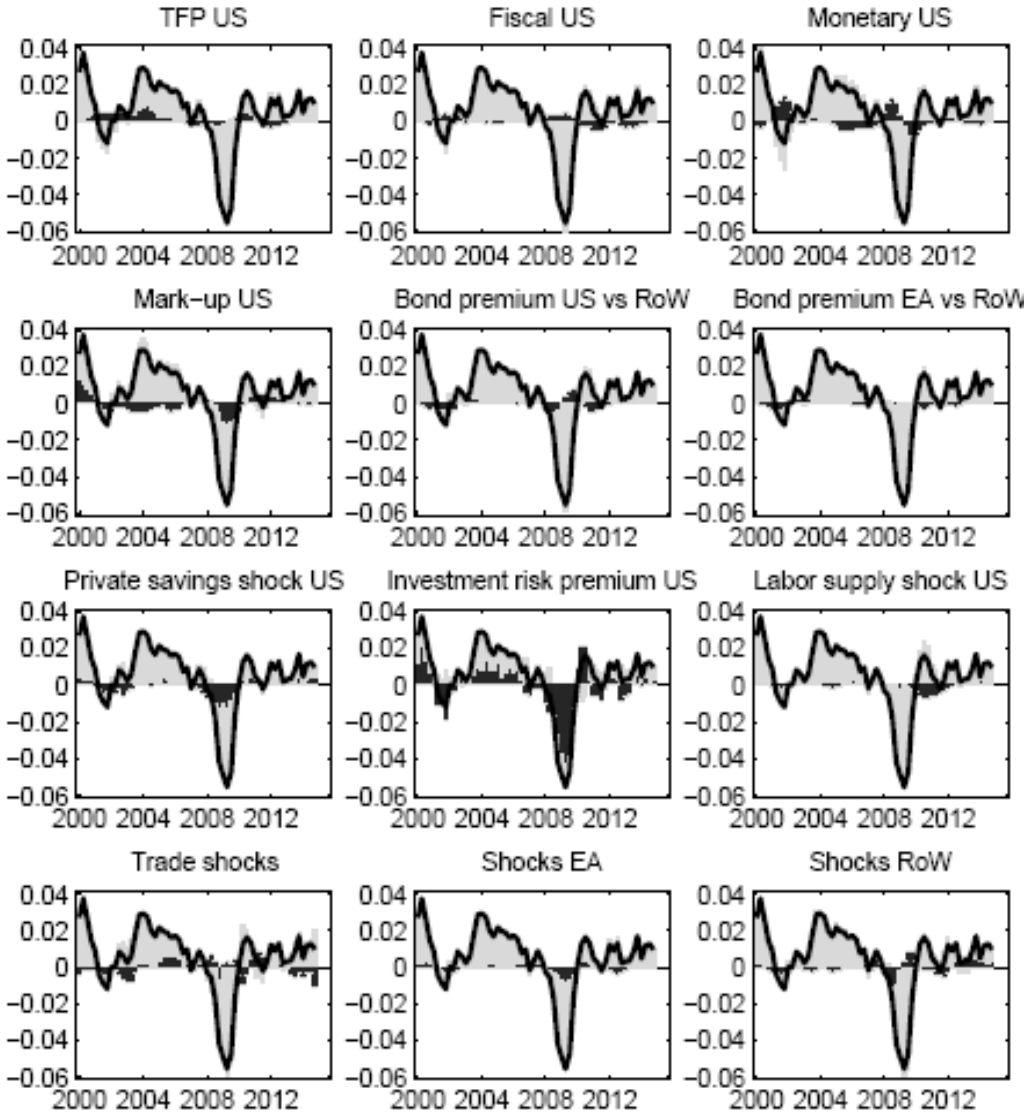
2009
- Investment risk premium increases
- Permanent level shift of TFP
- Negative trade shocks

2010
- Recovery: fall in risk premia

After 2011
- Rise in risk premium (sov debt crisis)

Less important:
- Price and wage markups
- Household savings
- RoW/US growth
- Fiscal policy

Historical Decompositions of real GDP growth rate in US



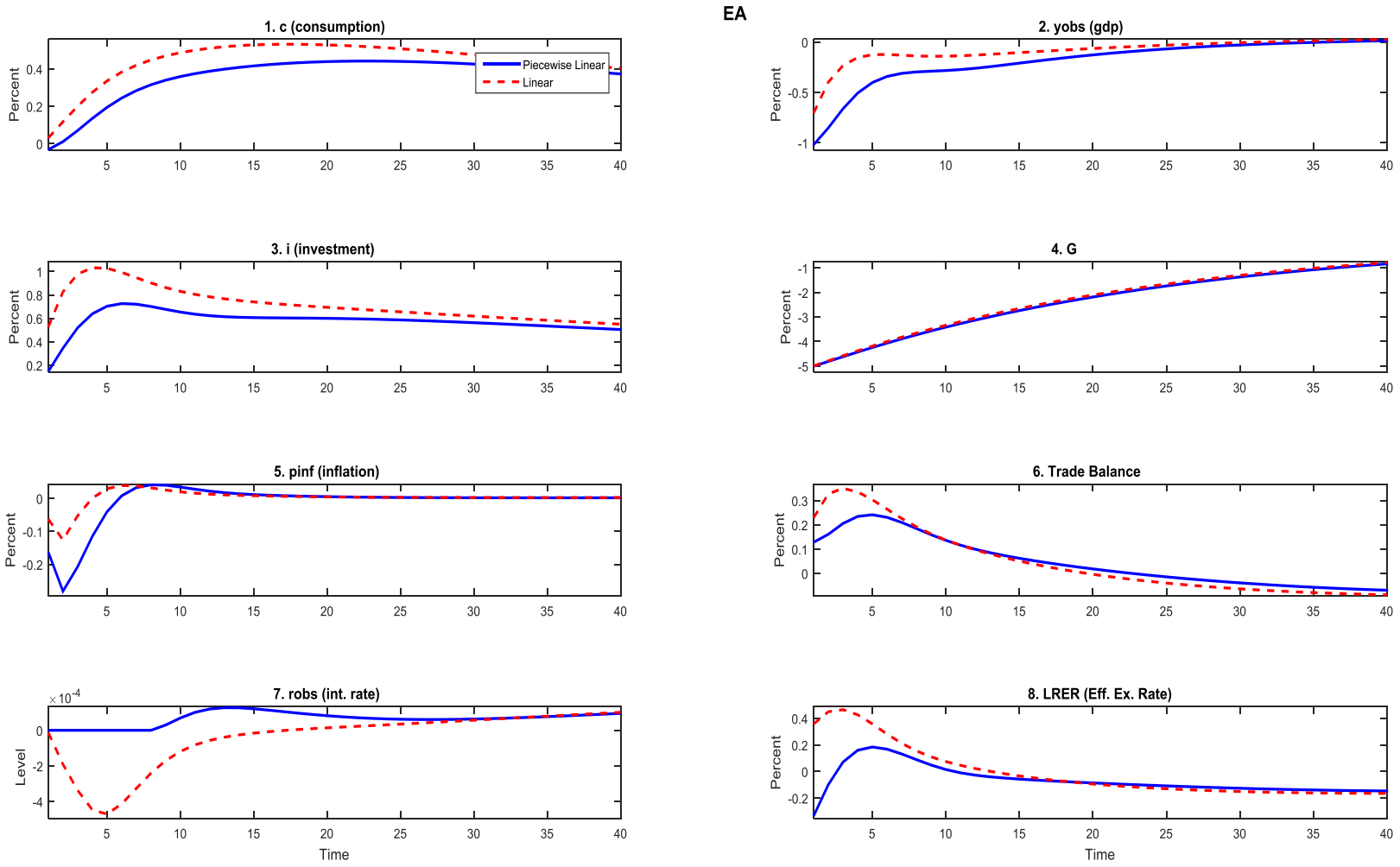
Investment risk premium explains pre-crisis boom

2008-2009

- Investment risk premium increases
- BUT more short-lived in the US than in EA
- Saving
- Price-markup increase

Monetary policy shocks slightly stabilizing

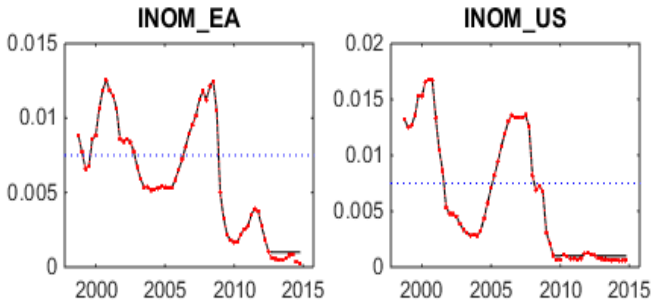
Comparing fiscal consolidation with and without a ZLB constraint



Multiplier ca 0.5 increases to ca 1 in case of 2 year expected ZLB

Shock decomposition with ZLB

Algorithm similar to Anzoategui, Comin, Gertler and Martinez (2015)



1. threshold and data
2. initial guess of history of regimes
3. state space matrices for each *t,* fed into into the filter/smoother recursion
4. guessed smoothed shocks and smoothed starting values of state vrbls
5. Using Occbin algorithm, new sequence of regimes
   - •expected duration of binding regimes
   - •anticipation of future constrained monetary policy for unbinding regimes
6. state space matrices, fed again into the filter/smoother recursion

The algorithm stops when the sequence of regimes converges, which implies that the resulting series of smoothed variables and shocks are consistent with the observables and take into account the OBC.

Shock decomposition with ZLB

	EA		*US*	
time	regime sequence	starting period of regime	regime sequence	starting period of regime
2008	0	1	0	1
2008.25	0	1	0	1
2008.5	0	1	0	1
2008.75	0	1	0	1
2009	0 1 0	1 2 7	0 1 0	1 3 5
2009.25	0 1 0	1 2 7	0 1 0	1 2 8
2009.5	0 1 0	1 2 6	0 1 0	1 2 7
2009.75	0 1 0	1 2 4	1 0	1 3
2010	0	1	1 0	1 2
2010.25	0	1	0 1 0	1 2 5
2010.5	0	1	1 0	1 3
2010.75	0	1	1 0	1 3
2011	0	1	1 0	1 4
2011.25	0	1	1 0	1 2
2011.5	0	1	1 0	1 2
2011.75	0	1	0 1 0	1 4 6
2012	0	1	0	1
2012.25	0	1	0	1
2012.5	0	1	0	1
2012.75	1 0	1 2	1 0	1 6
2013	1 0	1 3	1 0	1 3
2013.25	1 0	1 3	1 0	1 5
2013.5	1 0	1 4	1 0	1 4
2013.75	1 0	1 3	1 0	1 3
2014	1 0	1 4	1 0	1 7
2014.25	1 0	1 4	1 0	1 2
2014.5	1 0	1 3	1 0	1 2

Regime Sequence

0 = unconstrained

1 = constrained.

[1 0] =a constrained regime

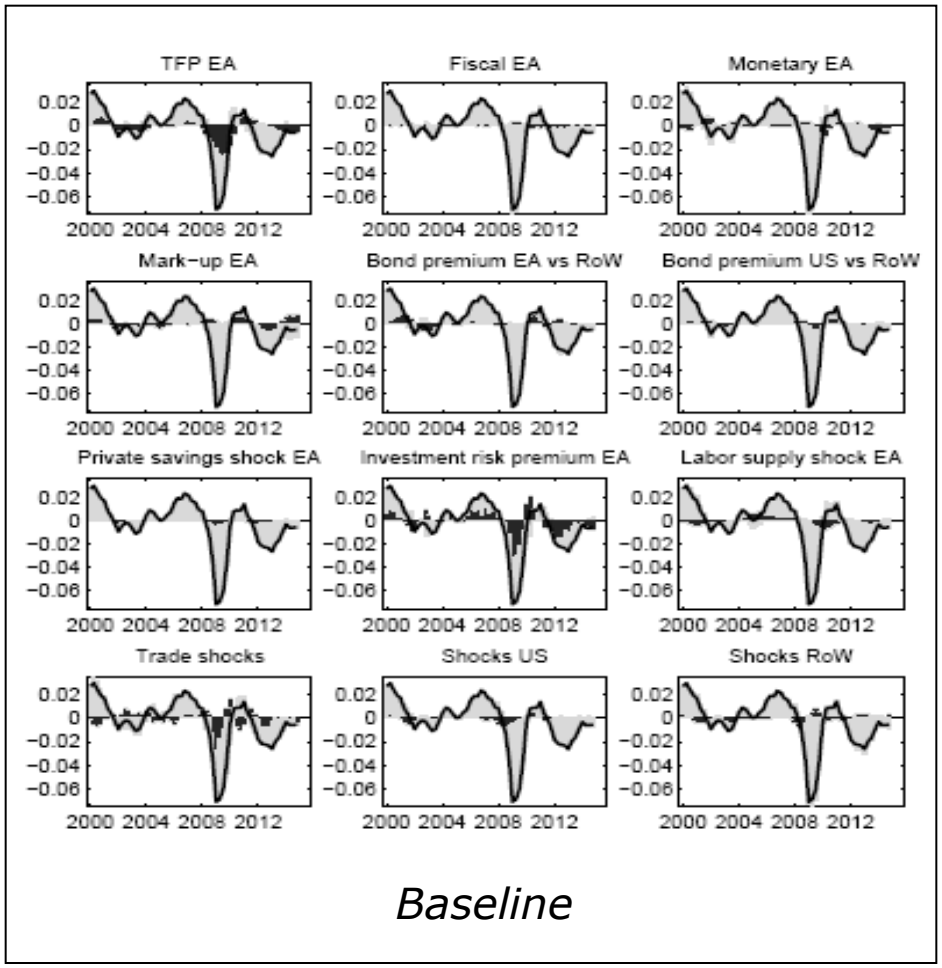
[0 1 0]= a regime that anticipates FUTURE constraints

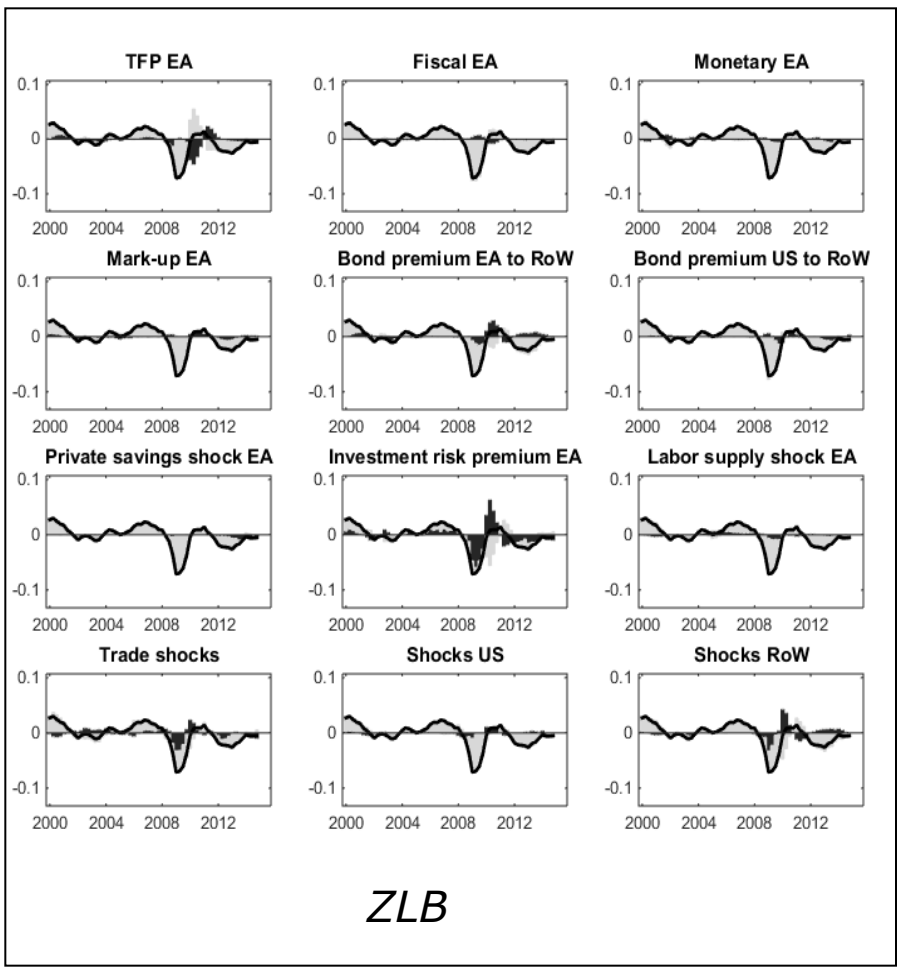
Starting period of regime

[1 7]=a constrained regime for 6 periods

[1 2 7] = a regime that anticipates FUTURE constraints starting in period 2 until period 6.

Shock decomposition with ZLB





Historical decompositions of real GDP growth rate (year-on-year) in EA [EA ZLB]: left [right] panel

Conclusions

- **EA**:
- TFP and Investment risk premium have been important drivers for Y and I/Y decline. Deleveraging less important
- Investment risk premium explains other dimensions
  - Trade balance dynamics
  - Wage increase after 2009
  - Deflation

- **US**:
- Investment risk premium and Households savings important for 2009 recession and GDP level shift. They also explain:
  - Falling inflation
  - Rising Trade Balance

  BUT
  - Strong recovery of investment risk premium
  - No permanent TFP contraction