Monetary/Fiscal Interactions with Forty-Two Budget Constraints

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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?

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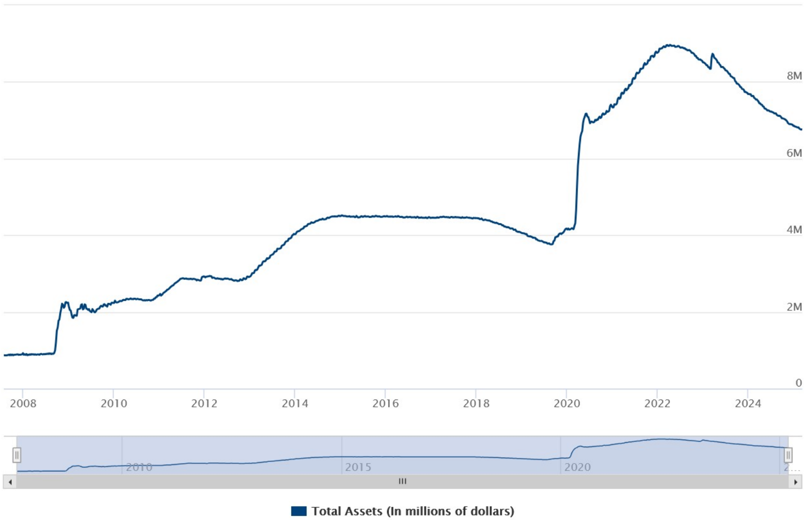
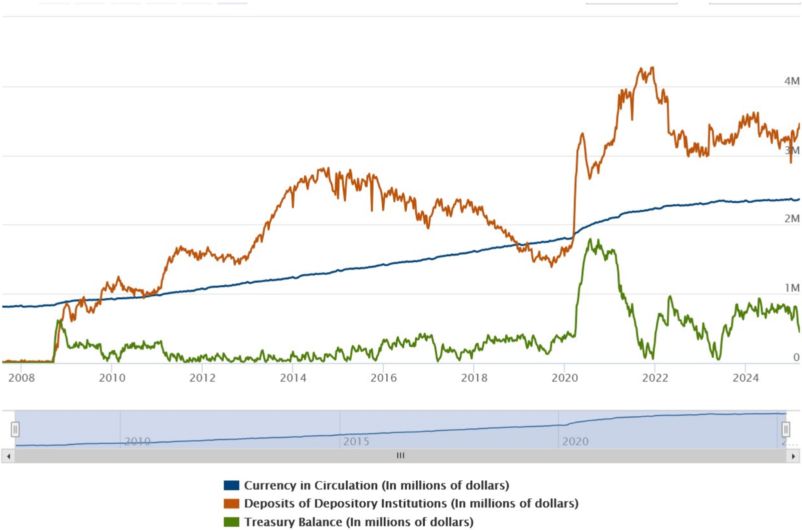
  - Who's paying if a member country defaults on its debt?
- Where Do we Draw the Line between Monetary and Fiscal Policy?

Warm-up: Interest-Rate Risk (Bassetto and Messer, 2013)
Total Assets of the Fed



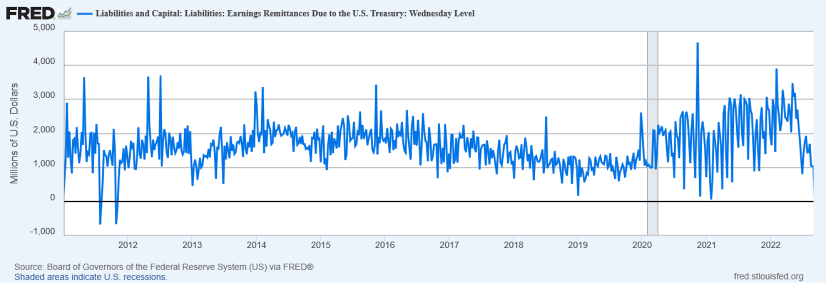
Source: Fed Res Board

Main Liabilities of the Fed



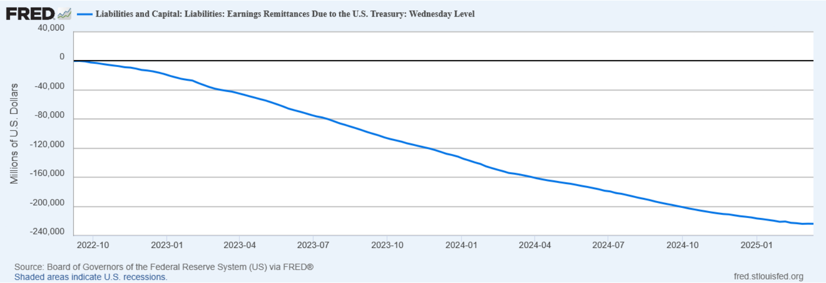
Source: Fed Res Board

Weekly Remittances from Fed to the Treasury



Cumulative total: ~ $ 1trn

Fed Deferred Asset



QE in Chile (and the United Kingdom)

- Central Bank of Chile (during COVID): Extended Credit to Banks
  - Credit risk...
  - but mostly collateralized by government-guaranteed loans
- Bank of England
  - Bought government bonds
  - Interest rate risk explicitly born by the UK Treasury
  - Only CB that engaged in outright sales of assets

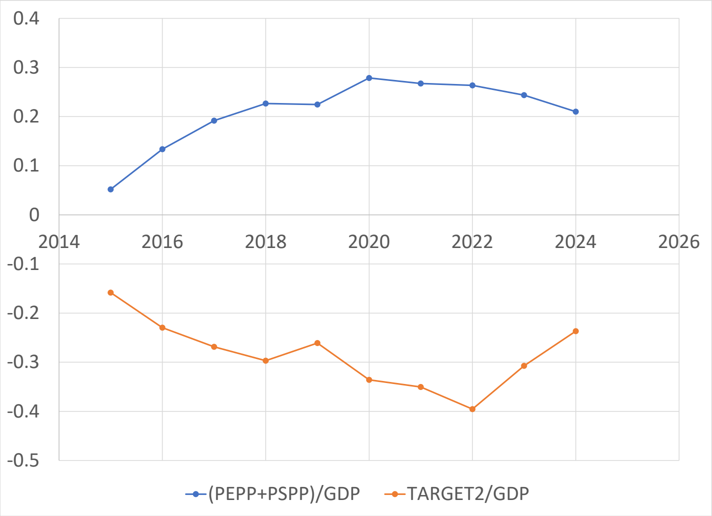
QE in Europe: sovereign default risk!

- 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

$$B^i_{t-1}(1-\delta I_t) = \frac{B^i_t}{1+R^i_t} + S^i_t + T^i_t,$$

- Each country issues one-period bonds B^i_t paying a (different) nominal interest rate R^i_t
  - A's debt is safe $\Longrightarrow I_t = 0$ for country A
  - B's debt is potentially subject to an exogenous haircut $\delta \to I_t = 1$ if B defaults at t
- LHS represents Treasury's repayment commitment (B^i_{t-1})
- RHS represents sources of funds: T^i_t is taxes on the residents of country i, S^i_t 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

$$
\begin{aligned}
&\bar{B}^A_{-1} + A_{-1} + \bar{B}^B_{-1}(1 - \delta I_0) \\
&- M_{-1} - X_{-1} + M_0 \frac{R^A_0}{1 + R^A_0} + X_0\left(\frac{1}{1 + R^X_0} - \frac{1}{1 + R^A_0}\right) \\
&+ E_0 \sum_{s=1}^{\infty} z_{0,s}\left[M_s \frac{R^A_s}{1 + R^A_s} + X_s\left(\frac{1}{1 + R^X_s} - \frac{1}{1 + R^A_s}\right)\right] = S^A_0 + S^B_0 \\
&+ E_0 \sum_{s=1}^{\infty} z_{0,s}(S^A_s + S^B_s) + \lim_{s \to \infty} E_0[z_{0,s}(\bar{B}^A_{s-1} + \bar{B}^B_{s-1}(1 - \delta I_{s-1})]
\end{aligned}
$$

- Transversality condition need not hold

Monetary/ Fiscal Interaction

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

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

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

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\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 $A_t^i = \alpha_i A_t$
- 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

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

- 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

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

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

Alternative shenanigans 1: Ponzi scheme

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

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

- TARGET2 balance explodes

Alternative shenanigans 2: stealing seigniorage

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

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

Putting Some Numbers in the Story – Challenges

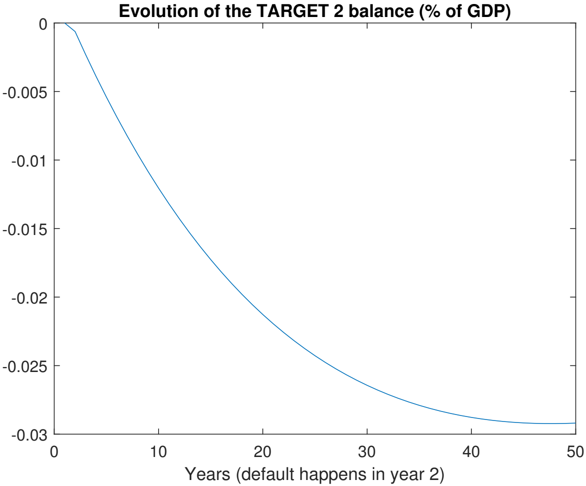
- Interest rates are low - why do we have a solvency problem in the first place?
- Interest rates are low - the PV of seigniorage is big (infinite?)

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



Other Issues (in Progress) - 1. What if Nobody Cuts Remittances?

- In previous experiments, the CB of country A cuts remittances so as to keep money growth unchanged
- What if they do not?
  - Faster money growth
  - Inflation?

2. Low Interest Rates

- What if debt of country A pays lower interest than the private sector?
- Country A is earning seigniorage
- TARGET2 imbalance shifts borrowing from country B to country A
- Country B appropriates some seigniorage
- Is this bad?

Wrapping up

- Assessing risk sharing principles is, in practice complicate
- Coordinating remittance policies is fundamental
- Drawing the boundary between monetary and fiscal policy is hard...

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- ... but it may matter a great deal
- To do: some more experiments