VII. LONG-RUN ECONOMIC GROWTH

A. Employment and Production

1. Employment and unemployment

   a. The unemployment rate is defined as the ratio of unemployed workers (those seeking employment) to the labor force.

   b. The natural rate of unemployment is the rate that prevails when all unemployment is voluntary (frictional plus structural).

2. The labor market

   a. Demanders of labor -- the firms

      • Profit maximization implies that the firm employs labor so long as \( MRP \geq W \)

      • Increase in the state of technology or the stock of capital raises the marginal product of each worker and thus shifts the labor demand curve to the right.

   b. Suppliers of labor -- the workers

      • In the aggregate, the substitution effect is slightly greater than the income effect. Thus, we have an upward, albeit steep, labor supply curve.

   c. Equilibrium in the labor market

      • The equilibrium or market-clearing wage is the rate that equates the quantity of labor demanded to the quantity of labor supplied.

      • In the long-run, the real wage \((w)\) is equal to the marginal product of labor \((MPN)\).

   d. Effects of taxes

      • Increases in the payroll tax decreases the demand for labor and thus lowers the level of long-run employment.
3. Aggregate production function -- shows how much output can be produced from given amounts of labor, capital, and technology.

- Provides a relationship between the aggregate level of output and the factors of production.

\[ Y = F(L, K, T) \]

where \( Y \) = gross domestic product
\( L \) = quantity of labor
\( K \) = stock of capital
\( T \) = technology

a. Labor alone

- A numeric example: \( Y = L^{0.7} \)
- Diminishing marginal product of labor makes the production function flatten out.
- Malthusian prediction of subsistence

b. Labor and capital alone

- A numeric example: \( Y = L^{0.7} \cdot K^{0.3} \)
- An increase in the stock of capital shifts the production function upward.
- An increase in the stock of capital prevents the Malthusian prediction from coming true.

c. Labor, capital and technology

- Technology is defined as anything that raises the amount of output that can be produced by given amounts of labor and capital.
- A numeric example: \( Y = T \cdot L^{0.7} \cdot K^{0.3} \)
- An increase in technology shifts the production function upward.
B. Spending and the Interest Rate

1. Spending shares

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

\[ \frac{Y}{Y} = \frac{C}{Y} + \frac{I}{Y} + \frac{G}{Y} + \frac{X}{Y} \]

\[ 1 - \frac{G}{Y} = \frac{C}{Y} + \frac{I}{Y} + \frac{X}{Y} \]

- The share of nongovernment spending is divided between consumption by households, investment by firms and net exports by foreign and domestic consumers.

2. Spending shares and the interest rate

a. Consumption-saving decision by consumers

- Households are making one independent decision -- how much to consume now (current consumption) versus consume tomorrow (saving).
- \( \frac{C}{Y} \) depends negatively upon the interest rate.

b. Investment decision by the firms

- \( \frac{I}{Y} \) depends negatively upon the interest rate.

c. Net export decision by domestic and foreign consumers

- \( \frac{X}{Y} \) depends negatively upon the nominal exchange rate.
- the nominal exchange rate depends positively upon the interest rate.
- \( \frac{X}{Y} \) depends negatively upon the interest rate.

d. Government spending decision by the government

- \( \frac{G}{Y} \) is independent of the interest rate.
3. Determination of the equilibrium interest rate $R$

   a. Sum up the $C/Y + I/Y + X/Y$ curves to get the nongovernmental share of income $NG/Y$ curve. The $NG/Y$ line is downward sloping reflecting the negative relationship between nongovernmental spending and the interest rate.

   b. Using the $G/Y$ share, the amount available for nongovernmental spending $1 - G/Y$ is a vertical line.

   c. In the long-run, the equilibrium interest rate $R$ is the interest rate that makes the sum of consumption, investment and net export shares $NG/Y$ equal the share available for nongovernmental spending $1 - G/Y$.

4. Applications

   a. A decrease in the budget deficit

      • Shifts the amount available for nongovernmental spending vertical line $1 - G/Y$ to the right.

      • Leads to a decrease in the equilibrium real interest rate $R$ which raises each of the nongovernmental shares $C/Y, I/Y$ and $X/Y$.

   b. A decrease in the U.S. saving rate

      • Leads to an increase in the consumption share $C/Y$ at each interest rate.

      • Shifts the nongovernmental share of income $NG/Y$ curve to the right.

      • Leads to an increase in the equilibrium real interest rate $R$ which lowers each of the nongovernmental shares $C/Y, I/Y$ and $X/Y$. 
C. Money and Inflation

1. What is money? Money is defined by its three functions.
   a. Medium of exchange
   b. Store of value
   c. Unit of account

2. Different types of money
   a. Commodity money
   b. Fiat money
      i) Currency
      ii) Checking deposits
      iii) Time deposits

3. The Federal Reserve System
   a. The "Fed" is the central bank of the United States and is responsible for monetary policy. The Fed conducts monetary policy through their control of the supply of money.
   b. The Federal Open Market Committee (FOMC) headed by the chairman of the Fed (that's Alan Greenspan not Frank Sinatra) meets eight times a year to decide upon the stance of monetary policy

4. Creation of money in a fractional reserve system
   a. Balance sheet
      • An asset is something owed to you.
      • A liability is something you owe someone else.
b. Balance sheets of the Fed and commercial banks

c. Deposit multiplier
   • Deposits = (1/required reserve ratio) x reserves

5. The quantity theory and the long-run neutrality of money

   a. The quantity theory of money: \( MV = Py \)
   
   b. The long-run neutrality of money
      
      • In the long-run, the velocity of money \( V \) is constant and real GDP \( y \) is determined by the factors of production. Therefore, the quantity of money \( M \) determines the price level \( P \) in the long-run.

D. Economic Growth

1. The growth accounting formula

   a. The production function: \( Y = T \cdot L^{0.7} \cdot K^{0.3} \)
   
   b. If you divide each side of the production function by \( L \), you get: \( Y/L = T \cdot (K/L)^{0.3} \)
   
   c. Convert levels into growth rates and you get the growth accounting formula:

      \[
      \text{(growth rate of } Y/L) = 0.3 \cdot \text{(growth rate of } K/L) + \text{(growth rate of } T) \]
   
2. The catch-up hypothesis

   a. Rich countries grow slower than poor countries.