Exam 1. Econ520. Spring 2012

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UNC

Instructions:

- Answer all questions.
- Clearly number your answers. Write legibly.
- Do *not* write your answers on the question sheets.
- *Explain* your answers – do not just state them.
- *Show* your derivations – do not just state the final result.
- Do not refer to any notes or books. You may use a calculator.
- The total time is 75 minutes.
- The total number of points is 100.

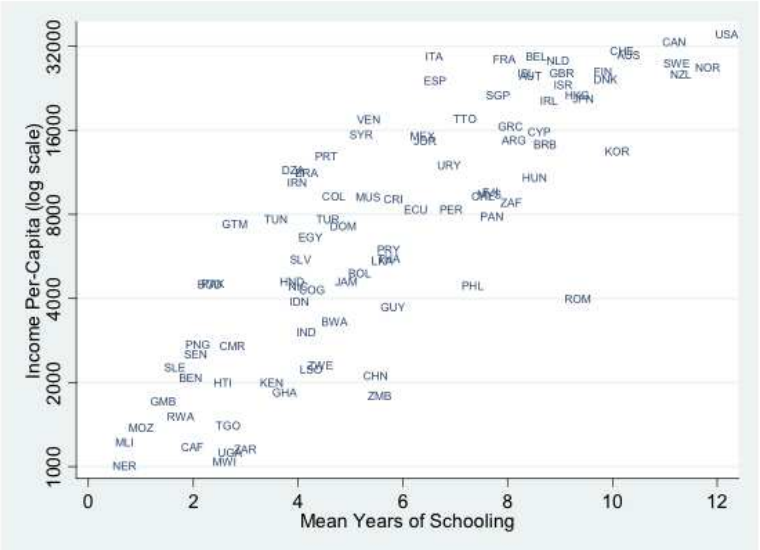

Figure 1: Years of school and per capita GDP
Source: Jones (2011)

1 Cross-country Income Differences

Your answer to the following 2 questions should be focused and avoid excessive detail.

1. [18 points] Figure 1 shows years of schooling and real GDP per capita for a large number of countries.

   (a) What message does the graph convey?

   (b) What conclusions can you draw about the importance of schooling for income differences? Explain.

   (c) In broad strokes, outline how you could could quantify the importance of schooling for cross-country income gaps.

2. [17 points] Outline the "Reversal of Fortune" argument supporting the hypothesis that institutions are important for cross-country income gaps. Figure 2 may help.

2 Solow Model

[20 points] Consider a Solow model that gives rise to the following law of motion for per capita capital:

$$\dot{k}_t = sAk_t^{\alpha} - \delta k_t \tag{1}$$

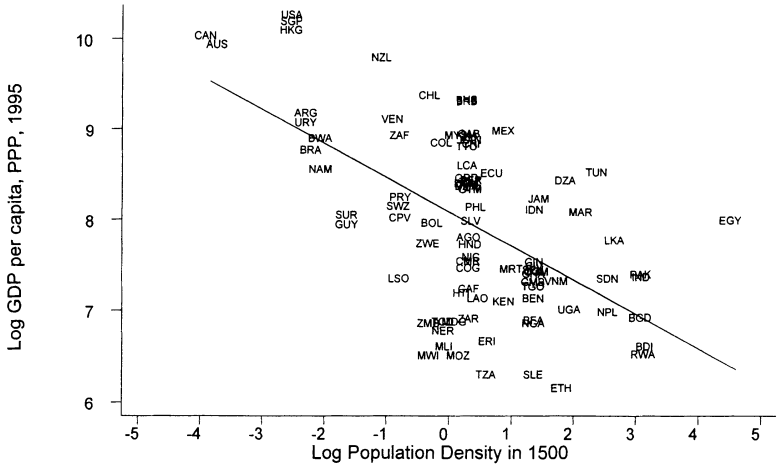

Figure 2: Reversal of Fortune
Source: Acemoglu et al.

Show how a country could sustain a constant, positive growth rate of k_t for an extended period of time by raising its saving rate. Illustrate your answer in a graph that shows $g(k_t)$ against k_t. Explain your graph.

3 Romer Model

Consider the following modified Romer model. The country adopts technologies from a frontier country. Frontier knowledge, A^F, grows exogenously at rate g. Domestic knowledge is acquired by investing labor:

$$\dot{A}_t = \delta s_R L_t (A_t^F - A_t) \tag{2}$$

We assume that the country starts out below the frontier and stays there forever: $A_t < A_t^F$. L_t is constant over time.

1. [10 points] Consider the evolution of the technology gap $x_t = A_t/A_t^F$. Show that
$$g(x_t) = \delta s_R L_t (1/x_t - 1) - g \tag{3}$$
2. [5 points] Consider the balanced growth path. Show that x_t is constant over time.
3. [15 points] Plot $g(x_t)$ against x_t. Show the balanced growth path and discuss whether it is stable.
4. [15 points] Show the effect of a one time, permanent increase in s_R on the time path of $g(x_t)$, starting at the balanced growth path.

End of exam.

4 Answers

4.1 Cross-country Income Differences

1. The figure contains no information about how important schooling might be.

   (a) The graph simply shows that schooling and income are correlated.

   (b) It contains no information about causality. Perhaps income causes schooling. Perhaps a third factor causes both.

   (c) To answer cause-effect questions we need a model. Postulate a production function, such as $Y = AK^{\alpha}(hL)^{1-\alpha}$. Find a way of measuring each country's h (for example using the Mincer approach we discussed in class). In the model, compute how much varying h over the range we see in the data changes Y.

   Another good answer would propose an IV regression.

2. Key points: among colonies, countries that were poor in the 1500s are rich today and have good institutions. Among non-colonies, rich countries are still rich today. The story told by Acemoglu et al.:

   - in poor, low population density colonies: the best option was to settle. Settlers brought institutions that protected citizen's rights.
   - in rich colonies: the best option was to extract resources from native populations (e.g. through forced labor). Settlers imposed institutions that favored the elite over the majority of citizens.
   - for some reason, which we don't fully understand, institutions persist for hundreds of years and still shape incomes today.

4.2 Solow Model

Start by plotting $g(k)$ against k and note that the graph is downward sloping. With a constant saving rate $g(k)$ converges to 0. See Figure 3.

To sustain growth, the saving rate must be raised continuously. That shifts up the sy curve. Of course, at some point s can no longer be raised. Then the growth rate falls to 0.

4.3 Romer Model

1. From the law of motion: $g(A) = \delta s_R L(A^F/A - 1)$. From the growth rate rules: $g(x) = g(A) - g(A^F)$.

2. We need $g(x)$ to be constant over time. This requires that x is constant over time.

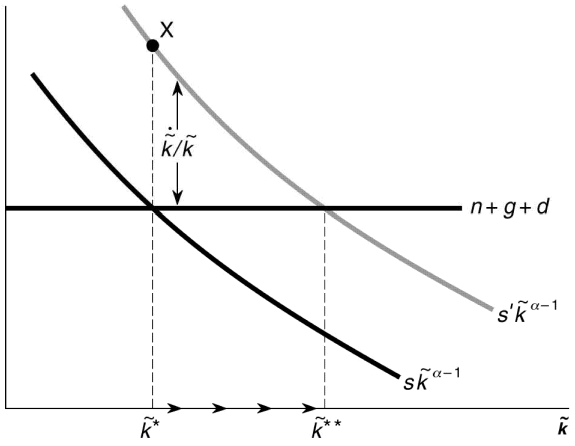

Figure 3: Solow Model

3. See figure 4. The graph is downward sloping because of the $1/x$ term. At $x = 1$ we have $g(x) = -g$, which verifies that the economy never catches up with the frontier. The balanced growth path is stable for the same reasons as in the original Romer model.

4. A one time increase in s_R shifts the $g(x)$ curve up. The path is exactly as in the Romer model: growth is high for some time, but peters out.

End of answers.

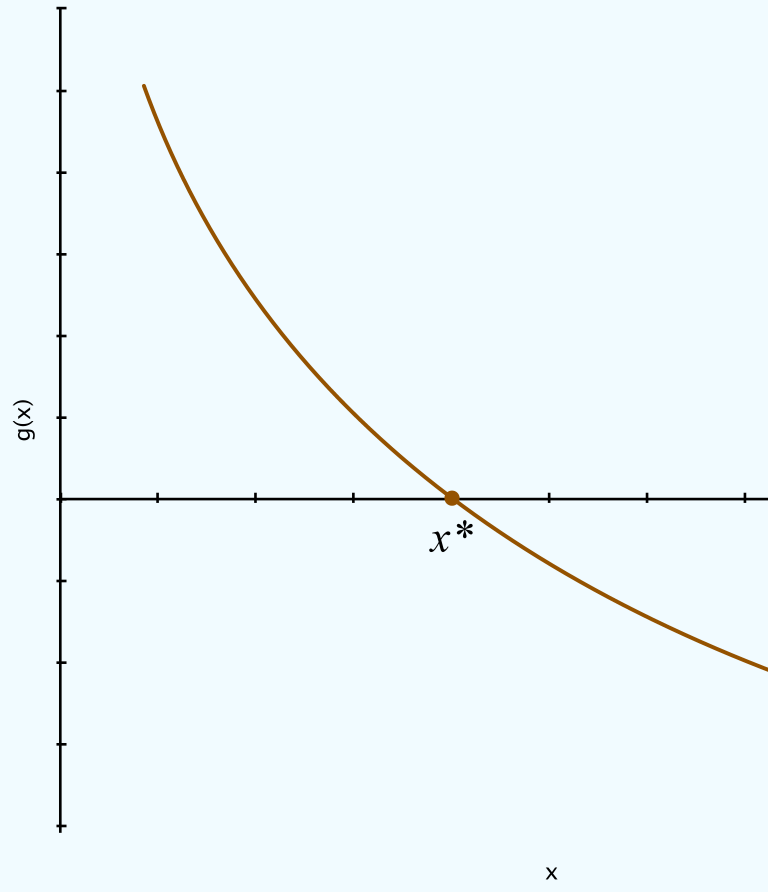

Figure 4: Modified Romer Model