ECO2143 Macroeconomic Theory II
Second mid-term examination: March 10, 2008
University of Ottawa
Professor: Louis Hotte
Time allowed: 1h 20min

Attention: *Not all questionnaires are the same. This is questionnaire* ***A****. On the answer sheet, you must indicate the letter of your questionnaire with the course's number as follows:* ***ECO2143A****. You must answer according to* ***the material seen in this course****. Read all answer choices before choosing your answer.* GOOD LUCK!

QUESTIONNAIRE A

I. MULTIPLE CHOICE QUESTIONS (4 points each)

ATTENTION: To simplify, whenever convenient, today's rich and industrialized countries such as Canada and Western Europe will be referred to as **ICs**, while today's poorer, less-developed countries will be referred to as **LDCs**.

(1) Which of the following best describes the relationship between health and income?
   (a) Better health leads to higher income.
   (b) There is no causal relationship between health and income.
   (c) Higher income leads to better health.
   (d) Better health leads to higher income *and* higher income leads to better health.✓
   (e) There is no correlation between health and income.

(2) Suppose that Country A has a higher output level and a higher level of factor accumulation than Country B. Which country has a higher level of productivity?
   (a) Country B
   (b) They both have the same level of productivity.
   (c) Country A
   (d) We cannot say which has a higher level of productivity without more information.✓

(3) Assume that the economy can be represented by the Solow model with the following output function $Y = K^{\alpha}(eL)^{1-\alpha}$, where each variable is defined as seen in class. Suppose the investment rate is $\gamma = 10\%$, the depreciation rate is $\delta = 5\%$, the growth of the labor force size is $n = 3\%$ per year and the rate of technological progress is $\hat{e} = 2\%$ per year. What will be the long-run, steady-state growth rate of *output per worker*?
   (a) 0%
   (b) 10%
   (c) 5%
   (d) 3%
   (e) 2%✓

(4) Using the information from question (3), what will be the long-run, steady-state growth rate of *aggregate output*?
   (a) 0%
   (b) 10%
   (c) 5%✓
   (d) 3%
   (e) 2%

(5) In a case study discussed in class which compared the growth experiences of Singapore and Hong Kong since 1960, it was seen that even though both countries had experienced similar output growth rates, productivity growth in Singapore was much lower than in Hong Kong. This led us to make the following observation:
   (a) Singapore's output growth rate will not be able to keep up with Hong Kong's in the long run because of diminishing returns to capital.✓
   (b) Hong Kong's output growth rate will not be able to keep up with Singapore's in the long run because of diminishing returns to capital.
   (c) Singapore's output growth rate will not be able to keep up with Hong Kong's in the long run because of increasing returns to productivity.
   (d) Hong Kong's output growth rate will not be able to keep up with Singapore's in the long run because of increasing returns to productivity.
   (e) We could not tell which of the two countries would keep on growing fastest.

(6) Compared to the growth rate of productivity seen today, how did the growth rate of productivity fare during the peak of the Industrial Revolution (1760-1830)?
   (a) Growth rates of productivity during the Industrial Revolution are comparable to those seen today.
   (b) It was much more robust during the Industrial Revolution.
   (c) It was not possible to measure productivity growth rates during the Industrial Revolution.
   (d) It was weaker during the Industrial Revolution.✓

(7) Suppose that goods A and B are perfect complements in consumption and are produced with a fixed total labor force size which must be allocated for the production of each good. The rate of technological progress is equal to 2% in sector A and zero in sector B. In the long run, we would expect
   (a) the output of both goods to grow at a rate of 2%.
   (b) the output of good A to grow at a rate of 2% while that of good B does not grow.
   (c) the output of both goods to stop growing.✓
   (d) all the labor force to be working in sector A where there is higher technological progress.
   (e) an equal distribution of the labor force between both sectors because they are perfect complements.

(8) According to the calculations based on the returns to education, it appears that

(a) In LDCs, human capital accounts for a much lower share of total national income than physical capital.
(b) In LDCs, human capital accounts for a much larger share of total national income than physical capital.
(c) In ICs, human capital accounts for a much lower share of total national income than physical capital.
(d) In ICs, human capital accounts for a larger share of total national income than physical capital.✓

(9) Which of the following would least likely be considered a general purpose technology?
(a) Internet
(b) Electricity
(c) Ford's assembly line
(d) Semiconductor
(e) A new way of dyeing fabric✓

(10) The fact that there are positive externalities to education suggests that
(a) governments should not subsidize education.
(b) education is a positively external business.
(c) people tend to receive too much education.
(d) less educated farmers are made worse off by their more educated neighbors.
(e) the returns to education based on salaries provide an underestimate of its true total social return.✓

II. PROBLEMS

(1) **(20 points) Human Capital**
Suppose, to simplify, that the total adult population size in the USA in 2000 was $L = 1,000$. Let L_X denote the number of adults with X years of schooling. According to the distribution of education levels across the adult population in the USA in 2000, we have: $L_0 = 8$, $L_4 = 43$, $L_8 = 39$, $L_{10} = 229$, $L_{12} = 200$, $L_{14} = 236$, $L_{16} = 245$. The returns to education are 13.4% per year for the first four years, 10.1% per year for years 5 to 8, and 6.8% per year for any additional year of education after the eighth year.

(a) **(10 points)** *Calculate the fraction of wages that are being paid to human capital in the total economy. (Give the details of your calculations with some explanations.)*

Suppose that the salary of a worker without any schooling is \$1. The total salaries received by the 8 workers without education is thus $8 * \$1 = \$8$. The 43 workers with 4 years of schooling each receive a salary of $\$1 * (1.134)^4 = \$1.65$, for a total salary for this group of $43 * \$1.65 = \$71$. And so on as per the following table:

schooling	no of workers	salary	total
0	8	1	8
4	43	$1.134^4 = 1.65$	71
8	39	$1.65 * 1.101^4 = 2.43$	94.77
10	229	$2.43 * 1.068^2 = 2.77$	634.33
12	200	$2.77 * 1.068^2 = 3.16$	632.00
14	236	$3.16 * 1.068^2 = 3.61$	852.00
16	245	$3.61 * 1.068^2 = 4.11$	1006.95
TOTAL:	1000		3299.05

Total salaries add up to \$3299. Raw work, i.e. work that does not require human capital, receives an aggregate payment of $1,000 * \$1 = \$1,000$, thus leaving an aggregate payment of \$2299 to remunerate human capital. The share of wages due to human capital is thus

$$\frac{3299 - 1000}{3299} = 69.7\%.$$

(b) **(10 points)** *If salaries make up* $2/3$ *of total national income, how important is human capital to explain total income levels? How does this compare to physical capital? And raw labor?*

If salaries make up 2/3 of total national income, then human capital explains $0.66 * 0.697 = 46\%$ of total income in the economy. (Another equivalent way to show this is to note that if salaries make up 2/3 of total national income, then total national income is equal to $3/2 * \$3299 = \$4948.5$. The share of human capital is again $2299/4948.5 = 46\%$.)

We have seen that physical capital is responsible for 33% of total national income. This suggests that human capital, at 46%, is more important than physical capital to explain income levels by a good margin.

As for raw labor, it explains $1000/3299 = 30.3\%$ of total salaries, and thus $2/3 * 0.303 = 20.2\%$ of total national income. It is much less important than both physical and human capitals, but certainly still significant for welfare. (Another way to obtain the same figure is with the following fraction: $1000/4948.5 = 20.2\%$.)

Remark: *For such a question, it is important to explain your calculations and interpret your results, even if very succinctly. This is often the only way that the corrector can make the difference between a student who has a good command of the* economic content *from one who has not.*

(2) **(20 points) Creative Destruction**
Describe what the process of "creative destruction" is about and discuss its implications

for economic growth. (Maximum 1.5 page with double line spacing.)

Creative destruction describes a situation where a newly *created* idea renders an existing one obsolete, that is, it *destroys* its purpose. In practice, this means that new products, or cheaper production processes, allows some firms to displace existing ones.

With competition, there is an endless cycle of new ideas being generated since it allows new firms to replace existing ones and reap their profits by offering better or cheaper products to consumers. Some economists believe that long-run growth, being driven by technological progress, is essentially explained in those terms.

A potential problem is that existing firms and their workers may try to block the introduction of new technology if they expect to lose from it. If governments yield to such pressure, economic growth may grind to a halt. The potential loss for consumers may be enormous. An important role for the Competition Bureau of Canada is to keep a watch on firms trying to reduce competition this way.