

Monetary/Fiscal Interactions with Forty-two Budget Constraints

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May 7, 2024

Motivation

- Monetary and Fiscal policy are ultimately connected by a common budget constraint.
- **Sims, 2004**
 - ▶ Institutionally, there are still two separate budget constraints
 - ▶ Details of fiscal backing of monetary policy may matter for inflation
 - ▶ Room for political economy
- “New-style central banking:” in-house fiscal policy by the central bank (Sims, Bassetto-Messer, Reis, Benigno, Benigno & Nisticò)

From 2 to 42 Budget Constraints

- Political frictions bigger in a currency union
- The Eurozone:
 - ▶ 20 National Treasuries
 - ▶ European Union
 - ▶ 20 National Central Banks (NCBs)
 - ▶ European Central Bank

Key Questions

- How does seigniorage flow from the monetary authority to the budget of each country ?
- Who is paying if a member country defaults on its debt ?

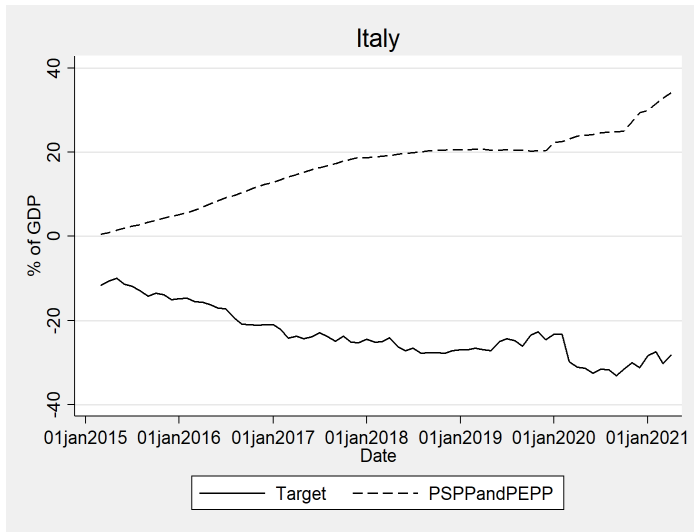
QE and default risk in Europe

- Focus on government bonds:
 - ▶ PSPP: Public Sector Purchase Programme
 - ▶ PEPP: Pandemic Emergency Purchase Programme
- How they work:
 - ▶ 10%: ECB buys supranational bonds
 - ▶ 10%: ECB buys national bonds
 - ▶ 80%: NCBs buy their Treasury's bonds
 - ▶ Risk of 80% not supposed to be shared

How does this work in practice

- Bank of Italy buys a bond from Italian bank:
 - ▶ Bol gets the bond
 - ▶ Bol issues reserves (**its own liability**)
- Bank of Italy buys a bond from a German bank:
 - ▶ Bol gets the bond
 - ▶ **Bundesbank** issues reserves
 - ▶ Bol incurs a TARGET2 liability against ECB, Buba a TARGET2 asset against ECB
- Interest rates:
 - ▶ Bol or Buba pay interest on reserves
 - ▶ TARGET2 balances pay interest at the MRO rate (top of corridor)
 - ▶ Bol pockets interest on Italian debt above MRO.

Bank of Italy Positions



More on TARGET2

- TARGET2 is debt of variable rate and **infinite maturity**
- **Unlimited balance**
- Before QE this made sense:
 - ▶ Just a counterparty for the reserves issued by the Eurosystem
 - ▶ NCB earns interest on TARGET2, pays interest on reserves, a wash
 - ▶ Risk on assets (loans to banks) is shared by all the Eurosystem
- Now risk is no longer shared (allegedly...)!

General Set up

- 2 countries (A and B) populated by a continuum of private households
- Each country has its own Treasury and its own NCB
- NCB A and NCB B are joined in a currency union ('Eurozone')
- We abstract from EU and ECB's budget constraints

Treasuries

- Flow BC for country i 's Treasury

$$B_{t-1}^i(1 - \delta I_t) = \frac{B_t^i}{1 + R_t^i} + S_t^i + T_t^i,$$

- Each country issues one-period bonds B_t^i paying a (different) nominal interest rate R_t^i
 - ▶ A's debt is safe $\implies I_t = 0$ for country A
 - ▶ B's debt is potentially subject to an exogenous haircut $\delta \rightarrow I_t = 1$ if B defaults at t
- LHS represents Treasury's repayment commitment (B_{t-1}^i)
- RHS represents sources of funds: T_t^i is taxes on the residents of country i , S_t^i transfers received from its NCB

Eurosystem: all central banks together

- Eurosystem's flow BC

$$M_t - M_{t-1} + \frac{X_t}{1 + R_t^X} - X_{t-1} = \frac{\bar{B}_t^A}{1 + R_t^A} - \bar{B}_{t-1}^A \\ + \frac{\bar{B}_t^B}{1 + R_t^B} - \bar{B}_{t-1}^B(1 - \delta I_t) + \frac{A_t}{1 + R_t^A} - A_{t-1} + S_t^A + S_t^B$$

- LHS are the funds raised by the Eurosystem: currency (M_t) and Reserves (X_t) beyond the previously issued
- RHS the uses: A_t loans to private sector (banks), \bar{B}_t^i loans to Treasury i , seigniorage
- Eurosystem controls A_t^i, \bar{B}_t^i
- Country B 's Treasury controls I_t , country i controls S_t^i
- private demand determines split on LHS

More on Remittance Policy

- No central rule on remittance policy S_t^i
- Set nationally and could be changed (within limits)
- Example: Bank of Italy remits 60% of profits annually (keeps 40% as reserves), no provision in case of losses
- No clear enforceable mandate for recapitalization

Eurosystem's Present Value BC

- Iterating flow BC forward

$$\begin{aligned} & \bar{B}_{-1}^A + A_{-1} + \bar{B}_{-1}^B(1 - \delta I_0) \\ & - M_{-1} - X_{-1} + M_0 \frac{R_0^A}{1 + R_0^A} + X_0 \left(\frac{1}{1 + R_0^X} - \frac{1}{1 + R_0^A} \right) \\ & + E_0 \sum_{s=1}^{\infty} z_{0,s} \left[M_s \frac{R_s^A}{1 + R_s^A} + X_s \left(\frac{1}{1 + R_s^X} - \frac{1}{1 + R_s^A} \right) \right] = S_0^A + S_0^B \\ & + E_0 \sum_{s=1}^{\infty} z_{0,s} (S_s^A + S_s^B) + \lim_{s \rightarrow \infty} E_0 [z_{0,s} (\bar{B}_{s-1}^A + \bar{B}_{s-1}^B(1 - \delta I_{s-1}))] \end{aligned}$$

- Transversality condition need not hold

Monetary/ Fiscal Interaction

- With a single Eurozone fiscal authority explosive term irrelevant (Modigliani-Miller theorem)

$$\begin{aligned} B_{A,-1} + B_{B,-1}(1 - \delta l_0) &= T_0^A + T_0^B + S_0^A + S_0^B \\ &+ E_0 \sum_{s=1}^{\infty} z_{0,s} \left[T_s^A + T_s^B + S_s^A + S_s^B \right] \\ &+ \lim_{s \rightarrow \infty} E_0 [z_{0,s} (\bar{B}_{A,s-1} + \bar{B}_{B,s-1}(1 - \delta l_{s-1}))] \end{aligned}$$

- Does not matter if CB remits profits to Treasury or keeps them in ever-increasing amounts of assets

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- Does not matter if CB remits profits to Treasury or keeps them in ever-increasing amounts of assets
- With many different fiscal authorities **asymmetries** may matter!

20 different NCBs

- Flow BC of country's i NCB

$$\begin{aligned} M_t^i - M_{t-1}^i + \frac{X_t^i - \tau_t^i}{1 + R_t^X} - (X_{t-1}^i - \tau_{t-1}^i) \\ = \frac{\bar{B}_{i,t}}{1 + R_t^i} - \bar{B}_{i,t-1}(1 - \delta I_t) - A_{t-1}^i + S_t^i + \frac{A_t^i}{1 + R_t^A} \end{aligned}$$

- τ_t^i : TARGET2 balance
- A_t^i : ordinary monetary policy operations \implies allocated according to capital key $A_t^i = \alpha_i A_t$
- Split of X_t^i vs τ_t^i depends on counterparty, irrelevant
- \bar{B}_t^i : 100% allocated to domestic NCB (to keep notation simple)

NCBs' PVBC

Rolling NCBs' flow BC forward we get

$$\begin{aligned}
 & \bar{B}_{i,-1}(1 - \delta I_0) + A_{-1}^i - M_{-1}^i - X_{-1}^i + \tau_{-1}^i \\
 & + M_0^i \frac{R_0^A}{1 + R_0^A} + (X_0^i - \tau_0^i) \left(\frac{1}{1 + R_0^X} - \frac{1}{1 + R_0^A} \right) \\
 & + E_0 \sum_{s=1}^{\infty} z_{0,s} \left[M_s^i \frac{R_s^A}{1 + R_s^A} + (X_s^i - \tau_s^i) \left(\frac{1}{1 + R_s^X} - \frac{1}{1 + R_s^A} \right) \right] \\
 & S_0^i + E_0 \sum_{s=1}^{\infty} z_{0,s} S_s^i + \lim_{s \rightarrow \infty} E_0 [z_{0,s} (\tau_s^i + \bar{B}_{i,s-1}(1 - \delta I_{s-1}))]
 \end{aligned}$$

- **Blue**: initial conditions
- **Green**: controlled by Eurosystem centrally (split det. by private sector)
- **Red**: controlled by country i 's government/CB (within limits)
- **Orange**: adjusts as a residual

Who pays for a default? Intended mechanism

$$\begin{aligned}
 & \bar{B}_{i,-1}(1 - \delta I_0) + A_{-1}^i - M_{-1}^i - X_{-1}^i + \tau_{-1}^i \\
 & + M_0^i \frac{R_0^A}{1 + R_0^A} + (X_0^i - \tau_0^i) \left(\frac{1}{1 + R_0^X} - \frac{1}{1 + R_0^A} \right) \\
 & + E_0 \sum_{s=1}^{\infty} z_{0,s} \left[M_s^i \frac{R_s^A}{1 + R_s^A} + (X_s^i - \tau_s^i) \left(\frac{1}{1 + R_s^X} - \frac{1}{1 + R_s^A} \right) \right] \\
 & = S_0^i + E_0 \sum_{s=1}^{\infty} z_{0,s} S_s^i + \lim_{s \rightarrow \infty} E_0 [z_{0,s} (\tau_s^i + \bar{B}_{i,s-1}(1 - \delta I_{s-1}))]
 \end{aligned}$$

- Loss is offset by lower future seigniorage remittances, risk stays within defaulting country
- May work if losses are not too big
- Otherwise, need $S_t^B < 0$

Alternative shenanigans 1: Ponzi scheme

Assume $R_t^A = R_t^X$ (no seigniorage from reserves, TARGET2)

$$\begin{aligned} & \bar{B}_{i,-1}(1 - \delta l_0) + A_{-1}^i - M_{-1}^i - X_{-1}^i + \tau_{-1}^i \\ & + M_0^i \frac{R_0^A}{1 + R_0^A} + E_0 \sum_{s=1}^{\infty} z_{0,s} M_s^i \frac{R_s^A}{1 + R_s^A} \\ & = S_0^i + E_0 \sum_{s=1}^{\infty} z_{0,s} S_s^i + \lim_{s \rightarrow \infty} E_0 [z_{0,s} (\tau_s^i + \bar{B}_{i,s-1}(1 - \delta l_{s-1}))] \end{aligned}$$

- TARGET2 balance explodes

Alternative shenanigans 2: stealing seigniorage

$$\begin{aligned}
 & \bar{B}_{i,-1}(1 - \delta I_0) + A_{-1}^i - M_{-1}^i - X_{-1}^i + \tau_{-1}^i \\
 & + M_0^i \frac{R_0^A}{1 + R_0^A} + (X_0^i - \tau_0^i) \left(\frac{1}{1 + R_0^X} - \frac{1}{1 + R_0^A} \right) \\
 & + E_0 \sum_{s=1}^{\infty} z_{0,s} \left[M_s^i \frac{R_s^A}{1 + R_s^A} + (X_s^i - \tau_s^i) \left(\frac{1}{1 + R_s^X} - \frac{1}{1 + R_s^A} \right) \right] \\
 & = S_0^i + E_0 \sum_{s=1}^{\infty} z_{0,s} S_s^i + \lim_{s \rightarrow \infty} E_0[\{z_{0,s}(\tau_s^i + \bar{B}_{i,s-1}(1 - \delta I_{s-1}))\}]
 \end{aligned}$$

- TARGET2 liability grows, does not explode, country B appropriates some seigniorage from the rest of the Eurozone

Putting Some Numbers in the Story – Challenges

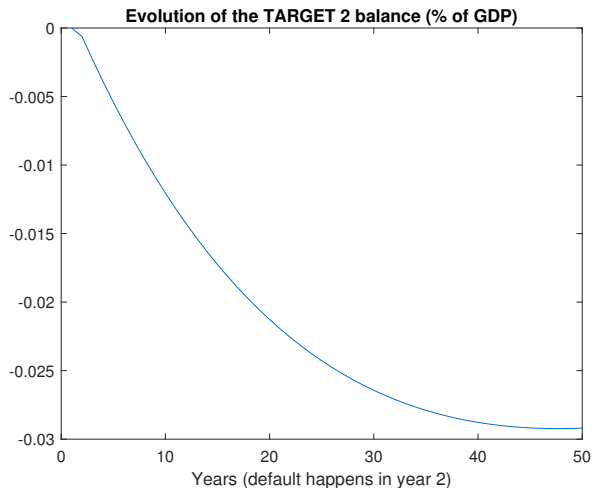
- Interest rates are low - why do we have a solvency problem in the first place?
- Interest rates are low - the PV of seigniorage is big (infinite?)

An Illustrative Quantitative Example

- 1% real growth
- 2% real interest rate
- 2% inflation (stable, set by ECB, using a constant growth for cash and reserves)
- Country B ("Italy") is 15% of Eurozone GDP
- Money demand: $M_t/(P_t Y_t) = 0.0096(R^A)^{-0.61}$
- Demand for reserves:
 $X_t/(P_t Y_t) = 0.0045((1 + R^A)/(1 + R^X) - 1)^{-0.61}$ (to get 25% assets/GDP in the initial steady state)
- One-time purchase of gov't bonds for 25% of GDP
- 50% haircut upon default

Shared Fiscal Cost

- 9% of fiscal cost born by other countries' taxpayers



Wrapping up

- Assessing risk sharing principles is, in practice complicate
- Coordinating remittance policies is fundamental:
- What happens if neither NCB cuts S_t^i enough?
- To do: some more experiments