Macroeconomics 3

Monetary/Fiscal interaction

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Today's lecture

- Quick introduction into the Fiscal Theory of the Price Level
- Interaction between fiscal and monetary policies
- Follow: Leeper (1991) and Leeper and Leith (2016)... related to Sargent, Wallace, et al. (1981)
- Our analysis so far abstracted from the fiscal branch of the government because it does not play a meaningful role, but it could under different specifications

Endowment economy

The representative consumer's objective

$$\max \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t u(c_t)$$

subject to a sequence of flow constraints

$$P_t c_t + P_t \tau_t + \mathbb{E}_t \left(Q_{t,t+1} D_t \right) = P_t y + P_t z_t + D_{t-1}$$

Endowment economy: constant

$Q_{t,t+1}$ is the price of an asset that pays 1 unit of "currency" tomorrow and P_t is the price level

Nominal debt is included in D_t and pays a gross nominal rate of R_t in period $t+1$

Endowment economy

$m_{t,t+1}$ is the stochastic discount factor of the household

By arbitrage

$$Q_{t,t+1} = m_{t,t+1} \frac{P_t}{P_{t+1}}$$

and

$$\frac{1}{R_t} = \mathbb{E}_t Q_{t,t+1}$$

The intertemporal budget constraint

$$\mathbb{E}_t \sum_{j=0}^{\infty} m_{t,t+j} c_{t+j} = \frac{D_{t-1}}{P_t} + \mathbb{E}_t \sum_{j=0}^{\infty} m_{t,t+j} (y - s_{t+j})$$

But in equilibrium $y = c_t$ and $m_{t,t+1} = \beta$

$$\frac{1}{R_t} = \beta \mathbb{E}_t \frac{1}{\pi_{t+1}}$$

Endowment economy

In the aggregate households only hold government debt

$$\frac{B_{t-1}}{P_t} = \mathbb{E}_t \sum_{j=0}^{\infty} \beta^j s_{t+j}$$

This is what Cochrane refers to as an equilibrium valuation equation

This equation does not impose any constraint on government future surpluses... we haven't said anything about the government yet. This equation is fully derived by households optimization and equilibrium conditions

Now, we turn to talk about the government

Endowment economy

Policy rules

$$\frac{1}{R_t} = \frac{1}{R^*} + \alpha_\pi \left(\frac{1}{\pi_t} - \frac{1}{\pi^*} \right) + \epsilon_t^M$$

$$s_t = s^* + \gamma \left(\frac{1}{R_t} \frac{B_{t-1}}{P_{t-1}} - \frac{b^*}{R^*} \right) + \epsilon_t^F$$

And the policies must be consistent with the Government's flow identity (notice the wording)

$$\frac{1}{R_t} \frac{B_t}{P_t} + s_t = \frac{B_{t-1}}{P_t}$$

Endowment economy

Policy rules

Use $\nu_t = \pi_t^{-1}$, after some algebra, the government's assumptions imply dynamics for the real debt and the inflation as a function of exogenous shocks

$$\mathbb{E}_t(\nu_{t+1} - \nu^*) = \frac{\alpha_\pi}{\beta}(\nu_t - \nu^*) + \frac{1}{\beta}\epsilon_t^M$$

$$\mathbb{E}_t\left(\frac{b_{t+1}}{R_{t+1}} - \frac{b^*}{R^*}\right) = (\beta^{-1} - \gamma)\left(\frac{b_t}{R_t} - \frac{b^*}{R^*}\right) + \mathbb{E}_t\epsilon_{t+1}^F$$

These equations are interrelated, the government issues nominal debt, not real debt... the price level is behind these equations and behind the interaction between monetary and fiscal policies

Endowment economy

Policy rules: AMP

Assume $\alpha_\pi / \beta > 1$. Solve forward for the dynamics of ν and the equilibrium interest rate

$$\nu_t = \nu^* - \frac{1}{\alpha_\pi} \sum_{j=0}^{\infty} \left(\frac{\beta}{\alpha_\pi} \right)^j \mathbb{E}_t \epsilon^M_{t+j}$$

What do we need to have a bounded solution for real debt?
If the government sets $\gamma > \beta^{-1} - 1$ the real debt equation does not explode. This means that future surpluses are going to increase more than one to one to the net interest rates implying that debt will not follow a divergent path, debt will eventually go back to the steady state

Endowment economy

Policy rules: the mechanism of AMP

Suppose a monetary policy shock (or higher shocks in the future)... effect: reduce ν_t, for a given P_{t-1} it implies an increase in P_t

On impact, the surplus is unaffected, but the real value of outstanding debt falls... and from

$$\frac{B_t}{P_t R_t} = -s_t + \frac{B_{t-1}}{P_t}$$

$\frac{B_t}{P_t}$ also falls... without any adjustment on the fiscal side, households are impoverished (negative wealth effect), this would reduce aggregate demand and push P_t down, counteracting the effects of the expansionary monetary shock...

Endowment economy

Policy rules: the mechanism of AMP

But if we have fiscal adjustment as the one required for debt to be stable, $\gamma > \beta^{-1} - 1$, surplus goes down by more than the real rate, eliminating the negative wealth effect and keeping the monetary shocks expansionary

Here, the impact of open market operation depends on keeping the fiscal policy constant, in the sense that eliminating the effects that monetary policy has on balance sheets (Wallace, 1981)

Endowment economy

Policy rules: the mechanism of AMP

About Ricardian Equivalence

A fiscal shock that here reduces surplus is financed by higher debt, given that inflation is pinned down by

$$\nu_t = \nu^* - \frac{1}{\alpha_\pi} \sum_{j=0}^{\infty} \left(\frac{\beta}{\alpha_\pi} \right)^j \mathbb{E}_t \epsilon_{t+j}^M$$

real debt also increases... this higher debt triggers future higher surpluses

This Ricardian Equivalence is not only a fiscal phenomenon, depends on the monetary policy

Endowment economy

Policy rules: AFP

Suppose now that $\gamma = 0$, solve for the real debt

$$\frac{b_t}{R_t} = \frac{b^*}{R^*} + \sum_{j=1}^{\infty} \beta^j \mathbb{E}_t \epsilon^F_{t+j}$$

The real value of debt depends on expected future surpluses from $t+1$ onward

Combining with the gov's identity we solve for inflation

$$\nu_t = \frac{(\beta^{-1} - 1)s^* + \sum_{j=0}^{\infty} \beta^j \mathbb{E}_t \epsilon^F_{t+j}}{b_{t-1}}$$

where $B_{t-1}/P_t = \nu_t b_{t-1}$ (i.e. b_{t-1} is predetermined), producing a solution for the price level

Endowment economy

Policy rules: AFP

The solution for the price level is

$$P_t = \frac{B_{t-1}}{(\beta^{-1} - 1)s^* + \sum_{j=0}^{\infty} \beta^j \mathbb{E}_t \epsilon^F_{t+j}}$$

Lower surpluses news, increases the price level, reducing the real value of debt!

Higher nominal debt raises the price level!

Monetary policy ensures that real debt and interest payments do not explode... needs to permit surprise inflation to revalue government debt

Unlike in AMP, here equilibrium inflation depends on current and expected fiscal shocks

Endowment economy

Policy rules: AFP

The role of monetary policy is the following, assuming iid shocks

$$\frac{1}{R_t} - \frac{1}{R^*} = \frac{\alpha_\pi}{\beta}\left[\frac{\beta(1-\beta)s^* + \beta\epsilon_t^F}{b_{t-1}} - \frac{1}{R^*}\right] + \epsilon_t^M$$

An aggressive response to inflation $\frac{\alpha_\pi}{\beta} > 1$ would make interest rate diverge to infinity violating the households budget constraint

A mild response to inflation would indeed increase inflation as increases the cost of financing for the government

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SARGENT, T. J., N. WALLACE, ET AL. (1981): "Some unpleasant monetarist arithmetic," *Federal reserve bank of minneapolis quarterly review*, 5(3), 1–17.