

Probably Too Little, Certainly Too Late. An Assessment of the Juncker Investment Plan

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Outline

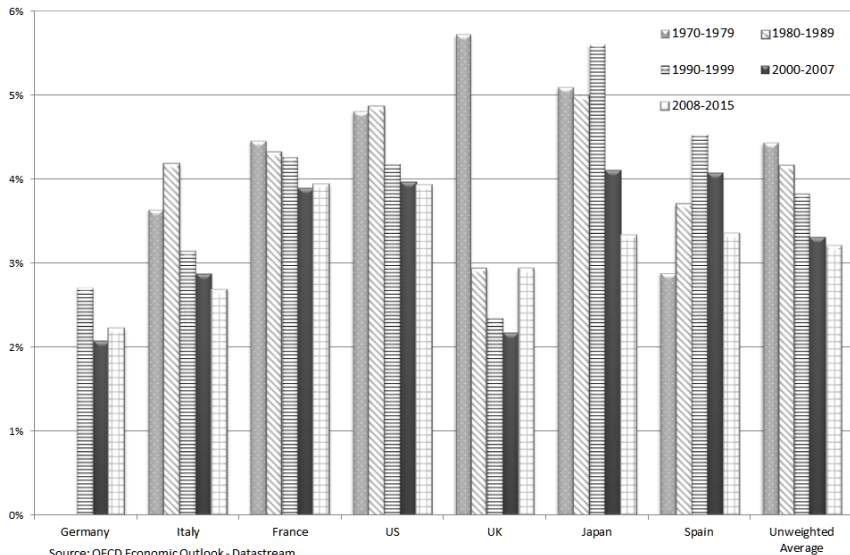
- 1 The Model
- 2 Simulating the Juncker Plan
- 3 The Zero Lower Bound and the Juncker Plan
- 4 A comparison with the Obama 2009 plan
- 5 Sensitivity analysis
- 6 Conclusion

Investment at historically low levels

- Total investment in 2015 still far below pre-crisis 2007 levels:
 - ▶ in EU, by 9% (in volume)
 - ▶ in EMU, by 11.9%
- Private investment low
 - ▶ because uncertainty and lack of global demand
 - ▶ despite historically low interest rates
- Public investment victim of consolidation policies
- Infrastructure insufficient or in poor condition

Public investment in selected OECD countries

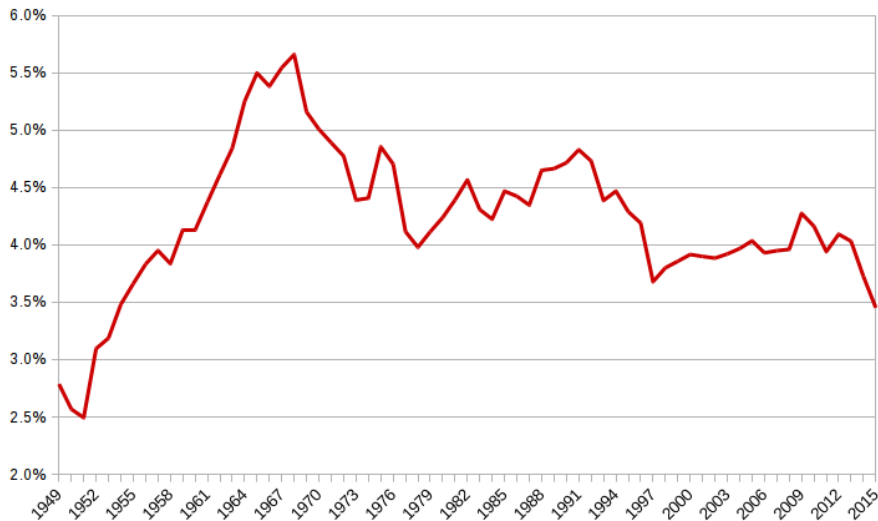
% of GDP



Source: OECD Economic Outlook - Datastream

Public investment in France

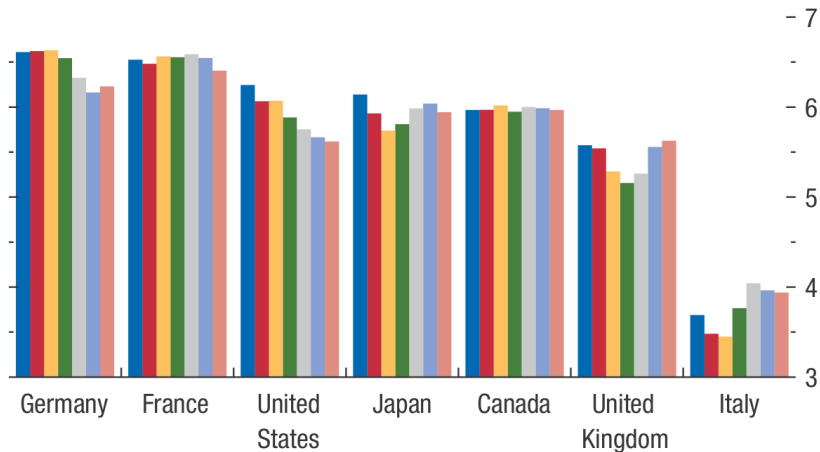
% of GDP



Source: INSEE

Infrastructure quality in selected OECD countries

2006 2008 2010 2012
2007 2009 2011



Source: IMF (2014)

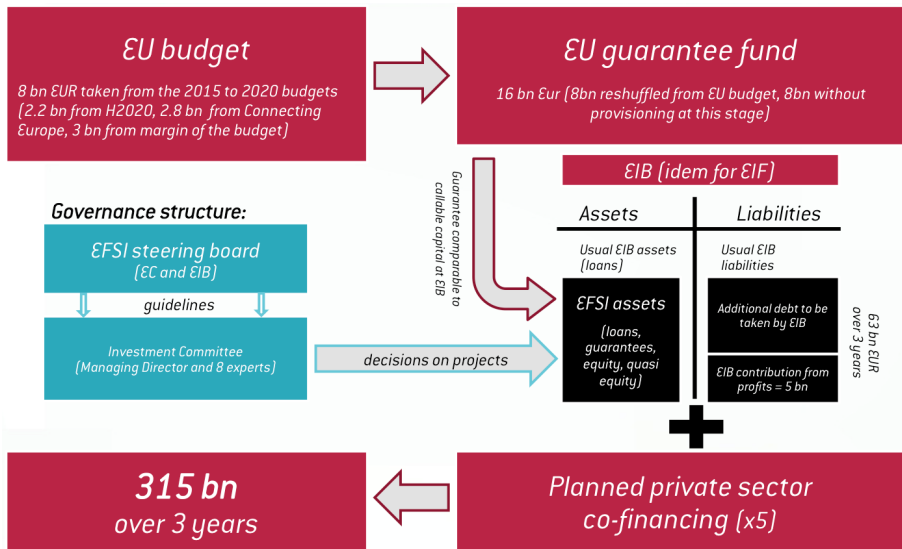
Time for a public investment push?

- Combines two positive effects:
 - ▶ demand in the short run
 - ▶ supply in the longer run
- Crowding-in of private investment (via complementarities)
- Historically low interest rates
- Multipliers likely high, hence may be a free lunch (IMF, 2014; OECD, 2016)

The Juncker plan

- Official name: European Fund for Strategic Investment (EFSI)
- Operated by:
 - ▶ European Investment Bank (EIB)
 - ▶ European Investment Fund (EIF), for the SME part
- Public-private partnership financing scheme
- Objective: trigger €315bn of new investment in Europe over 3 years
- Aims at financing projects riskier than usual EIB projects
- Fields:
 - ▶ infrastructure
 - ▶ research & development
 - ▶ environmental projects
 - ▶ support to SMEs (through partnerships with intermediary banks)

The Working of the Juncker Plan



Source: Claeys (2015)

State of play as of December 2016

Of which
EUR 17 bn
 signed

Approved EFSI financing*

Total investment related to EFSI approvals

EIB + EIF

52%

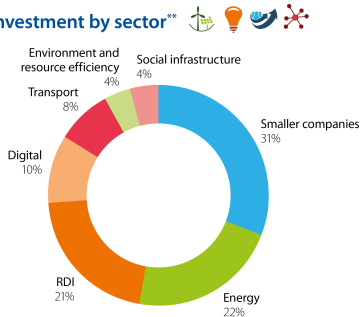
EUR 315bn

EUR 30.6bn

EUR 163.9bn

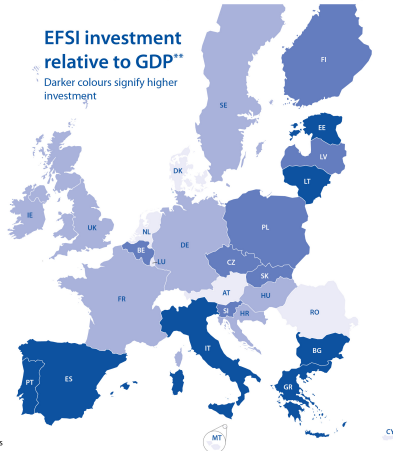
* EIB-approved: EUR 22.4bn
 EIF-approved: EUR 8.1bn

EFSI investment by sector**



EFSI investment relative to GDP**

Darker colours signify higher investment



**based on approved operations

Paper objectives

- Assess macro impact of Juncker plan through a DSGE model
- Both in “normal” times and in a liquidity trap
- Comparison with Obama 2009 plan

Main results

- Even under very favorable hypothesis, impact of Juncker plan moderate
- Had it been implemented earlier, could have been effective against ZLB (“certainly too late”)
- Had it been bigger (of the Obama plan size), would have been effective against ZLB even today (“probably too little”)
- Time-to-build and private leverage play critical roles

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Structure

- Closed-economy model of euro area
- Medium-scale DSGE with New Keynesian core
- Two types of households (Ricardian/Keynesian or patient/impatient): consume, supply labor
- Productive sector with 3 factors: labor, private capital, public capital
- Monetary authority: Taylor rule
- Fiscal authority:
 - ▶ Several taxes, adjusted through fiscal rule
 - ▶ Discretionary public investment decision
 - ▶ Co-financing of projects by private sector: households contribute out of their savings

Households

- Two categories:
patient/savers/Ricardian with discount factor β^S
impatient/borrowers/Keynesian with discount factor $\beta^B < \beta^S$
- Households maximize:

$$\max \mathbb{E}_0 \sum_{t=0}^{\infty} \beta(i)^t \mu_t \left[\frac{(C_t(i) - h C_{t-1})^{1-\sigma}}{1-\sigma} - \chi \frac{L_t(i)^{1+\epsilon}}{1+\epsilon} \right]$$

- ▶ external habit formation
- ▶ preference for leisure
- ▶ liquidity constraint on real debt:

$$\frac{B_t(i)}{P_t} \leq D > 0 \quad (1)$$

- ▶ time rate preference shock μ_t : used to bring the economy at ZLB

Patient Households (Savers) (1/2)

- Have access to financial markets:
 - ▶ can hold bonds issued by the government
 - ▶ can lend to firms investing in private capital
- Own the (intermediate good) firms, hence profits Π_t are part of their income
- Budget constraint in real terms:

$$\begin{aligned}(1 - \tau_t^w)w_t(i)L_t(i) + (1 - \tau_t^k)r_t^k K_{t-1}^S(i) + \frac{B_t^S(i)}{P_t} + \Pi_t = \\(1 + i_{t-1})\frac{B_{t-1}^S(i)}{P_t} + (1 + \tau_t^c)C_t^S(i) + I_t^S(i) + \\I_t^{GS} + \psi(u_t(i)) \bar{K}_{t-1}^S(i) + \frac{\gamma^w}{2}\pi_t^w(i)^2 w_t(i)\end{aligned}$$

Patient Households (Savers) (2/2)

Non standard elements

- Households are wage-setters, with Rotemberg-type adjustment cost:

$$\frac{\gamma^w}{2} \pi_t^w(i)^2 w_t$$

- Households invest $I_t^S(i)$ in private capital $\bar{K}_t^S(i)$, and decide the utilization intensity $u_t(i)$ (with convex adjustment cost). Thus:

$$K_t^S(i) = u_t(i) \bar{K}_t^S(i)$$

- Patient households can also invest in the public capital stock: I_t^{GS}
 - ▶ not the result of optimization
 - ▶ but follows an *ad hoc* behavioral rule (proportional to public contribution)
 - ▶ investment in public capital does not yield any direct private return

Impatient Households (Borrowers)

- Impatient households have access to the financial markets in order to contract a debt or save...
- ... but cannot invest in private or public capital
- Because these agents are less patients than savers, they borrow up to their credit constraint, so that $\frac{B_t^B(i)}{P_t} = D$.
- As a consequence, the budget constraint simplifies to:

$$(1 - \tau_t^w)w_t(i)L_t(i) = (1 + \tau_t^c)C_t^B(i) + \left(\frac{1 + i_{t-1}}{1 + \pi_t} - 1\right) D$$

- Same wage demand schedule as savers

Production

- The perfectly competitive final good sector produces for consumption, private investment and public investment.
- Inputs come from a monopolistically competitive intermediate sector. The intermediate sector drives the demand for labor, taking real wages as given.

The characterization of **Final Goods** is standard

$$\begin{aligned} \max_{y_t(j)} P_t Y_t - \int_0^1 p_t(j) y_t(j) dj \\ \text{s.t. } Y_t &= \left(\int_0^1 y_t(j)^{\frac{\theta_t^P - 1}{\theta_t^P}} dj \right)^{\frac{\theta_t^P}{\theta_t^P - 1}} \\ \Rightarrow y_t(j) &= \left(\frac{p_t(j)}{P_t} \right)^{-\theta_t^P} Y_t \end{aligned}$$

Intermediate Goods

- Technology (Leeper et al, 2010):

$$y_t(j) = z_t K_{t-1}(j)^\alpha L_t(j)^{1-\alpha} \left(K_{t-1}^G\right)^\nu$$

- K_t^G is aggregate public capital, ν its productivity
- Rotemberg nominal price rigidities. Price adjustment cost: $\frac{\gamma^p}{2} \pi_t(j)^2 Y_t$
- Cost minimization. Choice of $K_{t-1}(j)$ and $L_t(j)$ (given $y_s(t)$):

$$C(y_t(j)) = \min_{K_{t-1}(j), L_t(j)} w_t L_t(j) + r_t^k K_{t-1}(j)$$

$$\text{s.t. } y_t(j) \leq F(K_{t-1}(j), L_t(j), K_{t-1}^G)$$

- Profit maximization. Joint choice of $p_s(j)$ and $y_s(j)$:

$$\max_{p_s(j)} \mathbb{E}_t \sum_{s=t}^{\infty} \left(\beta^S\right)^{s-t} \frac{\lambda_s^S}{\lambda_t^S} \left[\frac{p_s(j)}{P_s} y_s(j) - C(y_s(j)) - \frac{\gamma^p}{2} \pi_s(j)^2 Y_s \right]$$

$$\text{s.t. } y_s(j) = \left(\frac{p_s(j)}{P_s}\right)^{-\theta_t^p} Y_s$$

Government

- Budget constraint:

$$T_t + \frac{B_t^G}{P_t} = G_t + I_t^G + \frac{1 + i_{t-1}}{1 + \pi_t} \frac{B_{t-1}^G}{P_{t-1}}$$

$$T_t = \tau_t^c \left((1 - n) C_t^S + n C_t^B \right) + \tau_t^w w_t L_t + \tau_t^k r_t^k (1 - n) K_{t-1}^S$$

- Fiscal rule (mimics the Stability and Growth Pact)

$$\Delta_t - r_t \frac{B_{t-1}^G}{P_{t-1}} = \Phi \left(\frac{B_{t-1}^G}{P_{t-1}} - b^{G^*} \right) - \varepsilon_t^G$$

$$\Delta_t = \tau_t^c \left((1 - n) C^{S^*} + n C^{B^*} \right) + \tau_t^w w^* L^* \\ + \tau_t^k r^k (1 - n) K^{S^*} - G_t - I^G$$

- The different tax rates are (exogenously) proportional to total tax revenues

Public Investment: Time to Build and Leverage

- “Time-to-build”. Choice of A_t yields a flow of expenditures for N periods: $A_t \sum_{s=0}^{N-1} \phi_s$
- Public investment comes from the government (A) and from patient households (A^S)
- At time t , total expenditure is the quota of all past decisions coming due:

$$I_t^G = \sum_{s=0}^{N-1} \phi_s A_{t-s} \quad I_t^{GS} = \sum_{s=0}^{N-1} \phi_s A_{t-s}^S$$

- The law of motion of capital:

$$K_t^G = (1 - \delta^G) K_{t-1}^G + A_{t-(N-1)} + (1 - n) A_{t-(N-1)}^S$$

with $1 - n$ fraction of patient households.

- Hypothesis on **leverage** triggered by government investment:

$$(1 - n) A_t^S = (\xi - 1) (A_t - A^*)$$

where $\xi \geq 1$ is the private leverage factor.

Monetary policy

The monetary authority follows a classical Taylor Rule, subject to a ZLB constraint:

$$1 + i_t = \max \left((1 + i_{t-1})^{\rho^i} \left(\frac{1 + \pi_t}{1 + \pi^*} \right)^{(1-\rho^i)\phi_\pi} \left(\frac{Y_t}{Y_{t-1}} \right)^{(1-\rho^i)\phi_Y} (1 + \varepsilon_t^i); 1 \right)$$

where $\rho^i \in [0, 1)$ is the interest rate smoothing parameter, $\phi_\pi > 0$ (resp. $\phi_Y \geq 0$) captures the central bank reaction to inflation (resp. growth)

Model Closure: Market Clearing

- The equilibrium on the final good market is given by

$$Y_t = (1 - n)C_t^S + nC_t^B + (1 - n)(I_t^S + I_t^{GS}) + G + I_t^G \\ + \int_0^1 \frac{\gamma^P}{2} \pi_t(j)^2 Y_t dj + \int_0^{1-n} \left[\frac{\gamma^W}{2} \pi_t^w(i)^2 w_t(i) + \psi(u_t(i)) \bar{K}_{t-1}^S(i) \right] di$$

- Market clearing on markets for debt, private capital and labor, implies:

$$B_t^G + nD + \int_0^{1-n} B_t^S(i) di = 0$$

$$(1 - n)K_t^S = \int_0^1 K_t(j) dj$$

$$L_t = \int_0^1 L_t(j) dj$$

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Doubts about plan effectiveness

- EIB/EU contributions are not new money
- Optimistic private leverage effect
- Incitative impact not certain: some projects may have been launched without EFSI support
- Quality of projects in terms of productivity contribution?

We ignore these concerns and focus on the most favorable case.

Output elasticity of public capital

$$Y_t = z_t K_{t-1}^\alpha L_t^\beta \left(K_{t-1}^G \right)^\nu$$

- Aschauer (1989b): $\nu = 0.24$ (core infrastructure in the US)
- Eberts (1986): $\nu = 0.03$ (at metropolitan level in the US)
- IMF (2014): $\nu = 0.17$ (core infrastructure of national govt.)
- Our benchmark value: $\nu = 0.1$

Calibrated parameters (1/2)

Share of borrowers	n	0.34
Private leverage factor of public investment	ξ	5
<i>Preferences</i>		
Discount rate of savers	β^S	0.995
Discount rate of borrowers	β^B	0.99
Disutility of labor	χ	1
Persistence of time rate preference	ρ^μ	0.75
<i>Production</i>		
Private capital depreciation rate	δ^k	0.025
Public capital depreciation rate	δ^G	0.0125
Private capital share in production	α	0.36
Public capital influence in production	ν	0.1
Private capital utilization rate (steady state)	u^*	0.85

Calibrated parameters (2/2)

<i>Price and wage stickiness</i>		
Market power (goods, at steady state)	θ^p^*	6
Market power (labor, at steady state)	θ^w^*	6.2
<i>Monetary policy</i>		
Inflation (steady state)	π^*	0
<i>Fiscal policy</i>		
Speed of fiscal consolidation	Φ	$\frac{1}{80}$
Debt target	b^G^*	$2.4Y^*$
Consumption tax (steady state)	τ^c^*	0.2
Capital income tax (steady state)	τ^k^*	0.184
Time to build of public investment	N	12
Time profile of public investment	ϕ_s	$\frac{1}{N}$
Government consumption (steady state)	G^*	$0.25Y^*$
Public investment (steady state)	A^*	$0.02Y^*$
Debt constraint of borrowers	D	$0.125Y^*$

Estimated parameters

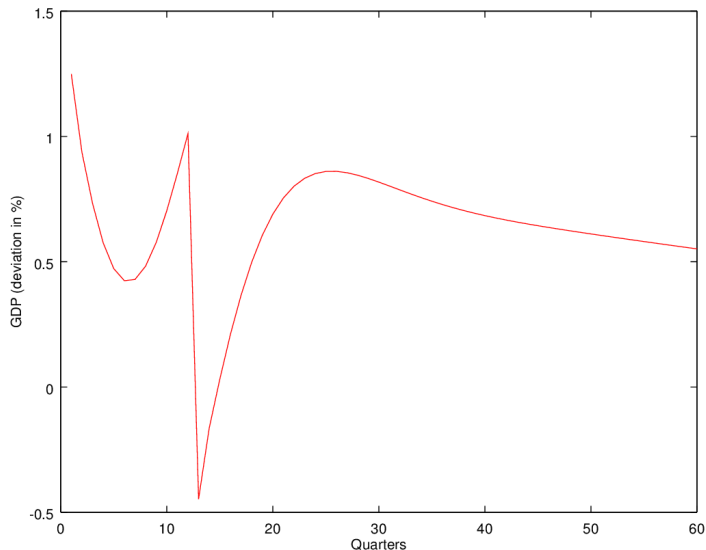
Parameter	Symbol	Prior			Posterior mode
		Type	Mean	St. Dev	
<i>Preferences</i>					
Frisch elasticity of labor	ε	Γ	2	0.25	1.9200
Relative risk aversion	σ	Γ	1.75	0.5	1.8951
Habit formation in consumption	h	β	0.5	0.2	0.8715
<i>Production</i>					
Adjustment cost on private investment	γ^I	N	5	0.25	5.1858
Elasticity of capacity utilization rate	σ_u	N	5	0.1	4.9879
Persistence of investment shock	ρ^k	β	0.5	0.2	0.9042
Persistence of productivity shock	ρ^z	β	0.5	0.2	0.8476
<i>Price and wage stickiness</i>					
Adjustment cost on wages	γ^w	Γ	110	100	353.5216
Adjustment cost on prices	γ^p	Γ	300	100	83.5008
Persistence of price markup shock	ρ^p	β	0.5	0.2	0.8972
Persistence of wage markup shock	ρ^w	β	0.5	0.2	0.1187
<i>Monetary policy</i>					
Persistence of interest rate	ρ^i	β	0.8	0.1	0.8065
Sensitivity to inflation	ϕ_π	Γ	1.7	0.1	1.7292
Sensitivity to GDP	ϕ_Y	N	0.125	0.05	0.1766

The Juncker plan in the model

- Positive temporary shock on public investment allowances
- Magnitude: 0.5% of annual GDP (one-period shock during quarter of plan launching)
- Because of time-to-build, new investment spread over 3 years
- Magnified by private leverage of 5
- New public capital operational 3 years after plan launching

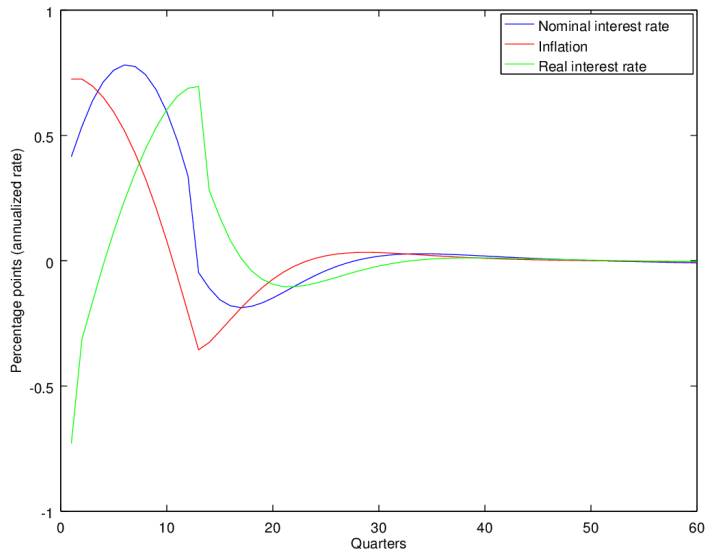
Impact of Juncker plan on output

Baseline scenario, deviation from steady state



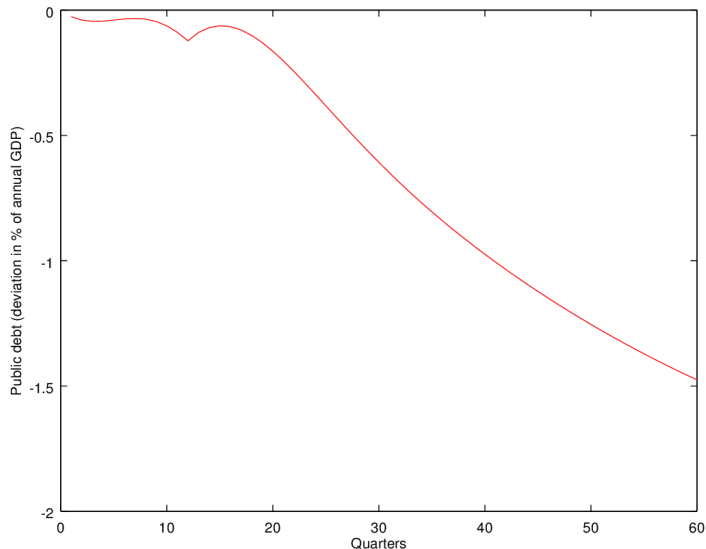
Inflation and interest rates

Baseline scenario



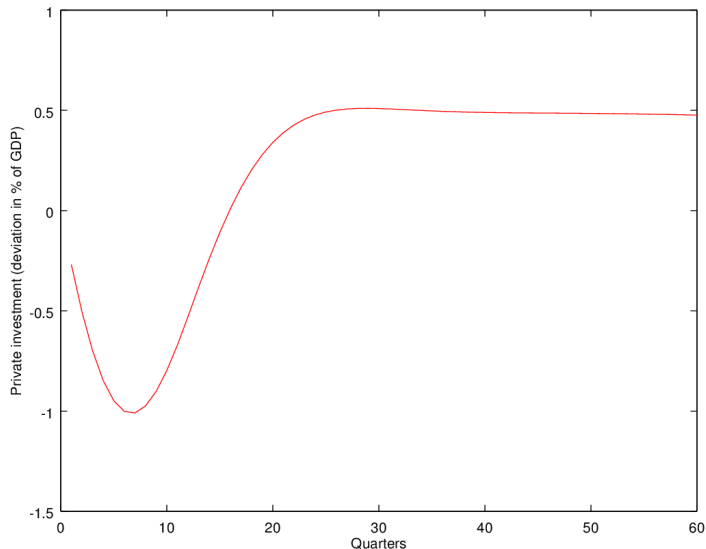
Public debt-to-GDP ratio

Baseline scenario, deviation from steady state



Private investment

Baseline scenario, deviation from steady state



Dynamic multipliers

Baseline calibration

	<i>1 year</i>	<i>3 years</i>	<i>10 years</i>	<i>20 years</i>
Without leverage	1.0	0.8	2.2	4.1
With leverage of 5	5.2	4.2	13.0	24.0

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The dual effect of a public investment push

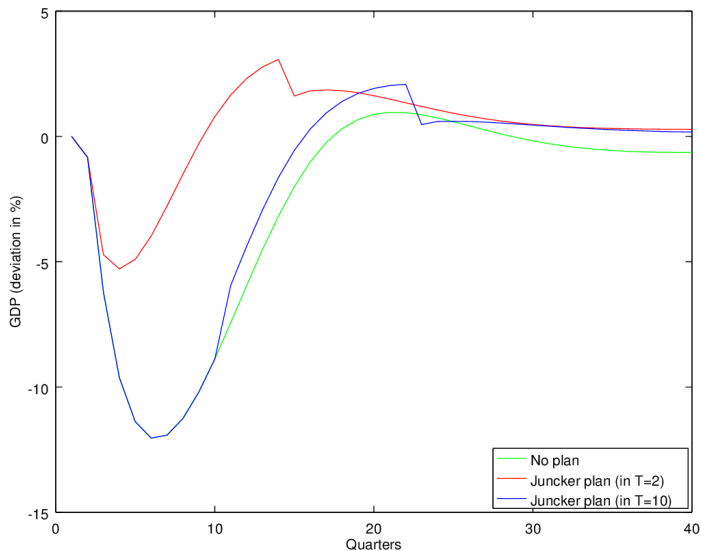
- Short run: demand effect, hence inflationary
- Long run: supply effect, hence deflationary
- Time-to-build governs relative timing of the two
- Bouakez et al. (2014): longer time-to-build beneficial in ZLB

Simulating a liquidity trap

- Shock to time preference rate (negative demand shock)
- Solution method: extended path
- Multiple equilibria problem: equilibrium selection based on euro area experience
- Without government intervention
 - ▶ ZLB lasts 14 quarters
 - ▶ GDP through at 12% below pre-crisis level, 5 quarters after shock

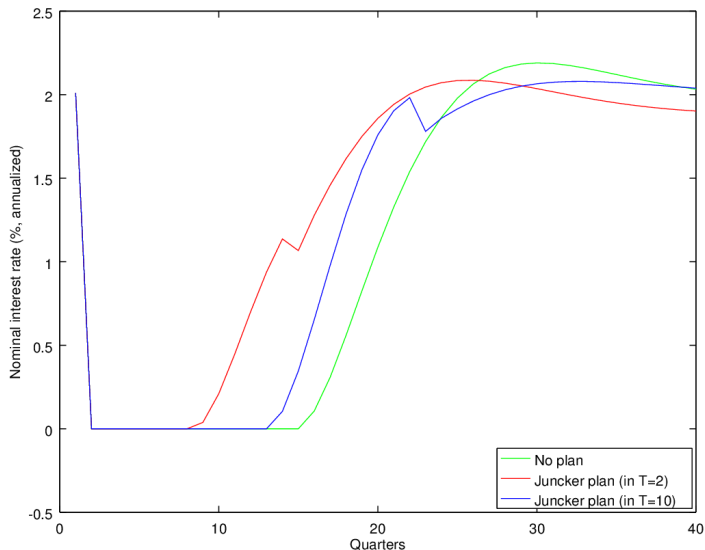
Impact on GDP

ZLB case, deviation from steady state



Nominal interest rate

ZLB case



Outline

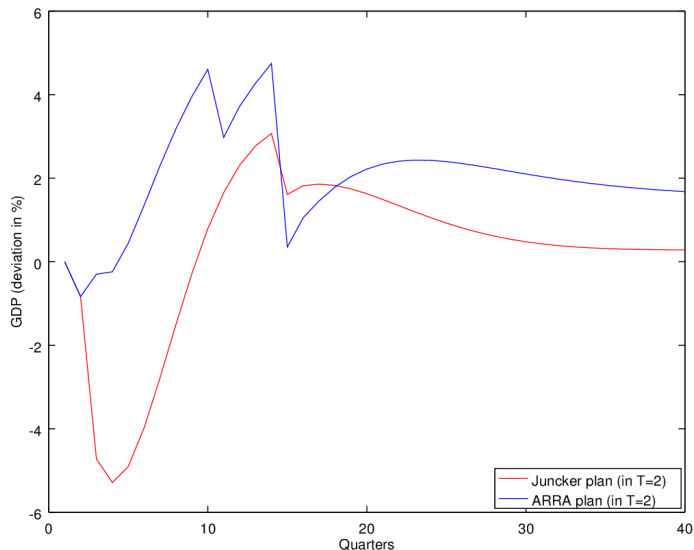
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The Obama plan

- American Recovery and Reinvestment Act (ARRA)
- \$789bn = 5.5% GDP
- 4% GDP over 2 years in tax breaks, 1.5% GDP public investment
- Quick implementation: voted Feb 2009, disbursements in summer

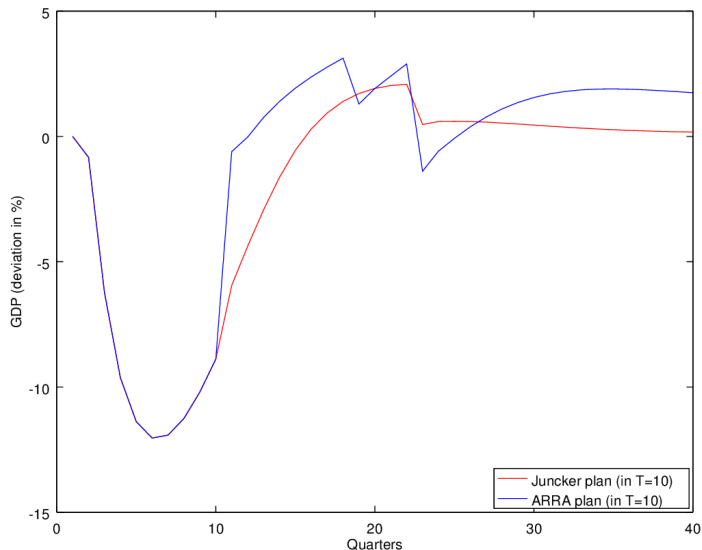
Impact of Juncker and Obama plans (in T=2)

ZLB case, deviation from steady state



Impact of Juncker and Obama plans (in T=10)

ZLB case, deviation from steady state



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Sensitivity of dynamic multipliers

To elasticity of production to public capital

<i>Elasticity (ν)</i>	<i>1 year</i>	<i>3 years</i>	<i>10 years</i>	<i>20 years</i>
0	1.12	0.79	0.24	-0.08
0.05	1.07	0.78	1.21	1.98
0.10	1.02	0.77	2.19	4.05
0.15	0.97	0.76	3.17	6.13
0.17	0.95	0.76	3.57	6.96

Sensitivity to time-to-build

- Reducing time-to-build has two effects:
 - ▶ demand effect short-lived (crowding out disappears)
 - ▶ deflationary effect comes sooner (bad for ZLB exit)
- Last property (Bouakez et al., 2014) verified:
 - ▶ if TTB of 1 quarter, ZLB exit is postponed
 - ▶ if plan at $T = 2$, by 6 quarters (and recession worsened)
 - ▶ if plan at $T = 10$, by 1 quarter

Sensitivity to private leverage

- Fiscal multiplier = quasi-linear function of private leverage
- However non-linear impact on debt-to-GDP: increase if no private leverage
- Important for pulling economy out of ZLB. If no private leverage, multiple equilibria (for Juncker plan at $T = 2$):
 - ▶ good equilibrium worse than with private leverage (2 more quarters in ZLB)
 - ▶ bad equilibrium: slightly worse than no government intervention (deflationary impact of public investment dominates)
- Policy conclusion: if private support does not follow expectations, need for bigger public involvement

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Conclusion

- Initial intuition of “too little and too late” confirmed
- Criticism could be rephrased as “probably too little, certainly too late”
- Member states announced plan extension on 6 December 2016 (€26 billion EU money instead of €16): acknowledgment of size problem, but still too late (spread over 2018-2022)
- Points to major flaw in European governance: rapidity of reaction
- Institutional architecture needs to be adapted to the post-“Great Moderation” world
- Limitations of our exercise: replication of the ZLB and of the plan complexity