1. What Determines the Total Production of Goods and Services

- Factors of production: the inputs used to produce goods and services
  (1) Capital (K)
  (2) Labor (L)

- Production function expresses mathematically how the factors of production determine the amount of output produced
  \[ Y = F(K, L) \]

  \textit{cf} Constant Returns to Scale (CRS): \( zY = F(zK, zL) \)

- Supply of goods and services
  ex) If the factors of production are fully utilized,
  \[ Y = F(\bar{K}, \bar{L}) = \bar{Y} \]
2. How is National Income Distributed to the Factors of Production

➔ Neoclassical theory of distribution

- Factor price: the amounts paid to the factors of production (wage, rent)
  ➔ determined by the supply and demand for that factor (fig. 3-2, p.47)

(1) The competitive firm’s demand for factors

- Marginal Product of Labor (MPL): the extra amount of output the firm gets from one extra unit of labor

➔ \( \text{MPL} = F(K, L + 1) - F(K, L) \text{,} \)
  
  In general, \( \text{MPL} = \frac{\Delta Y}{\Delta L} = \frac{\Delta F(K, L)}{\Delta L} \)
  
  ➔ Diminishing marginal product (fig. 3-3, p.49)

- Profit maximization

1) Profit = TR – TC
   = PY – WL - RK
   = PF(K, L) – WL - RK

2) Profit from hiring an additional unit of labor
   ➔ \( \Delta \text{ profit} = \Delta \text{ TR} - \Delta \text{ TC} = (P \times MPL) - W \)

➔ if \((P \times MPL) > W\), continue to hire until the next unit would no longer be profitable
3) Profit maximizing condition

\[ (P \times MPL) = W \Rightarrow MPL = W / P \]

- Marginal product of labor = real wage

- Firm’s labor demand curve = MPL schedule
  \[ \Rightarrow \text{For any given real wage, the firm hires up to the point at which the MPL equals the real wage} \ (\text{fig. 3-4, p.50}) \]

- Marginal Product of Capital (MPK): the extra amount of output the firm gets from one extra unit of capital
  \[ \Rightarrow \text{Firm’s capital demand curve = MPK schedule} \]

(2) How the markets for the factors of production distribute the economy’s total income

- If all firms in the economy are “competitive” and “profit-maximizing,”

Real economic profit

\[ Y - (MPL \times L) - (MPK \times K) = 0 \]

\[ \Rightarrow Y = F(K, L) = (MPL \times L) + (MPK \times K) \]

- The sum of factor payments equals total output

- “Total output is divided between the payments to capital and the payments to labor, depending on their marginal productivities”
3. What determines the Demand for Goods and Services?

- How the output from production is used

\[ Y = C + I + G + NX \]

1) Consumption (C)
2) Investment (I)
3) Government purchases (G)
4) Net exports (NX)

(1) Consumption (chapter 16)

- DI (Disposable Income) is the sum of the incomes of all the individuals in the economy after all taxes have been deducted and all transfer payment

\[ DI = GDP - Taxes + Transfers = Y - T = C + S \]

- Transfer payments: Government grants to individuals (= negative taxes)

1) The Consumption Function

\[ \text{Relationship between aggregate consumption expenditures and aggregate disposable income} \]

- Change in DI: movement along a consumption fn

- Change in any other variable that affects C:
  shift in the entire consumption fn
  e.g., wealth, price level, expectation of future income
2) Marginal Propensity to Consume (MPC)

→ MPC = change in C / change in DI
→ the slope of consumption function

cf) Marginal Propensity to Save (MPS)
→ MPS = change in S / change in DI

3) Average Propensity to Consume (APC)

→ APC = C / DI
→ the slope of a ray from the origin to a point on the consumption function

(2) Investment (chapter 17)

- **Gross Investment** is the spending on *new* plant, *new* equipment, *new* houses, and *additions* to inventories
  
  • Net investment = gross investment - depreciation

- Investment decisions are influenced by “the expected profit rate” and “the real interest rate”
  
  • The expected profit rate is affected by the phase of the business cycle, advances in technology, taxes
  
  • The lower the real interest rate, the greater is the amount of investment
- Nominal interest rate vs. Real interest rate
  
  • Nominal interest rate \( i \): the rate of interest that investors pay to borrow money
  
  • Real interest rate \( r \): the nominal interest rate corrected for the effects of inflation
  
  \[ r = i - \pi \text{ (inflation rate)} \]

  (3) Government purchases \( \xrightarrow{\text{exogenous}} \)

  (4) Net exports \( \xrightarrow{\text{exogenous}} \)

4. What Brings the Supply and Demand for Goods and Services into Equilibrium

\( \rightarrow \text{“Interest rate” has the crucial role of equilibrating supply and demand} \)

(1) Equilibrium in the Market for Goods and Services

- Demand for good and services

  \[ Y = C + I + G, \]
  \[ C = C(Y - T), \]
  \[ I = I(r), \]
  \[ G = \overline{G}, \quad T = \overline{T} \]
- Supply of good and services
  \[ Y = F(K, L) = \bar{Y} \]

- Equilibrium
  \[ \bar{Y} = C(\bar{Y} - T) + I(r) + \bar{G} \]

- The role of interest rate
  - \( r \) is the only variable not already determined
  - \( r \) must adjust to ensure that demand equals supply
    e.g., if \( r \) is too high, excess supply of goods and services.

(2) Equilibrium in the Financial Market

- National Saving
  From \( Y = C + I + G \),
  \[
  (Y - T - C) + (T - G) = I.
  \]
  → National Saving = Private Saving + Public Saving
    = Investment

- Equilibrium
  \[ \bar{Y} - C(\bar{Y} - T) - \bar{G} = \bar{S} = I(r) \]
- The role of interest rate (fig.3-7, p.60)
  • At the equilibrium interest rate, households’ desire to save balances firms’ desire to invest, and the quantity of loans supplied equals the quantity demanded
e.g., if $r$ is too low, excess demand for loans.

(3) Change in Savings

- An increase in government purchase (fig.3-8, p.62)
- A decrease in taxes

(4) Change in Investment (fig.3-10 & fig.3-11, p. 65)
- Technological innovation, change in tax laws etc.