Who Is Afraid of Eurobonds?

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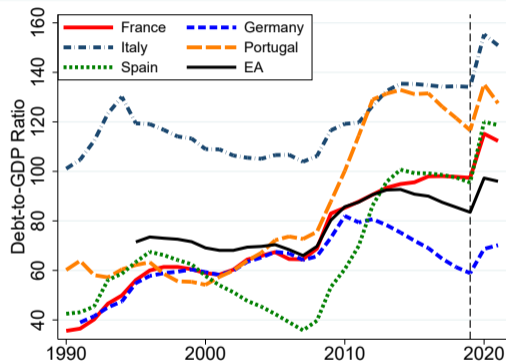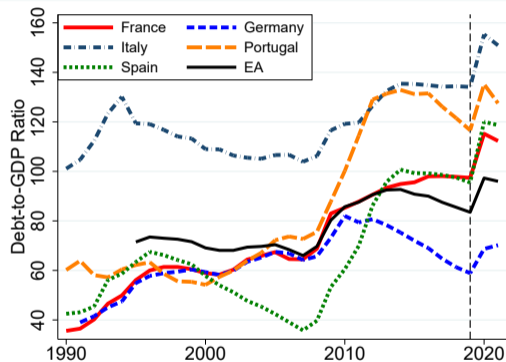
Anna Rogantini Picco

European Central Bank
CEPR

Where does the euro area stand?

- More countries in euro area have now elevated government debt
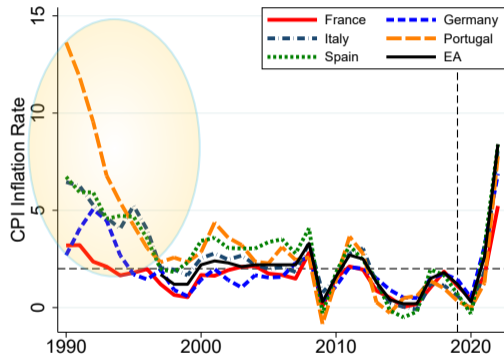
Where does the euro area stand?

- 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
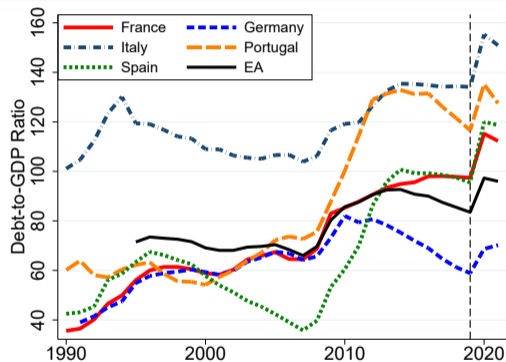
Where does the euro area stand?

- The fiscal rules worked well in the 2000s...
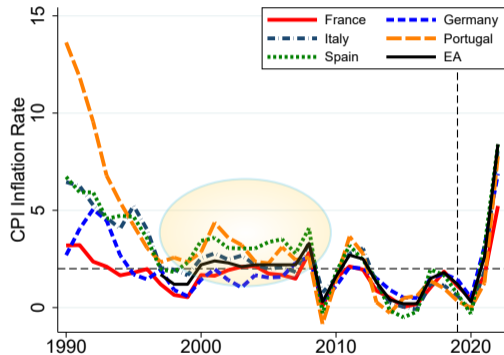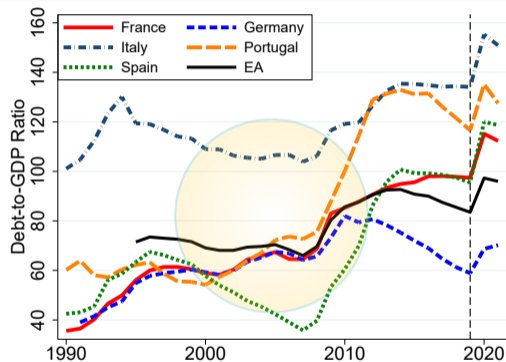
Where does the euro area stand?

- ...but when Great Recession hit, debt accumulated quickly
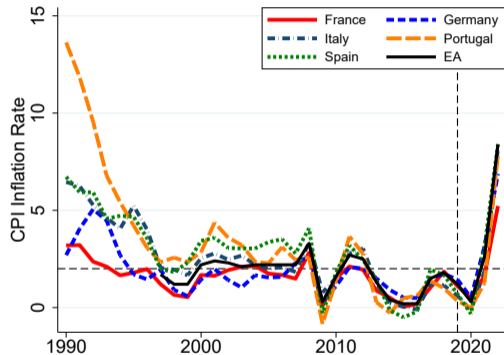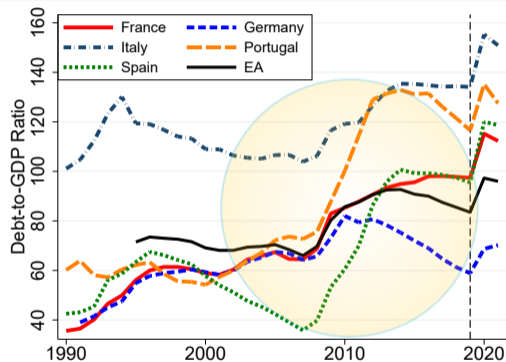
Where does the euro area stand?

- Euro area entered a phase of low inflation and ZLB episodes
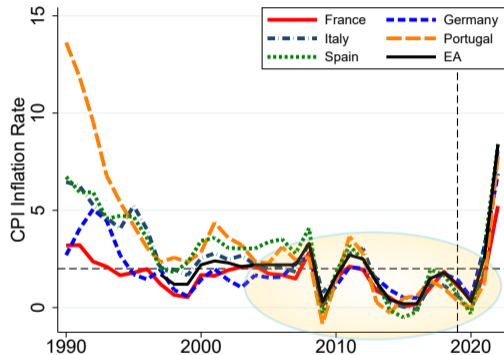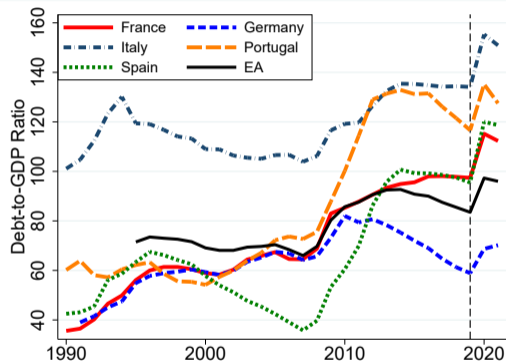
Where does the euro area stand?

- As a result, euro area had a sluggish recovery and debt remained elevated
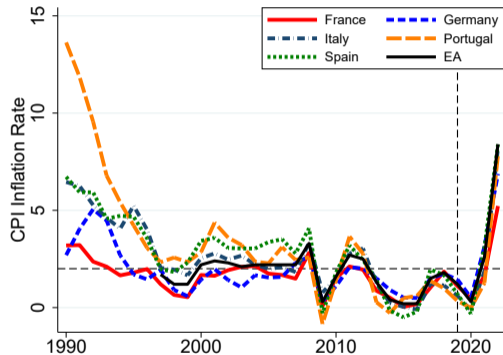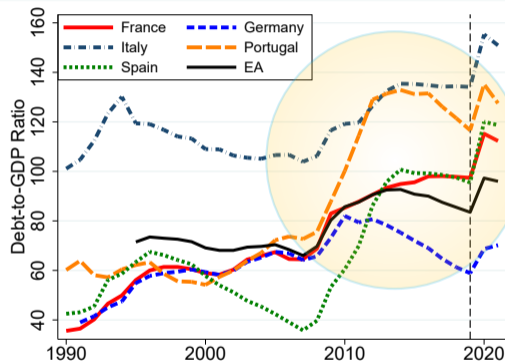
Where does the euro area stand?

- Pandemic further curtailed the ability of euro area policymakers to stabilize the economy
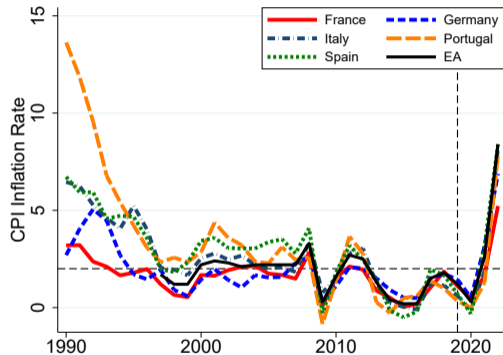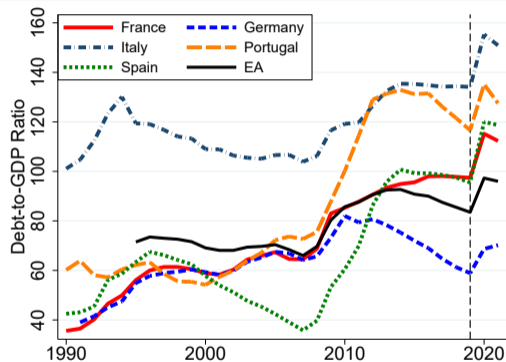
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- Fiscal rules were temporarily suspended...
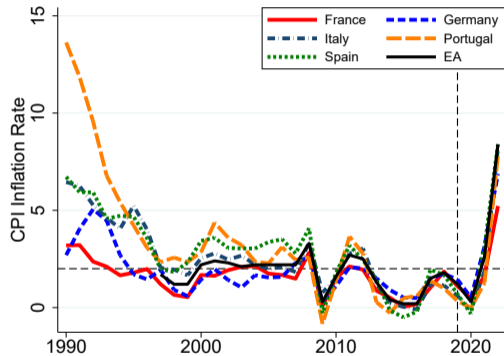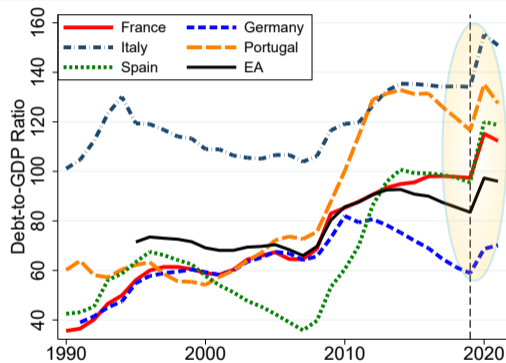
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- …and inflation increased
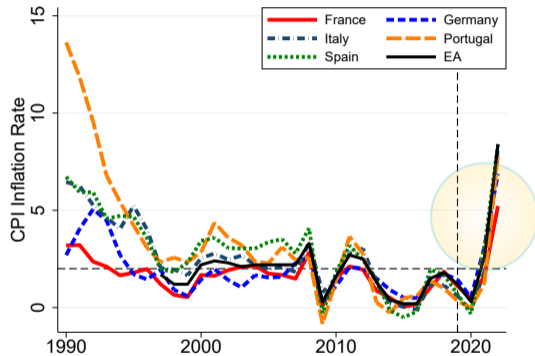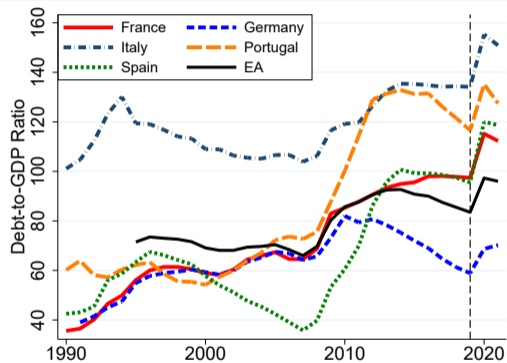
The euro area at a crossroads

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

+ We study a new monetary and fiscal framework that separates:
  - the need of short-run macroeconomic stabilisation
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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 $\rightarrow$ less accumulation of national debts $\rightarrow$ stronger recoveries

    2. Controlled reflation of EA when necessary $\rightarrow$ easing constraints on monetary policy

    3. Inflation increases modestly because of general equilibrium effects

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$+$ **Removes the risk of high inflation and fiscal stagflation** because fiscal rules are not suspended at the national level:

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+ **Improves welfare** in both high-debt and low-debt countries

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), Mackowiak and Schmidt (2024)

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

A Model of a Two-country Monetary Union

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- Households:
  - + savers and hand-to-mouth   ▶ preferences
  - + 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

- Final goods firms:

- Intermediate goods firms:

- Labor packers:

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

Policy Authorities

- National governments

- EA fiscal authority

- EA monetary authority

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

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

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$$P_t^{B,EA} B_t^{EA} + \tau_t^{EA,K}(R_t^K K_t + R_t^K K_t^*) + \tau_t^{EA,L}(W_t L_t + W_t^* L_t^*)$$
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- EA monetary authority
  - $+$ sets the interest rate of one-period risk-free bonds $R_t = \frac{1}{E_t Q_{t,t+1}}$

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

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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

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Lack of stabilization tools in high-debt country can lead national government of this country to be unwilling or unable to comply with fiscal rules

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+ The conflict can only be temporary, after which one of the two authorities has to give in

▸ matrix

New policy framework

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+ National governments follow strict fiscal rules to stabilise national debts

New policy framework and a large shock

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

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

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

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

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

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

+ 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%

+ Strength of fiscal response to debt-to-GDP: high-country debt-to-GDP back to steady-state in 15 years

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

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

+ Strength of fiscal response to debt-to-GDP: 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%

▸ table fiscal ▸ table ▸ MS prob

Three policy scenarios

We consider **three policy scenarios**

1. Old policy framework: Fiscal discipline always in place
   $\Rightarrow$ risk of deflation

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We consider **three policy scenarios**

1. Old policy framework: Fiscal discipline always in place
   $\Rightarrow$ risk of deflation

2. Old policy framework: Deviation from fiscal discipline
   $\Rightarrow$ risk of inflation and fiscal stagflation

3. New policy framework
   $\Rightarrow$ Stabilization policies separated from long-run fiscal sustainability
   $\Rightarrow$ 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**

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

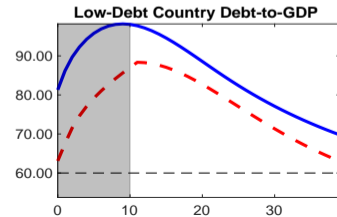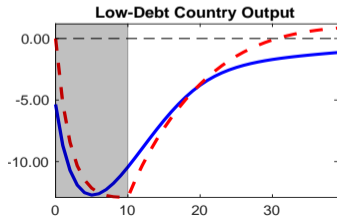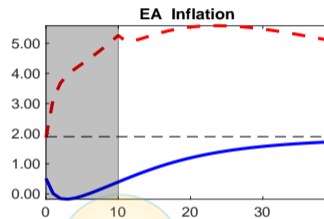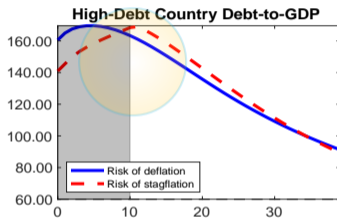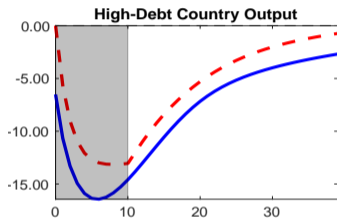- Strict fiscal rules + zero lower bound ⇒ Risk of deflation and deep recession
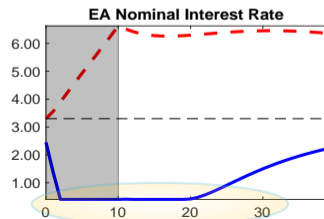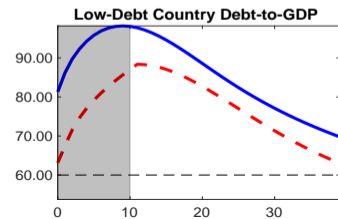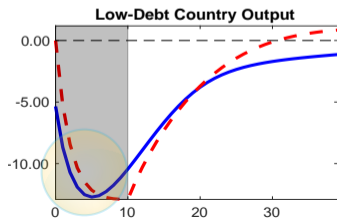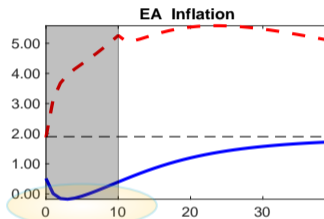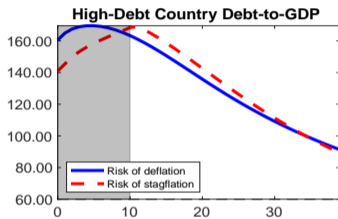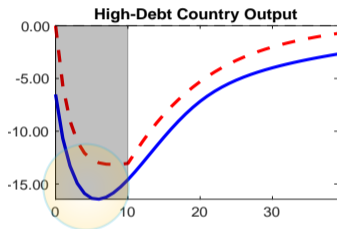
Old policy framework: From risk of deflation to risk of stagflation

- Suspend fiscal rules ⇒ Risk of stagflation if one country unwilling to revert to them
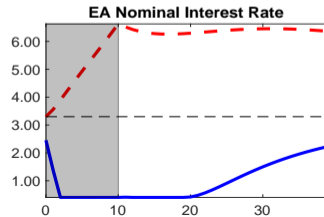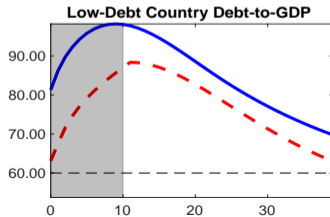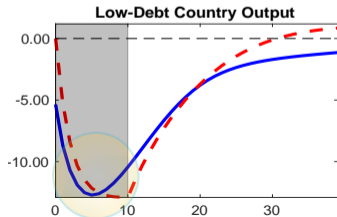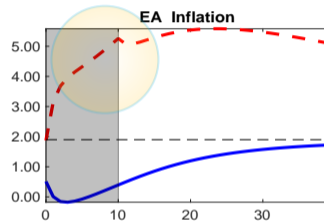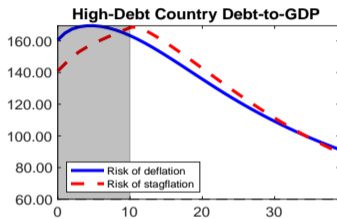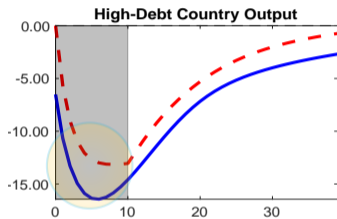
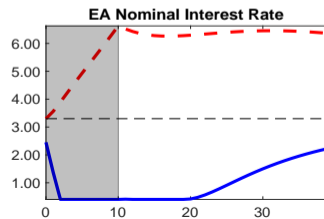# Old policy framework: From risk of deflation to risk of stagflation

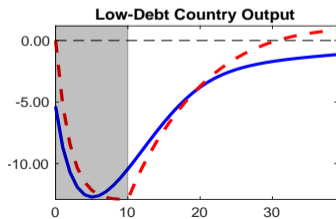- Monetary tightening further increases debt-to-GDP in high-debt country
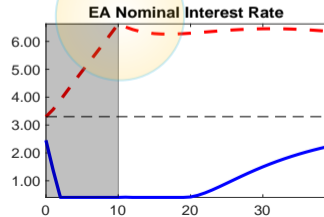
Old policy framework: From risk of deflation to risk of stagflation

- Spiral of growing inflation, deeper recession, and debt accumulation
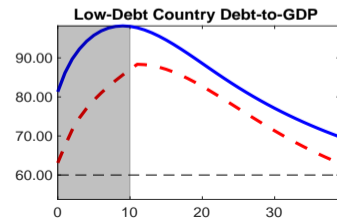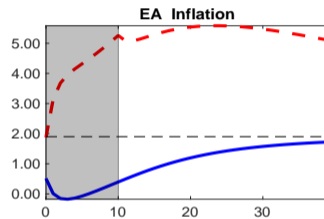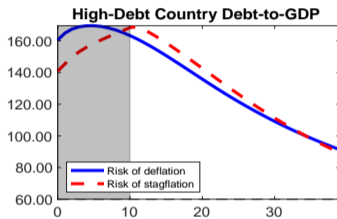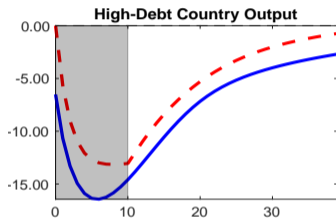
Distortionary taxes generate a drag on the economy
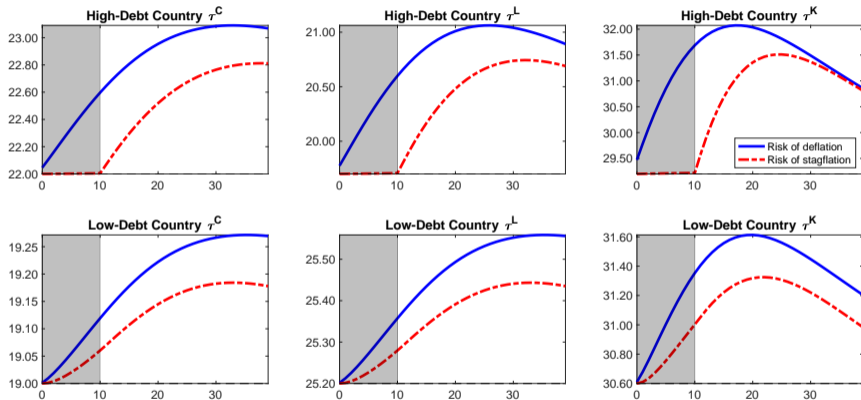
New policy framework: Controlled reflation

- 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
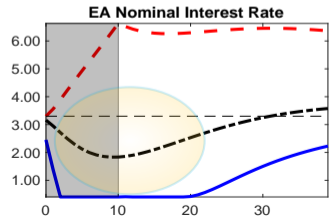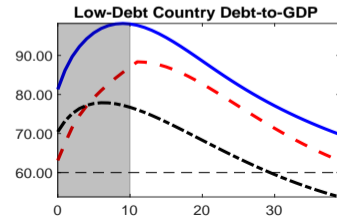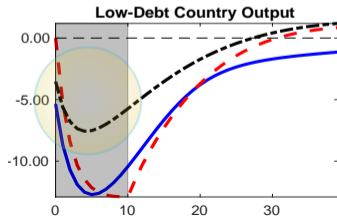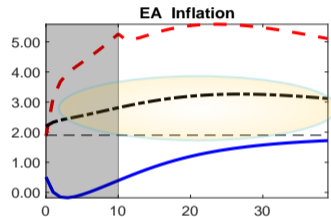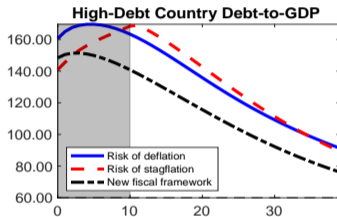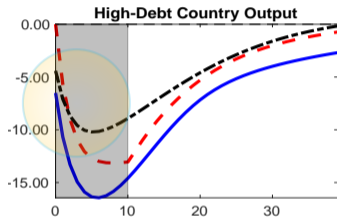
Why the new policy framework is effective

+ 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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  - Economy avoids the ZLB → monetary policy not constrained
  - Milder recession → less accumulation of debt → smaller expected fiscal adjustments

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+ Reinforcing effects
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  - Milder recession → less accumulation of debt → smaller expected fiscal adjustments

+ 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

Why Both Countries Benefit from the Policy Reform?

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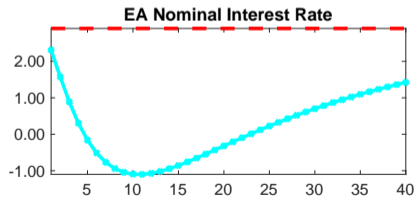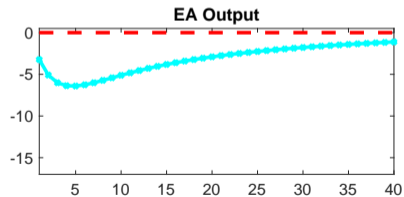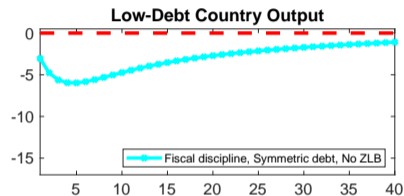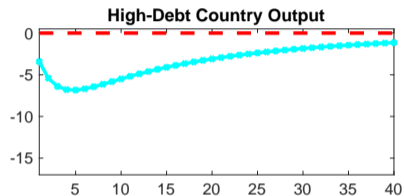
Why both countries benefit from the policy reform?

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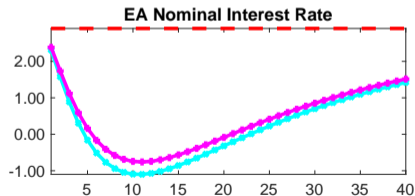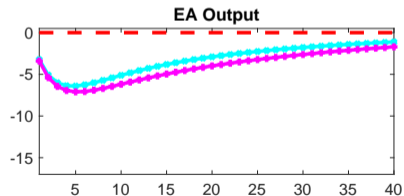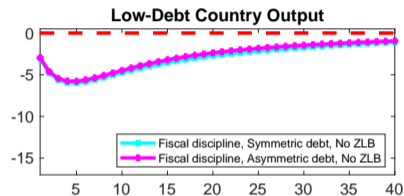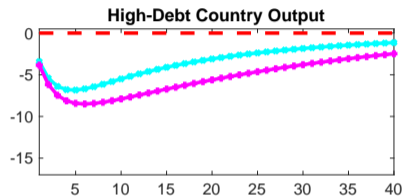
Why both countries benefit from the policy reform?

- 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
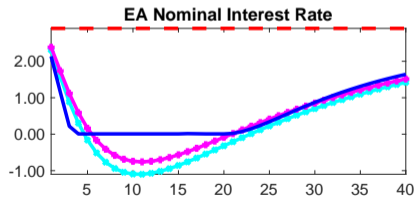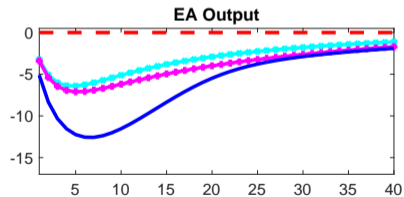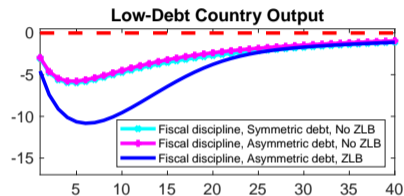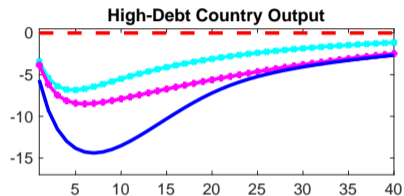
Why both countries benefit from the policy reform?

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

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Fiscal discipline, Symmetric debt, No ZLB
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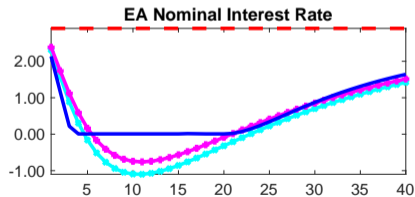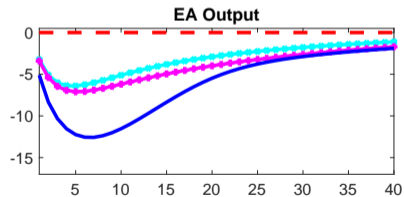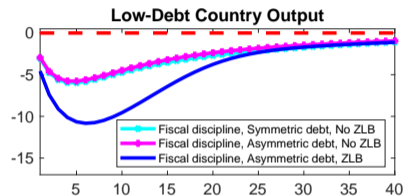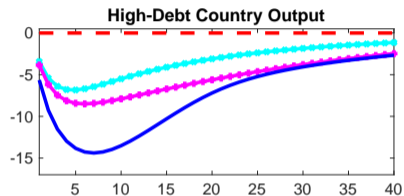
Why both countries benefit from the policy reform?

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

High-Debt Country Output

Low-Debt Country Output

Legend:
- Fiscal discipline, Symmetric debt, No ZLB
- Fiscal discipline, Asymmetric debt, No ZLB
- Fiscal discipline, Asymmetric debt, ZLB
- Emergency budget, Asymmetric debt, ZLB

EA Output

EA Nominal Interest Rate
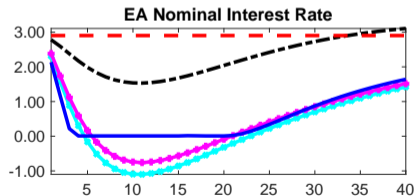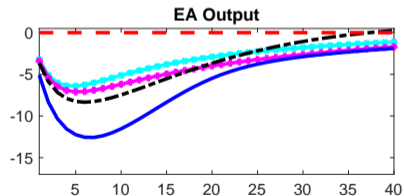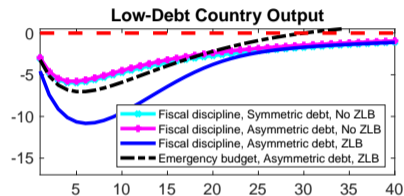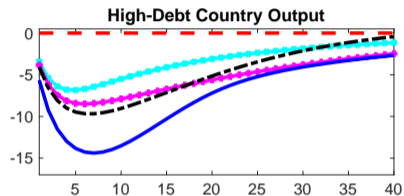
Welfare implications

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 *New Fiscal Framework*.

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

Appendix

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:

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

▶ back

▶ price indices

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

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

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 $j \in (\mu, 1]$

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

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

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

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

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

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)

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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.

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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_{IT}^{L}	Persistence of τ^L in IT	0.735	Estimated 2004-2020, EC, DG Taxation & Customs Union
ρ_{DE}^{L}	Persistence of τ^L in DE	0.735	Estimated 2004-2020, EC, DG Taxation & Customs Union
ρ_{EA}^{L}	Persistence of τ^L in EA	0.726	Estimated 2004-2020, EC, DG Taxation & Customs Union
ρ_{IT}^{K}	Persistence of τ^K in IT	0.606	Estimated 2006-2018, EC, DG Taxation & Customs Union
ρ_{DE}^{K}	Persistence of τ^K in DE	0.662	Estimated 2006-2018, EC, DG Taxation & Customs Union
ρ_{EA}^{K}	Persistence of τ^K in EA	0.502	Estimated 2006-2018, EC, DG Taxation & Customs Union
ρ_{IT}^{C}	Persistence of τ^C in IT	0.884	Estimated 2000-2020, EC, DG Taxation & Customs Union
ρ_{DE}^{C}	Persistence of τ^C in DE	0.833	Estimated 2000-2020, EC, DG Taxation & Customs Union
ρ_{EA}^{C}	Persistence of τ^C in EA	0.895	Estimated 2000-2020, EC, DG Taxation & Customs Union
ρ_{IT}^{G}	Persistence of G in IT	0.659	Estimated over 2007-2019, Eurostat
ρ_{DE}^{G}	Persistence of G in DE	0.365	Estimated over 2007-2019, Eurostat
ρ_{IT}^{Z}	Persistence of transfers rule	0.785	Estimated over 1996-2019, Eurostat
ρ_{DE}^{Z}	Persistence of transfers rule	0.636	Estimated over 2002-2019, Eurostat
ρ_{Z}^{EA}	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

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

Summary and parameterization

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

Parameter	Description	Fiscal Discipline	Fiscally-led framework	Conflict
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

Calibration V

Transition matrix Q between the 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

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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