Fiscal and Monetary Regimes: A Strategic Approach

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Views expressed are those of the authors and do not necessarily reflect those of the Banque de France or the Eurosystem.
Introduction

- Massive increase in the liabilities of many fiscal and monetary authorities since 2008
- Interdependence of fiscal and monetary policies back in the foreground

Sargent (1986): “Arithmetic makes the strategies of the monetary and fiscal authorities interdependent.”

- Since Wallace’s “game of chicken”, game-theoretic terminology (e.g., Sims 2013, Svensson 2017) to describe this interdependence but no formal game

This paper: A two-player game with legacy nominal public liabilities

⇒ Which assumptions yield an equilibrium which looks like what we see
1. Static game

2. Dynamic game
Simultaneous game, convex costs

- The fiscal authority $F$ sets a real primary surplus $\tau \in \mathbb{R}$ and the monetary authority $M$ a price level $p \in \mathbb{R}_+$
- $F$ and $M$ face a maturing nominal liability $b \geq 0$
- Move simultaneously; payoffs $U_F$ and $U_M$

\[
U_F(\tau, p) = -g_F(|\tau - \tau_F|) - f_F\left(\left(\frac{b}{p} - \tau\right)^+\right),
\]

\[
U_M(\tau, p) = -g_M(|p - p_M|) - f_M\left(\left(\frac{b}{p} - \tau\right)^+\right),
\]

where $(f_X, g_X)_{X \in \{F; M\}}$ are increasing, strictly convex and differentiable, $\tau_F > 0$, $p_M > 0$, and $g'_X(0) = 0$
Simultaneous game, convex costs

Remark 1: Convex costs imply that accommodation is a strategic substitute - Game of chicken

Remark 2: includes the case in which $F$ and $M$ share the same objective

$$-g_F (|\tau - \tau_F|) - g_M (|p - p_M|) - f \left( \left( \frac{b}{p} - \tau \right)^+ \right)$$

but do not cooperate to maximize it

Remark 3: Fiscal and monetary regimes. The strategy profile $(\tau_F, b/\tau_F)$ is what macroeconomists deem the fiscal regime and $(b/p_M, p_M)$ is the monetary regime
Simultaneous game, convex costs

Pure-strategy equilibria

$b < \tau_M p_F$

Multiple default-free equilibria \((\tau, p)\) s.t. \(b = \tau p\)

$b > \tau_M p_F$

Unique equilibrium with default

\(b^3 = \tau p\)

\(b^2 = \tau p\)

\(b^1 = \tau p\)
Equilibrium multiplicity and game setting

Convex costs

- Many pure-strategy equilibria (when $b \leq \tau_M p_F$)
- In addition many mixed-strategy equilibria with default
- Adding uncertainty yields equilibrium uniqueness but with strictly positive probability of default (even when uncertainty tends to 0)

Non-convex costs

- Also many pure-strategy equilibria
- As with convex costs, adding small uncertainty yields equilibria with counterfactual small defaults (and does not even yield a unique equilibrium)

⇒ Simultaneous games considered here fail to make precise and reasonable predictions
Sequential game, non-convex costs

- Fixed default cost for simplicity:

\[
U_F(\tau, p) = -|\tau - \tau_F| - \alpha_F \mathbb{1}_{\{b > \tau p\}} \\
U_M(\tau, p) = -|p - p_M| - \alpha_M \mathbb{1}_{\{b > \tau p\}}
\]

⇒ Unique equilibrium
Sequential game

◊ Simple and appealing properties:
  ▶ unique equilibrium
  ▶ no sovereign default below a threshold

◊ But who moves first?

“The question is, Which authority moves first, the monetary authority or the fiscal authority? In other words, Who imposes discipline on whom?” (Sargent and Wallace, 1981)

⇒ Seek implications from assumptions about first mover with a dynamic game
1. Static game

2. Dynamic game
Dynamic game: \( t \in \mathbb{N} \)

Actions, payoffs, assumptions

- \( F \) can trade nominal bonds
- \( M \) can purchase bonds held by the private sector by issuing remunerated reserves

\[
V_t^F = - \sum_{s \geq 0} \beta^s \left| \tau_{t+s} \right| - \beta (1 + \beta) \alpha_F \Delta_t,
\]

\[
V_t^M = - \sum_{s \geq 0} \beta^s \left| p_{t+s} - p_M \right| - \beta (1 + \beta) \alpha_M \Delta_t,
\]

Assumption 1: Immediate cost of default. \( \Delta_t = 1 \) if a strategy profile implies default on government debt held by the private sector after date \( t \)

Assumption 2: Reserves are non-defaultable. The monetary authority \( M \) incurs an arbitrarily large disutility from defaulting on reserves.
Dynamic game

Initial exogenous liabilities $b_{-1,1} = b_{-1,2} = b$

Intertemporal budget constraint with eq. bond prices when no default:

$$\frac{\beta b}{p_1} + \frac{\beta^2 b}{p_2} \leq \sum_{k \geq 0} \beta^k \tau_k$$
M leads: Summary

- **Monetary regime**
  - Commitment
    - **Monetary regime**
      - Partial accommodation by M and F
      - F rolls over date-1 liability to force M to accommodate
      - \( \tau_0 = \beta (1 + \beta) \left( \frac{b}{p_M + \beta \alpha_M} - \beta^2 \alpha_F \right)^+ \)
      - \( \tau_1 = 0 \)
      - \( \tau_2 = \beta (1 + \beta) \alpha_F \)
  - No commitment
    - \( \beta^2 \alpha_F p_M \)

- **Maximum accommodation by F**
  - Partial accommodation by M
  - Maximum accommodation by F
  - M issues reserves to commit to high
  - \( p_1 = p_2 \)
  - \( \alpha_F (p_M + \beta \alpha_M) \)
  - \( \alpha_F (p_M + \alpha_M) \)

- **Default**

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Barthélemy and Plantin

Wallace’s game of chicken

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Implications from limited commitment

1. $F$ can force $M$ to partially accommodate early by extending the maturity of date-1 debt to date 2: $F$ exploits its own time inconsistency

2. Once $F$ is indifferent with default, $M$ must use balance-sheet expansion to commit to high future price levels
Endogenous fiscal irresponsibility

Mechanism

- Time inconsistency: $F$ has a stronger preference for default when accommodation is more imminent

- By raising no surplus until date 2 and rolling over the date-1 installment $b$, $F$ maximizes the date-2 liability. At that time it is less willing to accommodate than earlier on

- This forces $M$ to accommodate at date 2 to avoid default

- Anticipating this, $M$ starts accommodating at date 1 because $p_1 = p_2$ is optimal
Balance-sheet expansion as a commitment device

Mechanism

- Suppose $M$ has an exogenous real income with date-1 present-value $\epsilon$
- Suppose $M$ issues (nominal) claims to $r < b$ at dates 1 and 2 to buy back public debt
- If $F$ defaults at date 1, $M$ must set $p_1 = p_2 = p^d$ such that
  \[
  \frac{(1 + \beta)r}{p^d} \leq \epsilon
  \]
- This means that ex post $M$ is indifferent between $p_1 = p_2 = p$ and default where
  \[
  (1 + \beta)(p - p_M) = \beta(1 + \beta)\alpha_M + (1 + \beta)(p^d - p_M)
  \]
  \[\rightarrow p = \beta\alpha_M + \frac{(1 + \beta)r}{\epsilon}\]
A novel rationale for quantitative easing

- Attempts at explaining why QE (swapping remunerated reserves and government bonds) might work in theory rely on assuming fundamental differences between these claims. Empirically unclear.

- Here $M$ swaps bonds for remunerated reserves, and these are perfect substitutes on the equilibrium path.

- Still it has a real effect because it affects off-equilibrium payoffs:

- With a large balance-sheet, sovereign default comes with inflation anyway so $M$ might as well accommodate.
### Summary

Partial accommodation by $F$
- Fiscal consolidation at any time
- Maximum accommodation by $M$
- Inflation at date 1 then $p_1 = p_2$

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<tr>
<th>Commitment</th>
<th>Partial accommodation by $F$</th>
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<td>Fiscal consolidation at any time</td>
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<td>$M$ issues reserves</td>
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No commitment

$\bar{b}$

$\alpha_F(p_M + \alpha_M)$
So, who has the bargaining power since 2008?

- Since 2008,
  - Unprecedented balance-sheet expansion by the Federal Reserve
  - Not much fiscal consolidation to say the least (Hall, 2013)
  - Not much inflation

- We can rule out full commitment as balance-sheet expansion useless in this case

- Limited commitment:
  - Under monetary lead, balance-sheet expansion only comes with massive early (date 0) fiscal consolidation and early (date 1) inflation
  - Fiscal lead and limited commitment: balance-sheet expansion with fiscal consolidation and inflation postponed to the long run (date 2)
Conclusion

◊ Breakthrough: Wallace’s game of chicken is a game

◊ Interesting routes for future work:
  ▶ Micro-foundations and mechanism-design approach to optimal mandate
  ▶ Uncertainty, e.g., regarding future authorities’ types
  ▶ Multiple fiscal authorities and a unique monetary authority as in the euro area