# Midterm Exam II (Open-Book)
# Advanced Macroeconomics
# Instructed by Xu & Yi
# Undergraduate Program in Economics, HUST
# Thursday, May/19/2016

**Name:** _____ **Student ID:**_____

**1.** (15+10+15=40 points) Answer the following questions based on your understanding of the Romer model in Chapter 3.

**(a)** Recall equation (3.39) in your textbook:

$$\pi(t) = \frac{\bar{L} - L_A}{A(t)} \left[ \frac{w(t)}{\phi} - w(t) \right], \tag{1}$$

where $w(t)$ is workers' wage at $t$, and $\frac{w(t)}{\phi}$ is said to be the price of the intermediate good charged by a specific monopoly firm. Why does the profit-maximizing firm set its price at $\frac{w(t)}{\phi}$? You should give your answers step by step, starting from equation (3.32).

**(b)** Recall equation (3.41) in your textbook:

$$\pi(t) = \frac{1-\phi}{\phi} \frac{\bar{L} - L_A}{\rho + BL_A} \frac{w(t)}{A(t)}. \tag{2}$$

There is obviously a typo（印刷错误）in the equation above. Point it out.

**(c)** What is the relationship between equations (3.37) and (3.41)? Show how the author gets the latter from the former **in your words**.

**2.** (10+10+10=30 points) In a well-cited paper, Young (1995) found out that, compared to an appealing annual growth rate of output (as high as 8.7%) during 1966-1990, the annual growth rate of TFP for Singapore during the same period was merely 0.2%. Basically, what Young did in the paper is to presume first a production function

$$Y = AK^{\alpha} L^{1-\alpha} \tag{3}$$

with $\alpha \in (0, 1)$, and then estimated the growth rate of TFP using

$$g_A = g_Y - \alpha g_K - (1-\alpha) g_L. \tag{4}$$

It is convenient for Young to use estimate $\alpha$ using capital share, and calculate $g_Y, g_K$ and $g_L$, and thus easy for him to estimate $g_A$ during the period.

**(a)** If an economy's output grows fast without significant improvements in its TFP, what does this fact imply on its future growth?

**(b)** The then Prime Minister of Singapore, Lee Kuan Yew（李光耀）, responded to Young's findings. Lee argued that, different from the cases of western developed countries, a significant part of technological progresses in Singapore actually happened as byproducts of capital accumulation (which had played a dominant role during the period), rather than as results of R&D activities. Let's rephrase Lee's viewpoint as equation

$$\begin{aligned} Y &= AK^{\alpha}L^{1-\alpha} \\ &= \hat{A}K^{\gamma}K^{\alpha}L^{1-\alpha} \\ &= \hat{A}K^{\alpha+\gamma}L^{1-\alpha}, \end{aligned} \tag{5}$$

Where $A = \hat{A}K^{\gamma}$ with $\hat{A}$ as the part of technology that evolves exogenously and $\gamma > 0$. Suppose we observe capital share $\alpha_K$ in reality, can we still interpret it as $\alpha$? If yes, explain why. If no, guess an expression for $\alpha_K$ and explain your intuition.

**(c)** Based on his points introduced in (b), Lee then argued that Young's results actually underestimated the TFP growth of Singapore. Show this result based on your answers above. (Hint: While estimating the TFP growth using equation(4), what was Young actually calculating based on equation (5)?)

**3.** (10+10+10=30 points) Answer the following questions based on your understanding of materials in Chapter 5.

**(a)** Table 5.3 tells us that, during recessions, real GDP averagely declined by 4.1% but unemployment rate averagely rose by only 1.8 percentage points. Explain this fact.

**(b)** Recall equation (5.21):

$$\frac{1-\ell_1}{1-\ell_2} = \frac{1}{e^{-\rho}(1+r)}\frac{w_2}{w_1}. \tag{6}$$

Given all other variables fixed, how does $w_1$ affect $\ell_1$? Explain the economic intuition behind your answer.

**(c)** According to your answer in (b), how does RBC theories explain the fluctuations in unemployment rates during business cycles? (Hint: what causes the change in $w_1$ as in (b)? Are those increased unemployed because of decreases in labor demand or decreases in labor supply?)

# Solutions and Hints

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Solution hints are given as below, please do me a favor by pointing out the mistakes and typos, if any, that I have made (yiming@hust.edu.cn).

1.(a) Hint: the mark-up pricing strategy for a monopolist.

1.(b) $\pi(t)$ should be replaced by $\Pi(t)$, which denotes the L.H.S. of (3.37).

1.(c) Hint: (3.41) solves for the L.H.S. of (3.37) on the balanced growth path.To see how (3.41) is derived from (3.37), you should explain how we get the growth rate of all kinds of variables in (3.37).

2.(a) According to Solow's findings, it means the current growth rate is not sustainable in the future. In some cases, researchers may even question the credibility of the reported growth rate.

2.(b) Hint: $\alpha_K \neq \alpha$ because the Constant Returns to Scale property does not hold any more. An intuitive guess, which is instructed in class, is $\alpha_K = \frac{\alpha+\gamma}{1+\gamma}$. Any similar answers exhibiting the intuitions that (1)all outputs are split up between labor and capital, and (2)the capital-labor shares are determined according to their relative importance in the production function, all receive full points.

2.(c) Hint: While thinking of calculating TFP using equation (4), Young was actually dealing with (7).

$$g_A = g_Y - \alpha_K g_K - (1-\alpha_K) g_L. \tag{7}$$

Mathematically, given $\alpha_K > \alpha$ and the economic growth of developing countries are usually companied with an extraordinarily high capital growth, Young's method tends to underestimate the TFP growth of Singapore. In other words, part of the contribution of TFP is mistakenly attributed to the capital accumulation.

3.(a) Hint: Notice that the average weekly hours also declined. Okun's law.

3.(b) Hint: $w_1 \uparrow \Longrightarrow \ell_1 \uparrow$

3.(c) Hint: an exogenous shock ($\tilde{A}_t$ or $\tilde{G}_t$) changes wage, which in turn changes labor supply and the equilibrium employment. As a result, according to RBC theory, a higher unemployment rate in economic cycles are explained by the reduced willingness to work in the current period, and this reduction is induced by exogenous shocks.