

UNIVERSITY OF CALIFORNIA  
Department of Economics

SPRING 2007  
C. Jones/D. Romer

ECONOMICS 202B

MIDTERM EXAMINATION

**The exam consists of two parts. Do each part in a separate blue book.**

## Part I (Romer)

### Section A. Multiple choice (8 points)

In your blue book, give the best answer to 2 of the following 3 questions.

Note:

— If you wish, you may add a brief explanation of your answer to AT MOST ONE question. In that case, your grade on that question will be based on your answer and explanation together. This means that an explanation can either raise or lower a grade.

— If you answer all 3 questions, your overall score will be based on your average, not on your 2 best scores.

1. Hall and Jones measure the contribution of differences in education to cross-country income differences by:

A. Running a cross-country regression (that is, a regression where the unit of observation is a country) of log output per worker on average years of education and other variables, using OLS.

B. Running a cross-country regression of log output per worker on average years of education and other variables, using IV, where the instruments are distance from the equator, a measure of trade openness based on geographic characteristics, and measures of native speakers of major European languages.

C. Combining micro evidence about how individuals' earnings depend on their years of education with data on the average years of education of workers in different countries.

D. Using micro evidence about the earnings of immigrants from different countries in the United States.

2. A reasonable question to ask concerning any theory that attributes large cross-country income differences to large inefficiencies in poor countries is:

A. Why do the residents of poor countries not find a way to eliminate the large inefficiencies and divide the resulting gains in a way that makes everyone (or almost everyone) better off?

B. Why don't foreign corporations buy the poor countries and manage them more efficiently?

C. Why don't wealthholders in wealthy countries invest more in poor countries, since the fact that output per worker is low in those countries must mean that capital per worker is low, and thus that the return to capital is high?

D. Why does anyone in the poor countries get any education, since the large inefficiencies must mean that the return to acquiring human capital is very low?

3. It appears that differences in abstract knowledge or ideas are not a major source of cross-country income differences because:

A. Calculations using the Solow model extended to include human capital suggest that differences in physical and human capital accumulation account for the vast majority of cross-country income differences.

B. The evidence indicates that increases in knowledge have little impact on output.

C. Abstract knowledge can easily be transferred from one country to another.

D. Direct measurement indicates that the amount of knowledge does not vary greatly across countries.

### Section B. Problem (28 points)

4. The Solow model with Leontief production. Consider an economy that is described by the Solow model, except that: (1) The production function is  $Y(t) = \min[K(t), A(t)L(t)]$ ; (2)  $n + g + \delta$  is assumed to satisfy  $0 < n + g + \delta < s$ .

A. As in the usual Solow model, define  $k \equiv K/(AL)$ ,  $y \equiv Y/(AL)$ . Find the function  $y = f(k)$  that gives  $y$  as a function of  $k$ . Does  $f(\bullet)$  satisfy the Inada conditions? Why or why not?

B. Draw the Solow diagram (that is, a diagram showing  $sf(k)$  and  $(n + g + \delta)k$  as functions of  $k$ ) for this model.

C. In the standard Solow model, there is a  $k^*$  such that for any  $k(0) > 0$ ,  $k$  converges to  $k^*$  and then remains there. Is this true in this model? Explain your answer.

D. Assume the economy starts on a balanced growth path with  $k > 0$ , and that there is a permanent increase in  $s$ . Is the long-run impact of this change on  $k$  positive, negative, or zero (or impossible to tell)? Is the long-run impact on  $y$  positive, negative, or zero (or impossible to tell)? Explain your answers.

E. Let us change the model to make technological change capital-augmenting rather than labor-augmenting. Specifically, assume  $Y(t) = \min[B(t)K(t), L(t)]$ . Assume the dynamics of  $B$  are given by  $\dot{B}(t) = gB(t)$ , and assume that  $sB(0) > n + \delta$ . The other assumptions are the same as in the standard Solow model.

i. Show that, if we define  $y \equiv Y/L$  and  $k \equiv K/L$ , the dynamics of  $k$  are given by  $\dot{k} = sy(t) - (n + \delta)k(t)$ .

ii. True or false: For any  $k(0) > 0$ , the economy converges to a situation where  $Y/L$  is growing at a constant rate. Explain your answer.

# Econ 202b Midterm Exam — Part II (Jones)

March 15, 2007

**PLEASE USE A NEW BLUE BOOK FOR PART II**

**Section A. Provide a brief answer to each question below (15 points total).**

1. True/False/Explain: The optimal allocation of resources in a particular economic environment typically depends on the institutions (including markets) that are present in that environment.
2. Consider a Neoclassical Growth Model that begins in steady state. Explain what happens to the steady-state value of  $\tilde{c} \equiv c/A$  if there is a one-time, unexpected, permanent increase in the exogenous rate of technical change.
3. In the Diamond OLG model with log utility and Cobb-Douglas production, suppose we decrease the capital exponent  $\alpha$  in the production function. Does this make the competitive equilibrium allocation more likely or less like to be dynamically inefficient? Why?

## Section B. Learning by Doing (29 Points)

Consider the following economic environment:

$$Y_t = A_t K_t^\alpha L_t^{1-\alpha} \quad 0 < \alpha < 1 \quad (1)$$

$$\dot{A}_t = Y_t^\sigma \quad \alpha + \sigma < 1, \quad A_0 > 0, \quad (2)$$

$$\dot{K}_t = Y_t - C_t - \delta K_t, \quad \delta > 0, \quad K_0 > 0, \quad (3)$$

$$L_t = L_0 e^{nt}, \quad n > 0, \quad L_0 > 0. \quad (4)$$

$$U_0 = \int_0^\infty u(c_t) e^{-(\rho-n)t} dt. \quad (5)$$

The notation should be familiar from class, and the equations have the usual interpretation. The only piece of the model that is new is that there is learning by doing: production leads to learning, which increases productivity. Assume  $\rho$  is sufficiently large so that preference orderings are well-defined.

- (a) (12 points) What is the growth rate of output per worker  $y \equiv Y/L$  along a balanced growth path? Interpret this result.
- (b) (12 points) Define a competitive equilibrium in this economy in which  $A_t$  is external to the individual firms. (No solving necessary).
- (c) (5 points) Is the allocation of resources in this competitive equilibrium socially optimal? Why or why not? (Hint: There is no need to write down any equations for this part; just a well-reasoned answer is fine).