

Midterm Exam

(October 21, 2022, **1 hour 15 minutes**)

Macroeconomics (Fall 2022)

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 50 points)** Consider the Solow-Swan model of growth. There are two countries, **Country A** and **Country B** that have same production function:

$$Y = A\sqrt{KL}$$

where K is physical capital, L is labor (which we assume to be equal to population), and A is the level of technology.

(a) **(3 points)** Does this production function exhibit constant returns to scale? Show.

(b) **(2 points)** Write down the production function in per-capita terms, that is, $y = Y/L$, and $k = K/L$.

Imagine that both **Country A** and **Country B** are closed. They have same technology levels, saving rates, depreciation rates, and population growth rates. The saving rate is the constant fraction s and the depreciation rate is δ . Population growth is exogenous constant number n .

(c) **(5 points)** Write down the fundamental equation of the Solow-Swan model. That is, write down the equation for dk/k as a function of the parameters A , s , n , δ , and the capital stock k .

(d) **(5 points)** Graph the savings curve and depreciation line. Is there a steady state? Is it unique?

(e) **(5 points)** Consider the parameters $A = 1$, $s = 0.2$, $\delta = 0.09$, $n = 0.01$. What is the steady-state capital stock per capita, k^* . Calculate.

Imagine that **Country A** is at its steady state and a severe earthquake breaks out in the country. As a consequence, the depreciation of capital of the **Country A** permanently increases from $\delta = 0.09$ to $\delta' = 0.19$ ($\delta < \delta'$).

(f) **(5 points)** How does the economy behave immediately after the earthquake? Explain with a graph (or graphs).

(g) **(5 points)** How does the economy behave in the long term? Explain with a graph (or graphs).

(h) **(5 points)** If there is a change in the steady state of the *Country A*, calculate the new steady-state capital per capita. Is it higher than before?

Suppose that population of *Country B* is 1 million (that is, $L = 1,000,000$). Imagine that the national assembly of *Country B* at the steady state decides to approve huge immigration from other countries in order to increase a labor force of the country. As a result, L increases immediately to L' ($L < L'$) and $L' = 2,000,000$. Assume that the immigration does not affect the population growth rate.

(i) **(5 points)** What happens to the current capital per capita k and the growth rate of k ? Explain with a graph (or graphs).

(j) **(5 points)** In the long run, what is the effect of the huge immigration? Explain with a graph (or graphs).

(k) **(5 points)** If there is a change in the steady state of the *Country B*, calculate the new steady-state capital per capita. Is it higher than before?

2. **(Total 15 points)** Suppose that an individual faces a concave resource constraint due to diminishing returns (that is, the more she works, the harder she gets additional fish). To be specific, her budget constraint is:

$$C = W + A\sqrt{L}$$

where L is the amount of work, W is wealth ($W > 0$), and C is consumption (of fish). Note that A denotes her productivity (or skill of catching fish).

(a) **(2 points)** Plot her resource constraint in the C - L space.

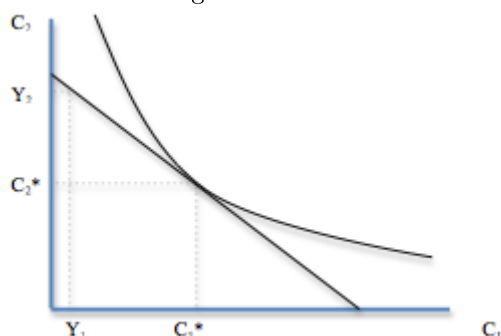
(b) **(3 points)** Find graphically the optimal amount of work effort (L^*) and consumption (C^*).

(c) **(5 points)** Imagine that a thief entered into her house last night and stole some fish. As a result, her wealth decreased from W to W' ($W > W' > 0$). Display her new budget constraint and her new likely behavior. Make sure you explain her behavior in terms of income and substitution effects.

(d) **(5 points)** Imagine instead that she learned new and better catching skills from YouTube. As a result, her productivity increases from A to A' ($A < A'$). Plot the new budget constraint and describe the new optimal choice for her. Make sure you explain her behavior in terms of income and substitution effects.

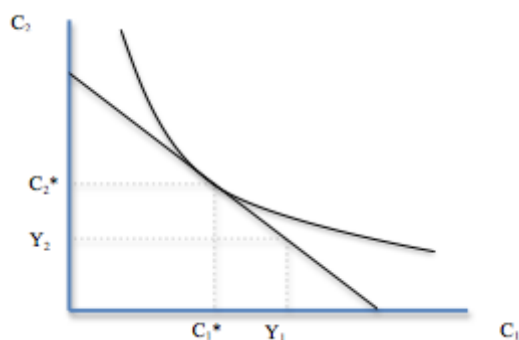
3. (Total 35 points) We consider the aggregate consumption behavior of two imaginary OPEN economies. The first economy is *Corea*. *Corea* is a poor economy where everybody believes that income in the future will be much larger than in the present. The optimal consumption in period 1 and period 2 is displayed as follows:

Figure 1: Corea



Corea has access to an international financial market whose real interest rate (that is, world interest rate) is r , and r is constant. The other country we consider is *Chosun*. *Chosun* also has access to the international financial market. *Chosun* is a rich country whose income is huge today but is expected to fall in the future. The behavior of *Chosun* is displayed as follows:

Figure 2: Chosun



- (a) (5 points) *Corea* and *Chosun*: who is borrowing and who is lending?
- (b) (10 points) Suppose that *Corea* is a well-known producer of rice. Imagine that the price of rice increases temporarily so today's income in *Corea* increases by 10 million dollars, but tomorrow's remains the same. What will happen to *Corea*'s aggregate consumption today? Explain your answer graphically.
- (c) (10 points) Suppose that there is an increase in world real interest rates. What is the behavior of aggregate consumption today and tomorrow for both *Corea* and *Chosun*? Make sure you decompose the overall effects into income and substitution effects. Is consumption for today (C_1) a decreasing function of interest rates? Explain. (Note: You don't have to draw graphs. If you need, you can draw diagram(s), but keep it in mind that your score will be reduced if your drawings are incorrect.)
- (d) (10 points) Suppose that *Corea* does not have access to international financial markets but Y_1 and Y_2 are still the ones displayed in Figure 1. What will C_1 and C_2 be in this case? What would the increase in C_1 when *Corea* experiences a temporary increase in income as described in part (b)? Is your answer different from the one you gave in (b) (in terms of the magnitude of the increase)? If so, why? (Note: You don't have to draw graphs. If you need, you can draw diagram(s), but keep it in mind that your score will be reduced if your drawings are incorrect.)