The Solow Growth Model & Long Term Economic Growth
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In lecture, we experimented with altering the Solow Growth model. The following practice problem demonstrates the influence of another experiment. I recommend working through the problem before consulting its solutions. I have prepared the following practice problem based on an examination question from Professor Olivier Morand at the University of Connecticut.

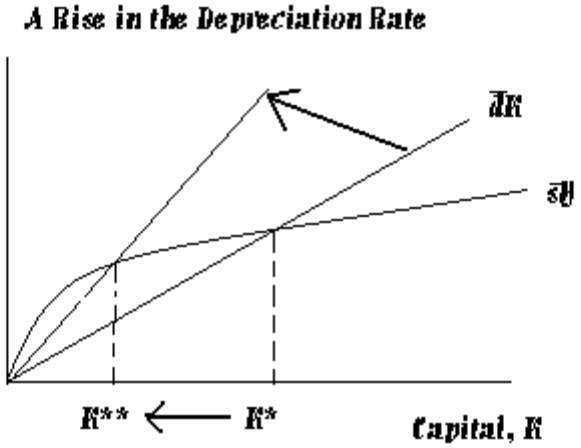
Questions:

In the Solow growth model, suppose that the depreciation rate increases.

1. Determine the effects of this on the per capita capital stock, and on output per capita at the steady state. Explain the economic intuition behind your results.
2. What other variable(s) affect the steady state in the Solow growth model?
3. Does the Solow model of economic growth provide us with a good theory to explain the observed differences in GDP per capita and in rates of growth of GDP per capita between countries? What do you think is missing from this theory?

Solutions:

1. The depreciation rate increases and causes the curve $\bar{d}k_t$ to pivot upward. Graphically, the Solow model is altered in the following manner:



The Steady State is defined as the level of K such that $\bar{s}\bar{A}K^{*1/3}\bar{L}^{2/3} = \bar{d}K^*$. This is the intersection of the two curves on the graph.

Clearly, as depreciation increases and shifts the curve upward, the steady state moves to the left and K* goes down.

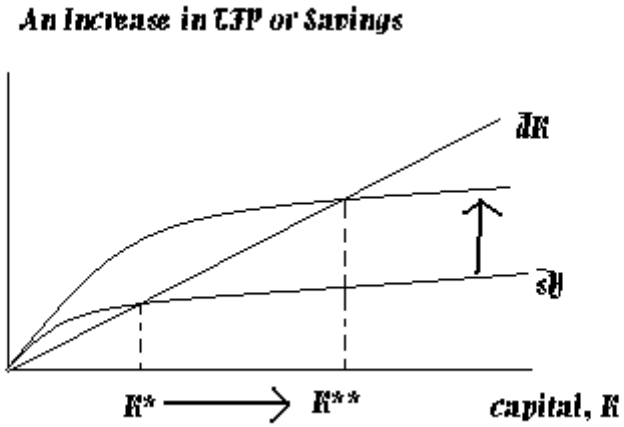
Therefore, the steady state per capita capital stock (k*) goes down. The steady state per capita output (y*) also goes down.

Intuitively, if depreciation increases, the economy as a whole has to spend more resources replacing the depreciated capital, and therefore achieves a lower steady state in the long run.

2. In addition to depreciation which has a negative relationship to the steady state, the following variables affect the steady state in a positive relationship: $\overline{A}, \overline{s}$.

Both of these variables shift the other curve in the model. An increase in $\overline{A}$ will cause k* and y* to increase. An increase in $\overline{s}$ will cause k* and y* to increase. See the following graph for the intuition.

Note that a change in K does not shift the steady state's outcome, but rather will only cause movement along the curve. Note that $\overline{L}$ will have consequences on the steady state, but I suggest you calculate the influence yourself to see its consequences (positive, negative, or uncertain) on y* and k*.



Also note that depreciation is negatively related to y* and k*, while TFP and savings are positively related to y* and k*.

3. Yes, it is a good theory to <u>begin</u> explaining these differences. An implication of the Solow growth model is the conditional convergence hypothesis, which states that "countries with similar $\overline{A}, \overline{s}, \overline{d}, \overline{L}$ will converge to the same steady state, and the poorest among this group will grow faster than the richest." That hypothesis is verified in some of the data.

However, there are many things left unexplained including, but not limited to, the following:

- The role of population growth, trade, and institutions
- The role of the quality of the labor force (human capital)
- The role of changes in TFP, technological progress
- The role of innovation, ideas, research and development.