Monetary/Fiscal Interactions with Forty-two Budget Constraints

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May 25, 2023

Motivation

- Monetary and Fiscal policy are connected by a common budget constraint.
  - Unpleasant monetarist arithmetic
  - FTPL
  - "New-style central banking:" in-house fiscal policy by the central bank (Sims, Bassetto-Messer, Reis, Benigno, Benigno & Nisticò)
- How does this work in 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's paying if a member country defaults on its debt ?

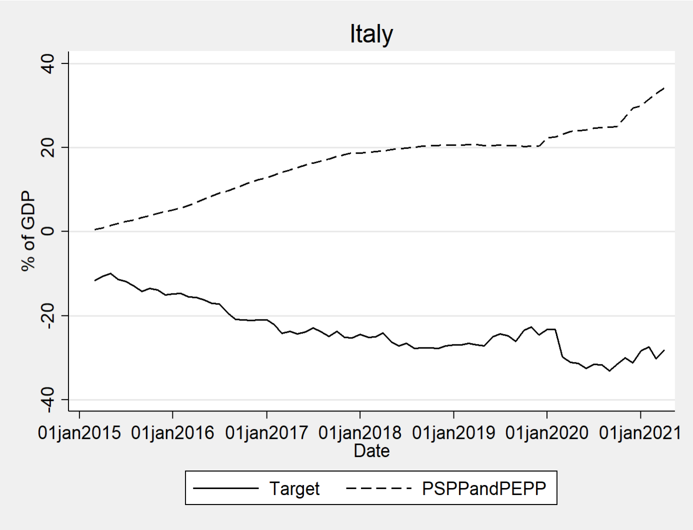
QE and default risk in Europe

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

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

- 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's Present Value BC

- Iterating flow BC forward

$$
\begin{aligned}
&\bar{B}^A_{-1} + A_{-1} + \bar{B}^B_{-1}(1-\delta l_0) \\
&- M_{-1} - X_{-1} + M_0 \frac{R^A_0}{1+R^A_0} + X_0\left(\frac{1}{1+R^X_0} - \frac{1}{1+R^A_0}\right) \\
+&E_0 \sum_{s=1}^{\infty} z_{0,s}\left[M_s \frac{R^A_s}{1+R^A_s} + X_s\left(\frac{1}{1+R^X_s} - \frac{1}{1+R^A_s}\right)\right] = S^A_0 + S^B_0 \\
+&E_0 \sum_{s=1}^{\infty} z_{0,s}(S^A_s + S^B_s) + \lim_{s\to\infty} E_0[z_{0,s}(\bar{B}^A_{s-1} + \bar{B}^B_{s-1}(1-\delta l_{s-1})]
\end{aligned}
$$

- Transversality condition need not hold

Monetary/ Fiscal Interaction

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

$$
\begin{aligned}
& B_{A,-1} + B_{B,-1}(1 - \delta I_0) = T_0^A + T_0^B + S_0^A + S_0^B \\
& + E_0 \sum_{s=1}^{\infty} z_{0,s} \left[T_s^A + T_s^B + S_s^A + S_s^B \right] \\
& + \lim_{s \to \infty} E_0 [z_{0,s} (\bar{B}_{A,s-1} + \bar{B}_{B,s-1}(1 - \delta I_{s-1}))]
\end{aligned}
$$

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

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& + \lim_{s\to\infty} E_0[z_{0,s}(\bar{B}_{A,s-1} + \bar{B}_{B,s-1}(1-\delta I_{s-1}))]
\end{aligned}
$$

- 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 $\Longrightarrow$ allocated according to capital key $A_t^i = \alpha_i A_t$
- Composition of liabilities (X_t^i vs τ_t^i) depends on counterparty, but irrelevant
- Allocation of bonds $\bar{B}_t^i$: as discussed previously, here we allocate them 100% to NCB

NCBs' PVBC

- Rolling NCBs' flow BC forward we get

$$\bar{B}_{i,-1}(1-\delta I_0) + A^i_{-1} - M^i_{-1} - X^i_{-1} + \tau^i_{-1}$$
$$+M^i_0 \frac{R^A_0}{1+R^A_0} + (X^i_0 - \tau^i_0)\left(\frac{1}{1+R^X_0} - \frac{1}{1+R^A_0}\right)$$
$$+E_0 \sum_{s=1}^{\infty} z_{0,s}\left[M^i_s \frac{R^A_s}{1+R^A_s} + (X^i_s - \tau^i_s)\left(\frac{1}{1+R^X_s} - \frac{1}{1+R^A_s}\right)\right]$$
$$= S^i_0 + E_0 \sum_{s=1}^{\infty} z_{0,s} S^i_s + \lim_{s\to\infty} E_0[z_{0,s}(\tau^i_s + \bar{B}_{i,s-1}(1-\delta I_{s-1}))]$$

  - Intended mechanism: Loss is offset by lower future seigniorage remittances, risk stays within defaulting country
  - May work if losses are not too big
  - Otherwise, need $S^B_t < 0$
  - Example: Bank of Italy remits 60% of profits annually (keeps 40% as reserves), no provision in case of losses

NCBs' PVBC

- Rolling NCBs' flow BC forward we get

$$
\begin{aligned}
&\bar{B}_{i,-1}(1-\delta I_0) + A^i_{-1} - M^i_{-1} - X^i_{-1} + \tau^i_{-1} \\
&+M^i_0 \frac{R^A_0}{1+R^A_0} + (X^i_0 - \tau^i_0)\left(\frac{1}{1+R^X_0} - \frac{1}{1+R^A_0}\right) \\
&+E_0 \sum_{s=1}^{\infty} z_{0,s}\left[M^i_s \frac{R^A_s}{1+R^A_s} + (X^i_s - \tau^i_s)\left(\frac{1}{1+R^X_s} - \frac{1}{1+R^A_s}\right)\right] \\
&= S^i_0 + E_0 \sum_{s=1}^{\infty} z_{0,s} S^i_s + \lim_{s\to\infty} E_0[z_{0,s}(\tau^i_s + \bar{B}_{i,s-1}(1-\delta I_{s-1}))]
\end{aligned}
$$

  - Alternative shenanigans, version 1: $R^X_t = R^A_t$: TARGET2 balances explode

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&+ E_0 \sum_{s=1}^{\infty} z_{0,s}\left[M^i_s \frac{R^A_s}{1+R^A_s} + (X^i_s - \tau^i_s)\left(\frac{1}{1+R^X_s} - \frac{1}{1+R^A_s}\right)\right] \\
&= S^i_0 + E_0 \sum_{s=1}^{\infty} z_{0,s} S^i_s + \lim_{s\to\infty} E_0[\{z_{0,s}(\tau^i_s + \bar{B}_{i,s-1}(1-\delta I_{s-1}))]
\end{aligned}
$$

  - Alternative shenanigans, version 2: $R^X_t < R^A_t$: TARGET2 liability grows, does not explode, Bank of Italy appropriates some seigniorage from the rest of the Eurozone

Putting Some Numbers in the Story – Challenges

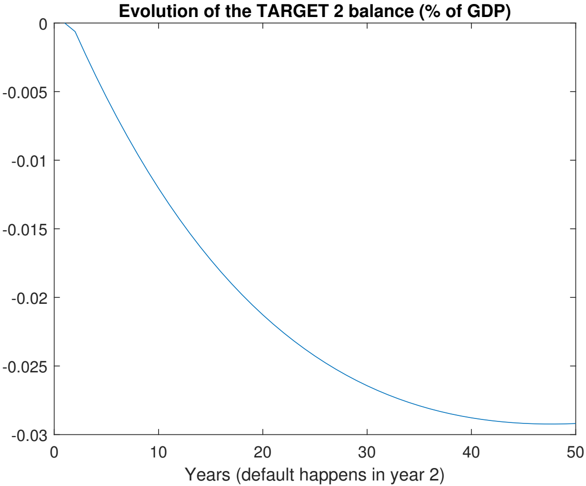
- Interest rates are low - why do we have a solvency problem in the first place?
- Interest rates are low - the PV of seigniorage is big (infinite?)

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