Chapter 23
Monetary Policy and the Federal Reserve
貨幣政策與中央銀行

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上課時間/地點: 週三上午9:10-12:00/海3006
Learning Objectives

1. Describe the structure and responsibilities of the Federal Reserve System
2. Analyze how changes in the federal funds rate and real interest rate affect planned aggregate expenditure and short-run equilibrium output
3. Show how the demand for money and the supply of money interact to determine the equilibrium nominal interest rate
4. Discuss how the Fed uses its ability to control the money supply to influence nominal and real interest rates
Learning Objective 1

央行的組織與責任
Fed Watch

• Analysts attempt to forecast Fed decisions about monetary policy
  – Greenspan briefcase indicator
  – Fed decisions have significant effects on financial markets and the macro economy

• Monetary policy is a major stabilization tool (穩定工具)
  – Quickly decided and implemented
  – More flexible and responsive than fiscal policy
The Federal Reserve

- Responsibilities of the Federal Reserve
  美國聯邦準備 (簡稱Fed; 即美國央行):
  - Conduct monetary policy
  - Oversee and regulate financial markets
    - Central to solving financial crises

- The Federal Reserve System began operations in 1914
  - Does not attempt to maximize profit
  - Promotes public goals such as economic growth, low inflation, and smoothly functioning financial markets
The Federal Reserve Organization

• The Federal Reserve System
  – 12 regional Federal Reserve banks (區域聯邦準備銀行)
    • Assess economic conditions in their region
    • Provide services to commercial banks in their region
  – 理事會(Board of Governors)，負責領導與管理
    • 為總統任命的7人小組，任期14年以確保制定貨幣政策時不會受到短期政治壓力的影响
    • 總統任命其中一位為理事會主席(chairman)，一次任期四年
      – Alan Greenspan (1987-2006)
      – Ben Bernanke (2006-2014)
      – Janet Yellen (2014-)
The Federal Reserve Organization

• 聯邦公開市場委員會(Federal Open Market Committee, FOMC)
  – 負責制定貨幣政策
  – 共12位成員(7位理事+5位區域聯邦準備銀行總裁)
  – 每年會面8次
  – 12位區域聯邦準備銀行總裁均出席FOMC會議，但只有5位具投票權(12位輪流)。
  – 紐約聯邦準備銀行總裁每次都有投票權
    • 因位處美國金融中心
    • 且負責執行公開市場操作
Stabilizing Financial Markets

• Motivation for creating the Fed
  – stabilize the financial markets and the economy

• Banking panics 銀行恐荒
  – 起源於民眾相信銀行可能會倒閉
  – Bank run (銀行擠兌): Depositors rush to withdraw funds
  – Banks have inadequate reserves to meet demand
    • Banks close

• Fed prevents bank panics by
  – Supervising and regulating banks
  – Loaning banks funds if needed
  – Fed did not prevent the bank panics of 1930 – 1933
Bank Panics, 1930 - 1933

- One-third of the banks closed
  - Increased the severity of the Great Depression
  - Difficult for small businesses and consumers to get credit
  - Money supply decreased
- With no federal deposit insurance (存款保险), people held cash
  - Feared banks would close and they would lose their deposits
  - Holding cash reduced banks' reserves
    - Lower reserves decreased the money supply by a multiple of the change in reserves
Bank Panics, 1930 - 1933

- Banks increased their reserve–deposit ratio (減少放款)
  - Further decreased the money supply

<table>
<thead>
<tr>
<th>Date</th>
<th>Currency Held by Public ($B)</th>
<th>Reserve – Deposit Ratio</th>
<th>Bank Reserves ($B)</th>
<th>Money Supply ($B)</th>
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</thead>
<tbody>
<tr>
<td>12 / 1929</td>
<td>3.85</td>
<td>0.075</td>
<td>3.15</td>
<td>45.9</td>
</tr>
<tr>
<td>12 / 1930</td>
<td>3.79</td>
<td>0.082</td>
<td>3.31</td>
<td>44.1</td>
</tr>
<tr>
<td>12 / 1931</td>
<td>4.59</td>
<td>0.092</td>
<td>3.11</td>
<td>37.3</td>
</tr>
<tr>
<td>12 / 1932</td>
<td>4.82</td>
<td>0.109</td>
<td>3.18</td>
<td>34.0</td>
</tr>
<tr>
<td>12 / 1933</td>
<td>4.85</td>
<td>0.133</td>
<td>3.45</td>
<td>30.8</td>
</tr>
</tbody>
</table>
Deposit Insurance

• Congress created deposit insurance in 1934
  – Deposits of less than $100,000 will be repaid even if the bank is bankrupt
    • Decreases incentive to withdraw funds on rumors
• No significant bank panics since 1934
• With less risk, depositors pay less attention to whether banks are making prudent investments
  – In the 1980s, many savings and loan associations went bankrupt
    • Cost the taxpayers hundreds of billions of dollars
Learning Objective 2

央行如何透過控制聯邦資金利率(或實質利率)以影響預擬總合支出?
The Fed and the Economy

Interest rates affect planned aggregate expenditure, PAE (LO2)

Changes in money supply cause changes in nominal interest rate (LO3)

Eliminate output gaps by changing the money supply (LO4)
Can the Fed Control the Real Interest Rate?

- Fed controls the money supply to control the nominal interest rate, $i$
  - Investment and saving decisions are based on the real interest rate, $r$
    - 在短期 Fed has some control over the real interest rate $r = i - \pi$, where $\pi$ is the rate of inflation
    - 長期下 $r$ 由可貸資金市場決定
- The Fed has good control over $i$
  - Inflation changes relatively slowly (短期價格變化相對較慢)
  - Changes in nominal rates become changes in real rates
  - By changing the money supply, Fed has good control over the federal funds rate, which in turn affects the nominal interest rate
Role of the Federal Funds Rate

- The **federal funds rate** (聯邦資金利率) is the rate commercial banks charge each other on short-term (usually overnight) loans (也稱為 inter-bank loan rate, 銀行同業間的隔夜拆款利率)
  - Banks borrow from each other if they have insufficient funds
  - Market determined rate
  - This interest rate is the one the Fed targets when changing the money supply

- To decrease the federal funds rate the Fed conducts open market purchases
  - Reserves increase
Role of the Federal Funds Rate

• Interest rates tend to move together (因為套利，到期日不同的各種資產的利率的關聯性很高)
  – 只要聯邦資金利率變動，其他利率(如三個月或一年的利率)就會朝同方向變動
  – Allowing us to speak of “the” interest rate

• 聯邦資金利率和貨幣供給是一體兩面:
  – 聯邦資金利率 ↓ 意味貨幣供給 ↑
  – 聯邦資金利率 ↑ 意味貨幣供給 ↓
The Federal Funds Rate, 1970-2011
Planned Spending and Real Interest Rate

- Planned aggregate expenditure has components that are affected by real interest rate (r)
  - Saving decisions of households (C) <見19章>
    - More saving at higher real interest rates
    - Higher saving means less consumption
  - Investment by firms (I) <見19章>
    - Higher real interest rates mean less investment
      - Investments are made if the cost of borrowing is less than the return on the investment

- Both consumption and planned investment decrease when the real interest rate increases
PAE & the Real Interest Rate
(Example 23.2)

- Components of aggregate spending are
  \[ C = 640 + 0.8 (Y - T) - 400 r \]
  \[ I_P = 250 - 600 r \]
  \[ G = 300 \]
  \[ NX = 20 \]
  \[ T = 250 \]

- If \( r \) increases from 0.04 to 0.05 (that is, from 4% to 5%)
  - Consumption decreases by 400 (0.01) = 4
  - Planned investment decreases by 600 (0.01) = 6

- A one percentage point increase in \( r \) reduces planned spending by 10
PAE & the Real Interest Rate
(Example 23.2)

PAE = C + I^p + G + NX
PAE = 640 + 0.8 (Y – 250) – 400 r + 250 – 600 r + 300 + 20
PAE = [1,010 – 1,000 r] + 0.8 Y

Autonomous expenditure  Induced expenditure

• In this example, planned aggregate expenditure depends on both the real interest rate and the level of output

  – Equilibrium output can only be found once we know the value of r (在凱恩斯基本模型中)
  <收入支出的乘數效果見第22章>
The Real Interest Rate & Short-Run Equilibrium Output
(Example 23.3)

PAE = 1,010 – 1,000 r + 0.8 Y

• Suppose the real interest rate is 5%, or 0.05
• Planned aggregate expenditure becomes

    PAE = 1,010 – 1,000 (0.05) + 0.8 Y
    PAE = 960 + 0.8 Y

• Short-run equilibrium output is PAE = Y

    Y = 960 + 0.8 Y
    0.2 Y = 960
    Y = $4,800

• The graphical solution is the same as before
Monetary Policy

Recessionary Gap

\[ r \downarrow \quad \rightarrow \quad C^P, I^P \uparrow \quad \rightarrow \quad PAE \uparrow \quad \rightarrow \quad Y \uparrow \text{ via the multiplier} \]

Expansionary Gap

\[ r \uparrow \quad \rightarrow \quad C^P, I^P \downarrow \quad \rightarrow \quad PAE \downarrow \quad \rightarrow \quad Y \downarrow \text{ via the multiplier} \]
The Fed Fights a Recession

\[ \text{PAE} = 1,010 - 1,000 \, r + 0.8 \, Y \]

- The real interest rate, \( r \), is 5%  
  - Short-run equilibrium output is $4,800
- Potential output is $5,000  
  - Recessionary gap is $200
- Multiplier is 5 \((=1/(1-0.8))\)
- Monetary policy can be used to increase PAE  
  - The first change in spending required is \(200 / 5 = 40\)
    \[ 1,000 \, (\Delta r) = 40 \]
    \[ \Delta r = 40 / 1,000 = 0.04 = 4\% \]
- The Fed should decrease the real interest rate to 1%
The Fed Fights a Recession

A reduction in $r$ shifts the expenditure line upward and closes the recessionary gap.

Planned aggregate expenditure (PAE)

Output ($Y$)

Expenditure line ($r = 1\%$)

Expenditure line ($r = 5\%$)

$Y = PAE$

$Y^*$
The Fed’s Response to 9/11

- Economy began slowing in late 2000
  - Internet Bubble (網路泡沫)
  - 911 terrorist attack led to contraction in travel, financial, and other industries
- In late 2000, the fed funds rate was 6.5%
  - January, 2001, the Fed cut the rate to 6.0%
  - More rate cuts followed
  - July, 2001, the rate was less than 4%
The Fed Response to 9/11

• After the 9/11 attacks
  – Fed immediately worked to restore normal operation of the financial markets and institutions
  – The Fed temporarily lowered the rate to 1.25% in the week following the attack

• In the aftermath, the Fed concerned that consumers would decrease spending
  – Interest rate was 2.0% in November, 2001
    • 4.5 percentage points lower than a year before

• Combination of tax cuts and aggressive monetary policy helped keep the 2001 recession shallow and short
The Fed Fights Inflation

• 央行兩個重要目標: 消除產出缺口與抗通膨
  – 鷹派: 控制通膨最重要
  – 鴿派: 兩者目標都重視,而不只是控制通膨

• Expansionary gap can lead to inflation
  – Planned spending is greater than normal output levels at the established prices
  – Short-run unplanned decreases in inventories
  – If gap persists, prices will increase
The Fed Fights Inflation

\[ PAE = 1,010 - 1,000 \, r + 0.8 \, Y \]

- The real interest rate, \( r \), is 5%
  - Short-run equilibrium output is $4,800
- Potential output is $4,600
  - Expansionary gap is $200
- Multiplier is 5
- Monetary policy can be used to decrease PAE
  - The first change in spending required is \( \frac{200}{5} = 40 \)
    \[ 1,000 \, (\Delta r) = 40 \]
    \[ \Delta r = \frac{40}{1,000} = 0.04 \]
- The Fed should decrease the real interest rate to 9%
The Fed Fights Inflation

Output ($Y$) = Planned aggregate expenditure ($PAE$)

An increase in $r$ shifts the expenditure line down and closes the expansionary gap.
Inflation and the Stock Market

• Bad news about inflation causes stock prices to decrease
• The reason is that investors anticipate the Fed will increase interest rates
  – Slows down economic activity, lowering firms' sales and perhaps profits
    • Lower profits mean lower dividends which mean lower stock prices
  – Higher interest rates make non-stock financial instruments more attractive
    • Reduces the demand for stocks and the stock prices
Should the Fed Respond to changes in asset prices?

• 中央银行是否应该介入资产市场，如股市与房市？

• The Fed has limited ability to manage the stock market
  – Fed does not know the "right" prices
    • Information available to the Fed is publicly available
  – Monetary policy is not well suited to addressing an asset bubble
    • 对于打房/股灾而言，升息可能使经济陷入萧条
Learning Objective 3

貨幣供需與均衡名目利率的決定
The Fed and Interest Rates

• Controlling the money supply is the primary task of the FOMC
  – In the very short run (where Y and P are given), money supply and demand determine the interest rate
    • 若貨幣供給的衡量是 M1
      \[ M1 = \text{通貨} + \text{活存} + \text{可開立支票的帳戶} + \text{旅行支票} \]
  – Fed manipulates money supply to achieve its desired interest rate (控制貨幣供給與控制名目利率是一體兩面)
    • 雖然新聞常聽到央行宣布利率而非貨幣供給
    • \( i \) is the holding money opportunity cost (見第36張投影片)
Demand for (nominal) Money

- The **demand for money** is the amount of wealth held in the form of money
  - 貨幣的三種功能: 交易媒介、儲存價值、計價單位
  - Business demand for money is similar to individuals'
    - Businesses hold more than half of the money stock
- **Portfolio allocation decisions** 資產配置決策 allocate a person's wealth among alternative forms
  - Diversification 分散投資風險 is owning a variety of different (real & financial) assets to manage risk
Demand for (nominal) Money

• Demand for money is sometimes called an individual’s liquidity preference 流動性偏好
  – The Cost – Benefit Principle indicates people will balance the marginal cost of holding money versus the marginal benefit
  • Money's benefit is the ability to make transactions
  – Quantity of money demanded increases with income
  – Technologies such as online banking and ATMs have reduced the demand for money (currency)
Demand for (nominal) Money

- The marginal cost of holding money is the (nominal) interest foregone
  - Most forms of money pay little or no interest
    - Assume the nominal interest rate on money is 0
      \[
      \text{持有貨幣的實質報酬} = 0 - \pi = -\pi \quad (1)
      \]
    - Alternative assets such as stocks or bonds have a positive nominal interest rate
      \[
      \text{持有非貨幣資產的實質報酬} = i - \pi \quad (2)
      \]
      \[
      (2) - (1) = \text{持有非貨幣資產的相對(實質)報酬} = i
      \]
      \[
      = \text{非貨幣資產的名目報酬率} i
      \]
  - The higher the nominal interest rate, the smaller the quantity of money demanded
Demand for (nominal) Money

• Demand for money depends on:
  – Real income or output \( (Y) \) 產出(實質GDP)
    • The higher the level of income, the greater the quantity of money demanded (因流動性偏好)
    • 當經濟擴張，經濟活動越頻繁，越需要貨幣進行交易
  – Nominal interest rate \( (i) \) 名目利率
    • The higher the interest rate, the lower the quantity of money demanded (因持有貨幣的機會成本上升)
    • 可看成各種不同名目利率的加權平均
  – The price level \( (P) \) 一般物價水準
    • The higher the price level, the greater the quantity of money demanded
Demand for (nominal) Money

- 名目貨幣需求函數

**MD = P \cdot L (Y, i, 金融市场稳定否, 金融创新, 支付方式, 外国部门对本国货币需求, ...)**

- MD 為名目貨幣需求(nominal money demand)
- P 為物價
- L 為貨幣需求函數
- Y 為實質所得或產出
- i 為非貨幣性資產的名目利率
Demand for (nominal) Money

- 貨幣需求函數的其他表達方式

\[
\frac{M_d}{P} = L(Y, i, \ldots)
\]

或

\[
\frac{M_d}{P} = L(Y, r + \pi^e, \ldots)
\]

- \(\frac{M_d}{P}\) 為實際貨幣需求 (demand for real money balance)
- \(r\) 為非貨幣性資產的實質利率
- \(\pi^e\) 為預期通貨膨脹率
The Money Demand Curve

- The **money demand curve** shows the relationship between the aggregate quantity of money demanded, MD, and the nominal interest rate.
  - An increase in the nominal interest rate increases the opportunity cost of holding money.
  - Negative slope 負斜率
The Money Demand Curve

• Changes in factors other than the nominal interest rate cause a shift in the money demand curve
使名目貨幣需求曲線移動的經濟變數

<table>
<thead>
<tr>
<th></th>
<th>貨幣需求</th>
<th>原因</th>
</tr>
</thead>
<tbody>
<tr>
<td>物價水準 $P$ 上升</td>
<td>等比例增加</td>
<td>物價水準倍增將使貨幣需求倍增</td>
</tr>
<tr>
<td>實質所得 $Y$ 上升</td>
<td>增加，但比例較低</td>
<td>所得提高代表交易量增加，故流動性需求增加</td>
</tr>
<tr>
<td>實質利率 $r$ 上升</td>
<td>減少</td>
<td>此時其他資產報酬率提高，大眾增加對其他資產需求，而降低對貨幣的需求</td>
</tr>
<tr>
<td>預期通貨膨脹率 $\pi^e$ 上升</td>
<td>減少</td>
<td>高預期通貨膨脹率代表其他資產報酬率增加，大眾增加對其他資產需求，而降低對貨幣的需求</td>
</tr>
<tr>
<td>財富水準上升</td>
<td>增加</td>
<td>財富增加後，其中一部分可以用貨幣方式持有</td>
</tr>
<tr>
<td>風險增加</td>
<td>增加（若其他資產投資風險增加）</td>
<td>其他資產投資風險增加會提高貨幣對民衆的吸引力</td>
</tr>
<tr>
<td></td>
<td>減少（若貨幣本身的風險增加）</td>
<td>持有貨幣風險增加將降低貨幣對民衆的吸引力</td>
</tr>
<tr>
<td>其他資產流動性增加</td>
<td>減少</td>
<td>其他資產投資流動性增加會提高這些資產對民衆的吸引力</td>
</tr>
<tr>
<td>支付方式的效率增加</td>
<td>減少</td>
<td>民衆可以不依靠貨幣完成交易</td>
</tr>
</tbody>
</table>

註: 其他資產指非貨幣性資産
Equilibrium in the Money Market

• 貨幣市場均衡式
  \[ M = MS = MD = P \cdot L (Y, i, ...) \]
  – MS 為貨幣供給，由央行決定
  – 變動速度 (i \gg Y \gg P)

• MD曲線和MS曲線的交點E為貨幣市場達到均衡
  – 決定了均衡名目利率
  – 與均衡貨幣數量

[Diagram showing the intersection of MS and MD curves at point E, representing the equilibrium in the money market.]
Equilibrium in the Money Market

• Suppose the interest rate is at $i_1$, below equilibrium (此時貨幣市場不均衡，MD>MS)
  – Quantity of money demanded is $M_1$, more than the money available

• To get more money, people sell bonds
  – Bond prices go down, interest rates rise
  – $i$ 上升使MD誘發性減少

• Quantity of money demanded decreases from $M_1$ to $M$
Learning Objective 4

央行貨幣政策的實施
Fed Controls the Nominal Interest Rate

- Fed policy is stated in terms of interest rates
  - The tool they use is the supply of money
- Initial equilibrium at $E$
- Fed increases the money supply to $MS'$
  - New equilibrium at $F$
  - Interest rate decreases to $i'$

To convince the market to hold the new, larger amount of money (因為持有貨幣的機會成本降低了)
The Fed Targets the Interest Rate

- The Fed **cannot** set the interest rate and the money supply independently
- Fed policy is announced in terms of interest rates (如: 聯邦資金利率之公告) because
  - Public is not familiar with the size of the money supply
  - Interest rate changes affect planned spending and the level of economic activity
  - Interest rates are easier to monitor than the money supply
The Fed primarily controls the supply of money (MS) with **open-market operations** (簡稱 OMO)

- An open-market purchase of bonds by the Fed increases the money supply
- An open-market sale of bonds by the Fed decreases the money supply
央行控制貨幣供給的手段二: 貼現窗口放款

- Fed offers lending facility to banks, called **discount window lending** (貼現窗口放款)
  - If a bank needs reserves, it can borrow from the Fed at the discount rate
  - The **discount rate** (貼現率) is the rate the Fed charges banks to borrow reserves
- Lending increases reserves and ultimately increases the money supply
- Changes in the discount rate signal tightening or loosening of the money supply
央行控制貨幣供給的手段三：法定準備

- The Fed can also change the reserve requirement (法定準備) for banks
  - The reserve requirement is the minimum percentage of bank deposits that must be held in reserves
  - The reserve requirement is rarely changed
- The Fed could increase the money supply by decreasing the reserve requirement
  - Banks would have excess reserves to loan
- The Fed could decrease the money supply by increasing the reserve requirement