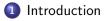
Lecture 4: Money in the RBC Model

Adam Hal Spencer

The University of Nottingham

Advanced Monetary Economics 2020





3 Model Equilibrium



Overview

- Last class we introduced the real business cycle DSGE.
- Allowed us to study the impact of technology shocks on the macroeconomy.
- What happens if we also allow households to save through cash holdings?

Overview

- Can potentially give us inflation and prices.
- There are problems though.
- Why would households hold money if they can earn a return from some other asset (e.g. capital or bonds that pay interest)?









Household Setup

- Let's forget about capital for now.
- Assume that households can hold cash m_{t+1} or discount bonds in each period b_{t+1} , (price of bonds is $q_t < 1$).
- Otherwise the setup is the same as the RBC model.

Household's Problem

• Problem:

$$\max_{\{c_t, n_t, b_{t+1}, m_{t+1}\}_{t=0}^{\infty}} \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left[\frac{c_t^{1-\sigma}}{1-\sigma} - \frac{n_t^{1+\psi}}{1+\psi} \right]$$

subject to their budget constraints

$$p_t c_t + q_t b_{t+1} + m_{t+1} \leq w_t n_t + m_t + b_t + d_t$$

 b_0, m_0 given

where p_t denotes the price of goods.

Household's Problem

- What role does money serve here?
- It's a unit of account: since now we have this price term p_t .
- 1 unit of consumption costs p_t of money at time t.
- Also the wage is nominal now: working gives w_t units of money.

Household's Problem

- How does this contrast to the previous lecture where goods were the numerairé?
- Without money: we'd say that working offers a wage that pays goods.

• Now money takes the role of the numerairé.









Household's Problem: Optimality

• Lagrangian given by

$$\mathcal{L} = \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left[\frac{c_t^{1-\sigma}}{1-\sigma} - \frac{n_t^{1+\psi}}{1+\psi} \right] \\ + \mathbb{E}_0 \sum_{t=0}^{\infty} \lambda_t \left[w_t n_t + m_t + b_t - m_{t+1} - q_t b_{t+1} - p_t c_t \right]$$

Household Optimality: First Order Conditions

FOCs:

$$\frac{\partial \mathcal{L}}{\partial c_t} = 0 \Rightarrow \beta^t c_t^{-\sigma} - p_t \lambda_t = 0$$
(1)

$$\frac{\partial \mathcal{L}}{\partial n_t} = 0 \Rightarrow -\beta^t n_t^{\psi} + \lambda_t w_t = 0$$
(2)

$$\frac{\partial \mathcal{L}}{\partial b_{t+1}} = 0 \Rightarrow -q_t \lambda_t + \mathbb{E}_t[\lambda_{t+1}] = 0$$
(3)

$$\frac{\partial \mathcal{L}}{\partial m_{t+1}} = 0 \Rightarrow -\lambda_t + \mathbb{E}_t[\lambda_{t+1}] = 0$$
(4)

What's the Problem with Money

• Compare equations (3) and (4)

$$q_t = 1$$

which is a contradiction.

- Recall: the bonds trade at a discount (pay interest).
- So money is dominated in this model.
- $\not\exists$ a monetary equilibrium here.

What's the Problem with Money

- We need to introduce some motivation for holding cash!
- Otherwise households will just save through the "better" asset that offers the return.

Optimal Monetary Policy

- What's the optimal policy in this environment?
- Who cares?
- Do whatever you want with money, won't affect welfare at all.
- Money is neutral in this environment.





3 Model Equilibrium



Takeaways

- We want cash in a model to talk about nominal prices.
- Just sticking money into the RBC model without some other frictions won't do the trick.
- Households need some other reason for holding cash.