Money and Banking
Lecture 9: Central Bank and Monetary Policy

Gu, Xin

School of Finance
Zhejiang Gongshang University

Outline

INTRODUCTION

- In last lecture, we discussed the role of central bank and money supply in *fiat money system*.
- Money supply is completed by central bank (*monetary base*), and commercial banks (*liability*).
- We use *open market operations* to prove that by creating *monetary base*, central bank could inject *flexible* money into the banking system. Under the work of *endogenous money creation* by balance sheet of commercial banks, the money supply in the economy would change correspondingly.
- In this lecture, we first continue to use central bank's balance sheet to verify the role of *lender of last resort*.
- Second, we take a quick review of monetary history and discuss why central bank is taking active monetary policy to contain inflation.
- Third, to contain inflation, how does central bank use monetary policy tools.

LENDER OF LAST RESORT

- When commercial banks confront with bank run, *healthy* banks are allowed to access central bank support, i.e., *discount lending window*.
- Through discount lending from central bank, *healthy* banks are able to get liquidity without fire sale of "good" assets.
- Banks could use "good" assets as *collateral* to get discount loans from central bank, and use the proceeds to meet liquidity demand.
- When banks survived from liquidity crisis, banks could repay the discount loans.
- The interest rate charged on discount loans is considered as *penalty rate* – it alters banks to have a good liquidity management.

WHY CENTRAL BANK IS RESPONSIBLE FOR INFLATION?

- Keynes (1936) mentioned in his seminal book *General Theory of Employment, Money and Interest* that speculation motive of holding money in financial crisis entails ineffectiveness of monetary policy, because money demand is unstable.
- In contrast, fiscal policy is more effective to stimulate *aggregate demand*. Active fiscal policy and accommodating monetary policy were considered as optimal policy mix in the 1950s.
- In addition, *Phillips curve*, i.e., negative relationship between inflation and unemployment, provided policymakers a trade-off menu. Either inflation tolerance, i.e., higher inflation, or employment improvement, i.e., lower unemployment rate.
- However, in the 1970s, *high inflation and high unemployment* was prevailing, that is, "Great Inflation".

Why Central Bank is Responsible for Inflation?

- Edward Phelps and Milton Friedman proposed that in the long run, there is no trade-off between inflation and unemployment, i.e., long-run Phillips curve is vertical.
- Economists from *Classical perspective* argue that the whole economy, given technology progress, has *full-employment level* output, in which all resources are optimally allocated. Yet, the realized output deviates from the full-employment level output somehow.
- Such a deviation is called *unemployment gap*, denoted as $(u_t - \bar{u})$.
- On the other side, economic agents (e.g., households and corporations) use all available information to optimize decisions.
- e.g., Households make optimal consumption plan not only based on today's but also tomorrow's income (i.e., permanent income hypothesis).

Why Central Bank is Responsible for Inflation?

- Economic agents at time t could forecast next period $t+1$ inflation, denoted as $E_t\pi_{t+1}$.
- Actual inflation π_t deviates from expected inflation, denoted as $\pi_t - E_{t-1}\pi_t$
- Phelps and Friedman *expectation-augmented Phillips curve* is $\pi_t = \pi_t^e - h(u_t - \bar{u})$.
- Expansionary fiscal policy plus easy monetary policy increase aggregate demand, leading to lower unemployment, i.e., negative unemployment gap.
- That brings about positive inflation gap, that is, $\pi_t > \pi_t^e$. Why so?

Why Central Bank is Responsible for Inflation?

- Government issues bond to finance increased government purchase (e.g., labor services and building materials for infrastructure).
- Central bank to take accommodating monetary policy to keep interest rate low so that financing cost for government is low.
- At time $t-1$, the public have no idea about government purchase increase, therefore the expected inflation π_t^e is 5%.
- At time t, central bank increases money supply more than expected, resulting 10% inflation (i.e., $\pi_t = 10\%$).

Why Central Bank is Responsible for Inflation?

- With *multiplier effect*, initial increased government purchase goes larger, pushing up aggregate demand.
- Increased price up encourages producers to produce more, because wage set in previous time is fixed. Labor is cheaper (why?) So, unemployment is lower.
- However, by the end of time t, households would ask 5% more increase in wage to compensate purchasing power loss because of *unanticipated inflation rise*.
- Real wage W_t/P_t keeps unchange as at time $t-1$. Producers have no incentive to keep expanded production scale. Added labor laid off, i.e., unemployment increases.

Why Central Bank is Responsible for Inflation?

- (*Unanticipated*) Expansionary fiscal policy plus easy monetary policy has no influence on labor market, unemployment is still as same as before.
- The only thing has changed is the price level, inflation goes up.
- Without fiscal policy, only expansionary monetary policy can also lead to higher inflation, but no improvement in employment.
- *Such proposition in Classical Macroeconomics and New Keynesian Macroeconomics is called* ***money neutrality***.

Why Central Bank is Responsible for Inflation?

- Central bank has the secret weapon, i.e., *monetary base*, which can be used to increase money supply in the whole system.
- From the 1970s, central banks are assigned an important job: *keep* ***price stability*** *as primary monetary policy objective*.
- So far, many central banks in developed and some developing economies adopt *inflation* as indicator for *price stability*.
- To be specific, central banks in those economies announce an inflation target (forecasted) to achieve given a period of time.
- Such a monetary policy framework is called *inflation-targeting monetary policy*.

Why Central Bank is Responsible for Inflation?

- However, *inflation-targeting monetary policy* does not mean the only goal of monetary policy is *price stability*.
- It also takes output gap $(y_t - \bar{y})$ into consideration, because it relates to social welfare too.
- Hence, *inflation-targeting* central banks pursue minimization of a social loss function

$$\min L = (\pi_t - \pi^*)^2 + \alpha(y_t - \bar{y})^2 ,$$

where π^* is inflation target set by central bank, α is tradeoff coefficient to measure the importance of output gap in the loss function.

Why Central Bank is Responsible for Inflation?

- Central bank, assigned with this job (minimize this social loss function), how to achieve that tools.
- Recall from your *Macroeconomics*, $y_t = c_t + i_t + g_t$, where durable consumption, investment and government expenditure (bond financing) all related to real interest rate r_t.
- *Fisher equation* tells us the relationship between real interest rate, nominal interest rate, and expected inflation as follows.

$$i_t = r_t + \pi_t^e ,$$

Why Central Bank is Responsible for Inflation?

- The trick used by modern monetary policy is that by keeping inflation in target, i.e., π_t^e is a constant, central bank can use tools to lower (raise) nominal interest rate i_t, to get lower (higher) real interest rate r_t, so that output y_t expands (contracts).
- It renders a famous monetary policy rule, i.e., Taylor's rule (John B. Taylor, 1993)

$$\hat{i}_t = \phi_\pi(\hat{\pi}_t - \hat{\pi}^*) + \phi_y(\hat{y}_t - \hat{y}^*) + \varepsilon_{MR,t}\,,$$

- $\phi_\pi > 1$ is the coefficient for interest rate to respond inflation, and Taylor's rule tells it should be greater than unity. Otherwise, the economy falls into indeterminancy, or disequilibrium.
- $\varepsilon_{MR,t}$ includes all other factors, e.g., unanticipated, affecting interest rate setting by central bank.

Why Central Bank is Responsible for Inflation?

- Modern central banks use New Keynesian economic model called *Dynamic Stochastic General Equilibrium* (DSGE) to explore the effectiveness of monetary policy.
- It states Taylor's rule as follows:

$$\hat{i}_t = \hat{i}_{t-1} + \phi_\pi(\hat{\pi}_t - \hat{\pi}^*) + \phi_y(\hat{y}_t - \hat{y}^*) + \varepsilon_{MR,t}\,,$$

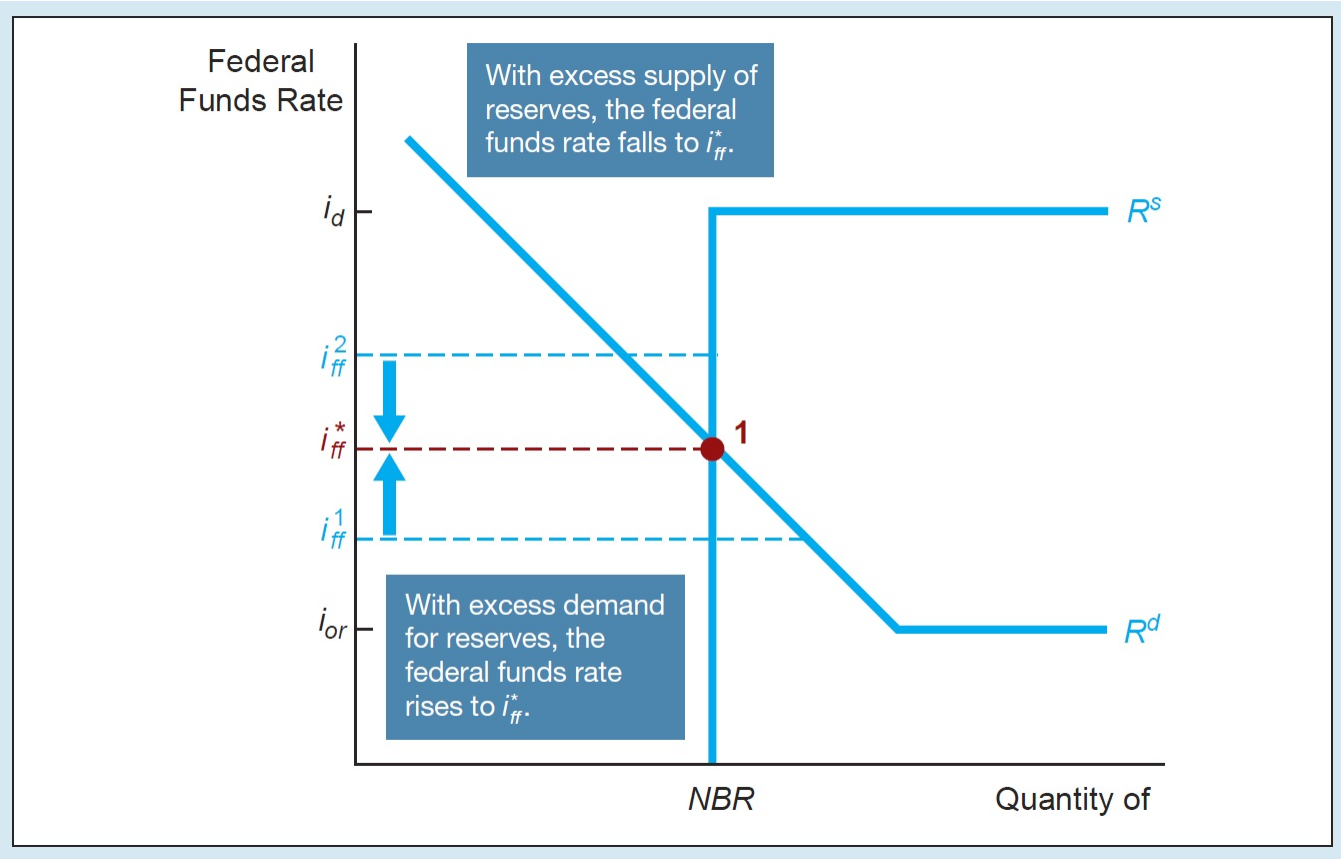
- $\hat{i}_{t-1}$ indicates *interest rate smoothing*. It shows central banks, instead of setting interest rate abruptly, set interest rate based on past interest rate path.
- Further discussion related to this topic is beyond the scope of this course.

Central Bank's Interest Rate Manipulation in Interbank Market

- In this section, we discuss how central banks to use monetary policy tools to manipulate interest rate in *interbank market*.
- To start with, analysis of supply and demand curve in interbank market is necessary.
- Interbank market is where *reserves* are supplied and demanded.
- Central banks employ monetary policy tools to influence *interest rate in interbank market*.

SUPPLY AND DEMAND IN INTERBANK MARKET

FIGURE 1: Supply and Demand in Interbank Market



Demand Curve in Interbank Market

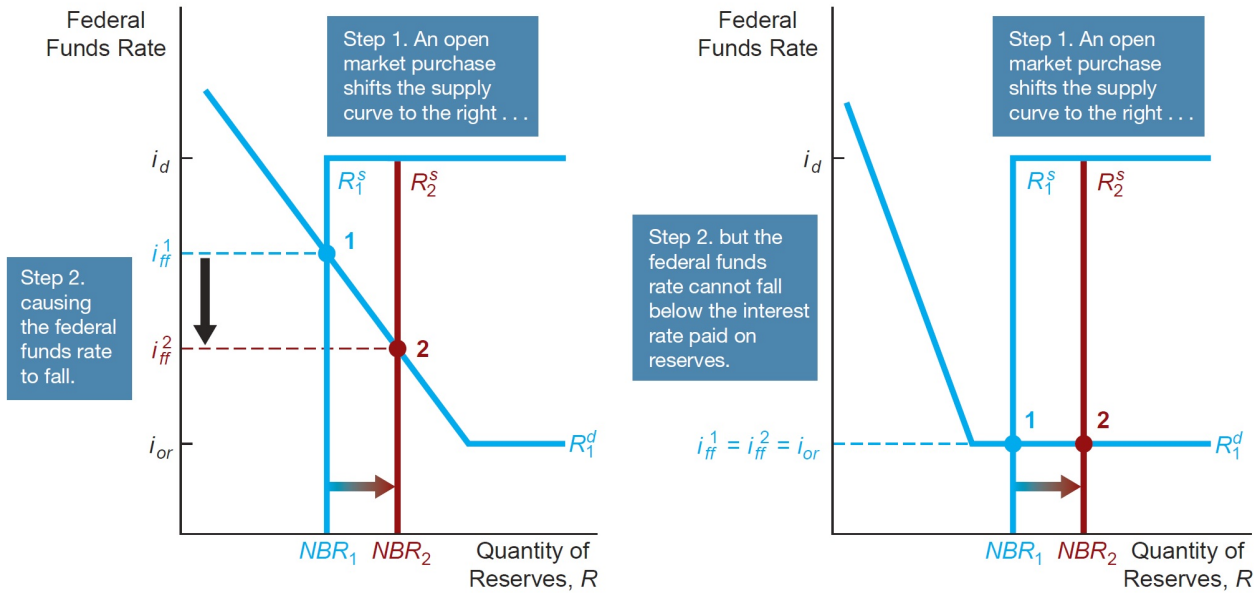
- Reserves in the banking system can be divided into two parts (1) required reserves and (2) excess reserves.
- Excess reserves are *insurance* against deposit outflows, and the cost of holding excess reserves is the opportunity cost, the interest rate earned on lending reserves out, minus the interest rate earned on these reserve, i_{or}.
- When interest rate in interbank market is above i_{or}, banks are willing to lend out excess reserves to earn extra interests.
- When the interest rate falls below i_{or}, banks prefer to holding excess reserves at the account of central bank to earn i_{or}.

Supply Curve in Interbank Market

- The supply of reserves, R^s, can be broken up into two components: reserves supplied by the central bank's open market operations, called *nonborrowed reserves* (NBR), and reserves borrowed from the central bank, called *borrowed reserves* (BR).
- The central bank will charge the interest rate i_d for financial institutions which borrow reserves from it.
- If the interest rate in interbank market goes above i_d, financial institutions (technically speaking) would borrow money from the central bank.
- So from the demand and supply curves we have i_{or} as *floor* and i_d as *ceiling*. Interest Rate Corridor.

OMOs on Interbank Market

FIGURE 2: Supply and Demand in Interbank Market

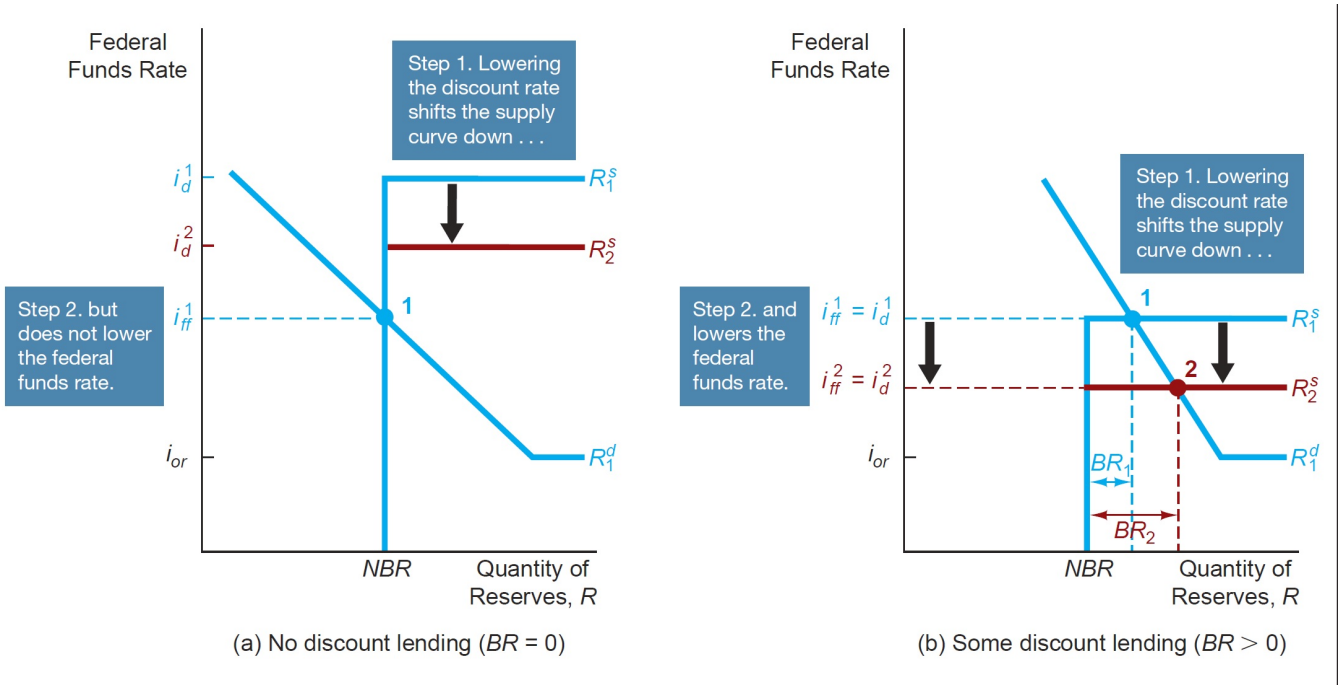


(a) Supply curve initially intersects demand curve in its downward-sloping section

(b) Supply curve initially intersects demand curve in its flat section

DISCOUNT LENDING ON INTERBANK MARKET

FIGURE 3: Supply and Demand in Interbank Market



Required Reserve Ratio on Interbank Market

Figure 4: Supply and Demand in Interbank Market