Advanced Monetary Economics

Tutorial 4

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Lecture 6

1. Unconventional monetary policy
    - forward guidance
    - quantitative easing (PEPP, APP)
    - side effects (state financing, structural reforms)

2. Transmission channels of monetary policy
    - interest rate channels
    - asset price channels
    - credit channels

1 Exercise

Question: Describe the interest rate channel and the expectation channel of monetary policy. Is the expectation channel relevant in case of an poliy rate at the zero lower bound?

- *Interest rate channel:* A decrease in the real interest rate $i_r = i - \pi^e$ increases the investments of companies and households due to lower earnings on savings and lower capital costs. The resulting increase in aggregate demand for goods increases GDP.

- A central bank can try to influence i_r via i and/or π^e.

- *Change of i:* Lowering the nominal interest rate i lowers the real interest rate in the case of delayed (rigid) price adjustments (which are reflected in delayed adjustments of π^e).

- *Change of π^e:* Increase in inflation expectations π^e lowers the real interest rate (expectation channel). This activates the interest rate channel.

- At the zero lower bound: no further reductions of the nominal interest rate. However, the interest rate channel can work via the expectation channel. In fact, the expectation channel is highly relevant in the case of the zero interest limit (foward guidance).

2 Exercise

Question: Explain the exchange rate channel using the interest rate parity condition. Distinguish between the nominal and real exchange rate and indicate under which (price) conditions, a nominal depreciation of the domestic currency leads to an increase in real income.

- *Interest rate parity condition:* interest rate euro zone = interest rate dollar + expected depreciation of the euro (or expected appreciation of the dollar)

- *Core assumptions:*

  - Perfect substitutability (interest/exchange rate yield as the only decision criterion, homogeneous securities market).

  - Perfect capital mobility (unrestricted capital movement).

- *Interpretation:* In equilibrium, domestic and foreign currency returns are equal. The return of an investment abroad (USA) does not only depend on the interest rate of the foreign asset. From the point of view of the domestic (euro zone) investor, the return also depends on a possible appreciation of the dollar against the euro (because after the security expires, the domestic investor converts the dollar-denominated return back into euros). At the time of investment (the time of the decision whether to invest in the domestic or foreign paper), the exchange rate at the time of expiration is not known, therefore: expectation formation.

- *Exchange rate channel:* Decline in domestic interest rates means that foreign securities have become relatively more attractive. This leads to an increased demand for dollars to purchase these papers, or a depreciation of the euro nominally.

- In the case of rigid goods prices at home and abroad: The nominal devaluation of the domestic currency leads to a real devaluation of the domestic currency (the domestic good becomes cheaper relative to the foreign good). As a result, net domestic exports increase and GDP rises.

- Distinction between nominal and real exchange rates:
  - Nominal exchange rate=$\frac{Euro}{1Dollar}$, example: 0.83 Euro/Dollar.
  - Price Dollar=$\frac{Dollar}{units\ of\ foreign\ goods}$, example: 10 Dollar/Kg.
  - Price Euro=$\frac{euro}{units\ of\ domestic\ goods}$, example: 15 Euro/litre.

  - Real exchange rate=$\frac{(Nominal\ exchangerate)(price\ \text{Dollar})}{price\ \text{Euro}}$
  - example: ([0.85 Euro/Dollar][10 Dollar/Kg.]/[15 Euro/Liter])=[8.5 Euro/Kg.]/[15 Euro/Liter]=0.566 Liter/Kg.

- Real exchange rate: physical exchange ratio between domestic and foreign goods.

3 Exercise

Question: Explain how a central bank can create investment and consumption incentives by increasing capital market values.

- Expansionary monetary policy: decrease in effective interest rates and increase in the value of shares and bonds.

- In the corporate sector:
  - Tobin's q = market value of capital (shares or equity) / replacement costs of the capital.
  - When q is high, companies have an incentive to issue shares to finance new investments (market value relative to replacement costs high).
  - Increasing investment leads to an increase in GDP.

- In the household sector: Increase in the market value of capital generates an increase in life income or assets. This leads to an increase in consumption and therefore in GDP.

4 Exercise

Question: Address the issue of adverse selection during the current crisis. Which transmission channel is disturbed in this case and how can it be reactivated?

- Problem of asymmetric information:
  - Can the borrower repay the money?
  - Does the borrower intend to repay the money?
- Anticipated by the borrower: Especially those who tend not to meet their payment obligations are those who like to borrow money and are also willing to pay high interest rates (adverse selection or moral hazard).
- Consequence (of anticipation by the lender): lower credit volume.

- During the crisis, the asset side of companies has decreased due to write-downs. $\longrightarrow$ Intensification of the adverse selection: less is lent (by commercial banks) for fear of asymmetric information.

- Balance sheet channel: If the expansionary monetary policy leads to an increase in capital market values, the asset side of the companies increases. Reduction of the problem of adverse selection and thus increase in the granting of loans.

Lecture 7

- start building theoretical model for the interest-rate channel

- answer the question: what is the effect of monetary policy on the economy?

- assumptions:

  1. one representative household
  2. one representative firm
  3. closed economy, no investment, no government consumption
  4. flexible prices

5 Money as a store of value

Households have the instantaneous utility function $u(c_t, l_t)$ with $u_c > 0, u_l > 0, u_{cc} < 0$, the discount factor β and can spend their time for leisure l and working time n:

$$l_t + n_t \leq 1.$$

The budget constraint is

$$P_t c_t + M_t \leq P_t w_t n_t + M_{t-1},$$

where P_t is the aggregate price level, c_t real consumption, M_t nominal money holdings, w_t the real wage and lower case letters denote real variables.

1. Defining inflation as $\pi_t = P_t/P_{t-1}$, set up the intertemporal Lagrangean for the household's problem and derive the first order conditions.

2. Formulate the complementary slackness conditions and check whether they are binding.

3. Derive the intertemporal consumption decision and discuss the impact of an increase of inflation on current consumption and savings.

Solution

1. Divide the budget constraint by P_t

$$c_t + m_t \leq w_t n_t + m_{t-1}/\pi_t.$$

The Lagrangean is

$$\mathcal{L} = \sum_{t=0}^{\infty} \beta^t \left[\begin{array}{c} u\left(c_t, l_t\right) + \mu_t \left(1 - l_t - n_t\right) \\ +\lambda_t \left(w_t n_t + m_{t-1}/\pi_t - c_t - m_t\right) \end{array} \right]$$

and the first order conditions w.r.t $c_t, l_t, n_t,$ and $m_t$are

$$\begin{aligned} u_{ct} &= \lambda_t \\ u_{lt} &= \mu_t \\ \lambda_t w_t &= \mu_t \\ \lambda_t &= \beta \frac{\lambda_{t+1}}{\pi_{t+1}}. \end{aligned}$$

2. The complementary slackness conditions for the households' budget constraint and time constraint are

$$\begin{aligned} \lambda_t \left(w_t n_t + m_{t-1}/\pi_t - c_t - m_t \right) &= 0 \\ \lambda_t &\geq 0 \\ w_t n_t + m_{t-1}/\pi_t - c_t - m_t &\geq 0 \end{aligned}$$

$$\begin{aligned} \mu_t \left(1 - l_t - n_t \right) &= 0 \\ \mu_t &\geq 0 \\ 1 - l_t - n_t &\geq 0. \end{aligned}$$

Condition $u_{ct} = \lambda_t$ implies that $\lambda_t > 0$ such that the budget constraint is binding.
Condition $u_{lt} = \mu_t$ implies that $\mu_t > 0$ such that the time constraint is binding.

3. The intertemporal consumption decision of the households is

$$\frac{u_{ct}}{u_{ct+1}} = \beta \frac{1}{\pi_{t+1}}$$

which implies that the ratio of the marginal utility of consumption today to the marginal utility of consumption tomorrow declines with the future inflation rate. Current consumption thus increases compared to future consumption given that $u_{cc} < 0$, or equivalently, savings in form of real money holdings decrease.

6 Money and interest rates

Usually money is not only held as a store of value. For this purpose, people commonly invest in assets which bear an interest, such as bonds B_t. Suppose that the representative household with the same utility function as in the previous exercise can invest in such assets in $t-1$ with interest i_{t-1}. The modified budget constraint is

$$P_t c_t + M_t + B_t \leq P_t w_t n_t + M_{t-1} + (1 + i_{t-1}) B_{t-1}.$$

Furthermore, there is a non-negativity constraint on money $M_t \geq 0$, which prevents the household to issue money.

1. Set up the Lagrangean and derive the first order and complementary slackness conditions.

2. When does the non-negativity constraint on money holdings bind? What is the intuition?

3. Why do people hold money?

Solution

1. The Lagrangean is

$$\mathcal{L} = \sum_{t=0}^{\infty} \beta^t \left[\begin{array}{c} u\left(c_t, l_t\right) + \mu_t \left(1 - l_t - n_t\right) + \psi_t m_t \\ +\lambda_t \left(w_t n_t + \left(1 + i_{t-1}\right) b_{t-1}/\pi_t + m_{t-1}/\pi_t - c_t - m_t - b_t\right) \end{array} \right].$$

The first order conditions w.r.t c_t, l_t, n_t, m_t and b_t are

$$\begin{aligned} u_{ct} &= \lambda_t \\ u_{lt} &= \mu_t \\ \lambda_t w_t &= \mu_t \\ \lambda_t - \psi_t &= \beta \frac{\lambda_{t+1}}{\pi_{t+1}} \\ \lambda_t &= \beta \frac{\lambda_{t+1}}{\pi_{t+1}} (1 + i_t) . \end{aligned}$$

The complementary slackness conditions are as before plus

$$\psi_t m_t = 0, \quad \psi_t \geq 0, \quad m_t \geq 0.$$

2. Combining the conditions for money and bonds gives

$$\psi_t = \frac{i_t}{1 + i_t} \lambda_t.$$

Since λ_t is strictly positive, the multiplier ψ_t on the non-negativity constraint on money holdings is strictly positive whenever the nominal interest rate exceeds

zero. Then, the non-negativity constraint is binding $m_t = 0$. If the nominal interest rate on government bonds is positive, households are not willing to invest in money, whose real rate of return is $1/\pi_{t+1}$ while the return on bonds is $\frac{(1+i_t)}{\pi_{t+1}}$.

3. People might be willing to hold money if money is needed for transactions for goods and services or if it yields utility directly.