**INVESTMENT**

- Investment is the most volatile component of GDP
  → Fluctuations in the economy’s output

- Why is investment negatively related to the interest rate?

- What causes the investment function to shift?

- Why does investment rise during booms and fall during recessions?

1. **Three Components of Investment**

1) Business fixed investment: the equipment and structures that business buy to use in production

2) Residential investment: new housing that people buy to live in and that landlords buy to rent

3) Inventory investment: those goods that businesses put aside in storage, including materials and supplies, work in process, and finished goods
2. Business Fixed Investment

(1) The neoclassical model of investment

- Examines the benefits and costs to firms of owning capital goods

\[ I = f(MPK, \text{ interest rate, tax rules}) \]

1) The rental price of capital (production firm)

- Real cost of a unit of capital to production firm
  \[ R/P \]
  where \( R \): rental rate, \( P \): the price of firm’s product

- The real benefit of a unit of capital
  \[ \text{The extra output produced with one more unit of capital (MPK)} \]

2) The cost of capital (rental firm)

- The real cost of capital (The cost of buying and renting out a unit of capital measured in units of the economy’s output)
  \[ (P_K/P)(r + \delta) \]
  where \( P_K \): the purchase price of a unit of capital, \( \delta \): the rate of depreciation (the fraction of value lost per period b/c wear and tear), \( r \): real interest rate
3) The determinants of investment

→ A rental firm’s decision about whether to increase or decrease its capital stock

• Profit rate (real profit per unit of capital)
  = Revenue – Cost
  = \( R / P - (P_K / P)(r + \delta) \)
  = \( MPK - (P_K / P)(r + \delta) \)

• The rental firm’s decision depends on whether owning and renting out capital is profitable.

→ The change in capital (net investment) depends on the difference b/t MPK and the cost of capital

\[ MPK > \text{cost of capital} \rightarrow \text{add to their capital stock} \]
\[ MPK < \text{cost of capital} \rightarrow \text{let their capital stock shrink} \]

→ Investment function (fig. 17-3)
\[ I = f[MPK - (P_K / P)(r + \delta)] + \delta K \]
\[ (b/c \ \Delta K = f[MPK - (P_K / P)(r + \delta)] \text{ and } I = \Delta K + \delta K) \]

4) Tax and Investment

• Tax law influence firms’ incentives to accumulate capital in many ways

• Corporate income tax: a tax on corporate profit

• Investment tax credit
The Stock Market and Tobin’s $q$

- A link between fluctuations in investment and fluctuations in the stock market

- Stock prices reflect the incentives to invest
  - Stock prices tend to be high when firms have many opportunities for profitable investment, because these profit opportunities means higher future income for the shareholders

- Tobin’s $q$
  \[ q = \frac{\text{market value of installed capital}}{\text{replacement cost of installed capital}} \]
  - numerator $\rightarrow$ the value of the economy’s capital as determined by the stock market
  - denominator $\rightarrow$ the price of the capital if it were purchased today

- Net investment decision
  - $q > 1 ~\rightarrow~$ raise the market value of firms’ stock by buying more capital
  - $q < 1 ~\rightarrow~$ will not replace capital as it wears out

- Advantage of Tobin’s $q$
  - reflects the expected future profitability of capital as well as the current profitability
3. Residential Investment

- Shifts in the demand for housing
  - Changes in equilibrium price of housing
  - Change in residential investment

- An economic boom (national income ↑)
- A large increase in the population
- The real interest rate (e.g., mortgages)
  (b/c the interest rate = the cost of the loan)

4. Inventory Investment

(1) Reasons for holding inventories

- Production Smoothing
  e.g., When sales are low, the firm produces more than it sells and put the extra goods into inventory

- Inventories as a factor of production
  - The larger the stock of inventories a firm holds, the more output it can produce

- Stock-out avoidance
  - Avoid running out of goods when sales are unexpectedly high

- Work in process
  - b/c a number of steps in production
(2) The Accelerator Model of Inventories

- Assumption: Firms hold a stock of inventories that is proportional to the firm’s level of output.
  e.g., When output is high, firms need more materials and supplies on hand.

\[ N = \beta Y \]

where \( N \): the economy’s stock of inventories
\( \beta \): a parameter reflecting how much inventory firms wish to hold as a proportion of output.

- Inventory investment: the change in the stock of inventories.

\[ I = \Delta N = \beta \Delta Y \]  (fig. 17-7)
where \( \Delta Y \): the acceleration of production.

\[ \text{Inventory investment depends on whether the economy is speeding up or slowing down} \]

(3) Inventories and the Real Interest Rate

- When a firm holds a good in inventory and sells it tomorrow.

\[ \text{it gives up the interest rate it could have earned b/t today and tomorrow} \]

- If real interest rate ↑

\[ \text{holding inventories becomes more costly} \]
\[ \text{reduce their stock} \]
MONEY SUPPLY AND MONEY DEMAND

- The supply of money and demand for money are crucial to many issues in macroeconomics
  
  • How the central bank controls the quantity of money
  
  • How monetary policy affects prices and interest rates in the LR (classical theory)
  
  • How monetary policy affects output and interest rates in the SR (IS-LM model)

1. Money Supply

- Money Supply \((M)\)
  
  \[ = \text{Currency (C)} + \text{Demand Deposit (D)} \]

- Reserves: the deposits that banks have received but have not lent out

(1) 100-Percent-Reserve Banking

- All deposits are held as reserves
  
  i.e., Banks accept deposits, place the money in reserve, and leave the money there until the depositor makes a withdrawal
(2) Fractional-Reserve Banking

- A system under which banks keep only a fraction of their deposits in reserve
  
  → Banks use some of their deposits to make loans
    (banks can charge interest on the loans)

  → Banks create money

Ex) the process of money creation

Assuming that the reserve-deposit ratio is constant,

Original deposit = $1,000

1st bank lending = \((1 - rr) \times 1,000\)

2nd bank lending = \((1 - rr)^2 \times 1,000\)

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Total Money supply = \([1 + (1 - rr) + (1 - rr)^2 + \cdots] \times 1,000 = \frac{1}{rr} \times 1,000\)

→ each $1 of reserves generate \(\frac{1}{rr}\) of money

- Only banks have the legal authority to create assets that are part of the money supply

- Banks are the only financial institutions that directly influence the money supply
(3) A Model of the Money Supply

- Examine how Fed policy, the choice of banks, and households decision influence the money supply

- Exogenous variables
  • Monetary base \((B) = \text{currency (C)} + \text{reserves (R)}\)  
    \(\rightarrow\) directly controlled by the Fed.
  • Reserve-deposit ratio \((rr)\)  
    \(\rightarrow\) determined by the business policies of banks
  • Currency-deposit ratio \((cr)\)  
    \(\rightarrow\) reflects the preference of households about the form of money they wish to hold

- Since \(M = C + D\) and \(B = C + R\),

\[
\frac{M}{B} = \frac{C + D}{C + R} \Rightarrow \frac{M}{B} = \frac{C/D + 1}{C/D + R/D} = \frac{cr + 1}{cr + rr}
\]

\(\Rightarrow\) \(M = \frac{cr + 1}{cr + rr} \times B = m \times B\)

where \(m\) is the money multiplier.
  i.e., each dollar of the monetary base produces \(m\) dollars of money
- Implications

  • The money supply is proportional to the monetary base

  • The lower Reserve-deposit ratio ($rr$), the more loans banks make, and the more money banks create from every dollar of reserve

  • The lower currency-deposit ratio ($cr$), the fewer dollars of the monetary base the public holds as currency, the more base dollars banks hold as reserves, and the more money banks can create

(4) Three Instruments of Monetary Policy

- Open-market operations: the purchases and sales of government bonds by the Fed.

  If the Fed buys bonds from the public
  \[ \rightarrow B \uparrow \rightarrow M^S \uparrow \]

- Reserve requirements: Fed regulations that impose on banks a minimum reserve-deposit ratio

  If reserve requirements $\uparrow \rightarrow rr \uparrow \rightarrow m \downarrow \rightarrow M^S \downarrow$

- Discount rate: the interest rate that the Fed charges when it makes loan to banks.

  If Discount rate $\uparrow \rightarrow$ loan from Fed$\downarrow \rightarrow B \downarrow \rightarrow M^S \downarrow$
2. Money Demand

- The quantity theory of money: \((M / P)^d = kY\)
- \((M / P)^d = L(\pi, Y)\)

(1) Portfolio Theories of Money Demand

- Emphasize the role of money as a store of value
  → People hold money as part of their portfolio of asset
  i.e., money offers a safe return (no risk), whereas the prices of stock and bonds may rise or fall (risky)
  → Households choose to hold money as a part of their optimal portfolio

- Money demand function: \((M / P)^d = L(r_s, r_b, \pi^e, W)\)
  \((-) \ (-) \ (-) \ (+)\)
  where \(r_s\): the expected real return on stock
  \(r_b\): the expected real return on bond
  \(\pi^e\): the expected inflation rate
  \(W\): real wealth
  → Although the portfolio approach to money demand may not be plausible when applied to M1, it may be a good theory to explain the demand for M2 or M3
(2) *Transaction Theories of Money Demand*

- Emphasize the role of money as a medium of exchange
  
  $\rightarrow$ Money is a dominated asset b/c people hold money, unlike other assets, to make purchase

  $\rightarrow$ best explain why people hold narrow measures of money (M1)

- Money has the cost of earning a low rate of return and the benefit of making transactions more convenient

  $\rightarrow$ People decide how much money to hold by trading off these costs and benefits

- Baumol-Tobin model of Cash Management

  • The benefit of holding money: “convenience”

  • The cost of holding money: “the foregone interest they would have received”

  $\rightarrow$ They show that money demand depends positively on expenditure (income) and negatively on the interest rate ($L(r,Y)$)