When do cooperation and commitment matter in a monetary union?

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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

Source: ECB

Source: EEAG Report, 2018
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


→ 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 \( i \)

\( \zeta : \) generic player in this world economy, \( \zeta = 1, 2, \ldots, X \)

with action \( x_\zeta \) and payoff \( V_\zeta : \)

\[ V_\zeta = V_\zeta(x), \quad x = (x_\zeta, x_{-\zeta}) \]

*Direct spillover effects* between two players \( \zeta \) and \( \zeta' \):

\[ \frac{\partial V_{\zeta'}(x)}{\partial x_{\zeta}} \]
A multi-stage game $\Gamma$ with stages $1, 2, \ldots, T^\Gamma$ is characterized by:

i) a commitment pattern ($= \text{order of moves of players}$) 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 $C_\theta$ maximizes

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

- each player belongs exactly to one coalition
- 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 \( \Gamma \) and \( \Gamma' \) to admit the same SPNE outcome \( z \)?

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

→ restrictions for \( z \) to be a SPNE outcome of any conceivable game \( \Gamma \)?

very severe
**Unifying framework for policy analysis**

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

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

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

i.e. if all direct spillovers vanish at $z^{Nash}$
Unifying framework for policy analysis

Linear-quadratic model for policy analysis

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

\( y \) is a \((P \times 1)\)–vector, summarizing the state of the economy:

\[
y = \bar{y} + Bx. \tag{1}\]

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

\( V_{\zeta} : \) weighted sum of squared deviations of \( y \) from \( y^{*\zeta} \):

\[
V_{\zeta} = \frac{1}{2} \left[ \omega_{1}^{\zeta} (y_{1}^{*\zeta} - y_{1})^2 + ... + \omega_{P}^{\zeta} (y_{P}^{*\zeta} - y_{P})^2 + ... + \omega_{P}^{\zeta} (y_{P}^{*\zeta} - y_{P})^2 \right] \tag{2}\]
Unifying framework for policy analysis

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

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

i.e. number of independent instruments (*here = number of players*)

matches the number of squared gaps (Tinbergen, 1952),

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

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 $z^{Nash} = B^{-1} [\mathbf{y}^* - \bar{\mathbf{y}}]

of $\Gamma^{Nash}$ satisfies $\frac{\partial V_{\mathbf{\xi}'}}{\partial x_{\mathbf{\xi}}} (z^{Nash}) = 0$, $\forall \mathbf{\xi}, \mathbf{\xi}' \in \Xi$, such that Proposition 1 applies.

→ **LQ ensures that all direct spillovers vanish at** $z^{Nash}$
$N$ member countries, $i = 1, 2, \ldots, N$

→ $N$ fiscal policymakers, each with one instrument/action $\tau_i$
→ 1 central bank with one instrument/action $\pi$
→ private agents with actions $a_{ij}$

in sum:

$$x = (a, \tau, \pi)$$

with: $\tau = (\tau_i, \tau_{-i})$, $a = (a_j, a_{-i})$, $a_i = (a_{ij}, a_{i,-j})$
Rewrite **Payoffs** $V_{\bar{z}}$:

Private agent $j$ in country $i$:

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

Fiscal policymaker $i$:

$$V_i = V_i(a, \tau, \pi)$$

Central bank:

$$V^M = \sum_{i=1}^{n} \omega^M_i V_i(a, \tau, \pi)$$
Dixit-Lambertini (2003):

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

ii) LQ representation

\[
\begin{align*}
U &= U(a, \pi) = \frac{1}{2}(\pi - \pi^e)^2 \\
V_i &= \frac{1}{2} \left[ \omega_i (y_i^* - y_i)^2 + \pi^2 \right] \\
y_i &= \bar{y}_i + \sum_{k=1}^{n} b_{ik} \tau_k + b_i (\pi - \pi^e)
\end{align*}
\]

note: existence of \textbf{ex ante direct fiscal spillovers} between countries via output equation, i.e.

\[
V_i = V_i(a, \tau_i, \tau_{-i}, \pi)
\]
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)
Chari-Kehoe (2008): not LQ, but consistent objectives between players

\[ U_{ij} = U_{ij}(a_{ij}, a_i, -j, \tau_i, \pi) \]

\[ V_i = \sum_{j \in M_i} U_{ij}(a_{ij}, a_i, -j, \tau_i, \pi), \quad V^M = \sum_{i=1}^{n} \omega_i^M V_i \]

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

→ 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…:

\[ y = \bar{y} + B_x x + B_\varepsilon \varepsilon, \quad \varepsilon \sim (0, \cdot) \]  
\[ x = \bar{r} + R_\varepsilon \varepsilon \]  
\[ E(V_i) = E(\tilde{V}_i) + \omega_i^\prime \Omega_y \omega_i, \]  
\[ E(\tilde{V}_i) = E(V_i^*) \]  

\[ E(V_i) : \text{expected welfare of representative private agent in country } i \]  
\[ E(\tilde{V}_i) : \text{flex-price solution, } \omega_i^\prime \Omega_y \omega_i : \text{stabilization component} \]  
\[ E(V_i^*) : \text{constrained Pareto efficient welfare, ex ante} \]  
\[ x : \text{vector of policy instruments (via ex ante chosen policy rules)} \]

→ Crucial: invertibility of \( B_x \)
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)