Solutions: EC1010 Tutorial Questions 1-4

February 19, 2010

Problem Set 1

1. Because prices are constant, both nominal and real GDP growth will be the same. Here, changes in both nominal and real GDP represent changes in production, not prices. Because prices are constant, the CPI will also be constant.

2. 1.) Real GDP uses constant prices. The rise in real GDP indicates that production rose. So if nominal GDP (i.e., production valued at *current* prices) fell, prices must have fallen i.e., deflation.

   2.) The economists are referring to the fact that the increase in GDP mainly reflects inventory investment. Because this does not reflect actual sales, it is not necessarily a good indicator of economic recovery.

3. a.) According to the graph, real GDP (and hence production) grew by around 58 percent.

   b.) Not necessarily: we don't know what happened GDP per capita, our measure of standard of living. To ascertain this, we'd have to know population trends.

   c.) Recall that GNP is the value of production attributable to domestic residents, no matter where they are. GNP would have been higher than GDP (foreign profits would be added to GDP to get GNP.)

   d.) Potential output was rising faster than real GDP.

4. Potential output would have fallen. Because of the destruction of capital stock, labour supply and technology, the productive capacity of the country would fall.

5. No. If both exports and imports are the same and large, then the economy would in fact be quite globalized, yet the current account would still be zero.

6. $Y = C - M = 50 - 50 = 0$. Because the country is not producing anything (and just importing to finance consumption) this situation is unsustainable over the long run.

7. Nominal GDP rises by 70. Incomes rise by 70. The forester's contribution (or "value added") is 50; the carpenter's is 20. The sum of "valued addeds" across the economy—another way of calculating GDP—is also 70.

8. It is real GDP. Namely, this reflects both wealth and population; really, we need both to generate lots of good athletes. A higher population gives a greater chance of getting a great athlete.

9. Because $G = X - M = 0$ and $Y = Y_n$, we have $Y_n = C + I$. Hence is C rises, I must fall. If Y_n rose, then both C *and* I would rise.

Problem Set 2

1. Using the $\frac{70}{g}$ rule, the doubling time is approximately $\frac{70}{7.2} = 9.7 \approx 10$ years.

2. From the $S = I$ formula, the economy with the lowest national savings has the lowest level of investment.

3. The important point here is that a minimum wage is designed to preserve a certain standard of living. As such, what matters is the *real* value of the nominal minimum wage. And because Ireland is experiencing deflation, the real value of the current minimum wage (of 8.65 euros) has risen above its previous value. As a result, it has risen to a level that presumably is above what's needed to preserve a basic standard of living. For this reason, the nominal value of the minimum wage can be reduced without entailing a reduction in living standards for those on the minimum wage.

4. (a) If everyone worked longer hours, then output would increase although K and L (i.e., the number of bodies) remains the same. The way to represent this is by an increase in A. Because the number of hours in a day is finite, longer hours will not generate sustained growth in Y.

   (b) By preventing firms from becoming more efficient, this law would reduce A.

   (c) If the economy spends more resources on research, then A would rise (assuming that research is productive and leads to more innovations.)

5. To generate a doubling of Y when $Y = AK^{\frac{1}{2}}L^{\frac{1}{2}}$, then K must increase fourfold. To see this, note that when there is four times as much capital, $Y = A(4K)^{\frac{1}{2}}L^{\frac{1}{2}} = 2AK^{\frac{1}{2}}L^{\frac{1}{2}} = 2Y$. With the production function $Y = AK$, then K must double. Idea is, diminishing returns to capital are more severe with the former production function. (There are no diminishing returns to capital with the latter function.) Because the usefulness of an input is mediated by its exponent, capital is more useful with the $Y = AK$ function.

6. If there's positive real GDP growth, then this must come from either (or a combination of) TFP, capital, and labour growth. If TFP growth is sufficiently large, we can have positive GDP growth together with falling capital and labour growth.

7. See Figure 1. The growth rate of Y in steady state is zero. And because L is constant by assumption, the growth rate of income per capita is also zero.

8. When the economy is in steady state, there is no further growth in K. Hence $\Delta K_t = sY_t - \delta K_t = 0 \Rightarrow \frac{K}{Y} = \frac{s}{\delta}$.

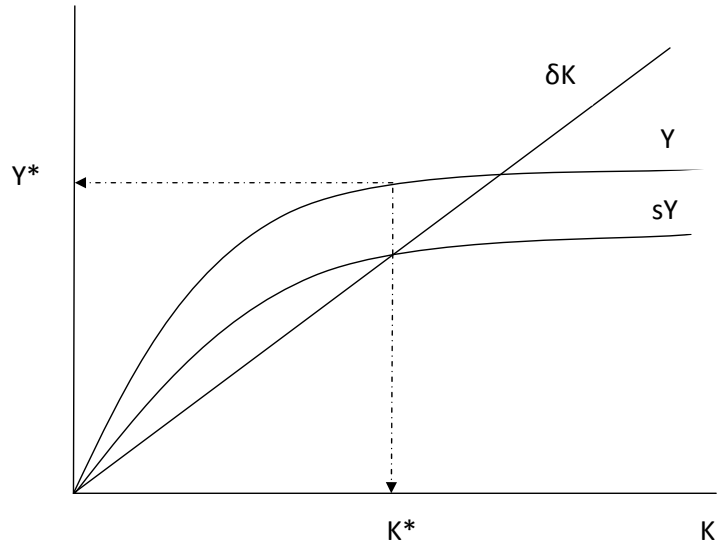

Figure 1: Steady State in Solow Model

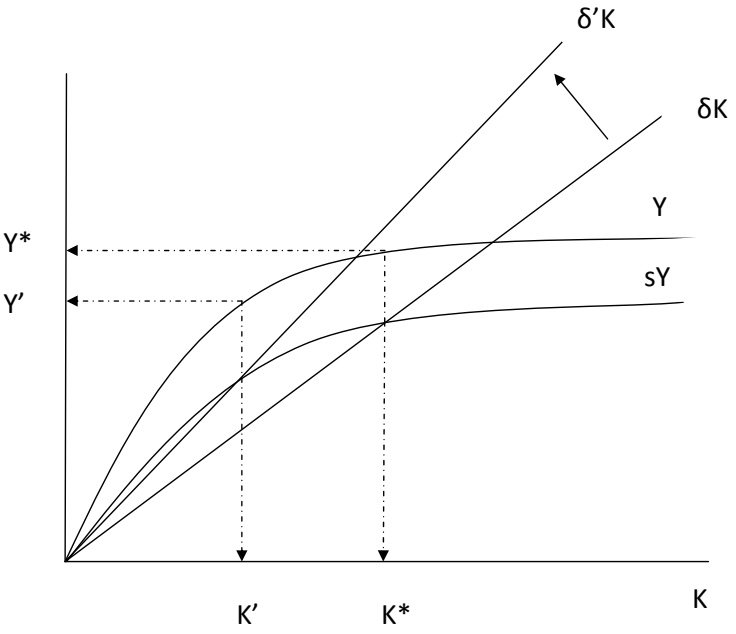

Figure 2: An Increase in Depreciation from δ to δ' in the Solow Model.

1 Problem Set 3

1. Most income differences across countries are attributable to differences in TFP.

2. Because C is below its steady state, K is growing at a positive rate. From the production function, $Y = AK^{\alpha}L^{1-\alpha}$, and so Y is also growing in C. (By contrast, in country A the capital stock is falling, while in B, there is no change in the capital stock.)

3. Because A is further below its steady state, its capital stock is growing fastest. As a result, Y in country A is also growing fastest. Because L is fixed (by assumption), the standard of living, $\frac{Y}{L}$, in country A is also growing fastest.

   If we did not know they had the same steady states, we would not be able to make any inferences about rates of growth. For instance, country A could also have a low steady state, in which case little if any growth would be forthcoming.

4. See Figure 3

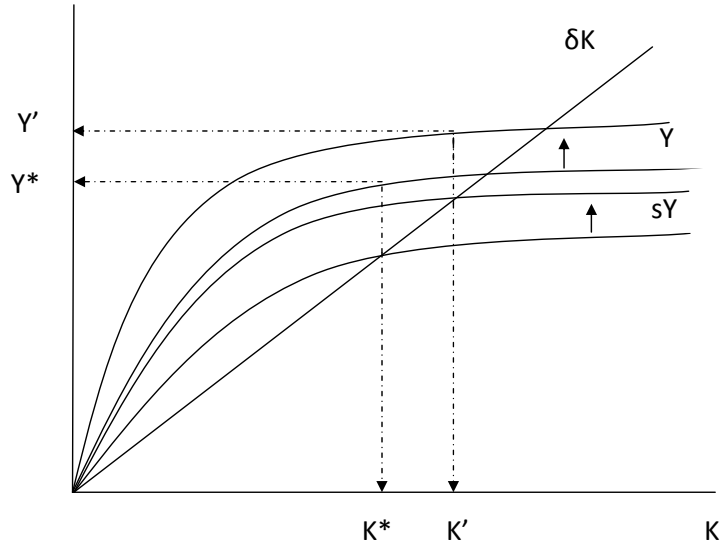

Figure 3: For both reasons, A would rise, causing an increase in the standard of living, $\frac{Y}{L}$.

5. See Figure 4.

6. Because China has good "fundamentals" (i.e., high s and A) and since it is currently relatively poor, it is growing rapidly towards its new steady state. According to the theory, the growth rate depends on the distance between where a country currently is and where it is going. This gap is large in China.

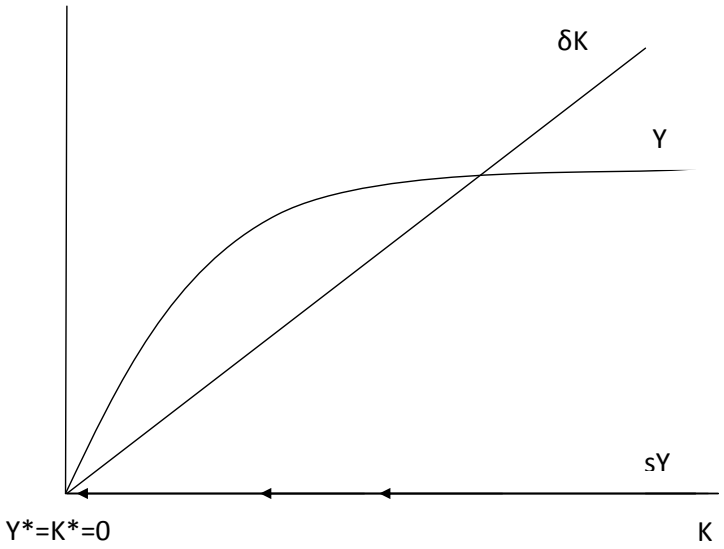

Figure 4: Both the capital stock and output fall to zero, which is the new steady state. Because $Y = 0$, the standard of living, $\frac{Y}{L}$, is also zero in steady state.

7. As the capital stock in China rises, the distance between where it is and its steady state falls. As a result, the growth rate of K will fall, leading to attendant falls in the growth rates of Y, and $\frac{Y}{L}$. (Note that I assume L is constant.)

8. Japan got closer to its steady state, causing the growth of K, Y, and $\frac{Y}{L}$ to fall.

9. No it doesn't, since its fundamentals (i.e., level of s and A) are low. For this reason, the distance between its current level of K and its steady state value is likely low (or indeed zero), leading to little, if any, growth. Formally, there is no reason to expect "catch-up" or conditional convergence.

Problem Set 4

(a) i.) Because developed economies rely primarily on TFP growth to sustain rising living standards, this could have caused a decline in the rate of growth of living standards across developed economies. Because poor countries (below steady state) rely primarily on capital accumulation to drive growth, this development would not have had such an effect on the rate of increase of living standards.

ii.) In contrast to manufacturing, it is relatively hard to achieve productivity improvements in the services sector. Think of education or health care.

(b) Because $g_K = g_Y$ and $g_L = 0$, we have $g_Y = g_A + \frac{1}{3}g_K + \frac{2}{3}g_L = g_A + \frac{1}{3}g_Y$. Multiplying across by 3 implies that $g_Y = \frac{3}{2}g_A$.

(c) $r = i - \pi = 5 - 3 = 2$ percent.

(d) $r = i - \pi = 4 - (-1) = 5$ percent. Deflation (i.e., negative inflation) raises real interest rates. Intuitively, falling prices means you can now buy more goods with the money you get back from the investment. In other words, the real return—i.e., the return in terms of goods—rises.

(e) Because the lender seeks a real returns of 4 percent, we must solve the equation, $4 = i - \pi = i - 11$. This implies $i = 15$ percent. This way, the real return will be $i - \pi = 15 - 11 = 4$, as required. However, if inflation is unexpectedly high—say 20 percent—the lenders real return will be $r = i - \pi = 15 - 20 = -5$; that is, the lender will receive a return below 4 percent. In reality, those involved in making financial contracts must pay a lot of attention to inflation forecasts. (Historically, a lot of savers have been "caught out" by unexpectedly high inflation, causing them to make real losses on their savings. In other words, the purchasing power of what they got back was *less* the the purchasing power of what the lent out.)

(f) In equilibrium, we have $S(r) = I(r)$, which implies that $\alpha + \beta r = \gamma + \zeta r$. Solving this gives the market-clearing real interest rate, $r = \frac{\alpha - \gamma}{\zeta - \beta}$. Because savings depends positively on the real interest rate, $\beta > 0$; and since investment depends inversely on the real interest rate $\zeta < 0$. If both saving and investment double, the market-clearing condition becomes $2S(r) = 2I(r)$, and this has the same solution as the initial problem. Intuitively, because both demand for funds and supply of funds doubles, there is no extra pressure on the real interest rate; as a result, it remains the same.

(g) i.) See Figure 5. We start off at point a, the initial equilibrium. When investment demand falls, the demand curve shifts and investment demand is now at point b. At this point, saving (which is still at point a) exceeds investment, and so there is downward pressure on the price of loanable funds. At this point, there is a surplus of savings, which puts downward pressure on price (here the real interest rate.) Intuitively, savers are "offering" their funds for cheaper rates to

entice investors to borrow. As the interest rate falls, two things happen. First, some savers decide to leave the market, so savings fall as we move from a to c. Second, as the interest rate falls, investment demand rises as we move from b to c. Intuitively, the fall in interest rates is enticing people to make more investment projects, thereby raising investment demand. Ultimately, we end up a c where the interest rate is lower and both savings and investment are lower; at this point of equilibrium, investment demand equals savings supply. The *actual* fall in investment is lower than the fall in investment *demand* (the length of the dotted line, or horizonal shift in investment curve.) This is because some investors were attracted to the market by the falling interest rates, and this offsets some of the initial fall in investment demand.

ii.) See Figure 6. In this case, the savings curve is steeper. If savings were less responsive to changes in interest rates, savings would not fall as sharply as we moved from point a to point c. As a result, the level of savings will be higher in the new equilibrium. Moreover, the interest rate now falls more, inducing more investment than before. As a result, both savings and investment are higher in equilibrium, while the interest rate is lower. But why does the interest rate now fall more? When investment demand falls, savings don't change much, since they are relatively insensitive to changes in interest rates. For this reason, we get a situation where investment demand—i.e., demand for funds—has fallen a lot, but savings—the supply of funds—don't change much. To clear the loanable funds market, therefore, the price—the interest rate—must fall a lot to lure investors back to the market to borrow funds from the stubborn savers.

iii.) Since the economy is always at potential, we always have $Y = C + I$, where Y denotes potential output. Because investment I falls in the new equilibrium, consumption C must therefore rise.

(h) See Figure 7. More uncertainty about the future would cause a rise in precautionary savings. A lower budget deficit would cause a rise in public savings. Overall, the savings curve would shift outwards twice, and national savings would rise. The rise in investment demand would shift the investment curve out. Whether the real interest rate in the new equilibrium is higher or lower than before depends on the magnitudes of the shifts in the curves. For example, if investment demand increased a lot, real interest rates could in fact be higher in the new equilibrium.

(i) This could occur if 1) investment demand fell 2) government savings rose or 3) private savings rose. (With an open economy, it could be due to a rise in capital inflows/international savings.)

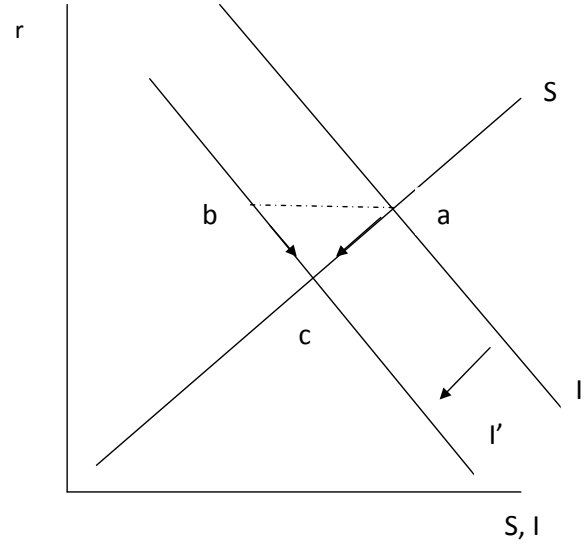

Figure 5: A Fall in Investment Demand

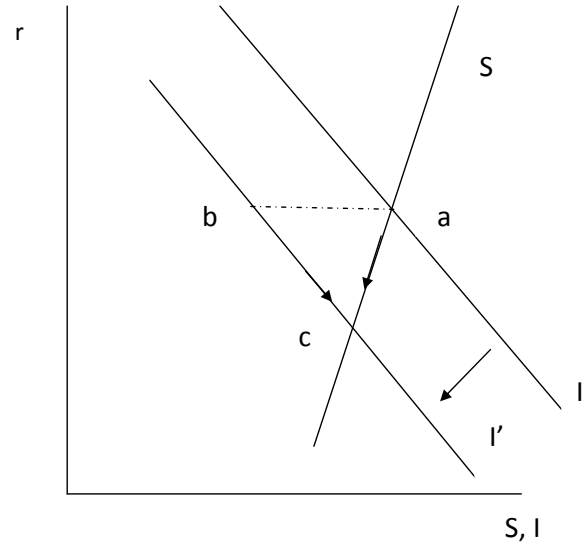

Figure 6: Less Elastic Savings Response.

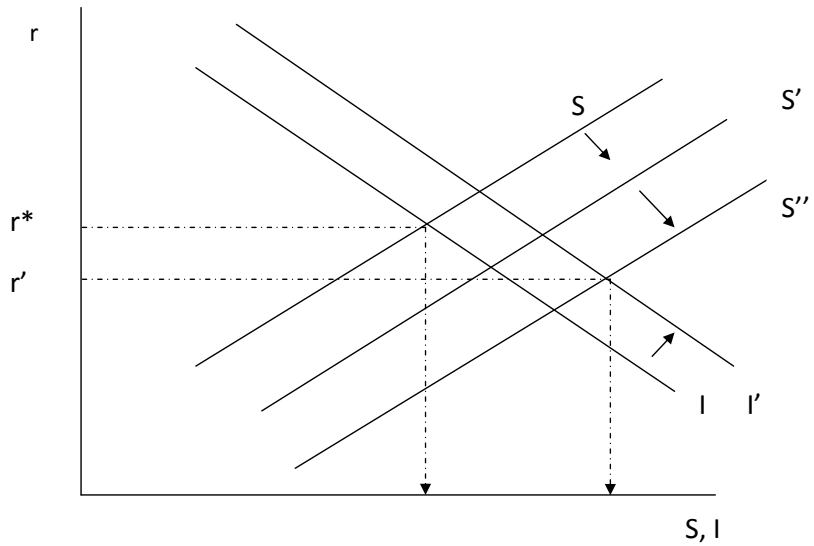

Figure 7: Rise in Private and Government Savings and Rise in Investment demand. Ultimately, the real interest rate changes falls from r^* to r'.