

Midterm Exam

(October 22, 2021, **1 hour 15 minutes**)

Macroeconomics (Fall 2021)

Professor: Wonmun Shin

* Write up your answers as **clearly, precisely, and concisely** as possible. Your grade will be reduced if your answer is unreasonably difficult to follow.

* Label the axes and curves when you draw graphs.

1. **(Total 40 points)** Suppose that an individual receives a wage rate (per hour) w and works L hours (among 24 hours of a day). He has normal preferences over leisure (ℓ , which is $\ell = 24 - L$) and consumption goods (C), which is represented by the usual indifference curve. Assume that he has wealth of W to begin with.

(a) **(3 points)** Write down the resource constraint the individual faces with.

(b) **(2 points)** Plot his resource constraint in the C - L space.

(c) **(5 points)** Find graphically the optimal amount of work effort (L^*) and consumption (C^*).

Imagine that the government starts to impose taxes on his **income** at the constant rate $0 < \tau < 1$.

(d) **(5 points)** How does the income tax affect the individual's consumption-labor choice? Display his new resource constraint and his new optimal choice. Make sure you explain his behavior in terms of income and substitution effects.

(e) **(10 points)** Suppose that the government provides a lump-sum transfer S to compensate the change in consumption after imposing tax. The amount of S is determined **to conserve the quantity of consumption and leisure that the individual had previous to the tax**. (i) Add a new budget constraint in the $C - L$ space. (ii) In the new optimum after both tax and transfer, is he going to consume more or less? (iii) Is he going to work more or less? (iv) Is your answer different from part (d)? If so, why? Explain in terms of income and substitution effects.

Imagine that, instead of imposing taxes on his **income**, the government decides to impose taxes on his **wealth** at the constant rate $0 < \tau < 1$.

(f) **(5 points)** How does the wealth tax affect the individual's consumption-labor choice? Display his new resource constraint and his new optimal choice. Make sure you explain his behavior in terms of income and substitution effects.

(g) **(5 points)** Compare the difference between the effects of income tax and the effects of wealth tax (specifically, compare your answer of part (f) with that of part (d)). Discuss two different tax schemes.

(h) **(5 points)** Suppose that the individual wins the lottery. That is, his wealth increases to W' (that is,

$W' > W$). Moreover, assume that there is **no wealth tax** (on both initial wealth and additional wealth). Display his new resource constraint and his new optimal choice. Make sure you explain his behavior in terms of income and substitution effects.

2. **(Total 30 points)** Consider the interest rate charged by the bank for borrowing is larger than the interest rate paid by the bank. In other words, the consumer can save at the interest rate r_s (s for saving) and can borrow at the rate r_b (b for borrowing) with $r_b > r_s$. The individual receives Y_1 and Y_2 in period 1 and 2 respectively as usual.

(a) **(3 points)** Graph the budget constraint for the individual.

(b) **(3 points)** Add to your graph the consumer's indifference curves. Show graphically three possible outcomes: one in which the consumer saves, one in which he borrows, and one in which he neither borrows nor saves.

(c) **(8 points)** Consider the case in which he **saves**. (i) How do consumption in period 1 (C_1) and consumption in period 2 (C_2) change when the interest rate r_b increases? (ii) How do consumption in period 1 (C_1) and consumption in period 2 (C_2) change when the interest rate r_s increases? (Note: Although r_s goes up, it is still less than r_b .)

(d) **(8 points)** Consider the case in which he **borrows**. (i) How do consumption in period 1 (C_1) and consumption in period 2 (C_2) change when the interest rate r_b increases? (ii) How do consumption in period 1 (C_1) and consumption in period 2 (C_2) change when the interest rate r_s increases? (Note: Although r_s goes up, it is still less than r_b .)

(e) **(8 points)** Consider the case in which he does **not borrow or save**. (i) How do consumption in period 1 (C_1) and consumption in period 2 (C_2) change when the interest rate r_b increases? (ii) How do consumption in period 1 (C_1) and consumption in period 2 (C_2) change when the interest rate r_s increases? (Note: Although r_s goes up, it is still less than r_b .)

3. **(Total 30 points)** Consider the classical model for goods market we discussed in class. We want to analyze the goods market in the space whose horizontal axis is Y (output) and vertical axis is r (interest rate).

(a) **(5 points)** How does the aggregate demand for goods (Y^D) relate to the interest rate (r)? (i) Explain your answer in detail (in terms of intuition, or using a diagram, or using an example, or using equations etc.), and (ii) display the aggregate demand curve on the Y - r plane.

(b) **(5 points)** How does the aggregate supply for goods (Y^S) relate to the interest rate (r)? (i) Explain your answer in detail (in terms of intuition, or using a diagram, or using an example, or using equations etc.), and (ii) display the aggregate supply curve on the Y - r plane.

(c) **(5 points)** Draw both the demand and supply curves on the same plane, and find an equilibrium (Y^*, r^*). If the current interest rate is lower than the equilibrium level (*i.e.* $r^\ell < r^*$ where r^ℓ is the current rate), what does happen?

(d) **(5 points)** Consider a **temporary** increase in the level of technology. How will the equilibrium consumption and interest rate change in the short run? Explain using a diagram.

(e) **(5 points)** Consider now a permanent increase in the level of technology. How will the equilibrium consumption and interest rate change in the short run? Explain using a diagram.

(f) **(5 points)** Consider now an anticipated permanent increase in the level of technology. Is the present consumption affected by technological progress in the future? Explain using a diagram.