

Advanced Macroeconomics
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Midterm Exam (Open-Book)
Undergraduate Program in Economics, HUST
Thursday, May/06/2021

Name: _____ **Student ID:** _____

1. ($10' + 10' + 20' + 10' = 50$ points) Two countries, A and B , are described by the Solow model with intensive production function $f(k) = k^{1/2}$. There are no technological changes in both countries, i.e., $g \equiv 0$ for both A and B . In both countries, $n + \delta = 0.1$. In country A , $s = 0.1$. In country B , the saving rate is a function of capital stock per unit of labor: $s = 0.2 \left(\frac{1}{1+k} \right)$.

- (a) Show that country B has a unique steady state, either in a mathematical way or by graphical illustrations.
- (b) Show that the two countries have the same steady state.
- (c) Solve for the growth rate of income per labor.
- (d) If both countries start with the same stock of capital per labor, which country will grow faster (in the sense of output per labor)? Will this country always grow faster?

2. ($10' + 20' + 20' = 50$ points) Answer the following questions:

- (a) Recall equation (2.3) in your textbook:

$$r(t) = f'(k(t)). \tag{2.3}$$

How do we get this equation? Is it a demand function or a supply function for the capital market?

(b) Recall equation (2.20) in your textbook:

$$\frac{\dot{c}(t)}{c(t)} = \frac{r(t) - \rho - \theta g}{\theta}. \quad (2.20)$$

Does the equation above depict the demand function or the supply function of capital?

(c) It is said that combining equations (2.3) and (2.20) yields equation (2.24):

$$\frac{\dot{c}(t)}{c(t)} = \frac{f'(k(t)) - \rho - \theta g}{\theta}. \quad (2.24)$$

What is the economic intuition behind the step “combining equations (2.3) and (2.20)”?