

Prof. Tybout

**Economics 404W**  
**First Midterm Exam**

February 21, 2006

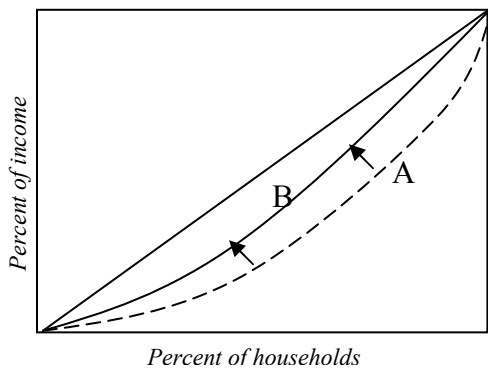
**KEY**

This exam has three sections. Each will be weighted in accordance with the time it is allotted.

There is no penalty for guessing, and partial credit will be awarded, so be sure to attempt all questions. For full credit on numerical problems, you must show your work.

**Part I: Multiple Choice (25 minutes)**

- 1) Referring to the Lorenz curves in the figure below, which statement best describes the change that occurs in a country that moves from curve A to curve B?

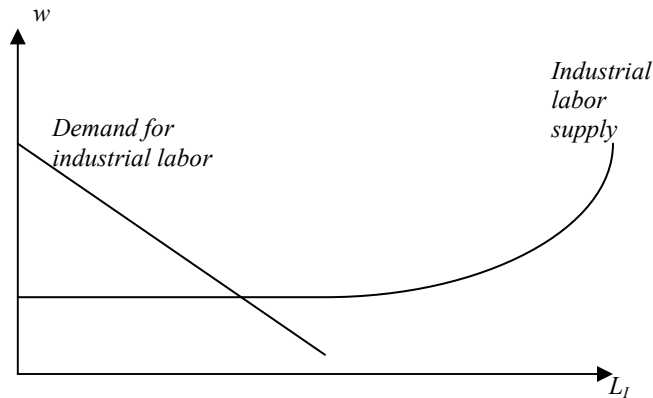


- a) The amount of inequality in this country has increased.
- b) The income share of the wealthiest 50 percent of households has gone up.
- c) **The amount of income inequality in this country has gone down.**
- d) The number of people below the poverty line in this country must have gone down.
- 2) The O-Ring theory suggests that poverty traps can emerge because:
- a) When entrepreneurs relocate to cities, this reduces the return to locating in the countryside.
- b) **When other workers are generally unskilled, the return to any individual from acquiring skills is low.**
- c) The marginal product of a skilled worker is highest when others around her are unskilled.
- d) When shanty towns spring up around cities, this creates an “O-Ring” of poverty that chokes commerce.
- 3) As countries go from very low levels of per capita income (around \$400) to moderate levels (around \$5,000), which of the following is *not* typically observed?
- a) **The share of agricultural output in GDP rises.**
- b) Government spending on education rises relative to GDP.
- c) Life expectancies rise.
- d) Savings rates rise.
- 4) In *The Elusive Quest for Growth*, William Easterly argues that:
- a) **Rapid capital accumulation is not essential for development.**
- b) The pay-off to education in developing countries has been extraordinarily high.
- c) Financial aid facilitates rapid investment and growth.
- d) The Harrod-Domar model is a good approximation to the structure of developing countries' economies.
- 5) If people save more when the return on savings is high, which of the following would be likely to encourage savings? (You may assume that the economy is characterized by the Solow model.)
- a) An increase in the rate of depreciation.
- b) A reduction in the rate of population growth.
- c) **A reduction in the rate of depreciation.**
- d) A temporary increase in the capital-labor ratio due to a sudden plague.

- 6) According to recent studies, rapid growth in the per capita incomes of Taiwan, S. Korea, Singapore and Hong Kong during the past 30 years is attributable to:
- a) human and physical capital accumulation.
  - b) growth in the labor force participation rate.
  - c) growth in total factor productivity.
  - d) **all of the above.**
  - e) (a) and (b) only.
- 7) Which of the following is *not* a reason why economic activity tends to become more concentrated in cities as the industrialization process unfolds?
- a) Manufacturers locate near their customers to save on transport costs.
  - b) Firms that locate near one another sometimes benefit from a shared knowledge base and skilled labor pool.
  - c) **Congestion costs tend to be unimportant in developing countries.**
  - d) Utilities can be delivered to firms and workers most efficiently when they (the firms and workers) are geographically concentrated.
- 8) Which of the following statements best characterizes the changes in income inequality that occur as countries develop?
- a) Inequality generally rises sharply as per capita income grows.
  - b) Inequality rises sharply, then falls gradually as per capita income grows.
  - c) Inequality generally falls sharply as per capita income grows.
  - d) **There is no general tendency for inequality to rise *or* fall as per capita income grows.**

**Part II: Short Answer (20 minutes)**

1. The diagram below depicts the demand for industrial labor in Lewis's "dual economy" model.



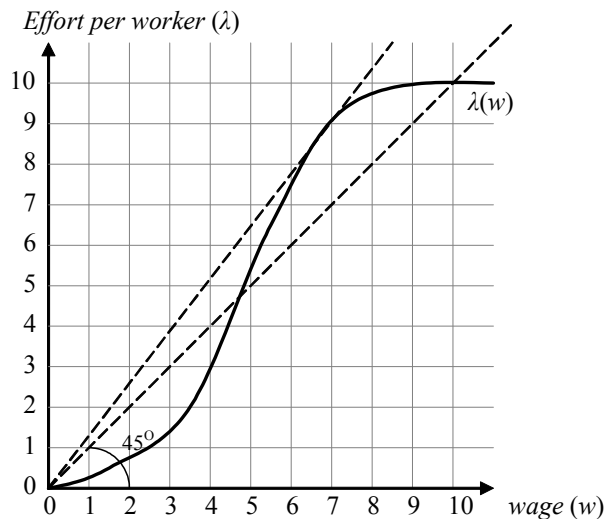
- a) Briefly explain why there is a flat portion in the industrial labor supply schedule.

Lewis assumes there is a surplus of labor in the rural sector. This labor can be attracted to the industrial sector by paying it slightly more than the subsistence wage, so the labor supply schedule is flat at this wage until surplus labor is exhausted. (Total of 5 points.)

- b) Explain which of the curves in this picture is likely to shift over time, and why. Also explain what the implications of this shift will be for the size of the industrial sector and the wage rate.

The demand for labor schedule will shift rightward as capital accumulates in the industrial sector. As this shift takes place, the industrial sector will grow and wages will eventually be driven up. (Total of 8 points.)

- 2) Suppose worker effort ( $\lambda$ ) is related to the wage rate ( $w$ ) as described by the curved line in the diagram below. (The dashed lines are provided for your convenience—they may or may not prove helpful.)



- a) List two reasons why this relationship might characterize modern sector workers in a developing country.

There are four possible reasons, although you only had to mention 2 of them:

1. Better paid workers can afford better nutrition, and thus are more productive workers. Beyond some wage rate, workers are well-nourished and the effect becomes unimportant.
2. Better paid workers can afford better health care, and thus are more productive. Beyond some wage rate, workers are well cared for and the effect becomes unimportant.
3. Higher wage rates attract a larger pool of workers, some of which are of a higher quality.
4. When workers are paid well, they work harder because they have a larger incentive to keep their jobs. Beyond some wage rate their effort is maxed out.

(4 points for each of two reasons.)

- c) If a modern sector employer is aware of this relationship between wages and productivity, at what wage rate does this employer maximize profits?  $w = \underline{7}$   
Briefly explain why.

At this wage worker effort per dollar spent on labor is maximized. (Total of 6 points.)

### Part III: Numerical problems (30 minutes)

1. In the country of Tropica, output is growing at a rate of 5 percent per annum:  $\Delta Y/Y = 0.05$ . Also, the savings rate in this country is  $s = 0.10$ , and the depreciation rate is  $\delta = 0.05$ .

- a) If the capital-output ratio is  $\theta_K = 2$ , is this economy behaving in a way that is consistent with the Harrod-Domar model? Briefly defend your answer.

Using the HD formula,  $\Delta Y/Y = (s/\theta_K) - \delta$ , the implied growth rate is  $(.10/2) - 0.05 = 0$ . Since the actual growth rate is 0.05, this is not consistent with the Harrod-Domar model. (Total of 5 points.)

- b) Instead of viewing Tropica as a Harrod-Domar economy, think of it as a Solow-Swan economy. If there is no productivity growth going on in this economy, and rate of growth in the labor force is 2 percent per annum ( $n = \Delta L/L = 0.04$ ), is this economy in long run steady state at the numbers provided above? (i.e.,  $\Delta Y/Y = 0.05$ ,  $s = 0.10$ ,  $\delta = 0.05$ ). (yes, no) No. Explain your answer.

Without productivity growth, the Solow-Swan model implies that output per worker cannot grow in a steady rate. But here it is growing at:  $0.05 - 0.04 = 0.01$  (Total of 5 points.)

- c) Continue to assume that Tropica is a Solow-Swan economy, and let its production function be  $y = k^{-.5}$ , where  $y = Y/L$  is output per worker and  $k = K/L$  is capital per worker. In the long run, what capital labor ratio ( $k$ ) would you expect to observe in Tropica? (Continue to assume  $s = 0.10$ ,  $\delta = 0.05$ ,  $n = \Delta L/L = 0.04$ ).  $k = \underline{1.23}$

$k = [s/(n + \delta)]^{1/(1-\alpha)} = (0.1 / 0.09)^{1/(1-0.5)} = 1.23$  (Total of 3 points.)

2. Suppose an economy is characterized by the production function  $y = A\sqrt{k}$ , where  $y = Y/L$  is output per worker,  $k = K/L$  is capital per worker, and  $A$  is a productivity index.

- a) Last year, the rate of growth in output per worker was  $\Delta y/y = 0.02$ , and the rate of growth in capital per worker was  $\Delta k/k = 0.02$ . What was the rate of growth in productivity?  $\Delta A/A = \underline{0.01}$ .

As in class and the lecture notes, productivity can be calculated using the formula  $\Delta A/A = \Delta y/y - \alpha (\Delta k/k)$ . In this case, since the production function is

$y = A\sqrt{k} = Ak^{1/2}$ , the elasticity of output with respect to capital is  $\alpha = 1/2$ .

Substituting into the formula yields  $\Delta A/A = 0.02 - (1/2)(0.02) = 0.01$ . (Total of 4 points.)

- b) If all of this productivity growth in this economy is due to improvements in the efficiency of labor, one might think of its production function as taking the form:

$y^* = \sqrt{k^*}$  where  $k^* = \frac{K}{\lambda_L L}$ ,  $y^* = \frac{Y}{\lambda_L L}$  and  $\lambda_L$  is an index of labor efficiency.

Under these conditions, what is the rate of growth in  $\lambda_L$  implied by the rate of growth in  $A$  that you calculated in part (i) above?  $\Delta\lambda_L/\lambda_L = \mu = \underline{0.02}$ .

As discussed in class, when all productivity gains are due to improvements in labor efficiency, we have  $\Delta A/A = (1 - \alpha)(\Delta\lambda_L/\lambda_L) = (1 - \alpha)\mu$ . In this example,  $\alpha = 1/2$  and  $\Delta A/A = 0.01$  (see part a above), so  $\mu =$

$$\left(\frac{1}{1 - \alpha}\right) \frac{\Delta A}{A} = \left(\frac{1}{1 - 0.5}\right) \cdot 0.01 = 0.02. \text{ (Total of 4 points.)}$$

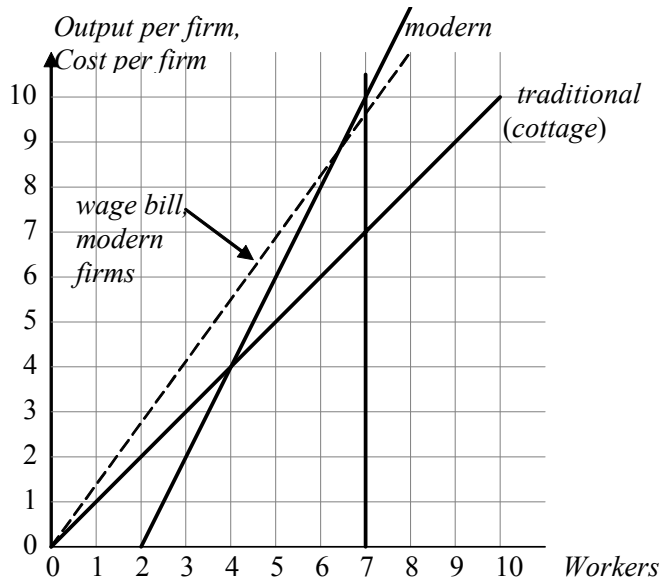
- c) Continue to assume that the conditions described in part (ii) hold. How fast will capital per worker grow when this economy is in steady state, and  $\lambda_L$  is growing at the rate you calculated in part (ii)?  $\Delta k/k = \underline{0.02}$ . (Note that the figure for  $\Delta k/k$  calculated in part (i) may or may not have been a steady state growth rate.)

In the Solow-Swan model with growth in labor efficiency, capital must be growing as fast as the labor input measured in efficiency units,  $\lambda_L L$ . This input grows at the rate  $n + \Delta\lambda_L/\lambda_L = n + \mu$ , where  $n$  is the rate of growth in the labor force. Thus capital per worker is growing at the rate:

$$\Delta k/k = \Delta K/K - \Delta L/L = n + \Delta\lambda_L/\lambda_L - n = \Delta\lambda_L/\lambda_L = \mu = 0.02.$$

(Total of 4 points.)

3. The diagram below depicts the production functions for modern and traditional or “cottage” firms in a developing country. (Refer to the solid, positively-sloped lines.) It also depicts the wage bill faced by modern firms as a function of their employment levels (refer to the dashed line), and the wage bill faced by traditional firms (which coincides with the production function for traditional firms, and is given by the 45° line from the origin.) Finally, you may assume that 7 workers are available per firm so long as all firms use the same production technology, be it modern or traditional.



- a) Briefly explain why the wage bill for modern firms is presumed to exceed the wage bill for a traditional employer at any given level of employment.

Workers must be compensated for the unpleasant environment and/or higher costs of urban living. (Total of 3 points.)

- b) Assume for the moment that all the producers are using traditional production techniques. How many units of output is each one selling? 7 If one of these producers were to switch from traditional to modern production techniques, would she require *more* or *less* labor to produce the same amount of output? less (about 5½ to be precise) Compared to her wage bill before switching, would she end up with a *larger* or *smaller* wage bill after switching? larger (about 7½ to be precise) (Total of 6 points.)

- c) Now assume that all the producers are using modern production techniques. How many units of output is each one selling? 10 If one of these producers were to switch from modern to traditional production techniques, would she require *more* or *less* labor to produce the same amount of output? more Compared to her wage bill before switching, would she end up with a *larger* or *smaller* wage bill after switching? larger (Total of 6 points.)