**Economics 102**

**Summer 2013**

**Answers to Homework #4**

**Due July 16, 2013**

**Directions:** The homework will be collected in a box **before** the lecture. Please place your name, TA name and section number on top of the homework (legibly). Make sure you write your name as it appears on your ID so that you can receive the correct grade. Please remember the section number for the section **you are registered,** because you will need that number when you submit exams and homework. Late homework will not be accepted so make plans ahead of time. **Please show your work.** Good luck!

Please remember to

* Staple your homework before submitting it.
* Do work that is at a professional level: you are creating your “brand” when you submit this homework!
* Not submit messy, illegible, sloppy work.

1. Consider the aggregate production function for Xia:

Y = 20K1/2L1/2

where Y is real GDP, K is units of capital, and L is units of labor. Labor and capital are the only inputs used in Xia to produce real GDP. Initially K is equal to 100 units. Use this information and Excel to answer this set of questions.

a. Fill in the following table (you will need to expand it from the truncated form provided here). Round all your answers to the nearest hundredth.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| L | K | Y | Marginal Product of Labor (MPl) | Labor Productivity (Y/L) |
| 0 | 100 |  | --- | --- |
| 1 | 100 |  |  |  |
| 2 | 100 |  |  |  |
| . | . |  |  |  |
| . | . |  |  |  |
| . | . |  |  |  |
| 100 | 100 |  |  |  |

b. Use Excel to graph the relationship between L and Y: measure L on the horizontal axis and Y on the vertical axis.

c. Describe verbally what happens to the marginal product of labor as the level of labor usage increases in Xia. Explain the intuition for this change in the marginal product of labor.

d. As labor increases, what happens to labor productivity? Explain why labor productivity exhibits this pattern.

e. Suppose the amount of capital in Xia increases to 225 units due to the enactment of legislation by the government that encourages investment spending. In words describe how this change in capital will cause the aggregate production function to change.

f. Given the change in capital described in (e), fill in the following table (you will need to expand it from the truncated form provided here).

|  |  |  |
| --- | --- | --- |
| L’ | K’ | Y’ |
| 0 | 225 |  |
| 1 | 225 |  |
| 2 | 225 |  |
| . | . |  |
| . | . |  |
| . | . |  |
| 100 | 225 |  |

g. Use Excel to graph the original aggregate production function and the new aggregate production function in a graph with L on the horizontal axis and Y on the vertical axis. Does the graph support your prediction in (e)?

Answers:

a.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| L | K | Y | MPl | Y/L |
| 0 | 100 | 0.00 |  |  |
| 1 | 100 | 200.00 | 200.00 | 200.00 |
| 2 | 100 | 282.84 | 82.84 | 141.42 |
| 3 | 100 | 346.41 | 63.57 | 115.47 |
| 4 | 100 | 400.00 | 53.59 | 100.00 |
| 5 | 100 | 447.21 | 47.21 | 89.44 |
| 6 | 100 | 489.90 | 42.68 | 81.65 |
| 7 | 100 | 529.15 | 39.25 | 75.59 |
| 8 | 100 | 565.69 | 36.54 | 70.71 |
| 9 | 100 | 600.00 | 34.31 | 66.67 |
| 10 | 100 | 632.46 | 32.46 | 63.25 |
| 11 | 100 | 663.32 | 30.87 | 60.30 |
| 12 | 100 | 692.82 | 29.50 | 57.74 |
| 13 | 100 | 721.11 | 28.29 | 55.47 |
| 14 | 100 | 748.33 | 27.22 | 53.45 |
| 15 | 100 | 774.60 | 26.27 | 51.64 |
| 16 | 100 | 800.00 | 25.40 | 50.00 |
| 17 | 100 | 824.62 | 24.62 | 48.51 |
| 18 | 100 | 848.53 | 23.91 | 47.14 |
| 19 | 100 | 871.78 | 23.25 | 45.88 |
| 20 | 100 | 894.43 | 22.65 | 44.72 |
| 21 | 100 | 916.52 | 22.09 | 43.64 |
| 22 | 100 | 938.08 | 21.57 | 42.64 |
| 23 | 100 | 959.17 | 21.08 | 41.70 |
| 24 | 100 | 979.80 | 20.63 | 40.82 |
| 25 | 100 | 1000.00 | 20.20 | 40.00 |
| 26 | 100 | 1019.80 | 19.80 | 39.22 |
| 27 | 100 | 1039.23 | 19.43 | 38.49 |
| 28 | 100 | 1058.30 | 19.07 | 37.80 |
| 29 | 100 | 1077.03 | 18.73 | 37.14 |
| 30 | 100 | 1095.45 | 18.41 | 36.51 |
| 31 | 100 | 1113.55 | 18.11 | 35.92 |
| 32 | 100 | 1131.37 | 17.82 | 35.36 |
| 33 | 100 | 1148.91 | 17.54 | 34.82 |
| 34 | 100 | 1166.19 | 17.28 | 34.30 |
| 35 | 100 | 1183.22 | 17.03 | 33.81 |
| 36 | 100 | 1200.00 | 16.78 | 33.33 |
| 37 | 100 | 1216.55 | 16.55 | 32.88 |
| 38 | 100 | 1232.88 | 16.33 | 32.44 |
| 39 | 100 | 1249.00 | 16.12 | 32.03 |
| 40 | 100 | 1264.91 | 15.91 | 31.62 |
| 41 | 100 | 1280.62 | 15.71 | 31.23 |
| 42 | 100 | 1296.15 | 15.52 | 30.86 |
| 43 | 100 | 1311.49 | 15.34 | 30.50 |
| 44 | 100 | 1326.65 | 15.16 | 30.15 |
| 45 | 100 | 1341.64 | 14.99 | 29.81 |
| 46 | 100 | 1356.47 | 14.83 | 29.49 |
| 47 | 100 | 1371.13 | 14.66 | 29.17 |
| 48 | 100 | 1385.64 | 14.51 | 28.87 |
| 49 | 100 | 1400.00 | 14.36 | 28.57 |
| 50 | 100 | 1414.21 | 14.21 | 28.28 |
| 51 | 100 | 1428.29 | 14.07 | 28.01 |
| 52 | 100 | 1442.22 | 13.93 | 27.74 |
| 53 | 100 | 1456.02 | 13.80 | 27.47 |
| 54 | 100 | 1469.69 | 13.67 | 27.22 |
| 55 | 100 | 1483.24 | 13.55 | 26.97 |
| 56 | 100 | 1496.66 | 13.42 | 26.73 |
| 57 | 100 | 1509.97 | 13.30 | 26.49 |
| 58 | 100 | 1523.15 | 13.19 | 26.26 |
| 59 | 100 | 1536.23 | 13.07 | 26.04 |
| 60 | 100 | 1549.19 | 12.96 | 25.82 |
| 61 | 100 | 1562.05 | 12.86 | 25.61 |
| 62 | 100 | 1574.80 | 12.75 | 25.40 |
| 63 | 100 | 1587.45 | 12.65 | 25.20 |
| 64 | 100 | 1600.00 | 12.55 | 25.00 |
| 65 | 100 | 1612.45 | 12.45 | 24.81 |
| 66 | 100 | 1624.81 | 12.36 | 24.62 |
| 67 | 100 | 1637.07 | 12.26 | 24.43 |
| 68 | 100 | 1649.24 | 12.17 | 24.25 |
| 69 | 100 | 1661.32 | 12.08 | 24.08 |
| 70 | 100 | 1673.32 | 12.00 | 23.90 |
| 71 | 100 | 1685.23 | 11.91 | 23.74 |
| 72 | 100 | 1697.06 | 11.83 | 23.57 |
| 73 | 100 | 1708.80 | 11.74 | 23.41 |
| 74 | 100 | 1720.47 | 11.66 | 23.25 |
| 75 | 100 | 1732.05 | 11.59 | 23.09 |
| 76 | 100 | 1743.56 | 11.51 | 22.94 |
| 77 | 100 | 1754.99 | 11.43 | 22.79 |
| 78 | 100 | 1766.35 | 11.36 | 22.65 |
| 79 | 100 | 1777.64 | 11.29 | 22.50 |
| 80 | 100 | 1788.85 | 11.22 | 22.36 |
| 81 | 100 | 1800.00 | 11.15 | 22.22 |
| 82 | 100 | 1811.08 | 11.08 | 22.09 |
| 83 | 100 | 1822.09 | 11.01 | 21.95 |
| 84 | 100 | 1833.03 | 10.94 | 21.82 |
| 85 | 100 | 1843.91 | 10.88 | 21.69 |
| 86 | 100 | 1854.72 | 10.81 | 21.57 |
| 87 | 100 | 1865.48 | 10.75 | 21.44 |
| 88 | 100 | 1876.17 | 10.69 | 21.32 |
| 89 | 100 | 1886.80 | 10.63 | 21.20 |
| 90 | 100 | 1897.37 | 10.57 | 21.08 |
| 91 | 100 | 1907.88 | 10.51 | 20.97 |
| 92 | 100 | 1918.33 | 10.45 | 20.85 |
| 93 | 100 | 1928.73 | 10.40 | 20.74 |
| 94 | 100 | 1939.07 | 10.34 | 20.63 |
| 95 | 100 | 1949.36 | 10.29 | 20.52 |
| 96 | 100 | 1959.59 | 10.23 | 20.41 |
| 97 | 100 | 1969.77 | 10.18 | 20.31 |
| 98 | 100 | 1979.90 | 10.13 | 20.20 |
| 99 | 100 | 1989.97 | 10.08 | 20.10 |
| 100 | 100 | 2000.00 | 10.03 | 20.00 |

b.

c. As the level of labor usage increases holding constant the level of capital, the marginal product of labor decreases: that is, the addition to total output from hiring an additional unit of labor gets smaller and smaller. This is not surprising given that we are holding capital constant: as more and more labor is hired, the labor has less capital per worker to work with and this means that the additional workers will not be as productive as were the workers hired earlier who had access to more capital per worker.

d. As labor usage increases, labor productivity decreases. This makes sense since we know that output is increasing as labor increases, but output is increasing at a diminishing rate. Since we are increasing labor by a unit at a time, but output is not increasing at a constant rate but rather is increasing at a diminishing rate this implies that Y/L will get smaller as L gets larger.

e. Holding everything else constant, an increase in capital should cause the aggregate production function to shift up at every level of labor usage. We can quickly see that the original aggregate production function could have been written as Y = 20(10)L1/2 and the new aggregate production function can be written as Y’ = 20(15)L1/2. Clearly the second equation will result in large levels of real GDP for any given level of labor when compared to the first equation.

f.

|  |  |  |
| --- | --- | --- |
| L | K | Y' |
| 0 | 225 | 0.00 |
| 1 | 225 | 300.00 |
| 2 | 225 | 424.26 |
| 3 | 225 | 519.62 |
| 4 | 225 | 600.00 |
| 5 | 225 | 670.82 |
| 6 | 225 | 734.85 |
| 7 | 225 | 793.73 |
| 8 | 225 | 848.53 |
| 9 | 225 | 900.00 |
| 10 | 225 | 948.68 |
| 11 | 225 | 994.99 |
| 12 | 225 | 1039.23 |
| 13 | 225 | 1081.67 |
| 14 | 225 | 1122.50 |
| 15 | 225 | 1161.90 |
| 16 | 225 | 1200.00 |
| 17 | 225 | 1236.93 |
| 18 | 225 | 1272.79 |
| 19 | 225 | 1307.67 |
| 20 | 225 | 1341.64 |
| 21 | 225 | 1374.77 |
| 22 | 225 | 1407.12 |
| 23 | 225 | 1438.75 |
| 24 | 225 | 1469.69 |
| 25 | 225 | 1500.00 |
| 26 | 225 | 1529.71 |
| 27 | 225 | 1558.85 |
| 28 | 225 | 1587.45 |
| 29 | 225 | 1615.55 |
| 30 | 225 | 1643.17 |
| 31 | 225 | 1670.33 |
| 32 | 225 | 1697.06 |
| 33 | 225 | 1723.37 |
| 34 | 225 | 1749.29 |
| 35 | 225 | 1774.82 |
| 36 | 225 | 1800.00 |
| 37 | 225 | 1824.83 |
| 38 | 225 | 1849.32 |
| 39 | 225 | 1873.50 |
| 40 | 225 | 1897.37 |
| 41 | 225 | 1920.94 |
| 42 | 225 | 1944.22 |
| 43 | 225 | 1967.23 |
| 44 | 225 | 1989.97 |
| 45 | 225 | 2012.46 |
| 46 | 225 | 2034.70 |
| 47 | 225 | 2056.70 |
| 48 | 225 | 2078.46 |
| 49 | 225 | 2100.00 |
| 50 | 225 | 2121.32 |
| 51 | 225 | 2142.43 |
| 52 | 225 | 2163.33 |
| 53 | 225 | 2184.03 |
| 54 | 225 | 2204.54 |
| 55 | 225 | 2224.86 |
| 56 | 225 | 2244.99 |
| 57 | 225 | 2264.95 |
| 58 | 225 | 2284.73 |
| 59 | 225 | 2304.34 |
| 60 | 225 | 2323.79 |
| 61 | 225 | 2343.07 |
| 62 | 225 | 2362.20 |
| 63 | 225 | 2381.18 |
| 64 | 225 | 2400.00 |
| 65 | 225 | 2418.68 |
| 66 | 225 | 2437.21 |
| 67 | 225 | 2455.61 |
| 68 | 225 | 2473.86 |
| 69 | 225 | 2491.99 |
| 70 | 225 | 2509.98 |
| 71 | 225 | 2527.84 |
| 72 | 225 | 2545.58 |
| 73 | 225 | 2563.20 |
| 74 | 225 | 2580.70 |
| 75 | 225 | 2598.08 |
| 76 | 225 | 2615.34 |
| 77 | 225 | 2632.49 |
| 78 | 225 | 2649.53 |
| 79 | 225 | 2666.46 |
| 80 | 225 | 2683.28 |
| 81 | 225 | 2700.00 |
| 82 | 225 | 2716.62 |
| 83 | 225 | 2733.13 |
| 84 | 225 | 2749.55 |
| 85 | 225 | 2765.86 |
| 86 | 225 | 2782.09 |
| 87 | 225 | 2798.21 |
| 88 | 225 | 2814.25 |
| 89 | 225 | 2830.19 |
| 90 | 225 | 2846.05 |
| 91 | 225 | 2861.82 |
| 92 | 225 | 2877.50 |
| 93 | 225 | 2893.10 |
| 94 | 225 | 2908.61 |
| 95 | 225 | 2924.04 |
| 96 | 225 | 2939.39 |
| 97 | 225 | 2954.66 |
| 98 | 225 | 2969.85 |
| 99 | 225 | 2984.96 |
| 100 | 225 | 3000.00 |

g. Yes, the graph supports the prediction that was made in (e).

2. Use the graph below of an economy’s aggregate production function to answer the following set of questions. Assume this economy uses only capital (K) and labor (L) to produce real GDP. Furthermore assume that the level of technology is held constant in the graph.



a. Suppose this economy is initially producing at point B but then moves to point A. Explain verbally the change in the economy that results from this movement.

b. Given the change in (a), what happened to labor productivity? Explain your answer.

c. Suppose that the economy is initially at point E and then something changes in this economy so that the economy produces at point C. Describe verbally what changed and then comment on how this movement from point E to point C affects labor productivity.

d. Given the change in (c), describe what happened to capital productivity as you moved from point E to point C. [Hint: you might want to think about drawing the aggregate production function with respect to capital-that is, draw a graph with capital on the horizontal axis and real GDP on the vertical axis and then do the analysis of the change described in (c).]

Answer:

a. The economy when it moves from point B to point A is still using the same amount of capital and technology, but it is now employing fewer units of labor and this results in the level of real GDP falling.

b. Labor productivity increases as this economy moves from point B to point A. Recall that labor productivity is defined as Y/L and in this case both Y and L are decreasing, but the decrease in L is greater than the decrease in Y: thus, Y/L increases. You can see this by drawing a straight line or ray from the origin through point B and then another line through the origin through point A: comparison of these two lines reveals that the slope of the line through point A is larger than the slope of the line through point B. The slope of this ray is equal to labor productivity: Y/L.

c. When the economy moves from point E to point C we know from inspection of the graph that labor is not changing and, by our assumption of fixed technology, that technology is not changing. Looking at the graph we see that capital is changing from K to K’ where K’ must be greater than K since at every level of labor usage we see that this economy can produce more real GDP with K’ than it can with K. As the level of capital increases then labor will be more productive: hence, labor productivity increases as this economy moves from point E to point C. We can see that by drawing the rays from the origin that pass through point E and point C. Notice that the ray that goes through point C has a steeper slope than the ray that goes through point E: this tells us that labor productivity has risen when this economy moves from point E to point C.

d. Capital productivity is defined as Y/K: in this example we know that capital has changed from K to K’ with K<K’. From the provided graph we can see that real GDP, Y, has changed as well: when capital is equal to K, the level of output is Y3 and when capital is K’, the level of output is Y1.Thus, capital productivity changes from Y3/K to Y1/K’. But, how do we know with certainty that capital productivity has decreased? This is intuitively true because we know that capital is increasing but labor is not changing: thus, each unit of capital is now having to work with less labor and that will mean that capital productivity must be falling. But, let’s look at a graph that makes this visually quite clear. This graph is drawn with capital on the horizontal axis and real GDP on the vertical axis. Note that when capital changes and we use this graph this results in a movement along the aggregate production function and not a shift.



3. Consider the loanable funds market for an economy. Initially the government of this economy is running a balanced budget. You are told that the supply of loanable funds curve is linear and that at an interest rate of 10%, $10,000 worth of loanable funds are supplied and at an interest rate of 5%, $5,000 worth of loanable funds are supplied. You are also told that the demand for loanable funds curve is linear and when interest rates are at 2%, $12,000 worth of funds are demanded and when the interest rate is 10%, no funds are demanded. Assume that this economy is initially a closed economy.

* 1. Given the above information, write an equation for the supply of loanable funds curve where r is the interest rate and Q is the quantity of loanable funds supplied.
	2. Given the above information write an equation for the demand for loanable funds curve where r is the interest rate and Q is the quantity of loanable funds demanded.
	3. Given the above information, what is the equilibrium interest rate and the equilibrium quantity of loanable funds?
	4. Suppose the government increases government spending by $1000 while raising taxes by $500. What do you predict will happen to the interest rate in the loanable funds market given this information? What do you predict will happen to the equilibrium quantity of loanable funds given this information? Explain your answer.
	5. Given the information in (d), calculate the new equilibrium interest rate and the new equilibrium quantity of loanable funds.

Answer:

a. You know that the equation will have the general form of r = mQ + b where r is the interest rate, Q is the quantity of loanable funds supplied, m is the slope of the line and b is the y-intercept of the line. You also know from the given information that the points (Q, r) = (5000, 5) and (10,000, 10) both sit on the supply of loanable funds curve. Use these two points to find the slope and then use one of these two points to find the value of the y-intercept. Thus, slope = 5/5000 = 1/1000. And, r = (1/1000)Q + b or 10 = (1/1000)(10,000) + b or b = 0. Thus, the equation for the supply of loanable funds curve is r = (1/1000)Q.

b. You know that the equation will have the general form of r = mQ + b where r is the interest rate, Q is the quantity of loanable funds demanded, m is the slope of the line and b is the y-intercept of the line. You also know from the given information that the points (Q, r) = (0, 10) and (12,000, 2) both sit on the demand for loanable funds curve. Use these two points to find the slope; we already know the y-intercept is 10 since when the interest rate is equal to 10%, the quantity of loanable funds demanded is equal to $0. Thus, slope = -1/1500. And, the equation for the demand for loanable funds curve is r = (-1/1500)Q + 10.

c. Use the supply and demand curves that you found in (a) and (b) to answer this question.

(1/1000)Q = (-1/1500)Q + 10

1500Q = -1000Q + (10)(1500)(1000)

2500Q = 10(1500)(1000) [Note how I am doing the math: I am trying to make the problem as easy as possible for me given that I am not using a calculator-no need to do all that multiplying until I have simplified the problem as much as possible!]

Q = 6000

r = (1/1000)(6000) = 6% or r = (-1/1500)(6000) – 10 = 6%

d. The government is now running a deficit since government spending exceeds tax revenue. The government will need to finance this deficit of $500 by borrowing funds from the loanable funds market. Effectively this will shift the demand for loanable funds curve to the right by $500 at every interest rate. The equilibrium interest rate will therefore increase and the equilibrium quantity of loanable funds will also increase.

e. We need to start by finding the new demand for loanable funds curve: this curve has shifted out from the original demand for loanable funds curve. At every interest rate the quantity of loanable funds demanded has increased by $500 in order to finance the government deficit. So, for example we know that the point (Q, r) = (500, 10) sits on this new demand for loanable funds curve. We also know that the new curve has the same slope as the initial loanable funds demand curve. Thus, r = (-1/1500)Q + b and using the point (500, 10) we get r = (-1/1500)Q + 31/3.

Use this new demand curve and the original supply curve to find the new equilibrium. Thus,

(1/1000)Q = (-1/1500)Q + 31/3

1500Q = -1000Q + (31)(1000)(1500)/3

2500Q = (31)(1000)(500)

Q = 6200

r = (1/1000)(Q) = (1/1000)(6200) = 6.2%

4. Consider the loanable funds market when answering this set of questions.

a. What are the three sources of savings for an economy?

b. Suppose the government runs a surplus. If we want to model this surplus on the supply side of the loanable funds market, then how will this surplus affect this curve? Explain your answer.

c. Suppose the government runs a surplus. If we want to model this surplus on the demand side of the loanable funds market, then how will this surplus affect this curve? Explain your answer.

d. Suppose that exports equal $1000 and imports equal $800. Given this information, what is the impact of net capital inflows on the supply of loanable funds curve?

Answer:

1. Private savings, government savings, and foreign savings in the form of net capital inflows.
2. When the government runs a surplus this means that it can now increase the level of savings at every interest rate. Effectively the supply of loanable funds increases at every interest rate: that is, the supply of loanable funds curve shifts to the right. (We could also model this on the demand for loanable funds side of the model: in this case the demand for loanable funds curve would shift to the left as the government, in running a surplus, will demand fewer funds at every interest rate on the demand side of the model.)
3. When the government runs a surplus this means that it does not need to demand funds in the loanable funds market. Effectively the demand for loanable funds decreases at every interest rate: that is, the demand for loanable funds curve shifts to the left. (We could also model this on the supply of loanable funds side of the model: in this case the supply of loanable funds curve would shift to the right as the government, in running a surplus, is able to supply more savings to the supply side of the model.)
4. In this example, net capital inflows are negative (M – X = 800 – 1000 = -200) and this implies that the supply of loanable funds curve has shifted to the left. At every interest rate there is less savings due to these net capital inflows.

5. Use the loanable funds market to answer the following questions. Assume this market is initially in equilibrium.

a. Suppose that consumer confidence increases and businesses anticipate that this is an ideal time to expand their businesses. Analyze the impact of this on the loanable funds market: identify any curves that shift and identify what happens to the equilibrium interest rate, the equilibrium quantity of loanable funds in the market, and the level of loanable funds demanded for investment.

b. Suppose that the government after several years of running deficits passes a balanced budget. Analyze the impact of this on the loanable funds market: identify any curves that shift and identify what happens to the equilibrium interest rate, the equilibrium quantity of loanable funds in the market, and the level of loanable funds demanded for investment.

c. Suppose the loanable funds market is initially in equilibrium. Then, the economy increases its trade deficit. Holding everything else constant, what do you predict will happen to the interest rate in this economy?

Answers:

1. When businesses decide they want to expand their businesses this results in a greater quantity of loanable funds being demanded at every interest rate. This implies that the demand for loanable funds curve will shift to the right at every interest rate. For a given supply of loanable funds curve this implies that the equilibrium interest rate will increase and that the equilibrium quantity of loanable funds will increase. The level of loanable funds demanded for investment will increase.
2. The government no longer is demanding loanable funds in the market since they have balanced the budget. This implies that at every interest rate the demand for loanable funds curve has shifted to the left: the equilibrium interest rate will decrease, the equilibrium quantity of funds demanded in the market will decrease, but the level of private investment demand for loanable funds will increase (when interest rates fall, the quantity of funds demanded for private investment will increase).
3. When the country’s trade deficit increases, this results in net capital inflows increasing: the supply of loanable funds curve shifts to the right. For a given demand for loanable funds curve this will result in the interest rate decreasing.