

Prof. Charles I. Jones
Econ 100b
Fall 2005

First Midterm Exam

October 6, 2005

Answer all questions. Use graphs and equations whenever possible to make your answers precise. The exam totals 80 points, one point per minute of class. This is a closed-book exam. No notes, calculators, or other aids are allowed.

1. *Short Answer Questions* (15 points total; 5 points each).
 - (a) Per capita GDP in Brazil grew by a factor of 4 between 1950 and 2000. What was its average annual growth rate (approximately; no calculator needed)?
 - (b) By how much does Taiwan's GDP change in this example: Taiwan imports 10 million dollars worth of computer parts, assembles them into computers, and then sells the results to a U.S. computer company for 15 million dollars.
 - (c) Consider two countries, one rich and the other poor. The ratio of total factor productivity in the rich country to total factor productivity in the poor country is a factor of 5. Suppose the countries have the same investment rate. According to the Solow model, will the ratio of per capita incomes for the two countries be more than 5 or less than 5 in the long run? Why?

2. *The Solow Model with Labor Force \neq Population* (35 points). This problem studies a Solow economy where the fraction of the population that works, \bar{x} , is allowed to be different from one. Here is the setup:

$$Y_t = \bar{A}K_t^{1/3}L_t^{2/3}$$

$$\Delta K_t = I_t - \bar{d}K_t, \quad K_0 = \bar{K}_0$$

$$C_t + I_t = Y_t$$

$$I_t = \bar{s}Y_t$$

$$L_t = \bar{x}\bar{N}.$$

Everything in this setup should be familiar to you other than the last equation. In this last equation, \bar{N} is the total population of the economy, and \bar{x} is the fraction of this population that works (it is a number between zero and one; the fraction $1 - \bar{x}$ is assumed to be on vacation).

- (a) (5 points) What are the endogenous variables in this problem? What are the exogenous parameters?
- (b) (10 points) Suppose the economy begins in steady state. Then, the fraction of the population that works rises permanently to \bar{x}' . Using a Solow Diagram, explain how the capital stock evolves over time.
- (c) (10 points) Solve algebraically for the new steady-state level of per capita output.
- (d) (10 points) Draw a graph showing how per capita output evolves over time.

3. *Learning by Doing and Growth* (30 points). This problem asks you to consider a variant of the Romer idea model. In this problem, the production of the consumption good itself leads to the discovery of new ideas (better production methods). This is like the Boeing airplane example mentioned briefly in class. Here is the setup:

$$Y_t = A_t L_t$$

$$\Delta A_t = \bar{v} Y_t$$

$$L_t = \bar{x} \bar{N}$$

- (a) (6 points) Provide two sentences of economic interpretation for each equation.
- (b) (12 points) What is the growth rate of per capita output along the balanced growth path?
- (c) (12 points) Suppose the economy is on a balanced growth path for several years. Then, the fraction of the population that works rises immediately and permanently to \bar{x}' . Draw a graph showing how per capita output evolves over time.