Who Is Afraid of Eurobonds?

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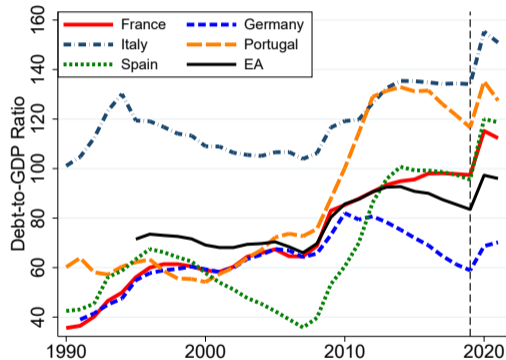
Anna Rogantini Picco
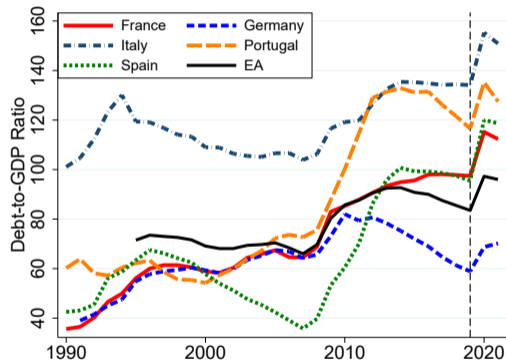
European Central Bank
Sveriges Riksbank & CEPR

Where does the euro area stand?

- More countries in euro area have now elevated government debt

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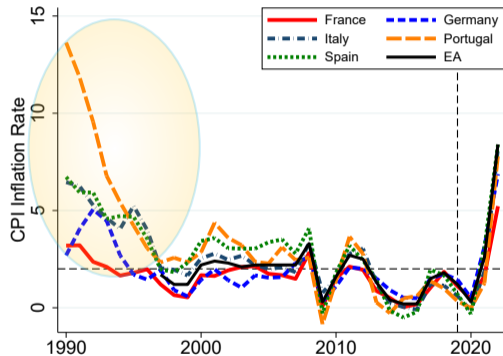
- Fiscal adjustments required at a time in which the euro area faces old and new challenges

Where does the euro area stand?

- In the 90s fiscal rules introduced and there was convergence across euro area countries
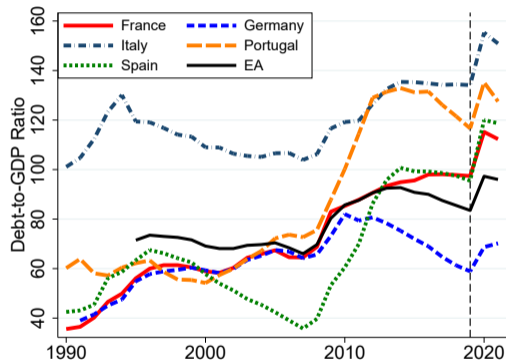
Where does the euro area stand?

- The fiscal rules worked well in the 2000s...
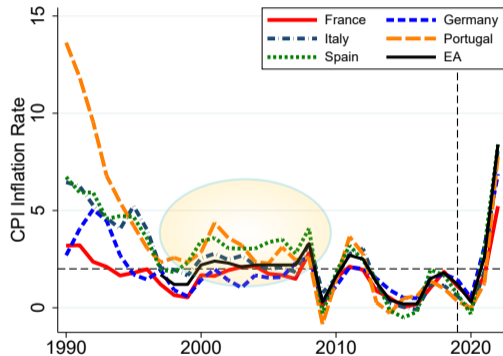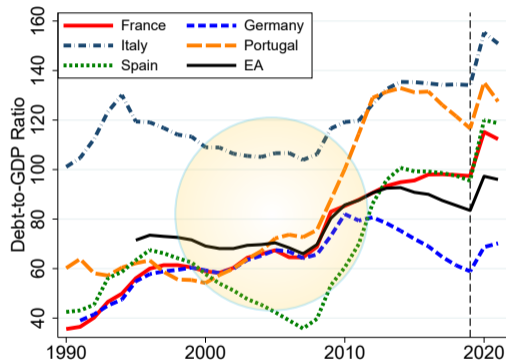
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- ...but when Great Recession hit, debt accumulated quickly
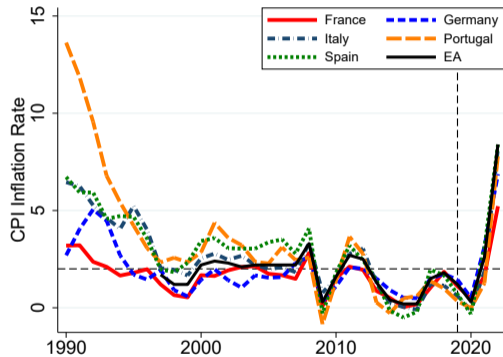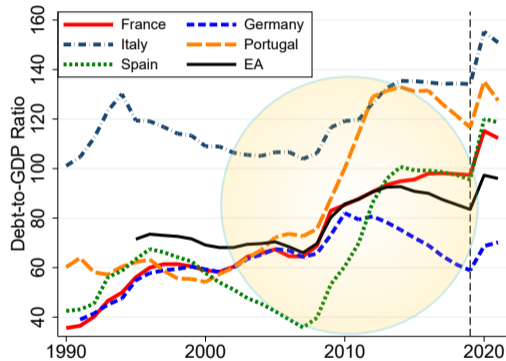
Where does the euro area stand?

- Euro area entered a phase of low inflation and ZLB episodes
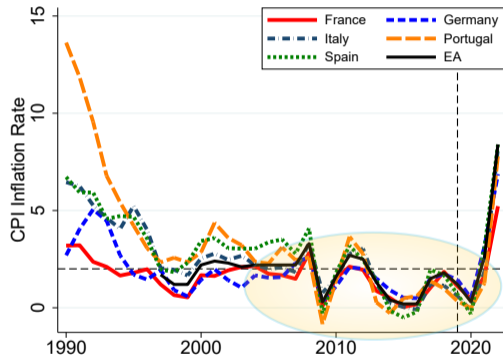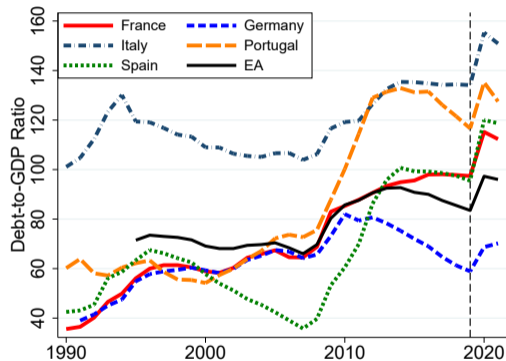
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- As a result, euro area had a sluggish recovery and debt remained elevated
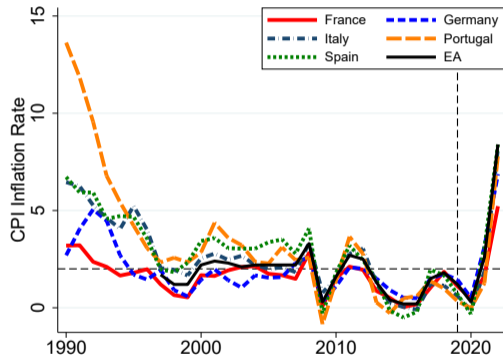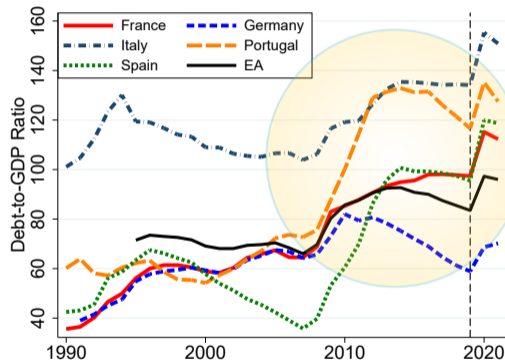
Where does the euro area stand?

- Pandemic further curtailed the ability of euro area policymakers to stabilize the economy
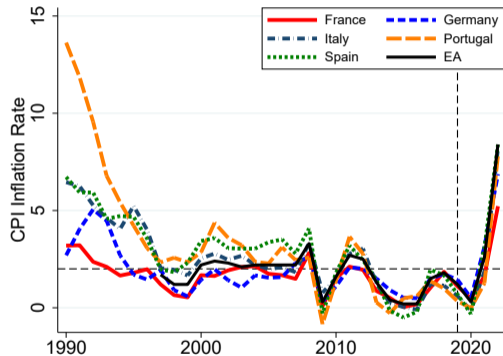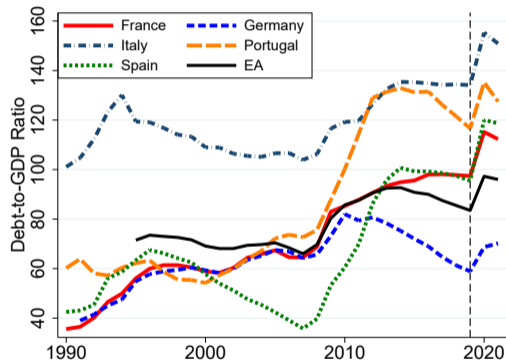
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- Fiscal rules were temporarily suspended...
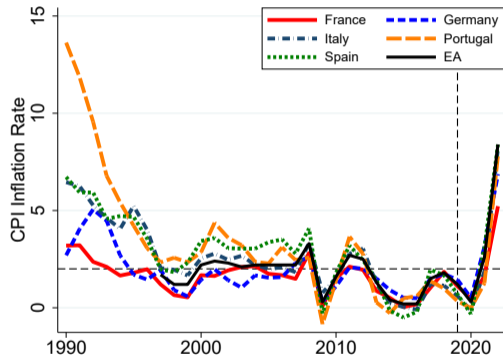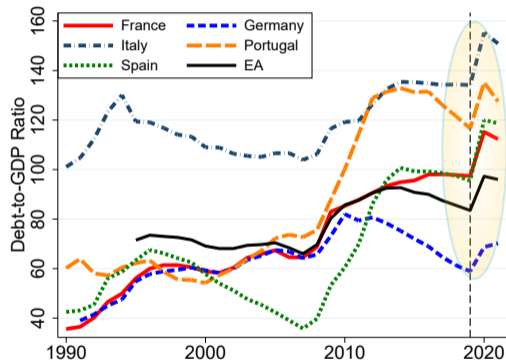
Where does the euro area stand?

- ...and now inflation is high
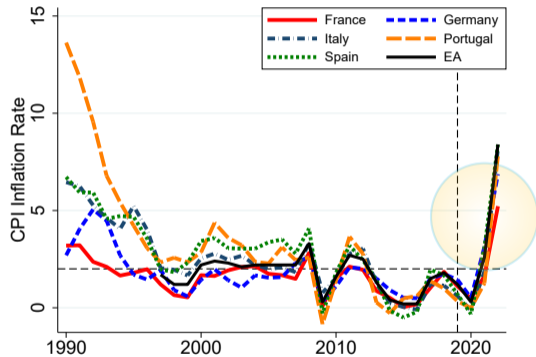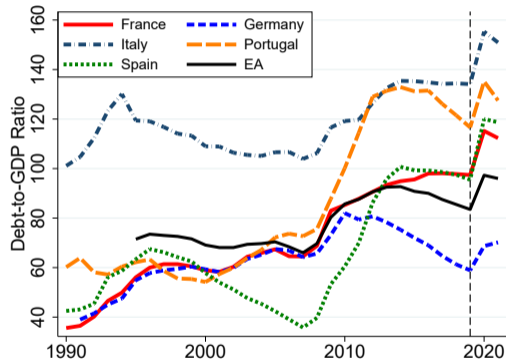
The euro area at a crossroads

With the current framework policy coordination in the euro area is hard to achieve:

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+ Adopt a new monetary and fiscal framework

A new policy framework

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+ We build quantitative two-country monetary union model calibrated to euro area to evaluate new vs old policy framework

Main findings

The new policy framework based on Eurobonds and a centralized euro area Treasury:

+ **Removes the risk of deflation** when debt is high and the ZLB is binding:

   1. Smaller recessions → less accumulation of national debts → stronger recoveries
   2. Controlled reflation of EA when necessary → easing constraints on monetary policy
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+ **Improves welfare** in both high-debt and low-debt countries

Model Overview

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- Backbone: Medium scale NK model
    + Households consume both domestic and imported goods
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- Central bank follows Taylor rule subject to ELB

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Three policy scenarios

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   ⇒ risk of deflation

2. Old policy framework: Deviation from fiscal discipline
   ⇒ risk of inflation and fiscal stagflation

3. New policy framework
   ⇒ Stabilization policies separated from long-run fiscal sustainability
   ⇒ Ability to coordinate to avoid ZLB and deflation without sparking high inflation

A large contractionary shock

+ Recession induced through large risk-premium shock
  - Persistence: Match average EABCN peak-to-trough
  - Volatility: Match output volatility over 1999Q1-2019Q4

+ Recessionary shock hits when debt-to-GDP away from steady state:
  - Country 1 (Italy): annual debt-to-GDP 134.8%
  - Country 2 (Germany): annual debt-to-GDP 61.9%

+ Compare:
  1. **Fiscal discipline**
  2. **Deviation from fiscal discipline**
  3. **New policy framework**

▶ calibration

Old policy framework: From risk of deflation to risk of stagflation

- Strict fiscal rules + zero lower bound ⇒ Risk of deflation and deep recession
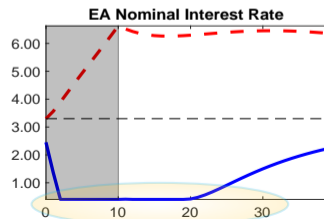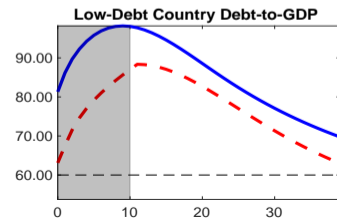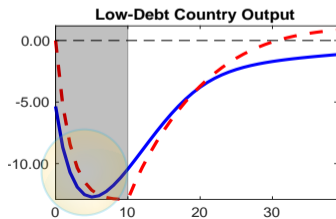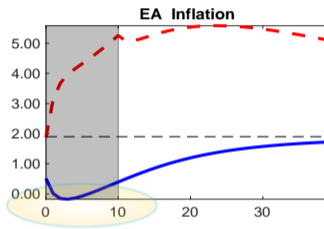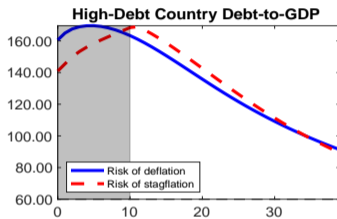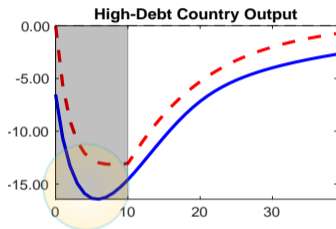
Old policy framework: From risk of deflation to risk of stagflation

- Suspend fiscal rules ⇒ Risk of stagflation if one country unwilling to revert to them
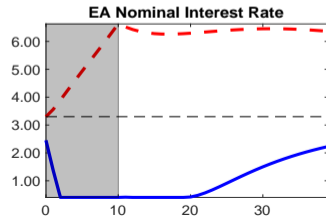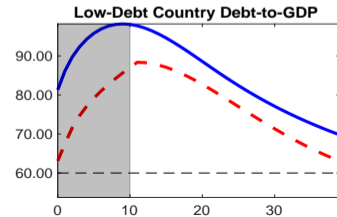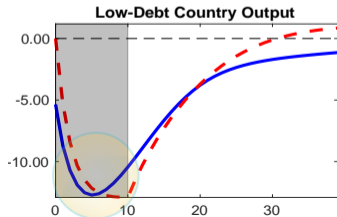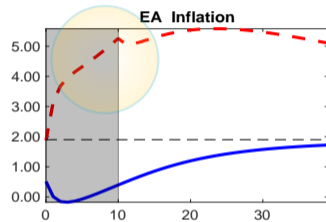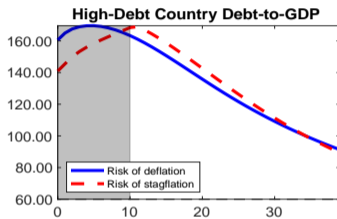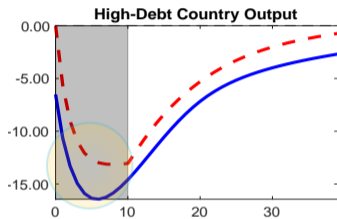
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- Monetary tightening further increases debt-to-GDP in high-debt country
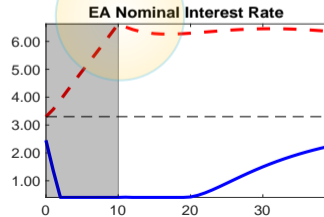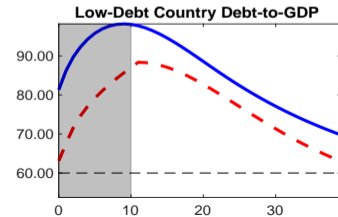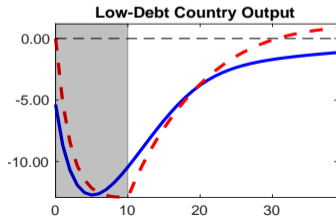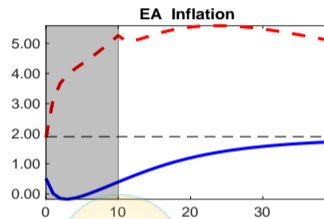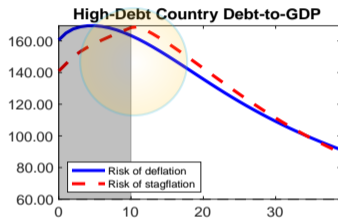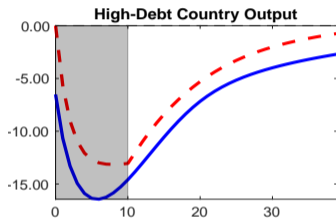
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- Spiral of growing inflation, deeper recession, and debt accumulation
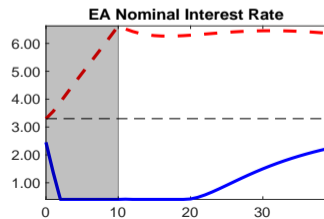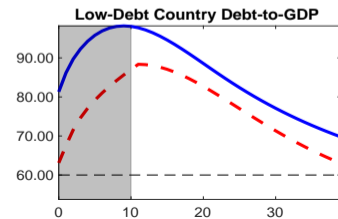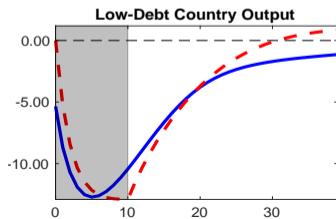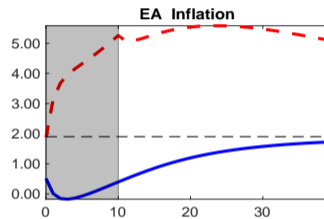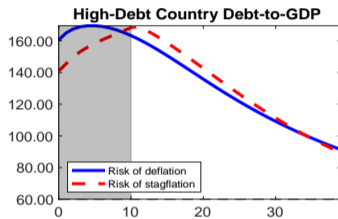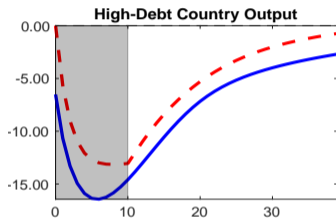
New policy framework: Controlled reflation

- New policy framework based on Eurobonds and euro area Treasury eliminates both risks

New policy framework: Controlled reflation

- No need to suspend fiscal rules $+$ ability to coordinate policies at ZLB

New policy framework: Controlled reflation

- No ZLB, milder recession, contained increase in inflation
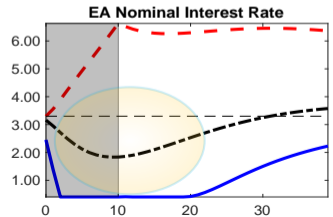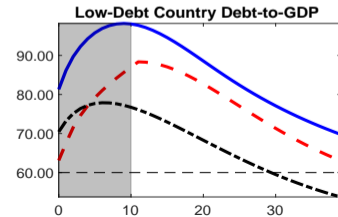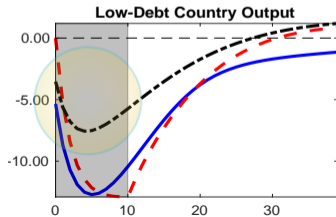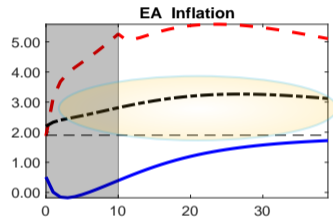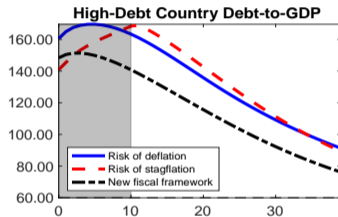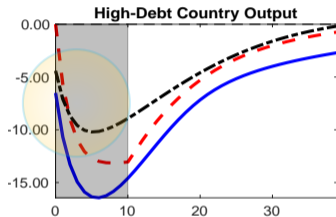
High-Debt Country Output

High-Debt Country Debt-to-GDP

EA Inflation

Low-Debt Country Output

Low-Debt Country Debt-to-GDP

EA Nominal Interest Rate

Legend:
- Risk of deflation
- Risk of stagflation
- New fiscal framework

Why the new policy framework is effective

+ New policy framework mitigates the recession relative to Fiscal Discipline because:
  - Works as automatic stabilizer that boosts spending and inflation expectations and lowers real interest rates
  - Eurobonds issued to finance fiscal stimulus not backed by expectations of future fiscal adjustments → fiscal stimulus more effective

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+ Only a moderate increase in inflation
  - GE effect: milder recession needs smaller stimulus and less inflation to stabilise Eurobonds
  - Fiscal discipline still maintained at national level

Conclusions

+ Coordination harder to achieve with current framework:

  1. fiscal rules and ZLB limit stabilization policies in response to large contractionary shock
  2. robust fiscal interventions require suspending fiscal rules

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+ Need to adopt new framework based on coordination and Eurobonds that separates:

  1. the need for short-run stabilisation (done at euro area level)
  2. from the issue of long-run fiscal sustainability (done at national level)

Conclusions

+ Coordination harder to achieve with current framework:
  1. fiscal rules and ZLB limit stabilization policies in response to large contractionary shock
  2. robust fiscal interventions require suspending fiscal rules

+ Swings between:
  1. risk of deflation
  2. risk of inflation and stagflation

+ Need to adopt new framework based on coordination and Eurobonds that separates:
  1. the need for short-run stabilisation (done at euro area level)
  2. from the issue of long-run fiscal sustainability (done at national level)

+ The new framework:
  1. helps reducing both risks
  2. is welfare improving for both high-debt and low-debt countries

Appendix

Where does the euro area stand?

Euro Area Yield curve

Legend:
- January 2, 2020
- January 4, 2021
- October 11, 2021

x-axis: 3 months, 6 months, 9 months, 1 year, 2 years, 3 years, 4 years, 5 years, 6 years, 7 years, 8 years, 9 years, 10 years
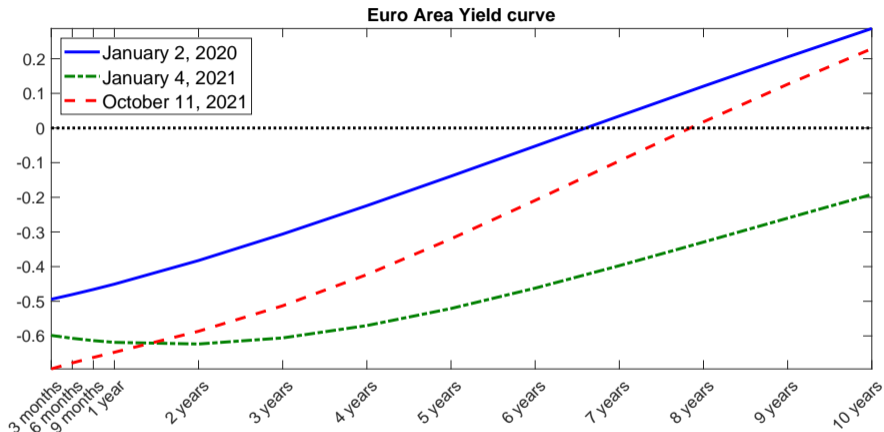
- Low and flat term structure considerably constrains monetary policy
- Limited space for the ECB to stabilize the EA economy in recession

Literature

+ Monetary and fiscal policy in currency unions

  Beetsma and Jensen (2005), Galí and Monacelli (2008), Ferrero (2009), Nakamura and Steinsson (2014), Farhi and Werning (2017)

+ Fiscal theory of the price level

  Sargent and Wallace (1981), Leeper (1991), Sims, (1994), Woodford, (1994, 1995, 2001); Cochrane (1999, 2001, 2023), Bergin (2000), Schmitt-Grohé and Uribe (2020), Jarocinski and Mackowiak (2017), Bianchi and Melosi (2019), Bianchi, Faccini, and Melosi (2023)

This paper: Monetary-fiscal coordination in currency union with Eurobonds

▶ Back

A TANK Model of a Two-country Monetary Union

- Households:

- Final goods firms:

- Intermediate goods firms:

- Labor packers:

A TANK Model of a Two-country Monetary Union

- Households:
  - $+$ savers and hand-to-mouth
  - $+$ value public consumption as a complement to private consumption
  - $+$ if savers, wage setters subject to a Calvo lottery
  - $+$ if savers, invest in physical capital and rent a share to domestic firms
  - $+$ if savers, buy their national debt, Eurobonds, and have access to state-contingent securities

  ▶ bc hh

  ▶ preferences

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- Final goods firms:
  + combine domestic and imported good with CES aggregator
  + sell this good to domestic households   ▶ final goods

- Intermediate goods firms:

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      ▶ bc hh

- Final goods firms:
    + combine domestic and imported good with CES aggregator
    + sell this good to domestic households ▶ final goods

- Intermediate goods firms:
    + hire labor and rent capital in competitive markets
    + price setters subject to a Calvo lottery
    + sell goods to domestic and foreign final goods firms ▶ interm. goods

- Labor packers:

A TANK Model of a Two-country Monetary Union

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    ▶ bc hh

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    ▶ final goods

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  - $+$ hire labor and rent capital in competitive markets
  - $+$ price setters subject to a Calvo lottery
  - $+$ sell goods to domestic and foreign final goods firms

    ▶ interm. goods

- Labor packers:
  - $+$ assemble differentiated labor input supplied by households
  - $+$ sell homogeneous labor to domestic firms in competitive market

    ▶ labor packers

▶ preferences

Policy Authorities

- National governments

- EA fiscal authority

- EA monetary authority

Policy Authorities

- **National governments**
  - $+$ issue national debts with a maturity structure to domestic savers
  - $+$ levy distortionary taxes on domestic households
  - $+$ purchase goods and transfer resources to domestic households

$$P_t^B B_t + \tau_t^K R_t^K K_t + \tau_t^L W_t L_t + \tau_t^C P_t^C C_t = (1 + \rho P_t^B) B_{t-1} + P_t^C G_t + P_t^C Z_t$$

- **EA fiscal authority**

- **EA monetary authority**

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- EA fiscal authority
  - $+$ issues Eurobonds with a maturity structure to home and foreign country's savers
  - $+$ levies distortionary taxes on home and foreign country's households
  - $+$ transfers resources to home and foreign country's households

$$P_t^{B,EA} B_t^{EA} + \tau_t^{EA,K}(R_t^K K_t + R_t^K K_t^*) + \tau_t^{EA,L}(W_t L_t + W_t^* L_t^*)$$
$$+ \tau_t^{EA,C}(P_t^C C_t + P_t^{C*} C_t^*) = (1 + \rho_{EA} P_t^{B,EA}) B_{t-1}^{EA} + P_t^C Z_t + P_t^{C*} Z_t^*$$

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$$+ \tau_t^{EA,C}(P_t^C C_t + P_t^{C*} C_t^*) = (1 + \rho_{EA} P_t^{B,EA}) B_{t-1}^{EA} + P_t^C Z_t + P_t^{C*} Z_t^*$$

- EA monetary authority
  - \+ sets the interest rate of one-period risk-free bonds $R_t = \frac{1}{E_t Q_{t,t+1}}$

Final Goods Firms

+ Final good produced combining C_t^H and C_t^F with technology

$$Q_t^C = \left[(1-\nu_c)^{\frac{1}{\mu_c}} C_t^{H \frac{\mu_c-1}{\mu_c}} + \nu_c^{\frac{1}{\mu_c}} C_t^{F \frac{\mu_c-1}{\mu_c}}\right]^{\frac{\mu_c}{\mu_c-1}}$$

ν_c degree of openness & μ_c elasticity of sub. between H & F goods

- Demand for H and F intermediate goods i and i^* by final consumption good firm:

$$C_t^H(i) = \left[\int_0^1 C_t^H(i)^{\frac{1}{1+\eta_p}}\right]^{1+\eta_p} \quad C_t^F(i) = \left[\int_0^1 C_t^F(i^*)^{\frac{1}{1+\eta_{p,x}}}\right]^{1+\eta_{p,x}}$$

$\eta_p, \eta_{p,x} > 0$ related to the intratemporal elasticities of sub. between the differentiated outputs supplied by the H and F intermediate firms

- Demand for H and F good bundles by final consumption good firm:

$$C_t^H = (1-\nu_C)\left(\frac{P_t^H}{P_t^C}\right)^{-\mu_C} Q_t^C \quad C_t^F = \nu_C \left(\frac{P_t^F}{P_t^C}\right)^{-\mu_C} Q_t^C$$

Intermediate Goods Firms

+ Intermediate goods firms

- Continuum of monopolistically competitive firms

- Use technology: $Y_t(i) = K_t(i)^\alpha (A_t L_t(i))^{1-\alpha} - A_t \Omega$

- Calvo-price setters

- Price indexation: $p_t^H(i) = (\pi_{t-1}^H)^{\chi_p} (\pi^H)^{1-\chi_p} P_{t-1}^H(i)$

- Face perfectly competitive factor markets for capital and labor

▸ back

Wages

- Both savers and non-savers supply differentiated labor service

- Labor packer produces composite labor $L_t = \left[\int_0^1 L_t(l)^{\frac{1}{1+\eta_w}} \, dl \right]^{1+\eta_w}$

- Profit maximisation yields labor demand $L_t(l) = L_t \left(\frac{W_t(l)}{W_t} \right)^{-\frac{1+\eta_w}{\eta_w}}$

- Wage set optimally by savers with prob ω_w

- Wage indexation $W_t(l) = W_{t-1}(l)(\Pi_{t-1} e^\gamma)^{\chi_w} (\Pi e^\gamma)^{1-\chi_w}$

▶ back

Households' Preferences

+ Savers
+ Hand-to-mouth

Same preferences

$$\mathcal{U}_t = \left((\ln C_t^*(j) - \tilde{C}_{t-1}^*) - \frac{L_t(j)^{1+\xi}}{1+\xi} \right),$$

where $C_t^*(j) \equiv C_t(j) + \alpha_G G_t$

▸ back

Households' Budget Constraints

- The nominal flow budget constraint for hand-to-mouth $j \in [0, \mu]$

$$P_t^C(1 + \tau_t^C + \tau_t^{EA,C})C_t^N(j) = (1 - \tau_t^L - \tau_t^{EA,L})\int_0^1 W_t(l)L_t^N(j,l)dl + P_t^C Z_t^N(j)$$

- The nominal flow budget constraint for saver $j \in (\mu, 1]$

$$P_t^C(1 + \tau_t^C + \tau_t^{EA,C})C_t^S(j) + P_t^I I_t(j) + \underbrace{E_t(\frac{Q_{t,t+1}B_{s,t+1}}{\epsilon_t^{rp}})}_{\text{AD securities}} + \underbrace{P_t^B B_t(j)}_{\text{national bond}} + \underbrace{P_t^{B,EA}B_t^{EA}(j)}_{\text{Eurobond}}$$

$$= B_{s,t}(j) + (1 + \rho P_t^B)B_{t-1}(j) + (1 + \rho P_t^{B,EA})B_{t-1}^{EA}(j)$$

$$+ (1 - \tau_t^L - \tau_t^{EA,L})\int_0^1 W_t(l)L_t^S(j,l)dl$$

$$+ (1 - \tau_t^K - \tau_t^{EA,K})R_t^K v_t(j)\bar{K}_{t-1}^S(j) - \psi(v_t)\bar{K}_{t-1}^S + P_t^C Z_t^S(j) + D_t(j)$$

▶ back

Who Is Afraid of Eurobonds?

Price Indices

$$P_t^C = \left[(1 - \nu_c) P_t^{H^{1-\mu_c}} + \nu_c P_t^{F^{1-\mu_c}} \right]^{\frac{1}{1-\mu_c}}$$

$$P_t^{C^*} = \left[\nu_c P_t^{H^{*^{1-\mu_c}}} + (1 - \nu_c) P_t^{F^{*^{1-\mu_c}}} \right]^{\frac{1}{1-\mu_c}}$$

▸ Back

Old policy framework: Fiscal Discipline

Fiscal authorities follow fiscal rules to stabilise their debts

+ National fiscal rules for $i \in \{IT, DE\}$

$$\hat{\tau}_{i,t}^{J} = \rho_J \hat{\tau}_{i,t-1}^{J} + (1 - \rho_J)\gamma_{J_i}\hat{s}_{b_i,t-1},$$

$$\hat{g}_{i,t} = \rho_G \hat{g}_{i,t-1} - (1 - \rho_G)\gamma_{G_i}\hat{s}_{b_i,t-1}$$

$$\hat{z}_{i,t} = \rho_Z \hat{z}_{i,t-1} - (1 - \rho_Z)\gamma_{Z_i}\hat{s}_{b_i,t-1} - (1 - \rho_Z)\gamma_{ZY_i}\hat{y}_{t-1}$$

$J \in \{C, L, K\}$ and $\hat{s}_{i,t} = \hat{b}_{i,t} - \hat{y}_{i,t}$ national debt-to-GDP ratio

+ EA fiscal rules

$$\hat{\tau}_{EA,t}^{J} = \rho_J \hat{\tau}_{EA,t-1}^{J} + (1 - \rho_J)\gamma_J\hat{s}_{bEA,t-1}$$

$$\hat{z}_{EA,t} = \rho_Z \hat{z}_{EA,t-1} - (1 - \rho_Z)\gamma_Z\hat{s}_{bEA,t-1} - (1 - \rho_Z)\gamma_{ZY}\hat{y}_{EA,t-1}$$

$J \in \{C, L, K\}$ and $\hat{s}_{bEA,t} = \hat{b}_{EA,t} - \hat{y}_{EA,t}$ is EA debt-to-GDP ratio

Old policy framework: Fiscal Discipline

+ The EA monetary authority follows a Taylor rule

$$\hat{R}_t = \max\left\{ -\ln R^*, \rho_r \hat{R}_{t-1} + (1 - \rho_r)\left[\phi_\pi \hat{\pi}_{EA,t} + \phi_y \hat{y}_{EA,t}\right] \right\}$$

where $\hat{\pi}_{EA,t} = \frac{1}{2}\hat{\pi}_{1,t} + \frac{1}{2}\hat{\pi}_{2,t}$ and $\hat{y}_{EA,t} = \frac{1}{2}\hat{y}_{1,t} + \frac{1}{2}\hat{y}_{2,t}$ are at EA level

+ The Taylor principle is satisfied; i.e., $\phi_\pi > 1$

+ ZLB: sequence of anticipated shocks to unconstrained Taylor rule

Old policy framework: Deviation from fiscal discipline

Lack of stabilization tools in high-debt country leads the national government of this country to refuse to comply with the fiscal rules

- During recession, conflict between high-debt country fiscal authority & monetary authority

- Three policy regimes: Monetary led, Fiscally led, and Conflict (with fiscal resolution)

The transition matrix Q of these three policy regimes is the following:

$$Q = \begin{pmatrix} p^{MM} & (1 - p^{FC} - p^{FF}) & 0 \\ (1 - p^{MM} - p^{MC}) & p^{FF} & 1 - p^{CC} \\ p^{MC} & p^{FC} & p^{CC} \end{pmatrix}$$

New policy framework

+ EA Treasury is not subject to limits on primary deficits when facing a recession

+ EA policy authorities can coordinate on a response to an exceptionally large recession

  1. EA fiscal authority issues Eurobonds to finance the fiscal stimulus

  2. ECB accommodates rise in inflation to stabilise the corresponding amount of Eurobonds

+ National governments follow strict fiscal rules to stabilise national debts

New policy framework and a large shock

+ EA fiscal rules ($J \in \{K, L, C\}$)

$$\hat{\tau}_{EA,t}^{J} = \rho_J \hat{\tau}_{EA,t-1}^{J} + (1 - \rho_J) \left[\gamma_J \hat{s}_{EA,t-1}^{P} + \gamma_J^{A} \underbrace{\left(\hat{s}_{EA,t-1} - \hat{s}_{EA,t-1}^{P} \right)}_{\text{Emergency budget}} \right]$$

$$\hat{z}_{EA,t} = \rho_Z \hat{z}_{EA,t-1} - (1 - \rho_Z) \left\{ \left[\gamma_Z \hat{s}_{EA,t-1}^{P} + \gamma_Z^{A} \underbrace{\left(\hat{s}_{EA,t-1} - \hat{s}_{EA,t-1}^{P} \right)}_{\text{Emergency budget}} \right] + \gamma_{ZY} \hat{y}_{EA,t-1} \right\}$$

where $\gamma_J \geq \beta^{-1} - 1 \geq \gamma_J^{A} = 0$

$\gamma_Z \geq \beta^{-1} - 1 \geq \gamma_Z^{A} = 0$

$\hat{s}_{EA,t-1}^{P}$ is Eurobonds to output ratio <u>IF</u> no large symmetric recessionary shock

New policy framework and a large shock

+ EA monetary authority tolerates increase in inflation to stabilise amount of Eurobonds due to EA large recession

$$\hat{R}_t = \max \left\{ -\ln R_*, \rho_R \hat{R}_{t-1} + (1-\rho_R) \left[\phi_\pi \hat{\pi}^P_{EA,t} + \phi^P_\pi \underbrace{\left(\hat{\pi}_t - \hat{\pi}^P_{EA,t} \right)}_{\substack{\text{inflation due to} \\ \text{emergency budget}}} + \phi_y \hat{y}_{EA,t} \right] \right\}$$

with $\phi_\pi > 1 > \phi^P_\pi = 0$

+ How do we pin down $\hat{s}^P_{EA,t}$ and $\hat{\pi}^P_{EA,t}$?

Emergency Budget

We construct a **counterfactual economy** where:

+ Large symmetric recessionary shocks are shut down

+ The ZLB never binds

+ Policymakers follow Fiscal Discipline

Calibration

National fiscal parameters:

+ Steady state and persistence of tax rates: EC, DG Taxation and Customs Union

+ Steady-state and persistence of G and Z: Eurostat

+ Steady-state national debt-to-GDP: 60%

+ Debt response for fiscal instruments: high-country debt-to-GDP back to steady-state in 15 years

EA fiscal parameters:

+ Steady-state of tax rates: 3%

+ Steady-state of Z: Eurostat

+ Steady-state EA debt-to-GDP: 7%

Calibration I

Parameter	Description	Value	Target/Source
Preferences			
β	Discount factor	0.999	Annual SS real rate of 1.35%
ξ	Inverse Frisch elasticity	2	Coenen et al. (2013)
θ	Habit in formation	0.59	Coenen et al. (2013)
α^G	Substitutability of private vs. gov. consumption	-0.24	Leeper et al. (2017)
Frictions and technology			
μ	Share of hand-to-mouth households	0.11	Leeper et al. (2017)
α	Elasticity in production function	0.33	SS share of labour income in total output of 70%
δ	Capital depreciation rate	0.025	Implies annual depreciation of 10%
s	Investment adjustment cost	5.56	Coenen et al. (2013)
ψ	Capital utilization cost	0.16	Leeper et al. (2013)
ω_p	Price Calvo parameter	0.93	Coenen et al. (2013)
ω_w	Wage Calvo parameter	0.78	Coenen et al. (2013)
χ_p	Price indexation	0.38	Coenen et al. (2013)
χ_w	Wage indexation	0.54	Coenen et al. (2013)
η_p	Price markup	0.163	Leeper et al. (2013)
η_w	Wage markup	0.286	Leeper et al. (2013)
$\nu_{C,IT}$	Degree of openness for IT	0.205	Albonico et al. (2019)
$\nu_{C,DE}$	Degree of openness for DE	0.261	Albonico et al. (2019)
$\mu_{C,IT}$	Elasticity of sub. between IT & DE	1.130	Albonico et al. (2019)
$\mu_{C,DE}$	Elasticity of sub. between DE & IT	1.300	Albonico et al. (2019)

▶ Back

Calibration II

Parameter	Description	Value	Target/Source
Monetary authority			
ϕ_π	Interest rate response to EA inflation	1.89	Coenen et al. (2013)
ϕ_y	Interest rate response to EA output	0.16	Coenen et al. (2013)
ρ_r	Interest rate smoothing	0.88	Coenen et al. (2013)
Risk Premium Shock			
ρ	Persistence of shock	0.96	Match average EABCN peak-to-trough
σ	Volatility of shock	0.011	Match output volatility over 1999Q1-2019Q4

Table: Calibrated values for model parameters and steady-state targets.

▶ Back

Calibration III

Parameter	Description	Value	Target/Source
Steady-state calibration targets			
$s_{b,IT}$	Quarterly debt-to-GDP in IT	2.4	Annualized 60%, Maastricht Treaty parameter
$s_{b,DE}$	Quarterly debt-to-GDP in DE	2.4	Annualized 60%, Maastricht Treaty parameter
$s_{b,EA}$	Quarterly debt-to-GDP in EA	0.28	Annualized 7%
$s_{gc,IT}$	Gov. expenditure-to-GDP ratio IT	0.187	Quarterly average in 2019, Eurostat
$s_{gc,DE}$	Gov. expenditure-to-GDP ratio DE	0.205	Quarterly average in 2019, Eurostat
τ_{IT}^L	Steady-state tax rate on labor IT	19.7%	EC, DG Taxation and Customs Union, 2018
τ_{DE}^L	Steady-state tax rate on labor DE	25.2%	EC, DG Taxation and Customs Union, 2018
τ_{EA}^L	Steady-state tax rate on labor EA	3%	
τ_{IT}^K	Steady-state tax rate on capital IT	29.2%	EC, DG Taxation and Customs Union, 2018
τ_{DE}^K	Steady-state tax rate on capital DE	30.6%	EC, DG Taxation and Customs Union, 2018
τ_{EA}^K	Steady-state tax rate on capital EA	3%	
τ_{IT}^C	Steady-state tax rate on cons. IT	22%	EC, DG Taxation and Customs Union, 2018
τ_{DE}^C	Steady-state tax rate on cons. DE	19%	EC, DG Taxation and Customs Union, 2018
τ_{EA}^C	Steady-state tax rate on cons. EA	3%	
Debt maturities			
ρ_{IT}	Debt maturity decay rate IT	0.963	Target yearly average maturity of 6.87 in 2019
ρ_{DE}	Debt maturity decay rate DE	0.964	Target yearly average maturity of of 5.94 in 2010
ρ_{EA}	Debt maturity decay rate EA	0.958	Target yearly average maturity of 6.6 in 2010

Table: Calibrated values for model parameters and steady-state targets. ▶ Back

Calibration IV

Parameter	Description	Value	Target/Source
Fiscal authorities			
ρ^L_{IT}	Persistence of τ^L in IT	0.735	Estimated 2004-2020, EC, DG Taxation & Customs Union
ρ^L_{DE}	Persistence of τ^L in DE	0.735	Estimated 2004-2020, EC, DG Taxation & Customs Union
ρ^L_{EA}	Persistence of τ^L in EA	0.726	Estimated 2004-2020, EC, DG Taxation & Customs Union
ρ^K_{IT}	Persistence of τ^K in IT	0.606	Estimated 2006-2018, EC, DG Taxation & Customs Union
ρ^K_{DE}	Persistence of τ^K in DE	0.662	Estimated 2006-2018, EC, DG Taxation & Customs Union
ρ^K_{EA}	Persistence of τ^K in EA	0.502	Estimated 2006-2018, EC, DG Taxation & Customs Union
ρ^C_{IT}	Persistence of τ^C in IT	0.884	Estimated 2000-2020, EC, DG Taxation & Customs Union
ρ^C_{DE}	Persistence of τ^C in DE	0.833	Estimated 2000-2020, EC, DG Taxation & Customs Union
ρ^C_{EA}	Persistence of τ^C in EA	0.895	Estimated 2000-2020, EC, DG Taxation & Customs Union
ρ^G_{IT}	Persistence of G in IT	0.659	Estimated over 2007-2019, Eurostat
ρ^G_{DE}	Persistence of G in DE	0.365	Estimated over 2007-2019, Eurostat
ρ^Z_{IT}	Persistence of transfers rule	0.785	Estimated over 1996-2019, Eurostat
ρ^Z_{DE}	Persistence of transfers rule	0.636	Estimated over 2002-2019, Eurostat
ρ^{EA}_{Z}	Persistence of transfers rule	0.880	Estimated over 2002-2019, Eurostat
γ^G	Debt response for G	0.11	IT debt-to-GDP to SS in 15 years
γ^Z	Debt response for transfers	0.11	IT debt-to-GDP to SS in 15 years
γ^L	Debt response for τ^L	0.11	IT debt-to-GDP to SS in 15 years
γ^K	Debt response, for τ^K	0.11	IT debt-to-GDP to SS in 15 years
γ^C	Debt response for τ^C	0.11	IT debt-to-GDP to SS in 15 years
ϕ_Y	Automatic stabilizers	0.11	IT debt-to-GDP to SS in 15 years

▶ Back

Table: Calibrated values for model parameters and steady-state targets.

Calibration V

Transition matrix Q between the four regimes is the following:

$$Q = \begin{pmatrix} p^{MM} & (1 - p^{FC} - p^{FF}) & 0 \\ (1 - p^{MM} - p^{MC}) & p^{FF} & 1 - p^{CC} \\ p^{MC} & p^{FC} & p^{CC} \end{pmatrix}$$

Transition probabilities:

- $p^{MM} = 0.9995$,
- $p^{FF} = 0.9995$,
- $p^{CC} = 0.9$.
- $p^{MC} = p^{FC} = 0$

The conflict is assumed to last 10 quarters

▶ Back

Summary and parameterization

+ Policy response to **a large contractionary shock**

Parameter	Description	Fiscal Discipline	New framework	Deviation
ϕ_π	Monetary response to π_{EA}	1.89	0.9	1.89
$\gamma_{J,IT}$	Fiscal response for IT	0.11	0.11	0.001
$\gamma_{J,DE}$	Fiscal response for DE	0.11	0.11	0.11
$\gamma_{J,EA}$	Fiscal response for EA	0.11	0.001	0.11

Table: Parameters of monetary and fiscal rules across policy scenarios.

+ $J \in \{C, L, K, G, Z\}$
+ $\phi_\pi = 1.89$ as estimated in Coenen, Straub, & Trabandt (2013)
+ $\gamma_J = 0.11$, IT debt-to-GDP to bring IT debt back to SS in 15 years under fiscal discipline
+ Transition probabilities across regimes as in Bianchi & Melosi (2019)

▸ matrix

EU fiscal governance

- Maastricht Treaty (1992): establishes fiscal rules
  - 60% debt-to-GDP and 3% deficit limit
  - No bail-out clause and no debt monetization

- Stability and Growth Pact (1997): adds more rigidity
  - Budget position close to balance or in surplus over medium term
  - Excessive deficit procedure if rules are violated

- Reform of Pact (2005): aims to reduce pro-cyclical bias of fiscal rules
  - Rules in cyclically adjusted terms with a medium term objective

- Fiscal compact (2012): reforms the Stability and Growth Pact
  - Establishes a minimum limit for the structural deficit
  - Introduces debt brake

- Stability and Growth Pact suspended by EU on March 23, 2020 until at least 2023

Why Both Countries Benefit from the Policy Reform?

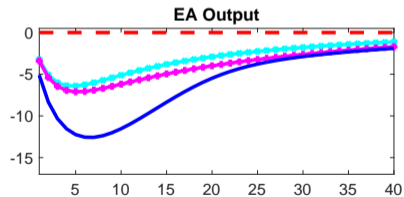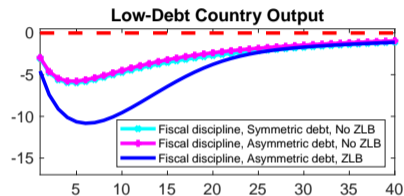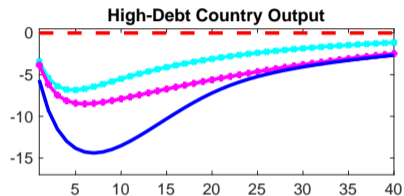- When monetary policy unconstrained, it is an effective stabilisation tool
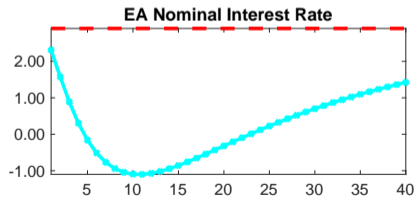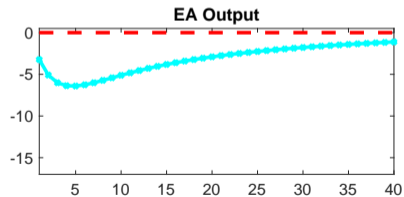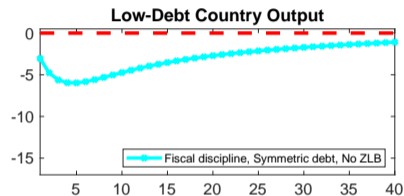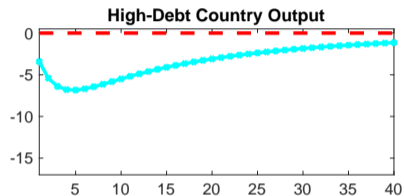
Why both countries benefit from the policy reform?

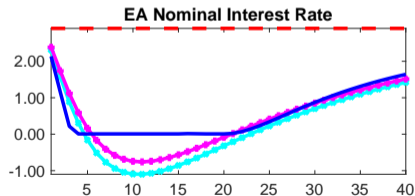- Large national debt matters somewhat for recovery under fiscal discipline
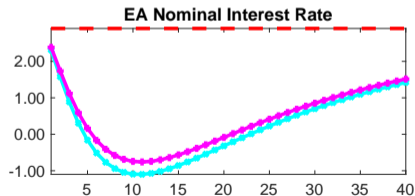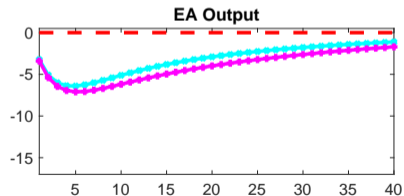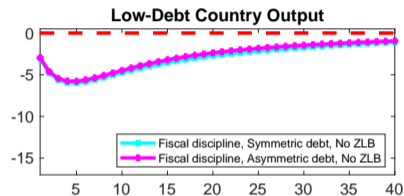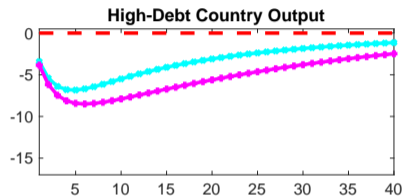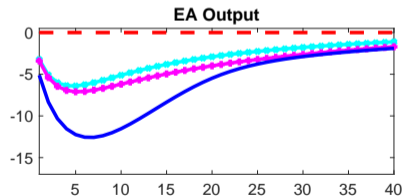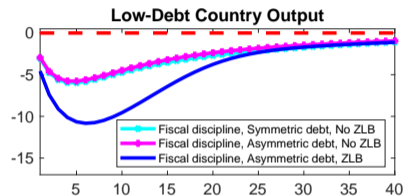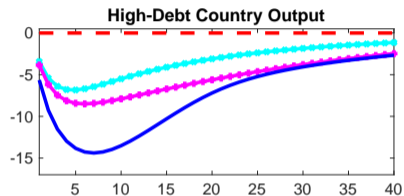
Why both countries benefit from the policy reform?

- If ZLB binds, lack of stabilisation tools for high-debt countries under fiscal discipline

High-Debt Country Output

Low-Debt Country Output

Fiscal discipline, Symmetric debt, No ZLB
Fiscal discipline, Asymmetric debt, No ZLB
Fiscal discipline, Asymmetric debt, ZLB
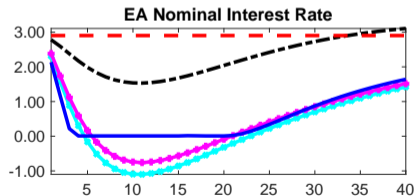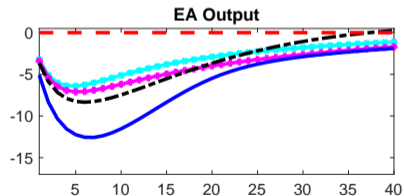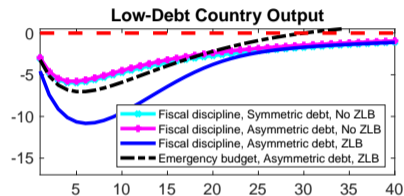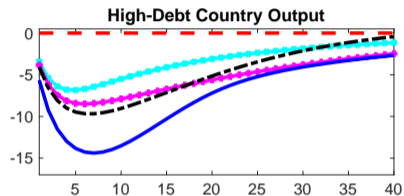
EA Output

EA Nominal Interest Rate
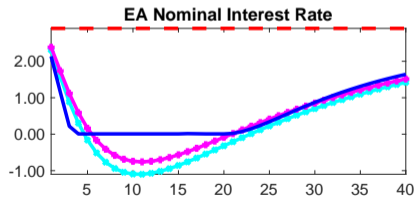
Why both countries benefit from the policy reform?

- Very costly, also for low-debt countries because euro area heavily integrated

High-Debt Country Output

Low-Debt Country Output

Fiscal discipline, Symmetric debt, No ZLB
Fiscal discipline, Asymmetric debt, No ZLB
Fiscal discipline, Asymmetric debt, ZLB

EA Output

EA Nominal Interest Rate

Why both countries benefit from the policy reform?

- Scope for Eurobonds as stabilisation tool if ZLB binds and large national debt

Welfare implications

Variables	Old framework	New Framework
Euro Area Output	16.797	11.707
Euro Area Inflation	0.617	0.427
High-Debt Country Output	18.103	12.273
High-Debt Country Inflation	0.640	0.426
Low-Debt Country Output	15.516	11.147
Low-Debt Country Inflation	0.640	0.426
ZLB Frequency	0.210	0.089

Table: Volatilities of Output and Inflation for 1000 simulations of 40 periods under *Fiscal Discipline* and *Emergency Budget*.