UNIVERSITY OF CALIFORNIA
DEPARTMENT OF ECONOMICS

Economics 202B
Spring 2007
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Problem Set 3
Due in lecture Thursday, February 8

1. (This is based on Jones, AER, 2002.) Consider the model presented in equations (3.45)-(3.49) of Romer, with the assumption that $G(E) = e^{\phi E}$. Suppose, however, that E, rather than being constant, is increasing steadily: $\dot{E}(t) = m$, where $m > 0$. (Assume that, despite the steady increase in the amount of education people are getting, the growth rate of the number of workers is constant and equal to n, as in the basic model.)

a. With this change in the model, what is the long-run growth rate of output per worker?

b. In the United States over the past century, if we measure E as years of schooling, $\phi \approx 0.1$ and $m \approx 1/15$. Overall growth of output per worker has been about 2 percent per year. In light of your answer to (a), approximately what fraction of this overall growth has been due to increasing education?

c. Can $\dot{E}(t)$ continue to equal $m > 0$ forever? Explain.

2. Romer, Problem 3.18.

3. (A different form of measurement error.) Suppose the true relationship between social infrastructure (SI) and log income per person (y) is $y_i = \alpha + \beta SI_i + \varepsilon_i$. SI and ε are uncorrelated. Unfortunately, there are two components of social infrastructure, SI^A and SI^B (with $SI_i = SI_i^A + SI_i^B$), and we only have data on one of the components, SI^A. Both SI^A and SI^B are uncorrelated with ε. We are considering running an OLS regression of y on a constant and SI^A.

a. Derive an expression of the form, $y_i = \alpha + \beta SI_i^A$ + other stuff.

b. Use your answer to part (a) to determine whether an OLS regression of y on a constant and SI^A will produce an unbiased estimate of the impact of social infrastructure on income if:

i. SI^A and SI^B are uncorrelated.

ii. SI^A and SI^B are positively correlated.

4. Consider a cross-country regression of log output per worker on a measure of social infrastructure,

$$\ln(Y_i/L_i) = a + bSI_i + e_i. \qquad (*)$$

A variable Z is a good instrument for SI if it is correlated with SI and if:

(OVER)

A. It is uncorrelated with the fitted residuals when we estimate (*) by OLS.

B. We know from auxiliary evidence that Z is not affected by social infrastructure,

C. If we regress Z on a constant and SI we obtain a coefficient that is not significantly different from zero, and so we cannot reject the null hypothesis that Z is not affected by SI.

D. (A) or (B).

E. (A) or (C).

F. (B) or (C).

G. None of the above.

EXTRA PROBLEMS (NOT TO BE HANDED IN/ONLY SKETCHES OF ANSWERS WILL BE PROVIDED)

5. Romer, Problem 3.14.

6. Romer, Problem 3.17.

7. Romer, Problem 3.20.

8. The following does NOT contain an important element of rent-seeking:

A. An inventor applies for a patent.

B. A farmer responds to an increase in the price of corn by planting more corn.

C. An airline charges more for a round-trip that does not involve a Saturday-night stay than for a round-trip that does.

D. (A) and (B).

E. (A) and (C).

F. (B) and (C).

G. None of the above (that is, (A), (B), and (C) all contain an important element of rent-seeking).

9. A positive correlation between measured social infrastructure and income per person could arise from:

A. A positive effect of social infrastructure on income per person.

B. A positive effect of income per person on social infrastructure.

C. A third factor that has a positive effect on both social infrastructure and income per person.

D. Measurement error in our measure of social infrastructure that is positively correlated with some other factor that has a positive effect on income per person.

E. (A) and (B).

F. (A), (B), and (C).

G. (A), (B), and (D).

H. All of the above.