

# Macroeconomic

谢泽健

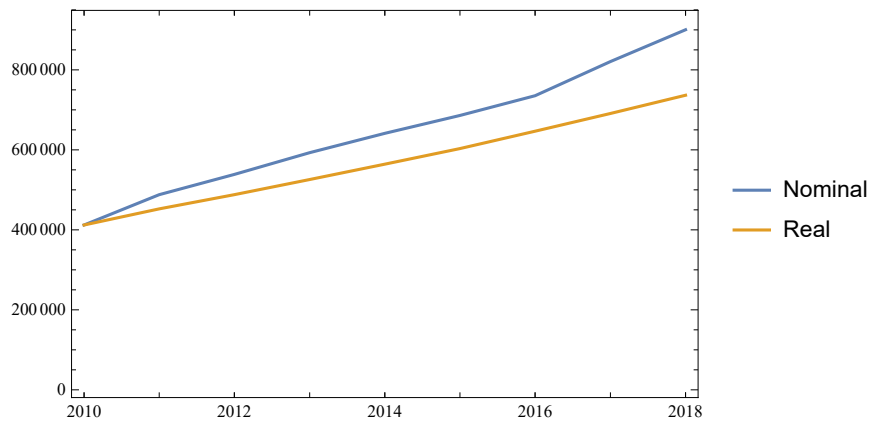
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## Assignment

2019.3.10

### Chapter 2: The Data of Macroeconomics

Choose 2010 as base year, Chinese Nominal GDP and Real GDP are shown as below:



From the figure, the Chinese GDP growth rate tends to a constant, but become smaller and smaller year by year.

At 2018, the  $\frac{\text{GNP}-\text{GDP}}{\text{GDP}}$  in Japan is

$$(556\,853.60 - 542\,853.84) / 542\,853.84 = 2.57892 \% \quad (1)$$

Which smaller than 3.2 % in 2012.

At 2017, the  $\frac{\text{GNP}-\text{GDP}}{\text{GDP}}$  in China is

$$(818\,461.0 - 820\,754.3) / 820\,754.3 = -0.279414 \% \quad (2)$$

Which larger than -0.5 % in 2012

At 2017, the  $\frac{\text{GNP}-\text{GDP}}{\text{GDP}}$  in the U.S. is

$$(19.6076 - 19.3906) / 19.3906 = 1.1191 \% \quad (3)$$

Which smaller than 1.7 % in 2012.

### Chapter 3: National Income : Where It Comes From and Where It Goes

4.

Suppose that an economy's production function is Cobb-Douglas with parameter  $\alpha = 0.3$ .

a. What fractions of income do capital and labor receive?

When parameter  $\alpha = 0.3$ , the Cobb–Douglas production function is:

$$F(K, L) = A K^{0.3} L^{0.7} \quad (4)$$

Hence, capital receive 30 % of income while labor get 70 %.

b. Suppose that immigration increases the labor force by 10 percent. What happens to total output (in percent)? The rental price of capital? The real wage?

**Total output:**

If the labor force increases 10 %, the production can be calculated as follows:

$$F(K, L) = A K^{0.3} (1.1 L)^{0.7} = 1.1^{0.7} A K^{0.3} L^{0.7} \quad (5)$$

hence the total output increases:

$$\left(1.1^{0.7} A K^{0.3} L^{0.7} - A K^{0.3} L^{0.7}\right) / \left(A K^{0.3} L^{0.7}\right) = 1.1^{0.7} - 1 \approx 6.8993 \% \quad (6)$$

**Rental price:**

The original rental price is:

$$p_1 = \frac{R}{P} = \text{MPK} = 0.3 A K^{-0.7} L^{0.7} \quad (7)$$

The present rental price is

$$p_2 = \frac{R}{P} = \text{MPK} = 0.3 A K^{-0.7} (1.1 L)^{0.7} \quad (8)$$

hence the rental price increases:

$$\frac{p_2 - p_1}{p_1} = \left(0.3 A K^{-0.7} (1.1 L)^{0.7} - 0.3 A K^{-0.7} L^{0.7}\right) / \left(0.3 A K^{-0.7} L^{0.7}\right) = 6.8993 \% \quad (9)$$

**Real wage:**

The original real wage is:

$$w_1 = \text{MPL} = 0.7 A K^{0.3} L^{-0.3} \quad (10)$$

The present real wage is:

$$w_2 = 0.7 A K^{0.3} (1.1 L)^{-0.3} \quad (11)$$

hen the real wage decreases:

$$(w_2 - w_1) / w_1 = \left(0.7 A K^{0.3} (1.1 L)^{-0.3} - 0.7 A K^{0.3} L^{-0.3}\right) / \left(0.7 A K^{0.3} L^{-0.3}\right) = -2.81881 \% \quad (12)$$

c. Suppose that a gift of capital from abroad raises the capital stock by 10 percent. What happens to total output (in percent)? The rental price of capital? The real wage?

Similar to previous question, the total out put increases:

$$\left(A(1.1 K)^{0.3} L^{0.7} - A K^{0.3} L^{0.7}\right) / \left(A K^{0.3} L^{0.7}\right) = 1.1^{0.3} - 1 = 2.90058 \% \quad (13)$$

The rental price decreases:

$$\left(1.1^{-0.7} - 1\right) / 1 = -6.45402 \% \quad (14)$$

The real wage increase 2.90058%

d. Suppose that a technological advance raises the value of the parameter  $A$  by 10 percent. What happens to total output (in percent)? The rental price of capital? The real wage?

The total output increase:

$$\left((1.1 A) K^{0.3} L^{0.7} - A K^{0.3} L^{0.7}\right) / \left(A K^{0.3} L^{0.7}\right) = 10 \% \quad (15)$$

The rental price increases:

$$\left(0.3 (1.1 A) K^{-0.7} L^{0.7} - 0.3 A K^{-0.7} L^{0.7}\right) / \left(0.3 A K^{-0.7} L^{0.7}\right) = 10 \% \quad (16)$$

The real wage increase:

$$\left(0.7 (1.1 A) K^{0.3} L^{-0.3} - 0.7 A K^{0.3} L^{-0.3}\right) / \left(0.7 A K^{0.3} L^{-0.3}\right) = 10 \% \quad (17)$$

7.

**Consider a Cobb–Douglas production function with three inputs.  $K$  is capital (the number of machines),  $L$  is labor (the number of workers), and  $H$  is human capital (the number of college degrees among the workers). The production function is**

$$Y = K^{1/3} L^{1/3} H^{1/3} \quad (18)$$

**a. Derive an expression for the marginal product of labor. How does an increase in the amount of human capital affect the marginal product of labor?**

According to the definition of MPL:

$$MPL = \frac{\partial Y}{\partial L} = \left(H^{1/3} K^{1/3}\right) / \left(3 L^{2/3}\right) \quad (19)$$

From this expression, we get that when human capital increases, MPL also increases.

**b. Derive an expression for the marginal product of human capital. How does an increase in the amount of human capital affect the marginal product of human capital?**

$$MPH = \left(K^{1/3} L^{1/3}\right) / \left(3 H^{2/3}\right) \quad (20)$$

When human capital increases, MPH decreases.

**c. What is the income share paid to labor? What is the income share paid to human capital? In the national income accounts of this economy, what share of total income do you think workers would appear to receive? (Hint: Consider where the return to human capital shows up.)**

The amount income paid to labor is real wage times the number of workers:

$$MPL \times L = \left(\left(H^{1/3} K^{1/3}\right) / \left(3 L^{2/3}\right)\right) L \quad (21)$$

The income share paid to labor is:

$$(\text{real wage}) / (\text{total output}) = \left(\left(\left(H^{1/3} K^{1/3}\right) / \left(3 L^{2/3}\right)\right) L\right) / \left(K^{1/3} L^{1/3} H^{1/3}\right) = \frac{1}{3} \quad (22)$$

Similarly, we could obtain the income share paid to human capital:

$$\left(\left(K^{1/3} L^{1/3}\right) / \left(3 H^{2/3}\right)\right) H / \left(K^{1/3} L^{1/3} H^{1/3}\right) = \frac{1}{3} \quad (23)$$

Because the human capital is owned by workers themselves, workers receive  $\frac{2}{3}$  income.

**d. An unskilled worker earns the marginal product of labor, whereas a skilled worker earns the marginal product of labor plus the marginal product of human capital. Using your answers to parts (a) and (b), find the ratio of the skilled wage to the unskilled wage. How does an increase in the amount of human capital affect this ratio? Explain.**

For a skilled worker, his unit wage is MPL + MPH, while unskilled one is MPL, the ratio between them is:

$$(MPL + MPH) / MPL = \left(\left(H^{1/3} K^{1/3}\right) / \left(3 L^{2/3}\right) + \left(K^{1/3} L^{1/3}\right) / \left(3 H^{2/3}\right)\right) / \left(H^{1/3} K^{1/3}\right) / \left(3 L^{2/3}\right) = (H + L) / H \quad (24)$$

When  $H$  increases, the ratio decreases. That is because MPH decreases.

*e. Some people advocate government funding of college scholarships as a way of creating a more egalitarian society. Others argue that scholarships help only those who are able to go to college. Do your answers to the preceding questions shed light on this debate?*

I advocate government funding of college scholarships as a way of creating a more egalitarian society. More government funding of college scholarships increase  $H$ , which reduce MPH, let the difference between skilled workers and unskilled workers decrease.

**10.**

*Consider an economy described as follows:*

$$\begin{aligned} Y &= C + I + G \\ Y &= 8000 \\ G &= 2500 \\ T &= 2000 \\ C &= 1000 + \frac{2}{3}(Y - T) \\ I &= 1200 - 100r \end{aligned}$$

*a. In this economy, compute private saving, public saving, and national saving.*

Private saving:

$$S_{\text{private}} = Y - T - C = 1000 \quad (25)$$

Public saving:

$$S_{\text{public}} = T - G = -500 \quad (26)$$

National saving:

$$S_{\text{nation}} = S_{\text{private}} + S_{\text{public}} = 500 \quad (27)$$

*b. Find the equilibrium interest rate.*

When the market reaches equilibrium,  $S$  must equal to  $I$ .

$$S = 500 = 1200 - 100r \quad (28)$$

Solve it, we obtain  $r = 7$ .

*c. Now suppose that  $G$  is reduced by 500. Compute private saving, public saving, and national saving.*

Private saving:

$$S_{\text{private}} = Y - T - C = 1000 \quad (29)$$

Public saving:

$$S_{\text{public}} = T - G = 0 \quad (30)$$

National saving:

$$S_{\text{nation}} = S_{\text{private}} + S_{\text{public}} = 1000 \quad (31)$$

*d. Find the new equilibrium interest rate.*

$$1000 = 1200 - 100r \quad (32)$$

Solve it, we obtain  $r = 2$ .

**12.**

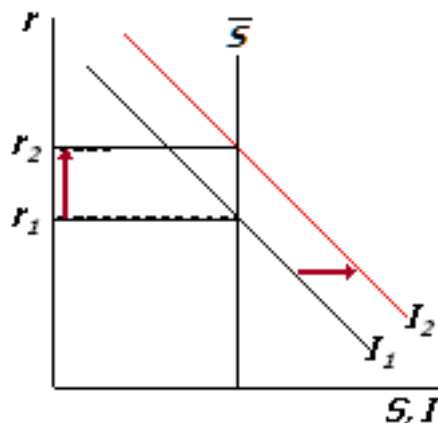
*When the government subsidizes investment, such as with an investment tax credit, the subsidy often applies to only some types of investment. This question asks you to consider the effect of such a change. Suppose there are two types of investment in the economy: business investment and residential investment. The interest rate adjusts to*

**equilibrate national saving and total investment, which is the sum of business investment and residential investment. Now suppose that the government institutes an investment tax credit only for business investment.**

**a.** How does this policy affect the demand curve for business investment? The demand curve for residential investment

This policy makes the demand curve for business investment **shifts to the right**, while **doesn't affect** demand curve for residential investment.

**b.** Draw the economy's supply and demand curves for loanable funds. How does this policy affect the supply and demand for loanable funds? What happens to the equilibrium interest rate?



This policy makes the demand for loanable funds **increases**, the demand curve for loanable funds shifts to the right. But the supply for loanable funds is **fixed**, so the equilibrium interest rate **increases**.

**c.** Compare the old and the new equilibria. How does this policy affect the total quantity of investment? The quantity of business investment? The quantity of residential investment?

Because the loanable funds is fixed, the total quantity of investment is keep **unchanged**. But the The quantity of business investment will **increase** thanks to the policy, which lead to the quantity of residential investment will **decrease**.

## Chapter 4 : The Monetary System : What It Is and How It Works

**4.**

**In the nation of Wiknam, people hold \$1,000 of currency and \$4,000 of demand deposits in the only bank, Wikbank. The reserve–deposit ratio is 0.25.**

**a.** What are the money supply, the monetary base, and the money multiplier?

According to the problem:

$$C = 1000, D = 4000, rr = 0.25 \quad (33)$$

Money supply:

$$M = C + D = 5000 \quad (34)$$

Monetary base:

$$B = C + R = C + D \times rr = 2000 \quad (35)$$

Money multiplier:

$$m = \frac{M}{B} = 2.5 \quad (36)$$

**b.** Assume that Wikbank is a simple bank: it takes in deposits, makes loans, and has no capital. Show Wikbank's balance sheet. What value of loans does the bank have outstanding?

Wikbank's balance sheet			
Assets		Liabilities and Owners' Equity	
Reserves	1000	Deposits	4000
Loans	3000		

The value of outstanding loans is 3000 \$.

**c.** Wiknam's central bank wants to increase the money supply by 10 percent. Should it buy or sell government bonds in open-market operations? Assuming no change in the money multiplier, calculate, in dollars, how much central bank needs to transact.

They should buy government bonds to increase money supply. Monetary base should increase 10 %:

$$2000 \times 10 \% = 200 \quad (37)$$

So central bank need to buy 200\$ government bonds.

5.

**In the economy of Paniccia, the monetary base is \$1,000. People hold a third of their money in the form of currency (and thus two-thirds as bank deposits). Banks hold a third of their deposits in reserve.**

**a.** What are the reserve–deposit ratio, the currency–deposit ratio, the money multiplier, and the money supply?

According to the problem:

$$rr = \frac{1}{3} \quad (38)$$

$$cr = \frac{1/3}{2/3} = \frac{1}{2} \quad (39)$$

Hence:

$$m = (cr + 1) / (cr + rr) = \frac{9}{5} \quad (40)$$

$$M = m B = 1800 \quad (41)$$

**b.** One day, fear about the banking system strikes the population, and people now want to hold half their money in the form of currency. If the central bank does nothing, what is the new money supply?

According to the problem, cr becomes 1

The new money multiplier is:

$$m = (cr + 1) / (cr + rr) = \frac{3}{2} \quad (42)$$

Hence:

$$M = m B = 1500 \quad (43)$$

**c.** If, in the face of this panic, the central bank wants to conduct an open-market operation o keep the money supply at its original level, does it buy or sell government bonds? Calculate, in dollars, how much the central bank needs to transact.

They should buy government bonds to increase money supply. The monetary base should be increased to:

$$B = \frac{M}{m} = 1800/3/2 = 1200 \quad (44)$$

Hence central bank needs to buy 200\$ government bonds.

9.

**Jimmy Paul Miller starts his own bank, called JPM. As owner, Jimmy puts in \$2,000 of his own money. JPM then borrows \$4,000 in a long-term loan from Jimmy's uncle, accepts \$14,000 in demand deposits from his neighbors, buys \$7,000 of U.S. Treasury bonds, lends \$10,000 to local businesses to finance new investments, and keeps the remainder of the bank's assets as reserves at the Fed.**

**a. Show JPM's balance sheet. What is JPM's leverage ratio?**

JPM's balance sheet			
Assets		Liabilities and Owner's Equity	
Reserves	3000	Deposits	14000
Loans	10000	Debts	4000
U.S. Treasury bonds	7000	Capital	2000

The leverage ratio is:

$$(\text{total asset})/(\text{owners' equity}) = 20\,000/2000 = 10 \quad (45)$$

**b. An economic downturn causes 5 percent of the local businesses to declare bankruptcy and default on their loans. Show JPM's new balance sheet. By what percentage does the value of JPM's assets fall? By what percentage does JPM's capital fall?**

5 percent of the local businesses to declare bankruptcy and default on their loans means that 5 % loan cannot be recovered, so the asset decrease:

$$10\,000 \times 5\% = 500 \quad (46)$$

JPM's balance sheet			
Assets		Liabilities and Owner's Equity	
Reserves	3000	Deposits	14000
Loans	9500	Debts	4000
U.S. Treasury bonds	7000	Capital	1500

$$\frac{500}{20\,000} = 2.5\% \quad (47)$$

$$\frac{500}{2000} = 25\% \quad (48)$$

JPM's assets fall 2.5%, capital fall 25%