

When do cooperation and commitment matter in a monetary union?

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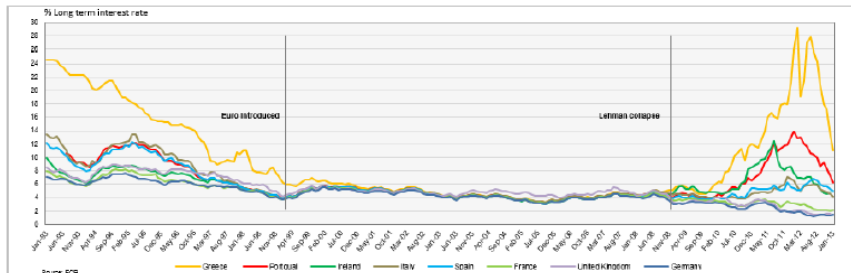
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Outline of the presentation

- 1) Motivation and main idea
- 2) Unifying framework for policy analysis
- 3) Applications: Monetary unions
- 4) Extensions: International monetary policy cooperation
- 5) Conclusion

Motivation

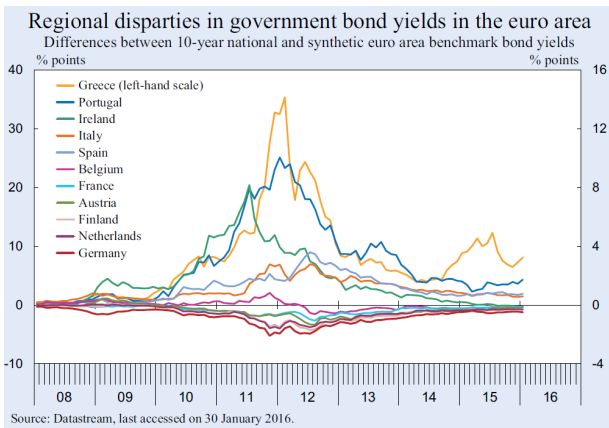
Selected European 10-year government bond yields: Long-term developments (1993-2013)



Source: ECB

Motivation

10-year Euro Area government bond yields: Recent developments (2008-2016)



Motivation

Monetary unions:

Irrelevance of (monetary) commitment and (fiscal) cooperation

“If the monetary and fiscal authorities in a monetary union have identical output and inflation goals, those goals can be achieved without the need for fiscal coordination, without the need for monetary commitment, irrespective of which authority moves first and despite any disagreement about the relative weights of the two sets of objectives.”

1) **Dixit and Lambertini (2003):** → **D-L-result**

key insight: this logic works even **if there are ex ante direct fiscal spillovers**

Motivation

Monetary unions: D-L-result is a challenge for

2) **Chari and Kehoe (2007, 2008):**

→ **Relevance of monetary commitment and fiscal cooperation**

intuition: if FP moves prior to MP: non-cooperative FP's speculate on monetary bail-out in second stage. To kill this 'bad' equilibrium:

i) regime of fiscal cooperation or ii) MP needs to move first.

key insight: this logic works even **if there are no direct fiscal spillovers**

Motivation

International monetary policymaking: D-L-result is a challenge for

3) **Rogoff (1985):**

“Increased international monetary **cooperation** may be **counterproductive.**”

4) **Canzoneri and Henderson (1991):**

“Monetary policy in each country affects economic welfare both at home and abroad.” → **Cooperation improves welfare**

5) ...but **not** for **Obstfeld and Rogoff (2002):**

→ **Cooperation not needed**

Motivation

What is going on here...?

...well, **all 5 statements** are **correct** and they are supported by consistent theoretical models

→ *idea of the paper*:

reproduce these results as special cases of a **simple unifying framework**

key ingredients of this framework: **Linear-quadratic models** are

i) technically **special** and

ii) can be used in the spirit of Tinbergen (1952) **or** Barro-Gordon (1983)

→ cooperation and commitment problems

depend on **number of instruments** relative to **number of objectives**

Unifying framework for policy analysis

N nations with index i

ζ : generic player in this world economy, $\zeta = 1, 2, \dots, X$

with action x_{ζ} and payoff V_{ζ} :

$$V_{\zeta} = V_{\zeta}(\mathbf{x}), \quad \mathbf{x} = (x_{\zeta}, \mathbf{x}_{-\zeta})$$

Direct spillover effects between two players ζ and ζ' : $\frac{\partial V_{\zeta'}(\mathbf{x})}{\partial x_{\zeta}}$

Unifying framework for policy analysis

A multi-stage game Γ with stages $1, 2, \dots, T^\Gamma$ is characterized by:

- i) a **commitment pattern** (= *order of moves of players*) and
- ii) a **coalition structure**

Unifying framework for policy analysis

ad i) **commitment pattern:** each player is assigned to act at one particular stage, only once (*one shot games*)

ad ii) **coalitions:** can be formed only by players acting at the same stage. a coalition C_θ maximizes

$$W_\theta = \sum_{\xi \in C_\theta} \omega_\xi V_\xi(\mathbf{x}),$$

- each player belongs exactly to one coalition

Unifying framework for policy analysis

- a very large number of different games can be imagined,
with different commitment patterns and coalition structures

- how to compare different games?

→ **restrictions** for two particular games Γ and Γ' to admit the same
SPNE outcome \mathbf{z}

severe (to be checked: implications of *order of moves*, *spillovers etc...*)

→ **restrictions** for \mathbf{z} to be a SPNE outcome of *any conceivable game* Γ ?
very severe

Unifying framework for policy analysis

Simultaneous-move Nash game Γ^{Nash} with **equilibrium outcome** \mathbf{z}^{Nash} as a special reference point:

Proposition 1: Consider the game Γ^{Nash} and assume it admits the interior Nash equilibrium outcome \mathbf{z}^{Nash} . Then, \mathbf{z}^{Nash} is a SPNE outcome of any extensive-form game Γ , characterized by arbitrary coalition structures and commitment patterns, **if**

$$\frac{\partial V_{\xi'}(\mathbf{z}^{Nash})}{\partial x_{\xi}} = 0, \quad \forall \xi, \xi' \in \Xi.$$

i.e. **if all direct spillovers vanish at \mathbf{z}^{Nash}**

Unifying framework for policy analysis

Linear-quadratic model for policy analysis

→ good candidate to satisfy ‘irrelevance result’ of Proposition 1

\mathbf{y} is a $(P \times 1)$ -vector, summarizing the state of the economy:

$$\mathbf{y} = \bar{\mathbf{y}} + \mathbf{B}\mathbf{x}. \quad (1)$$

$\mathbf{y}^{*\zeta}$ is a $(P \times 1)$ -vector of target values held by player ζ

V_ζ : weighted sum of squared deviations of \mathbf{y} from $\mathbf{y}^{*\zeta}$:

$$V_\zeta = \frac{1}{2} \left[\omega_1^\zeta (y_1^{*\zeta} - y_1)^2 + \dots + \omega_p^\zeta (y_p^{*\zeta} - y_p)^2 + \dots + \omega_P^\zeta (y_P^{*\zeta} - y_P)^2 \right] \quad (2)$$

Unifying framework for policy analysis

The **LQ-model** satisfies **Proposition 1** if

A1) $P = X$ (and \mathbf{B}^{-1} exists)

i.e. number of independent instruments (*here = number of players*) matches the number of squared gaps (Tinbergen, 1952),

A2) $\mathbf{y}^{*\zeta} = \mathbf{y}^*$, $\forall \zeta$,

i.e. target values \mathbf{y}^* shared by all players

Proposition 2: Assume A1 and A2. Then, for an economy described by (1) and (2), the unique Nash equilibrium outcome $\mathbf{z}^{Nash} = \mathbf{B}^{-1} [\mathbf{y}^* - \bar{\mathbf{y}}]$ of Γ^{Nash} satisfies $\frac{\partial V_{\zeta'}(\mathbf{z}^{Nash})}{\partial x_{\zeta}} = 0$, $\forall \zeta, \zeta' \in \Xi$, such that Proposition 1 applies.

→ **LQ** ensures that all direct spillovers vanish at \mathbf{z}^{Nash}

Applications: Monetary Unions

N member countries, $i = 1, 2, \dots, N$

→ N fiscal policymakers, each with one instrument/action τ_i

→ 1 central bank with one instrument/action π

→ private agents with actions a_{ij}

in sum:

$$\mathbf{x} = (\mathbf{a}, \boldsymbol{\tau}, \pi)$$

with: $\boldsymbol{\tau} = (\tau_i, \tau_{-i})$, $\mathbf{a} = (\mathbf{a}_i, \mathbf{a}_{-i})$, $\mathbf{a}_i = (a_{ij}, \mathbf{a}_{i,-j})$

Applications: Monetary Unions

Rewrite **Payoffs** V_{ξ} :

Private agent j in country i :

$$U_{ij} = U_{ij}(\mathbf{a}, \boldsymbol{\tau}, \pi)$$

Fiscal policymaker i :

$$V_i = V_i(\mathbf{a}, \boldsymbol{\tau}, \pi)$$

Central bank:

$$V^M = \sum_{i=1}^n \omega_i^M V_i(\mathbf{a}, \boldsymbol{\tau}, \pi)$$

Applications: Monetary Unions

Dixit-Lambertini (2003):

- i) uniform private sector: $a_{ij} = a = \pi^e$ (*rational inflation expectations*)
- ii) LQ representation

$$U = U(a, \pi) = \frac{1}{2}(\pi - \pi^e)^2$$

$$V_i = \frac{1}{2} \left[\omega_i (y_i^* - y_i)^2 + \pi^2 \right]$$

$$y_i = \bar{y}_i + \sum_{k=1}^n b_{ik} \tau_k + b_i (\pi - \pi^e)$$

note: existence of **ex ante direct fiscal spillovers** between countries via output equation, i.e.

$$V_i = V_i(a, \tau_i, \tau_{-i}, \pi)$$

Applications: Monetary Unions

Dixit-Lambertini (2003): *Irrelevance of cooperation and commitment, in fact, between all players (private, fiscal, monetary)*

why? **Proposition 2 applies**

$N + 2$ players with $N + 2$ instruments and $N + 2$ objectives

→ **all direct spillovers vanish at z^{Nash}**

To see why this result is special:

→ **more general LQ** economy of **Dixit-Lambertini (2001)** with **'non-shared' target values**

→ **non-LQ** economy of **Chari-Kehoe (2008)**

Applications: Monetary Unions

Chari-Kehoe (2008): not LQ, but consistent objectives between players

$$U_{ij} = U_{ij}(a_{ij}, \mathbf{a}_{i,-j}, \tau_i, \pi)$$

$$V_i = \sum_{j \in \mathcal{M}_i} U_{ij}(a_{ij}, \mathbf{a}_{i,-j}, \tau_i, \pi), \quad V^M = \sum_{i=1}^n \omega_i^M V_i$$

- i) **no direct spillovers (private, fiscal) between countries**
- ii) **but: direct private spillovers within countries**

→ *ii) makes commitment patterns relevant ('envelope theorem fails')*
 → **Fiscal cooperation is needed** if monetary policy moves last (because of **indirect** fiscal spillovers between countries via private externalities);
not needed if monetary policy moves first.

Extensions: International monetary policy cooperation

'first-generation models': Rogoff (1985) and Canzoneri-Henderson (1991)

→ LQ-models

→ focus: monetary spillovers between countries; no fiscal policy

i) results are in tradition of Barro-Gordon (1983):

cooperation not irrelevant because of '*instrument shortage*'

ii) results in tradition of Tinbergen (1952) *could* be established if fiscal policies introduced à la DL:

irrelevance result via '*instrument sufficiency*' (Proposition 2)

Extensions: International monetary policy cooperation

to capture ‘**second-generation models**’ (Obstfeld/Rogoff) with explicit microfoundations, find a stochastic representation...:

$$\mathbf{y} = \bar{\mathbf{y}} + \mathbf{B}_x \mathbf{x} + \mathbf{B}_\varepsilon \varepsilon, \quad \varepsilon \sim (\mathbf{0}, \Sigma_\varepsilon) \quad (3)$$

$$\mathbf{x} = \bar{\mathbf{r}} + \mathbf{R}_\varepsilon \varepsilon \quad (4)$$

$$E(V_i) = E(\tilde{V}_i) + \omega_i' \Omega_y \omega_i, \quad (5)$$

$$E(\tilde{V}_i) = E(V_i^*) \quad (6)$$

$E(V_i)$: expected welfare of representative private agent in country i

$E(\tilde{V}_i)$: flex-price solution, $\omega_i' \Omega_y \omega_i$: stabilization component

$E(V_i^*)$: constrained Pareto efficient welfare, ex ante

\mathbf{x} : vector of policy instruments (via ex ante chosen policy rules)

→ Crucial: invertibility of \mathbf{B}_x

Extensions: International monetary policy cooperation

Obstfeld-Rogoff (2002) and Canzoneri et al. (2005):

- New Keynesian two-country open economy model with sticky wages
- $E(\tilde{V}_i)$: flexible wage solution
- **key idea:** check i) $E(\tilde{V}_i) = E(V_i^*)$ and ii) 'instrument sufficiency' ?

Obstfeld-Rogoff (2002) and Canzoneri et al. (2005): *If i) the flexible wage solution is constrained Pareto efficient ex ante and if ii) there are sufficient instruments to stabilize the economies at this solution then coalition structures and commitment patterns between policymakers become irrelevant.*

Extensions: International monetary policy cooperation

→ key improvement of 'second-generation models':

criteria of i) $E(\tilde{V}_i) = E(V_i^*)$ and ii) '*instrument sufficiency*':

- require joint assessment
- likely to be shock-specific

OR-example: assume incomplete capital markets
global shocks may ensure efficient risk sharing,
while country-specific shocks do not

Conclusion

- Subtleties matter: LQ vs. non-LQ set-up...
- Different modelling traditions: Tinbergen vs. Barro-Gordon
- To reduce cooperation and commitment problems:
 - i) **free up additional instruments?**
 - ii) **'align' and 'reduce' policy objectives?**
 - directly*: prioritize objectives of policymakers
 - indirectly*: in O/R-type models make financial markets more complete

Further comments on DL-set-up:

- a) MP suffers from time inconsistency problem, while FP does not: is such **asymmetry between policymakers** plausible?
- b) **Instruments** need to be **independent** vs. role of **jointly shared public sector budget constraint?** (see: Leith/von Thadden, 2010)