Fiscal policy coordination in currency unions at the effective lower bound

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The question

Need to coordinate fiscal stabilization policy in currency unions?
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Pre-crisis paradigm: no

- Stabilization of area-wide fluctuations left to monetary policy
- Country-specific fluctuations smoothed by fiscal policy
  (Beetsma & Jensen 2005, Galí & Monacelli 2008)
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- Stabilization of area-wide fluctuations left to monetary policy
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  (Beetsma & Jensen 2005, Galí & Monacelli 2008)

Global financial crisis

- Return of fiscal stabilization policy, notably as monetary policy constrained by effective lower bound
- Fiscal stimulus in EA smaller than in US
Cyclical adjusted budget deficit

Percentage point of GDP, change relative to 2007

United States

Euro area
Consumption of general government

Units of potential output

max, increase relative to mean: 5.7% (EA) vs 10.4% (US)
This paper

Optimal public consumption in currency union

- Focus on discretionary policy once effective lower bound binds
- Benchmark results in the absence of coordination against results for coordination
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Framework: Galí & Monacelli (2005, 2008); two new aspects
- Monetary policy constrained by effective lower bound
- Optimal non-cooperative fiscal policy
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Optimal public consumption in currency union

▶ Focus on discretionary policy once effective lower bound binds
▶ Benchmark results in the absence of coordination against results for coordination

Framework: Galí & Monacelli (2005, 2008); two new aspects
▶ Monetary policy constrained by effective lower bound
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Abstract from
▶ Non-conventional monetary policy
▶ Sovereign risk e.g. Corsetti, Kuester, Meier & Müller (2014)
▶ Deficit bias e.g. Beetsma & Uhlig (1999), Krogstrup & Wyplosz (2010)
Related literature

Government spending multipliers: ELB vs fixed exchange rates

Fiscal coordination in open economies at ZLB
- Cook & Devereux (2011), Blanchard, Erceg & Lindé (2016)

Terms of trade externality
New Keynesian model of a currency union

Basic model due to Galí & Monacelli (2008)

- Currency union as continuum of small open economies
- Within each country: households, firms, fiscal authority
- Common monetary policy
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Basic model due to Galí & Monacelli (2008)
- Currency union as continuum of small open economies
- Within each country: households, firms, fiscal authority
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No strategic interaction
- Country-wide developments impact terms of trade, but not union-wide variables
Representative household in country $i \in [0, 1]$

Period utility

$$U(C_t^i, N_t^i, G_t^i) = (1 - \chi) \log C_t^i + \chi \log G_t^i - \frac{(N_t^i)^{1+\varphi}}{1 + \varphi}$$

with $C_t^i \equiv \frac{(C_{H,t}^i)^{1-\alpha} (C_{F,t}^i)^\alpha}{(1 - \alpha)^{1-\alpha} \alpha^\alpha}$

- $C_t^i$ denotes private and $G_t^i$ public consumption, $N_t^i$ is hours worked, $0 < \chi < 1$ and $\varphi > 0$
- $C_{H,t}$ and $C_{F,t}$: aggregates of domestic and union wide bundles
- $\alpha \in (0, 1)$: home bias accounts for deviation from PPP
- Financial markets are complete
Variety producing firm $j \in [0, 1]$ in country $i$

- Produce with linear technology $Y_t^i(j) = N_t^i(j)$
- Monopolistic competition, price rigidities (Calvo)
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Government sector in country $i$

- Public consumption $G_t^i$: domestically produced goods only
- Lump-sum taxes (Ricardian equivalence)
Variety producing firm $j \in [0, 1]$ in country $i$

- Produce with linear technology $Y^i_t(j) = N^i_t(j)$
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Government sector in country $i$

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Monetary policy

- Sets nominal interest rate at union level: $i^*_t$
Approximate equilibrium dynamics: country level

New Keynesian Phillips curve (with $\gamma \equiv G/Y$)

$$\pi^i_t = \beta E_t\{\pi^i_{t+1}\} + \lambda \left( \frac{1}{1-\gamma} + \varphi \right) \hat{y}^i_t - \frac{\lambda \gamma}{1-\gamma} \hat{g}^i_t$$ (1)

Inflation and terms of trade

$$\pi^i_t - \pi^*_t = -(s^i_t - s^i_{t-1})$$ (2)

where $\pi^i_t \equiv p^i_t - p^i_{t-1}$ and $s^i_t \equiv p^*_t - p_t$

Aggregate demand

$$\hat{y}^i_t = \gamma (\hat{g}^i_t - \hat{g}^*_t) + (1-\gamma)s^i_t + \hat{y}^*_t$$ (3)
Approximate equilibrium dynamics: union level

New Keynesian Phillips curve

\[ \pi_t^* = \beta E_t \{ \pi_{t+1}^* \} + \lambda \left( \frac{1}{1 - \gamma} + \varphi \right) \hat{y}_t^* - \frac{\lambda \gamma}{1 - \gamma} \hat{g}_t^* \quad (4) \]

Aggregate demand

\[ \hat{y}_t^* = E_t \{ \hat{y}_{t+1}^* \} - \gamma E_t \{ \hat{g}_{t+1}^* - \hat{g}_t^* \} \]
\[ - (1 - \gamma) \left[ i_t^* - E_t \{ \pi_{t+1}^* \} + \Delta_t + \Delta_t + r \right] \quad (5) \]

where \( \Delta_t \) is exogenous spread (Woodford, 2011)

- Markov: shock \( \Delta_t = \Delta_H \) lasts with prob. \( \mu \), else zero

Interest rate rule

\[ i_t^* = \max \{ r - \Delta_t + \phi_\pi \pi_t^*, 0 \} \quad (6) \]
Given initial conditions \((s_{-1})\) and a path for the exogenous spread \(\{\Delta_t\}_{t=0}^{\infty}\) an equilibrium is a collection of

1. country-specific stochastic processes \(\{\hat{y}_t^i, \pi_t^i, s_t^i\}_{t=0}^{\infty}\) for all \(i \in [0, 1]\)

2. union-wide stochastic processes \(\{\hat{y}_t^*, \pi_t^*\}_{t=0}^{\infty}\) with
\[
\hat{y}_t^* = \int_0^1 \hat{y}_t^i \, di, \ \pi_t^* = \int_0^1 \pi_t^i \, di
\]
such that for given \(\{\hat{g}_t^i\}_{t=0}^{\infty}\) for all \(i \in [0, 1]\) with \(\hat{g}_t^* = \int_0^1 \hat{g}_t^i \, di\) and the path for the nominal interest rate \(\{i_t^*\}_{t=0}^{\infty}\) determined by (6)

3. equilibrium conditions (3) - (2) are satisfied for each country \(i\) and

4. equilibrium conditions (5) and (4) are satisfied on the union level.
Government spending multiplier on output
Corsetti, Kuester, Müller (2013), Fahri, Werning (2016)

Consider exogenous variation in government consumption while effective lower bound binds, then

\[
\frac{1}{\gamma} \frac{d\hat{y}_i^L}{d\hat{g}_L^i} \leq 1 \leq \frac{1}{\gamma} \frac{d\hat{y}_L^*}{d\hat{g}_L^*}
\]
Consider exogenous variation in government consumption while effective lower bound binds, then

\[ \frac{1}{\gamma} \frac{d\hat{y}_i}{d\hat{g}_L} \leq 1 \leq \frac{1}{\gamma} \frac{d\hat{y}_L^*}{d\hat{g}_L^*} \]

Intuition: government spending inflationary

- Union-wide impulse: real interest rate declines, boosting private expenditure
Consider exogenous variation in government consumption while effective lower bound binds, then

\[
\frac{1}{\gamma} \frac{d\hat{y}_L}{d\hat{g}_L} \leq 1 \leq \frac{1}{\gamma} \frac{d\hat{y}_L^*}{d\hat{g}_L^*}
\]

Intuition: government spending inflationary

- Union-wide impulse: real interest rate declines, boosting private expenditure
- Country level only: terms of trade appreciate, reducing demand for domestic goods
Optimal discretionary fiscal policy

Need to coordinate fiscal stabilization policy in currency unions?

- Optimal policy w/ coordination:
  maximize union-wide welfare

- Optimal policy w/o coordination (Nash):
  maximize domestic welfare taking aggregate variables as given
Optimal discretionary fiscal policy

Need to coordinate fiscal stabilization policy in currency unions?

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Strategy based on linear quadratic approach

- Compute steady states w/ and w/o coordination as solution to social planner problems
- Approximate welfare up to 2nd order, relying on Benigno & Woodford (2006)
- Compute optimal discretionary fiscal policy at effective lower bound
Optimal government spending in steady state


Steady states w/ and w/o coordination are given by

\[ \gamma^{Coord} = \chi < \frac{\chi}{(1 - \alpha)(1 - \chi) + \chi} = \gamma^{Nash} \]

Intuition
- Coordination: provide efficient level of spending
- Nash: appreciate terms of trade to economize on labor effort

Some empirical observations
- US data: \( \gamma^{Coord} = 0.15 \); EA data: \( \gamma^{Nash} = 0.19 \)
- Implies \( \alpha = 0.29 \)
Optimal fiscal stabilization under discretion at ELB: Coordination

Maximize union wide (period) utility

\[-\frac{1}{2} \int_0^1 \left( \frac{\varepsilon}{\lambda} (\pi_t^i)^2 + (1 + \varphi)(\hat{\gamma}_t^i)^2 + \frac{\gamma}{1 - \gamma} (\hat{g}_t^i - \hat{y}_t^i)^2 \right) \, di \]

Subject to

\[
\hat{y}_t^* = E_t\{\hat{y}_{t+1}^*\} - (1 - \gamma) [i_t^* - E_t\{\pi_{t+1}^*\} + \Delta_t] - \gamma E_t\{\hat{g}_{t+1}^* - \hat{g}_t^*\} \\
\pi_t^* = \beta E_t\{\pi_{t+1}^*\} + \lambda \left( \frac{1}{1 - \gamma} + \varphi \right) \hat{y}_t^* - \frac{\lambda \gamma}{1 - \gamma} \hat{g}_t^* 
\]

where \( \gamma = \gamma^{Coord} \) and \( i_t^* = 0 \)
Optimal fiscal stabilization under discretion at ELB: Nash

Maximize

\[ V(s^i_{t-1}, \pi^*_t, \hat{c}^*_t) = \max_{\pi_t^i, \hat{y}_t^i, \hat{g}_t^i, s_t^i} \left[ -\frac{1}{2} \left( \frac{\varepsilon}{\lambda} (\pi_t^i)^2 + (1 + \phi)(\hat{y}_t^i)^2 + \frac{\gamma}{1 - \gamma} (\hat{g}_t^i - \hat{y}_t^i)^2 \right) \right. \]

\[ \left. + \beta E_t V(s^i_t, \pi^*_{t+1}, \hat{c}^*_{t+1}) \right] \]

Subject to

\[ \hat{y}_t^i = \gamma (\hat{g}_t^i - \hat{g}^*_t) + (1 - \gamma)s_t^i + \hat{y}_t^* \]

\[ \pi_t^i = \beta E_t \{ \pi_{t+1}^i \} + \lambda \left( \frac{1}{1 - \gamma + \phi} \right) \hat{y}_t^i - \frac{\lambda \gamma}{1 - \gamma} \hat{g}_t^i \]

\[ \pi_t^i - \pi_t^* = -(s_t^i - s_{t-1}^i) \]

where \( \gamma = \gamma^{Nash} \)
A special case: smaller stimulus w/o coordination

Effective lower bound, symmetric equilibrium and $\beta \to 0$

$$\hat{g}_{L,\text{Nash}} < \hat{g}_{L,\text{Coord}}$$
A special case: smaller stimulus w/o coordination

Effective lower bound, symmetric equilibrium and $\beta \to 0$

\[ \hat{g}^*,\text{Nash} < \hat{g}^*,\text{Coord} \]

Inflationary impact of higher government spending differs

- *Union-wide* inflation lowers real rate: expansionary
- *Domestic* inflation appreciates terms of trade: contractionary

Different from steady state

- Non-cooperative policy maker prefers weaker terms of trade ("being competitive"), because output below potential at ELB
Quantitative illustration

Contrast optimal fiscal response w/ and w/o coordination

- ELB binds because of spread shock
- Severity of crisis measured by $\mu$

Parameterization

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\beta$</td>
<td>0.99</td>
<td>Time discount factor</td>
</tr>
<tr>
<td>$\chi$</td>
<td>0.148</td>
<td>Public consumption-GDP ratio</td>
</tr>
<tr>
<td>$\alpha$</td>
<td>0.2874</td>
<td>Import-share in steady state</td>
</tr>
<tr>
<td>$\theta$</td>
<td>0.925</td>
<td>Degree of price stickiness</td>
</tr>
<tr>
<td>$\varepsilon$</td>
<td>6</td>
<td>Elasticity of substitution</td>
</tr>
<tr>
<td>$\varphi$</td>
<td>4</td>
<td>Inverse of Frisch elasticity of labor supply</td>
</tr>
<tr>
<td>$\phi_{\pi}$</td>
<td>1.5</td>
<td>Taylor coefficient</td>
</tr>
<tr>
<td>$\Delta_H$</td>
<td>0.02</td>
<td>ELB scenario</td>
</tr>
</tbody>
</table>
Gap between Nash and Coordination: $\hat{g}^*_L, \text{Nash} - \hat{g}^*_L, \text{Coord}$
Optimal level of spending: w/ and w/o coordination

![Graph showing the optimal level of spending with and without coordination.](image-url)
Consumption-equivalent compensation for lack of coordination at ELB
Conclusion

Need to coordinate fiscal stabilization policy in currency unions?

- Yes. If effective lower bound binds
Conclusion

Need to coordinate fiscal stabilization policy in currency unions?
▶ Yes. If effective lower bound binds

Fiscal policy outcomes w/o coordination
▶ Too much public consumption in steady state
▶ Too little stimulus at effective lower bound
Need to coordinate fiscal stabilization policy in currency unions?

- Yes. If effective lower bound binds

Fiscal policy outcomes w/o coordination

- Too much public consumption in steady state
- Too little stimulus at effective lower bound

Consumption-equivalent compensation increases in expected duration of ELB episode

- Strong case for coordination