

Lecture 4: Money in the RBC Model

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Roadmap

- 1 Introduction
- 2 Model Environment
- 3 Model Equilibrium
- 4 Conclusion

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)?

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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 numeraire?
- Without money: we'd say that working offers a wage that pays goods.
- Now money takes the role of the numeraire.

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Household's Problem: Optimality

- Lagrangian given by

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

Household Optimality: First Order Conditions

- FOCs:

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

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

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

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

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.
- \nexists 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.

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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.