

**UNIVERSITY OF TORONTO**  
**Faculty of Arts and Science**

**December 15, 2011**

**ECO362H1F (Economic Growth)**  
Instructor: Kripa Freitas

**Duration: 2 hours**

**Non-programmable calculator allowed**

This examination paper consists of **12** pages and **5** questions. Please bring any discrepancy to the attention of an invigilator. The number in brackets at the start of each question is the number of points the question is worth.

Answer all questions.

**This is a closed book, closed notes exam. All diagrams need to be clearly labeled and you must give arguments to support your answers for full credit.**

For graders' use:

	Score
1 (18)	
2 (25)	
3 (25)	
4 (14)	
5 (18)	
Total (100)	

1. Consider the Malthus model where output is produced using land ( $T$ ) and labor ( $L$ ) in the following way  $Y_t = AT^\beta L_t^{1-\beta}$ ,  $0 < \beta < 1$ . The quantity of land ( $T$ ) and the productivity ( $A$ ) are constant. The growth rate of labor depends on per-capita incomes. In particular, suppose  $L_{t+1} = (\pi y_t)L_t$  where  $\pi$  is a constant and  $y$  is per-capita income.

(a) [4] Derive the equation for the evolution of per-capita incomes. i.e.  $y_{t+1}$  in terms of  $y_t$ . Show all your steps and working clearly for full credit.

(b) [4] Derive the equation for steady state per-capita income  $y^{SS}$  and population  $L^{SS}$ . Show all your steps and working clearly for full credit.

- (c) [10] Suppose the amount of land in the economy increases. What would be the effects on the economy when this happens? Specifically describe the effects on per-capita income ( $y$ ) and population ( $L$ ). Explain the intuition behind the effects. Make sure your diagrams are clearly labeled for full credit

## 2. Inequality

- (a) [10] Consider two possible income levels. The poor earn \$1000, the rich earn \$2000 per head. Country A has 4 people in its economy. 2 poor, 2 rich. Country B also has 4 people, 1 poor and 3 rich. Draw the Lorenz curves for both countries on the same diagram. Mark your diagrams clearly. Points will be deducted if the diagrams are not clearly marked.

- (b) [4] Based on the Lorenz curves which country has a higher inequality? Why?

- (c) [5] Briefly discuss how inequality could affect growth through the effect on physical capital accumulation

- (d) [6] Briefly, what is Kuznets' inverted U hypothesis and discuss the evidence for it?

3. Consider the Solow model with productivity growth. The production function is Cobb-Douglas  $Y_t = K_t^\alpha (e_t L_t)^{1-\alpha}$ . Where  $e$  denotes the productivity. Productivity growth rate is constant and is given by  $\hat{e}$  and population grows at rate  $n$ . The investment rate in the economy is denoted by  $\gamma$ . It is a constant fraction of output in the economy. Depreciation is denoted by  $\delta$ .

- (a) [3] Derive the equation for per-capita income  $y$  as a function of the capital per effective labor ratio ( $k_t = \frac{K_t}{e_t L_t}$ )

- (b) [4] Starting from the capital accumulation equation derive the equation for the evolution of the capital per effective labor ratio in the economy. i.e. derive an equation for  $k_{t+1}$  as a function of  $k_t$  and the parameters of the model.

- (c) [4] On a graph of  $k_{t+1}$  against  $k_t$  show graphically how the economy would evolve from any starting point.

- (d) [4] What is the growth rate of per-capita income ( $y$ ) and what is the growth rate of total output ( $Y$ ) ? Derive the equations for the growth rates of each.

- (e) [10] Suppose that the only thing that changes in the model is a one time arrival of a group of refugees which raises the population. These refugees behave exactly like all other agents in the economy. Describe the effects of this change on per-capita incomes ( $y$ ), and total output ( $Y$ ) in words and in diagrams. Also explain the intuition behind these changes.



4. Growth and development accounting. Consider two countries  $A$  and  $B$ . The table below has data for these two countries for 2000 and 2002. For both countries, the production function (in per worker terms) is given by  $y = Ak^\alpha h^{1-\alpha}$  where  $\alpha = 1/3$ ,  $y$  is per-capita income,  $h$  is human capital per worker and  $k$  is physical capital per worker and  $A$  is productivity.

- (a) [7] For the year 2000, what is the ratio of productivities for these two countries? Show all your working clearly for full credit

Country	Year	$y$	$k$	$h$
$A$	2000	1000	500	700
	2002	1210	590	800
$B$	2000	1500	600	800
	2002	1550	637	900

- (b) [7] What is the productivity growth rate for country  $B$  between 2000-2002? Show all your working clearly for full credit

Country	Year	$y$	$k$	$h$
$A$	2000	1000	500	700
	2002	1210	590	800
$B$	2000	1500	600	800
	2002	1550	637	900

5. Short answers.

(a) [6] What is the equity-efficiency trade-off ?

(b) [6] Briefly discuss one types of inefficiency that can lead to productivity differences across countries

- (c) [6] Briefly discuss one public good the government provides that is important for economic growth

**End of examination**  
**Total pages: 12**  
**Total marks: 100**