

EE312 Macroeconomics, 2/2015 (Sec. 046402)
Problem Sets 5 Chapter 6

* Exam will consist of essay-type questions only.

PART 1. True or False. Short Answer. If the statement is False, comment.

Chapter 6. Real Intertemporal Model with Investment (Part 1)

1. ...T.....(T/F) A firm will invest more the higher its expected future total factor productivity, the lower its current capital stock, and the lower the real interest rate.
True.
2. ...T.....(T/F) The price of current leisure relative to future leisure is represented by $\frac{w(1+r)}{w'}$.
True.
3.F....(T/F) If w and w' are held constant, a decrease in the real interest rate results in an increase in the price of current leisure relative to future leisure.
.False. A decrease in the real interest rate results in a decrease in the price.
4.F....(T/F) Assume the real interest rate increases. If the income effect dominates the substitution effect, current consumption for lenders will fall.
False. The increase in the real interest rate will increase current consumption if the income effect > substitution effect because the total effect on current consumption = substitution effect + income effect. Because income effect is positive and substitution effect is negative, total effect > 0.
5.F....(T/F) Current leisure will increase when the real interest rate decreases if the income effect dominates the substitution effect.
False. Current leisure will decrease when the real interest rate decreases if income effects dominate the substitution effects.
6.T....(T/F) An increase in the present value of taxes results in an increase in current labor supply.
True.
7.F....(T/F) AThe slope of the demand curve, $C^d(r)$ (plot against Y), is the marginal propensity to save.
False. The slope is the marginal propensity to consume.
8.F....(T/F) The labor demand curve is downward sloping because hiring more labor increases total productivity.
False. The labor demand curve is downward sloping because hiring more labor decreases marginal productivity.
9.F....(T/F) As N increases, both total and marginal productivity rise.
False. Total productivity rises and marginal productivity falls with increases in N .
10.T....(T/F) Shifts in the labor demand curve are caused by changes in total factor productivity and the current capital stock..
True.
11.T....(T/F) Movements along the labor demand curve are caused by changes in real wages.
True.
12.T....(T/F) If capital fully depreciates every period (depreciation = 100%), the marginal benefit from investment will be $\frac{MPK'}{1+r}$.
True.

13.F....(T/F) An increase in wealth increases labor demand because laborers demand less money.
False. An increase in wealth affects consumer's side. An increase in wealth affects labour supply. N^S decreases for all levels of wage as wealth increases [labour supply shifts to the left].
14. ...F.....(T/F) A decrease in productivity causes a change in N^S because workers must supply more labor to produce any given Y .
False. A decrease in productivity (z) affects the firm's side. A decrease in productivity leads production function to shift downward. Marginal product of labour decreases for all levels of labour input. Hence, labour demand decreases for all levels of wage [labour demand shifts to the left].

Part 2. Short Answer.

1. Name three factors that determine the representative consumer's current supply of labor and how each factor affects supply.

The real wage, the real interest rate, and lifetime wealth.

2. How do the three factors listed above affect the representative consumer's supply of labor?

Assuming that substitution effects outweigh the income effects: 1) An increase (decrease) in the real wage increases (decreases) the opportunity cost of leisure and causes an increase labor supply; 2) an increase (decrease) in the real interest rate increases (decreases) labor supply; and 3) an increase (decrease) in lifetime wealth increases the quantity of leisure in the current and future periods and causes a decrease in labor supply.

3. Explain what is meant by diminishing marginal productivity of labor.

Marginal productivity of labor refers to the additional output brought forth by hiring one more laborer and holding all other inputs constant. It is assumed to diminish (after a point) as each additional laborer brings a smaller increase to firm output, as other inputs remain constant.

4. Explain the following true statement: A change in preferences affects labor supply while a change in technology affects labor demand.

A change in preferences affects utility because leisure is a component of utility and changes in preferences for leisure affect the labor-leisure decision. This, in turn, affects the labor supply. Labor demand is the derived demand for labor by firms. This demand is a function of the marginal product of labor, which is determined by technology. Hence, technology affects labor demand.

5. An increase in the real interest rate, holding current and future wages constant, results in an increase in the price of current leisure relative to future leisure. Is this statement true or false? Explain.

The statement is true. An increase in r means that the return on income (or wages) earned in the current period will be higher than before the r increase. Consuming leisure implies forgoing this return. As the return rises, so does the cost of current leisure.

6. What is the slope of the private demands for investment goods and government purchases in the current goods market diagram?

The slopes are both equal to zero as neither is a function of Y . The slope of government purchases is usually equal to zero. The slope of private demand for investment goods is equal to marginal propensity to invest, MPI .

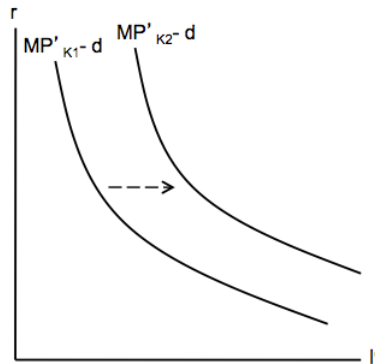
7. What is the flaw in the following statement? "If the real interest rate rises, lifetime wealth declines, causing leisure to decline, labor supply to rise thereby causing a leftward shift in output supply."

The flaw is confusing a movement along a curve with a shift in a curve. The change in interest rates causes a movement along, not a shift in, output supply.

8. Show changes in optimal investment schedule for decrease in z' and r . Graphically Illustrate.

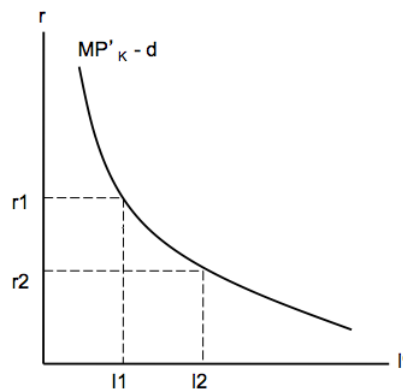
A decrease in z' will cause a decrease in investment shifting the optimal investment schedule to the left from $MP'_{K1} - d$ to $MP'_{K2} - d$ as shown in the graph below.

- A higher z' increases MP'_K . The optimal investment curve shifts to the right.



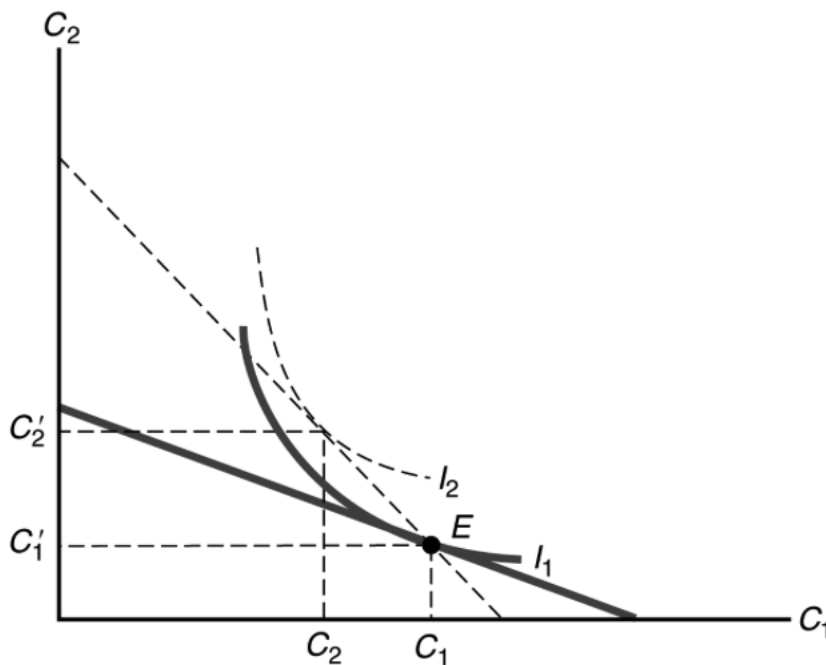
A decrease in r , say from r_1 to r_2 , will cause an increase in the quantity invested as represented by a movement southeast along the optimal investment schedule from I_1 to I_2 as shown in the graph below.

- $I^d = (MP'_K - d)$ gives the level of I required for the net MP'_K to be equal to the real interest rate, given K .



9. Assume Bill consumes his endowments and therefore neither lends nor borrows. Will an increase in the interest rate cause Bill to increase first and second period consumption? Prove it graphically.

ANSWER. First assume $t' = 0$. With the endowment point E , note that there is no way of drawing a higher indifference curve that is to the right of C_1 nor below C_1' . This proves future consumption must increase and current consumption must decrease with the increase in r .



10. Assume that $\Delta t = -2$ and $\Delta t' = 2$. Under what conditions will Ricardian Equivalence hold?

ANSWER. Because present values matter for Ricardian Equivalence, the theorem will hold for $\Delta t = -2$ and $\Delta t' = 2$, if, and only if, the real interest rate is zero.

11. Assume an economy with 100 identical consumers. In the current period, each receives income of 8 units and pays taxes of 3 units, while in the future period, each receives income of 10 units and pays taxes of 4.75 units. The government purchases 400 units in the current period and 370 in the future period and borrows $B = 100$ in the current period. The real interest rate is 5 percent.

- What is the life time wealth for each consumer?
- Derive the government's present-value budget constraint and show that it holds.
- What is aggregate private saving, government saving, and aggregate consumption?
- How does aggregate private saving and government saving change if current period taxes are increased to 4 units in the current period and decreased to 3.7 units in the future?

ANSWER

- What is the life time wealth for each consumer?

The life time wealth of each consumer is $8 - 3 + \frac{10 - 4.75}{1 + 0.05} = 10$.

- Derive the government's present-value budget constraint and show that it holds.

The government's present-value budget constraint is

$$\begin{aligned}
 G + \frac{G'}{1+r} &= Nt + \frac{Nt'}{1+r} \\
 400 + \frac{370}{1+0.05} &= 100 \times 3 + \frac{100 \times 4.75}{1+0.05} \\
 400 + \frac{370}{1.05} &= 300 + \frac{475}{1.05} \\
 \frac{(400 \times 1.05) + 370}{1.05} &= \frac{(300 \times 1.05) + 475}{1.05} \\
 \frac{420 + 370}{1.05} &= \frac{315 + 475}{1.05} \\
 \frac{790}{1.05} &= \frac{790}{1.05}
 \end{aligned}$$

Hence, the government budget constraint does hold.

- What is aggregate private saving, government saving, and aggregate consumption?

Government Saving is $S^G = T - G = Nt - G = (100 \times 3) - 400 = 100$. Aggregate private saving, $S^P = 100$. Thus, aggregate current period consumption is $N(y - t - s) = Ny - Nt - S^P = (100 \times 8) - (100 \times 3) - 100 = 400$.

- How does aggregate private saving and government saving change if current period taxes are increased to 4 units in the current period and decreased to 3.7 units in the future?

If current period taxes are increased by 1 unit, it has to be matched with a decrease in $(1+r)\Delta t = (1+0.05)1 = 1.05$ units in future tax. Hence, if current period taxes are increased to 4 unit (current tax increases by 1 unit) in the current period and decreased to $4.75 - 1.05 = 3.7$ units in the future (future tax decreases by 1.05 units), lifetime wealth can be shown to remain constant and thus aggregate consumption remains constant. Aggregate private saving $= (y - t - c) \times 100 = (8 - 4 - 4) \times 100 = 0$ and government saving is just the negative of that, 0. Thus consumers do not save but consume all their income available in each period.

12. Prove graphically that the interest rate must fall with increases in G when $MPC = 1$. Graphically Illustrate.

Because $MPC = 1$, the increase in G is exactly offset by the decrease in C^d caused by the decrease in lifetime wealth. Thus the Y^d curve does not move. The Y^s curve, on the other hand, shifts to the right from Y_1^s to Y_2^s as the decrease in lifetime wealth causes an increase in the current labor supply. Thus, the real interest rate must fall as it does below from r_1 to r_2 .

