Fiscal-Monetary Interactions and the FTPL:

The Central Bank Balance Sheet

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Some current data

Assets and liabilities of the ECB (annual GDP in 2024q3: EU = 17.7 tn, EA20 = 15 tn)

Assets and liabilities of the Fed (US annual GDP in 2023: 27.7tn)

Remittances from the Fed to the Treasury ECB's profits and losses

Interest on excess reserves: Fed, ECB

Excess reserves: Fed ECB

Bassetto and Messer (2013)

Fiscal Consequences of Paying Interest on Reserves

- Interest on reserves (IOR) is a big change in the conduct of monetary policy and the behaviour of CB balance sheet
- Without IOR, CB liabilities are limited by demand for money
- With IOR, the CB can expand its balance sheet without limit, and take on risk. This can lead to profits and losses, and has *fiscal implications*
- In the case of losses, the transfer rule between CB and Treasury determines *CB independence*, via its ability to control inflation

Model

- Infinite horizon economy with flexible prices $\rightarrow$ abstract from *effects* of monetary policy

- Treasury budget constraint

$$B_{t-1} + D_{t-1} = \frac{B_t}{1+R_t} + Q_t(D_t - D_{t-1}) + S_t + T_t$$

  B_t and D_t are short-term debt and consols; Q_t is the price of consols, S_t are dividend transfers *from* the CB, T_t are lump-sum taxes on the private sector

- Central bank budget constraint

$$M_t - M_{t-1} = \frac{B_t^{cb}}{1+R_t} - B_{t-1}^{cb} + Q_t(D_t^{cb} - D_{t-1}^{cb}) - D_{t-1}^{cb} + S_t + X_{t-1} - \frac{X_t}{1+R_t}$$

  X_t are interest-bearing excess reserves, remunerated at the same rate of short-term debt

Central bank profits

- Central bank profits at *Historical Cost*

$$\Pi^{HC} := \frac{R_{t-1}}{1+R_{t-1}}(B^{cb}_{t-1} - X_{t-1}) + D^{cb}_{t-1} + (Q_t - \bar{Q}_{t-1})(D^{cb}_{t-1} - D^{cb}_t)\mathbb{1}_{[D^{cb}_{t-1} - D^{cb}_t]}$$

net interest on short-term net assets; coupon payments from consols; realised capital gains/losses from selling consols

- Central bank profits when *Marked to Market*

$$\Pi^{MM} := \frac{R_{t-1}}{1+R_{t-1}}(B^{cb}_{t-1} - X_{t-1}) + D^{cb}_{t-1} + (Q_t - Q_{t-1})D^{cb}_{t-1}$$

net interest on short-term net assets; coupon payments from consols; realised *and unrealised* capital gains/losses on consols

Private sector behaviour

$$\max_{\{c_t,B_t,X_t,M_t,D_t\}} \quad \mathbb{E}_0 \sum_{t=0}^{\infty} q_0^t[c_t + v(M_t/P_t)] \quad \text{where} \quad q_0^t = \prod_{s=0}^{t} \beta_s, \quad \beta_t \text{ random}$$

$$\text{s.t.} \quad \frac{B_t + X_t}{1+R_t} + Q_t D_t + M_t + T_t \leq M_{t-1} + P_t(y_t - c_t) + B_{t-1} + X_{t-1} + (1+Q_t)D_{t-1}$$

$$v'(M_t/P_t) = \frac{R_t}{1+R_t} \qquad \text{(money demand)}$$

$$1 = \beta_t(1+R_t)\mathbb{E}\frac{P_t}{P_{t+1}} \qquad \text{(Fisher equation / Euler eq. for bonds/reserves)}$$

$$Q_t = \beta_t \mathbb{E}(1+Q_{t+1})\frac{P_t}{P_{t+1}} \qquad \text{(Euler eq. for consols)}$$

$\Rightarrow$ consol price is subject to future interest rate risk $Q_t = \mathbb{E}_t \sum_{s=1}^{\infty} q_t^{t+s} \frac{P_t}{P_{t+s}} = \mathbb{E}_t \sum_{s=0}^{\infty} \frac{1}{1+R_{t+s}}$

PVBCs

- Households discount future payoff x_{t+k} at $PV_t(x_{t+k}) := \mathbb{E}_t q_t^{t+k}$

- Treasury

$$B_{t-1} + (1 + Q_t)D_{t-1} = \sum_{s=t}^{\infty} PV_t(S_s + T_s)$$

- Central bank

$$B_{t-1}^{cb} + (1 + Q_t)D_{t-1}^{cb} - X_{t-1} + \sum_{s=t}^{\infty} PV_t(M_s - M_{s-1}) = \sum_{s=t}^{\infty} PV_t(S_s)$$

LHS: net value of the central bank ($\approx$ CB capital or equity) + PV of seigniorage profits

RHS: PV of dividends to treasury

Property of equilibria

Irrelevance proposition: the timing of taxes and CB dividends is irrelevant; only their PV matters.

We have the same Competitive Eqm, if

- taxes increase by ΔT at t_1, and decrease by $\Delta T \prod_{s=t_1}^{t_2-1}(1+R_s)$ at $t_2 > t_1$
- the Treasury increases short-term between t_1 and t_2 accordingly

or if

- CB dividends decrease by ΔS at t_1, and increase by $\Delta S \prod_{s=t_1}^{t_2-1}(1+R_s)$ at $t_2 > t_1$
- between t_1 and t_2, the Treasury increases issuance, and the CB increases holdings, of short-term debt accordingly

Note: timing irrelevant only in an ideal world where T and CB *commit* to entire future strategy at time 0

In practice, realistic to assume

- CB concerned with price stability
- T concerned with fiscal implications of CB transfers

Central bank recapitalisation

Consider an extreme example: CB pays initial dividend > PV(future dividends)

$$B_{-1}^{cb} + (1 + Q_0)D_{-1}^{cb} - X_{-1} + \sum_{s=0}^{\infty} PV_0(M_s - M_{s-1}) < S_0$$

At $t = 1$, CB will have negative capital/net value

$$B_0^{cb} + (1 + Q_1)D_0^{cb} - X_0 + \sum_{s=1}^{\infty} PV_1(M_s - M_{s-1}) < 0$$

Only sustainable if the Treasury eventually recapitalises the CB by sending reverse transfers

Otherwise, CB would have to increase PV(seigniorage), endangering price stability

Analysing different scenarios

- Fix arbitrary paths for $\{P_t, R_t, M_t/P_t\}$
- Study CB profits and evolution of its net worth under different policy scenarios/asset management strategies, from "conservative" to "aggressive"

Assumption: $R_t > 0$ **for all** t

(a) Bills only: no IOR, no long-term assets $\Rightarrow \Pi_t^j > 0$ for all t

$$\Pi_t^{HC} = \Pi_t^{MM} = B_{t-1}^{cb} \frac{R_{t-1}}{1 + R_{t-1}} \geq 0$$

If money is *fiat* (unbacked, $M_t \geq M_{t-1}$ for all t), then profits are not needed to redeem money, and the CB can guarantee a positive stream of dividends to the Treasury

Analysing different scenarios

(b) Buy and hold: no IOR, long-term assets held to maturity $\Rightarrow \Pi_t^{HC} > 0$ for all t

$$\Pi_t^{HC} = B_{t-1}^{cb} \frac{R_{t-1}}{1 + R_{t-1}} + D_{t-1}^{cb} \geq 0$$

capital losses are possible but never realised, so profits at cost are non-negative

(c) Unlevered active trading: no IOR, arbitrary asset strategy $\Rightarrow$ CB losses $\geq$

$$\Pi_t^{MM} = \frac{R_{t-1}}{1 + R_{t-1}} B_{t-1}^{cb} + D_{t-1}^{cb} + (Q_t - Q_{t-1}) D_{t-1}^{cb} \geq -Q_{t-1} D_{t-1}$$

CB can at most lose all of its investment. If money is fiat, CB can still guarantee a positive stream of dividends to the Treasury. In the worst case where $B_{t-1}^{cb} = 0$ and $Q_t = 0$

$$\sum_{s=t}^{\infty} PV_t(M_s - M_{s-1}) = \sum_{s=t}^{\infty} PV_t(S_s)$$

Analysing different scenarios

(c) Quantitative easing: IOR, arbitrary asset strategy $\Rightarrow$ *levered* active trading, losses can be arbitrarily large

- CB wealth available to invest at t is

$$W_t := B_{t-1}^{cb} + (1+Q_t)D_{t-1}^{cb} - S_t - X_t + M_t - M_{t-1}$$

- Portfolio allocation problem: large X_t = leverage = arbitrarily large D_t^{cb}

$$\frac{B_t^{cb} - X_t}{1+R_t} + Q_t D_t^{cb} = W_t$$

- Value of asset portfolio at $t+1$ can be written as

$$B_t^{cb} + (1+Q_{t+1})D_t^{cb} - X_t = (1+R_t)W_t + D_t^{cb}\left[Q_{t+1} - \beta\mathbb{E}_t\left((1+R_{t+1})Q_{t+1}P_t/P_{t+1}\right)\right]$$

- The CB PVBC implies the CB may eventually need a recapitalisation or higher seigniorage

$$B_{t-1}^{cb} + (1+Q_t)D_{t-1}^{cb} - X_{t-1} + \sum_{s=t}^{\infty} PV_t(M_s - M_{s-1}) = \sum_{s=t}^{\infty} PV_t(S_s)$$

Central bank capital and balance sheet risk

- In reality, exposure to variety of risks: interest rate, default, exchange rate, commodity price

- CB financial stability is an elusive concept
  - In corporate finance, capital/equity is measured for liquidation value of firm, or as market value
  - CBs cannot be liquidated: creditors cannot demand conversion to anything $\neq$ money
  - CBs market value is irrelevant, as goal is not profits and shares are not traded

- Only real possibility is that private agents are unwilling to hold CB liabilities
  - e.g., Tresury dividend policy not enough to cover PV of seigniorage and asset returns
  - this implies $P_t \to \infty$, and typically currency reform and "new" central bank

See related discussion in Hall and Reis (2015)

References

Bassetto, Marco and Todd Messer, "Fiscal Consequences of Paying Interest on Reserves," *Fiscal Studies*, 2013, *34* (4), 413–546.

Hall, Robert E. and Ricardo Reis, "Maintaining Central-Bank Financial Stability under New-Style Central Banking," Working Paper 21173, NBER 2015.