Economic 100B
Macroeconomic Analysis
Professor Steven Wood
Spring 2007
Exam #1 ANSWERS

Please sign the following oath:

The answers on this test are entirely my own work. I neither gave nor received any aid while taking this test. I will not discuss the questions on this test until after 3:30 p.m. on February 15, 2007.

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Signature

Any test turned in without a signature indicating that you have taken this oath will be assigned a grade of zero.

Graph Instructions

When drawing diagrams, the following rules apply:

a. Completely, clearly and accurately label all axis, lines, curves, and equilibrium points.

b. The original diagram and equilibrium points MUST be drawn in black or pencil.

c. The first shift of any line(s) and the new equilibrium points MUST be drawn in red.

d. The second shift of any line(s) and new equilibrium points MUST be drawn in blue

e. The third shift of any line(s) and new equilibrium points MUST be drawn in green.

Do NOT open this test until instructed to do so.

Good Luck!
A. **Multiple Choice Questions.** Mark the letter corresponding to the best answer in the corresponding space at the bottom of the page. (3 points each; total of 30 points.)

1. Robert Fogel, a Nobel Laureate, has argued that better health or a higher level of nutrition of workers is important in generating higher standards of living. In the Solow model, we would represent such a change as:

   a. A one time rise in N because this effectively leads to more workers.
   b. A rise in labor force growth, n-dot.
   c. **A rise in technology, A.**
   d. Slower rates of decreasing returns to capital accumulation because workers are healthier.
   e. Higher depreciation rates, δ, because there are now more people working.

2. According to the Solow model, all of these statements about the steady state standard of living are true EXCEPT:

   a. **It depends on how poor the country was (relative to other countries) in the past, say a hundred years ago.**
   b. It is higher if the level of “human capital” or job skills of the economy is higher.
   c. It is independent of the population of the economy.
   d. Without technological progress, it does not change.
   e. Its rate of growth is independent of the savings rate.

3. In microeconomic theory, the average wage rate depends positively on the level of capital per worker. Given this fact, what will happen to the wage rate in an economy, according to the Solow model, if technology, A, increases?

   a. It will not change because only A has changed.
   b. **It will rise because a rise in A induces a rise in capital per worker.**
   c. It will fall because there are now more people working.
   d. It will rise at first but subsequently return to the initial level in the new steady state.
   e. It will initially fall because people will now work longer hours, increasing labor supply and depressing the wage again.

4. According to the “Lucas Growth Model,” the rate of growth of output per worker in the steady state is equal to the share of time spent accumulating knowledge. All of the following statements about this model are true EXCEPT:

   a. It is similar to New Growth Theory because growth in the steady state is now an endogenous variable.
   b. It is similar to New Growth Theory because it places emphasis on knowledge accumulation and activities such as research and development.
   c. **It is similar to the basic Solow model because it gives policymakers a way to increase the standard of living once an economy reaches its steady state.**
   d. It is different from the basic Solow model because it embraces the concept of “knowledge” explicitly and the time spent accumulating it.
   e. There is no conditional convergence with this model.

5. Suppose the production function is given by Y=AL. Then, according to the growth accounting formula, labor’s share is now:

   a. 0.3
   b. 0.5
   c. 0.7
   d. **1.0**
   e. None of the above.
6. All of the following statements about the velocity of money are true EXCEPT:
   a. The quantity theory of money assumes a constant velocity.
   b. If M and P are constant, a rise in velocity raises real GDP.
   c. If M is constant a fall in velocity lowers nominal GDP.
   d. If velocity growth increases by 1%, then, all else constant, inflation will increase by 1%.
   e. The equation of exchange assumes a constant velocity.

7. People tend to save very little when they retire. Over the next few decades, a large portion of the baby boom population in the US will retire. If the rate of investment and the government budget balance remain constant, then:
   a. The current account balance will rise.
   b. The current account balance will fall.
   c. This should have no effect on the current account balance.
   d. Net exports will rise.
   e. There will be no change in net exports.

8. According to real business cycle theory, a permanent increase in taxation (which is spent by the government but not on investment) induces people to work harder and so increases productivity. In the Solow model, such a change would lead ultimately to:
   a. A higher standard of living.
   b. A lower standard of living.
   c. An indeterminate effect on the standard of living.
   d. A higher saving rate.
   e. A lower saving rate.

9. Suppose that, for some reason, the economy becomes less efficient at investment. That is, for any given amount of investment expenditure, we now get less investment. In the Solow model, we could best represent this as:
   a. A sudden fall in K.
   b. A sudden rise in K.
   c. A fall in the saving rate.
   d. A rise in the saving rate.
   e. A fall in the rate of depreciation.

10. Bangladesh today has the same standard of living as the US had in 1836 and it is not growing. Using this information, which of the following statement is true regarding Bangladesh:
    a. It will soon experience faster growth because the convergence hypothesis dictates that poorer countries grow faster than rich countries.
    b. An increase in money growth would raise the standard of living.
    c. Conditional convergence suggests it will soon experience “catch-up” growth.
    d. Currently there is no reason to expect Bangladesh’s standard of living to grow in the future.
    e. The standard of living in Bangladesh will deteriorate, since it is caught in a “poverty trap.”
B. Solow Growth Model Problems. Answer BOTH of the following questions in the space below.

1. In the country of Akinback, income-per-worker is rising. Suddenly, a highly contagious disease kills one quarter of the workers between the ages of 25 and 35 years. Workers of other ages are not affected by the disease. The disease then disappears. Depreciation rates were not affected. However, in Akinback, job skills and saving rates rise with age. (35 points.)

   a. Based only on this information, use Solow Growth Model diagram to accurately and clearly show:

      i. Akinback’s initial economic situation,

      ii. What effects the disease had on Akinback’s capital-to-labor ratio and level of income-per-worker, and

      iii. Akinback’s initial and final steady states.
b. Provide a brief economic explanation of the changes you showed in your diagram above as well as any adjustment process that occurs during the transition period from Akinback’s initial situation to its final steady state. Be sure to discuss what happens to the level of income-per-worker and to the rate of economic growth during both the transition period and at the long-run equilibriums.

Akinback’s initial steady state is at “A” with a capital-to-labor ratio of \((K/N)_A\) and income-per-worker of \((Y/N)_A\). At this steady state, the economy’s long-run equilibrium growth rate would be the same as its labor force growth rate, i.e. \(\dot{y} = \dot{n}\).

However, because we are told that Akinback’s income-per-worker level is rising we know that economic growth is greater than labor force growth, i.e., \(\dot{y} > \dot{n}\). This means that Akinback’s actual position is below its steady state at “A”. The capital-to-labor ratio is \((K/N)_0 < (K/N)_A\) and income-per-worker is \((Y/N)_0 < (Y/N)_A\).

Three things then happen.

First, the disease kills one quarter of the workers between the ages of 25 and 35 years. This immediately reduces the size of the labor force, \(N\). As a result, the capital-to-labor ratio rise to \((K/N)_1\). [Depending on how large a proportion the workers who are 25 to 35 years old are to the total labor force, it is possible that \((K/N)_1 > (K/N)_A\).]

Second, these deaths increase the average age of the work force. Because job skills rise with age in Akinback, productivity also increases. This is represented by an increase in the level of technology, \(A\), and shifts both the production function and the saving function up.

Third, because these deaths increase the average age of the work force and saving rates also increase with age in Akinback, the economy’s saving rate, \(v\), increases. This shifts the saving function up again.

The result of these last two factors is to create a new, higher steady state at “B”.

However, the economy is actually at \((K/N)_1\). At this capital-to-labor ratio, actual investment is greater than balanced investment, i.e., \(I_a/N > I_b/N\), because of the increase in saving due to higher income-per-worker due to increased productivity and because of the increase in the saving rate, \(v\), due to higher personal saving rates. This means that more actual investment is taking place than is necessary in order to keep the capital-to-labor ratio constant at \((K/N)_1\). As a result the capital-to-labor ratio will increase. It will continue to rise until it reaches \((K/N)_B\) and the new, higher steady state at “B” is reached.

During the transition period from \((K/N)_1\) to \((K/N)_B\), the capital-to-labor ratio is rising. Consequently, the growth rate of the capital stock exceeds the labor force growth rate, i.e., \(\dot{k} > \dot{n}\). Because the capital-to-labor ratio is rising so is income-per-worker. As a result, economic growth exceeds labor force growth, i.e., \(\dot{y} > \dot{n}\). This will continue until the new, lower steady state at “B” is reached.

Once the new, higher steady state at “B” is reached, the capital-to-labor ratio will become constant because actual investment will equal balanced investment. As a result, the rate of growth of the capital stock will equal the growth rate of the labor force, i.e., \(\dot{k} = \dot{n}\). In addition, because the capital-to-labor ratio is constant, income-per-worker will also be constant. As a result, the economy’s long-run equilibrium growth rate will equal its labor force growth, i.e., \(\dot{y} = \dot{n}\).
2. Because income-per-worker has been falling, Hugo Chavez, the President of Venezuela, is threatening to nationalize key sectors of the economy in order to create a “workers paradise.” He has also pledged a major increase in government spending in order to subsidize food, fuel, and housing for the poor. He plans on paying for this increase in government spending by exporting more oil, Venezuela’s main product. (35 points.)

   a. Based only on this information and assuming—as most economists do—that government enterprises are less efficient than private sector business firms, use a Solow Growth Model diagram to accurately and clearly show:

      i. Venezuela’s initial economic situation,

      ii. The effect of these policies on Venezuela’s capital-to-labor ratio and level of income-per-worker, and

      iii. Venezuela’s initial and final steady states.
b. Provide a brief economic explanation of the changes you showed in your diagram above as well as any adjustment process that occurs during the transition period from Venezuela’s initial situation to its final steady state. Be sure to discuss what happens to the level of income-per-worker and to the rate of economic growth during both the transition period and at the long-run equilibriums.

Venezuela’s initial steady state is at “A” with a capital-to-labor ratio of (K/N)A and income-per-worker of (Y/N)A. At this steady state, the economy’s long-run equilibrium growth rate would be the same as its labor force growth rate, i.e., y-dot = n-dot.

However, because we are told that Venezuela’s income-per-worker level is falling we know that economic growth is less than labor force growth, i.e., y-dot < n-dot. This means that Venezuela’s actual situation is above its steady state at “A”. The capital-to-labor ratio is (K/N)0 > (K/N)A and income-per-worker is (Y/N)0 > (Y/N)A.

Three things then happen.

First, the nationalization of key sectors of the economy causes the economy to become less efficient (by assumption). This is represented by a reduction in technology, A, and shifts both the production function and the saving function lower.

Second, the increase in government spending to subsidize food, fuel, and housing for the poor reduces government savings. This reduces the nation’s saving rate, v, and shifts the saving function even lower.

Third, the increase in exports reduces foreign savings (either lower net foreign borrowing or higher net foreign lending). This reduces the nation’s saving rate, v, and shifts the saving function even lower.

The combination of these three events creates a new, lower steady state at “B”.

However, the economy is actually at (K/N)0. At this capital-to-labor ratio, actual investment is below balanced investment, i.e., Ia/N < Ib/N, because the decrease in saving due to lower income-per-worker from being less efficient and because of the declines in the saving rate, v, because of higher government spending and higher exports. This means that not enough actual investment is taking place to keep the capital-to-labor ratio constant at (K/N)0. As a result, the capital-to-labor ratio will fall. It will continue to decline until it reaches (K/N)B and the new, lower steady state at “B” is reached.

During the transition period from (K/N)0 to (K/N)B, the capital-to-labor ratio is falling. Consequently, the rate of growth of the capital stock will be less than labor force growth, i.e., k-dot < n-dot. Because the production function has shifted down and because the capital-to-labor ratio is declining, income-per-worker will also be declining. As a result, economic growth will be less than labor force growth, i.e. y-dot < n-dot. This will continue until the new, lower steady state at “B” is reached.

Once the new, lower steady state at “B” is reached, the capital-to-labor ratio will become constant because actual investment will equal balanced investment. As a result, the rate of growth of the capital stock will equal labor force growth, i.e., k-dot = n-dot. In addition, because the capital-to-labor ratio is constant, income-per-worker will also be constant. As a result, the economy’s long-run equilibrium growth rate will be equal its labor force growth, i.e., y-dot = n-dot.