Intermediate Macroeconomics: Homework 2*

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Due Thursday, October 8th. Please send your answers to Do Lee dql204@nyu.edu.

Question 1: Numerical Questions

Please complete the following exercises from the main textbook (Abel, Bernanke, and Croushore).

(1) Numerical Problem 5, Chapter 3, page 101 for 8th edition, pages 104 for 9th edition, page 108 for the 10th edition.

Consider an economy in which the marginal product of labor MPN is $MPN = 309 - 2N$, where N is the amount of labor used. The amount of labor supplied, NS, is given by $NS = 22 + 12w + 2T$, where w is the real wage and T is a lump-sum tax levied on individuals.

a. Use the concepts of income effect and substitution effect to explain why an increase in lump-sum taxes will increase the amount of labor supplied.

b. Suppose that $T = 35$. What are the equilibrium values of employment and the real wage?

c. With T remaining equal to 35, the government passes minimum-wage legislation that requires firms to pay a real wage greater than or equal to 7. What are the resulting values of employment and the real wage?

Note: In the 8th, 10th editions, the MPN is $MPN = 309 - 2N$ while in the 9th edition, the MPN is $MPN = 3095 - 2N$. I will treat either expression as correct when I mark your homework. However, I believe that the expression in the 8th edition makes more sense given the rest of the problem.

(2) Numerical Problem 7, Chapter 4, pages 148-149 for 8th edition, pages 152 for 9th edition, page 156 for the 10th edition.

Suppose that the economywide expected future marginal product of capital is $MPK^f = 20 - 0.02K$, where K is the future capital stock. The depreciation rate of capital, d, is 20% per period. The current capital stock is 900 units of capital. The price of a unit of capital is 1 unit of output. Firms pay taxes equal to 15% of their output. The consumption function in the economy is $C = 100 + 0.5Y - 200r$, where C is consumption, Y is output, and r is the real interest rate. Government purchases equal 200, and full-employment output is 1000.

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a. Suppose that the real interest rate is 10% per period. What are the values of the tax-adjusted user cost of capital, the desired future capital stock, and the desired level of investment?

b. Now consider the real interest rate determined by goods market equilibrium. This part of the problem will guide you to this interest rate.

   i. Write the tax-adjusted user cost of capital as a function of the real interest rate r. Also write the desired future capital stock and desired investment as functions of r.

   ii. Use the investment function derived in Part (i) along with the consumption function and government purchases, to calculate the real interest rate that clears the goods market. What are the goods market-clearing values of consumption, saving, and investment? What are the tax-adjusted user cost of capital and the desired capital stock in this equilibrium?

Question 2: Consumption Smoothing

Recall the basic model of consumption choice. There are two periods: present and future. Assume households have the following lifetime utility:

$$u(c) + \beta u(c^f)$$

where $u(c) = \sqrt{c}$, the discount rate $\beta < 1$ (i.e., the rate at which households discount utility from future consumption). Assume also that households start with no initial wealth, $a = 0$, but receive income today, y, and income tomorrow, y^f. The interest rate, r, is equal to 4%. Assume that the discount rate β is such that:

$$\beta(1 + r) = \sqrt{1.02} \approx 1.01$$

(1) Write down the consumers' intertemporal budget constraint and indicate which terms stand for the present value of lifetime income and lifetime consumption. State the full consumers' maximization problem. [Do not solve yet]

(2) Substitute the budget constraint in the utility function to turn the consumers' problem into an unconstrained maximization problem.

(3) Derive the first-order condition that characterizes the optimal consumption choice. Show that the condition you obtain is the standard consumer Euler equation:

$$u'(c) = \beta(1 + r)u'(c^f)$$

and substitute $u'(\cdot)$ with its actual value in this exercise.

(4) Incomes today and tomorrow are such that $y = y^f = 50,000$. Using the Euler equation and the intertemporal budget constraint, solve for consumption today, c, and tomorrow, c^f

(5) Assume now that today's income increases by 10%. Compute the new optimal consumption choices for today and tomorrow.

(6) Using your answers to parts (4) and (5), compute the percent increase in c after the income shock. Do the same for tomorrow's consumption. How do these rates of increase compare to the income shock? Explain how this captures the idea of consumption smoothing [i.e., the idea that people tend to prefer a stable consumption path, so temporary shocks to income are spread over time]

(7) How would your answers to parts (4) and (5) change if the increase in income was in fact permanent, i.e. if y and y^f increased by 10%?

Question 3: Ricardian Equivalence Revisted

Consider a household that maximizes utility from consumption over two periods

$$\max_{C_1,C_2} u(C_1) + \beta u(C_2)$$

Without any taxation, the household would be subject to the usual intertemporal budget constraint

$$C_1 + \frac{C_2}{1+R} = W$$

Now, suppose that there is a government that needs to spend G in period 1. This spending must be paid for by taxing the household. The government can either collect a lump sum tax from the household in period 1, or borrow the necessary amount through the international financial market at interest rate R_G and repay the loan (including interest) by collecting a lump sum tax from the household in period 2 .

(1) Assume $R_G < R$. Is it better for the household if the government taxes in period 1, or period 2? Show it mathematically.

(2) Does the Ricardian equivalence hold? Explain why or why not.