**Economics 102**
**Summer 2015**
**Answers to Homework #4**
**Due Monday, July 13, 2015**

**Directions:** The homework will be collected in a box **before** the lecture. Please place your name 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. Late homework will not be accepted so make plans ahead of time. **Please show your work.** Good luck!

**Please realize that you are essentially creating "your brand" when you submit this homework. Do you want your homework to convey that you are competent, careful, and professional? Or, do you want to convey the image that you are careless, sloppy, and less than professional. For the rest of your life you will be creating your brand: please think about what you are saying about yourself when you do any work for someone else!**

1. Consider the aggregate production function for Tortulia:

$$Y = 4K^{1/2}L^{1/2}$$

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 Tortulia to produce real GDP. Initially K is equal to 81 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 | 81 | | --- | --- |
| 1 | 81 | | | |
| 2 | 81 | | | |
| . | . | | | |
| . | . | | | |
| . | . | | | |
| 100 | 81 | | | |

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

c. From your table in (a) and your graph in (b) you should be able to see that the marginal product of labor decreases as the level of labor usage increases in Tortulia, holding the level of capital constant. Explain the intuition for why this is true.

d. In your table as the value of labor gets bigger, what happened to labor productivity? After describing what happened to labor productivity as labor increases, provide a reason for why labor productivity exhibits this pattern.

e. Suppose the amount of capital in Tortulia decreases to 64 units due to a hurricane that blows across the country destroying much of the capital that Tortulia initially had. 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 | 64 | |
| 1 | 64 | |
| 2 | 64 | |
| . | . | |
| . | . | |
| . | . | |
| 100 | 64 | |

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:

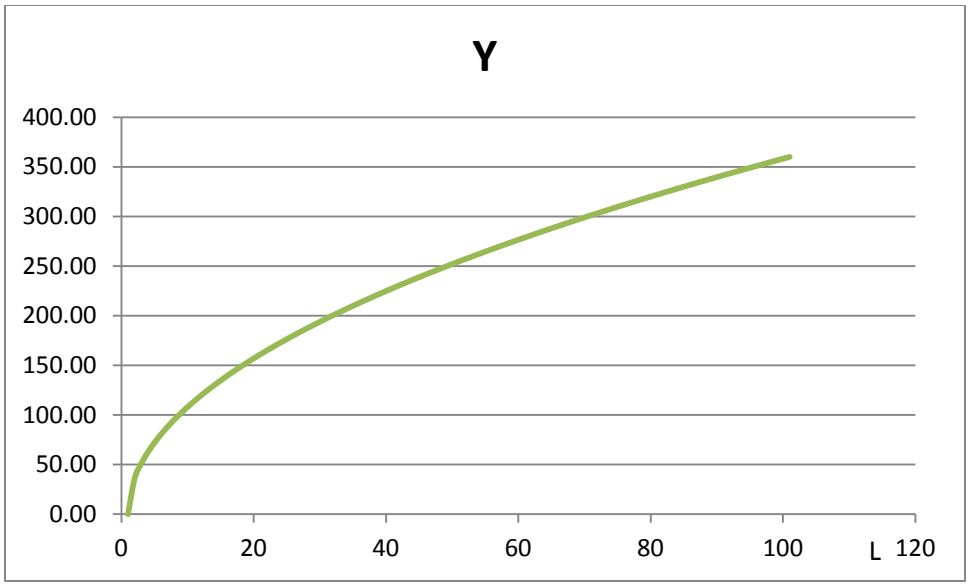
a.

| L | K | Y | MPl | Y/L |
|---|---|---|---|---|
| 0 | 81 | 0.00 | | |
| 1 | 81 | 36.00 | 36.00 | 36.00 |
| 2 | 81 | 50.91 | 14.91 | 25.46 |
| 3 | 81 | 62.35 | 11.44 | 20.78 |
| 4 | 81 | 72.00 | 9.65 | 18.00 |
| 5 | 81 | 80.50 | 8.50 | 16.10 |
| 6 | 81 | 88.18 | 7.68 | 14.70 |
| 7 | 81 | 95.25 | 7.07 | 13.61 |
| 8 | 81 | 101.82 | 6.58 | 12.73 |
| 9 | 81 | 108.00 | 6.18 | 12.00 |
| 10 | 81 | 113.84 | 5.84 | 11.38 |
| 11 | 81 | 119.40 | 5.56 | 10.85 |
| 12 | 81 | 124.71 | 5.31 | 10.39 |
| 13 | 81 | 129.80 | 5.09 | 9.98 |
| 14 | 81 | 134.70 | 4.90 | 9.62 |
| 15 | 81 | 139.43 | 4.73 | 9.30 |
| 16 | 81 | 144.00 | 4.57 | 9.00 |
| 17 | 81 | 148.43 | 4.43 | 8.73 |
| 18 | 81 | 152.74 | 4.30 | 8.49 |
| 19 | 81 | 156.92 | 4.19 | 8.26 |

| | | | | |
|---|---|---|---|---|
| 20 | 81 | 161.00 | 4.08 | 8.05 |
| 21 | 81 | 164.97 | 3.98 | 7.86 |
| 22 | 81 | 168.85 | 3.88 | 7.68 |
| 23 | 81 | 172.65 | 3.79 | 7.51 |
| 24 | 81 | 176.36 | 3.71 | 7.35 |
| 25 | 81 | 180.00 | 3.64 | 7.20 |
| 26 | 81 | 183.56 | 3.56 | 7.06 |
| 27 | 81 | 187.06 | 3.50 | 6.93 |
| 28 | 81 | 190.49 | 3.43 | 6.80 |
| 29 | 81 | 193.87 | 3.37 | 6.69 |
| 30 | 81 | 197.18 | 3.31 | 6.57 |
| 31 | 81 | 200.44 | 3.26 | 6.47 |
| 32 | 81 | 203.65 | 3.21 | 6.36 |
| 33 | 81 | 206.80 | 3.16 | 6.27 |
| 34 | 81 | 209.91 | 3.11 | 6.17 |
| 35 | 81 | 212.98 | 3.06 | 6.09 |
| 36 | 81 | 216.00 | 3.02 | 6.00 |
| 37 | 81 | 218.98 | 2.98 | 5.92 |
| 38 | 81 | 221.92 | 2.94 | 5.84 |
| 39 | 81 | 224.82 | 2.90 | 5.76 |
| 40 | 81 | 227.68 | 2.86 | 5.69 |
| 41 | 81 | 230.51 | 2.83 | 5.62 |
| 42 | 81 | 233.31 | 2.79 | 5.55 |
| 43 | 81 | 236.07 | 2.76 | 5.49 |
| 44 | 81 | 238.80 | 2.73 | 5.43 |
| 45 | 81 | 241.50 | 2.70 | 5.37 |
| 46 | 81 | 244.16 | 2.67 | 5.31 |
| 47 | 81 | 246.80 | 2.64 | 5.25 |
| 48 | 81 | 249.42 | 2.61 | 5.20 |
| 49 | 81 | 252.00 | 2.58 | 5.14 |
| 50 | 81 | 254.56 | 2.56 | 5.09 |
| 51 | 81 | 257.09 | 2.53 | 5.04 |
| 52 | 81 | 259.60 | 2.51 | 4.99 |
| 53 | 81 | 262.08 | 2.48 | 4.94 |
| 54 | 81 | 264.54 | 2.46 | 4.90 |
| 55 | 81 | 266.98 | 2.44 | 4.85 |
| 56 | 81 | 269.40 | 2.42 | 4.81 |
| 57 | 81 | 271.79 | 2.39 | 4.77 |
| 58 | 81 | 274.17 | 2.37 | 4.73 |
| 59 | 81 | 276.52 | 2.35 | 4.69 |
| 60 | 81 | 278.85 | 2.33 | 4.65 |
| 61 | 81 | 281.17 | 2.31 | 4.61 |
| 62 | 81 | 283.46 | 2.30 | 4.57 |

| | | | | |
|---|---|---|---|---|
| 63 | 81 | 285.74 | 2.28 | 4.54 |
| 64 | 81 | 288.00 | 2.26 | 4.50 |
| 65 | 81 | 290.24 | 2.24 | 4.47 |
| 66 | 81 | 292.47 | 2.22 | 4.43 |
| 67 | 81 | 294.67 | 2.21 | 4.40 |
| 68 | 81 | 296.86 | 2.19 | 4.37 |
| 69 | 81 | 299.04 | 2.17 | 4.33 |
| 70 | 81 | 301.20 | 2.16 | 4.30 |
| 71 | 81 | 303.34 | 2.14 | 4.27 |
| 72 | 81 | 305.47 | 2.13 | 4.24 |
| 73 | 81 | 307.58 | 2.11 | 4.21 |
| 74 | 81 | 309.68 | 2.10 | 4.18 |
| 75 | 81 | 311.77 | 2.09 | 4.16 |
| 76 | 81 | 313.84 | 2.07 | 4.13 |
| 77 | 81 | 315.90 | 2.06 | 4.10 |
| 78 | 81 | 317.94 | 2.04 | 4.08 |
| 79 | 81 | 319.97 | 2.03 | 4.05 |
| 80 | 81 | 321.99 | 2.02 | 4.02 |
| 81 | 81 | 324.00 | 2.01 | 4.00 |
| 82 | 81 | 325.99 | 1.99 | 3.98 |
| 83 | 81 | 327.98 | 1.98 | 3.95 |
| 84 | 81 | 329.95 | 1.97 | 3.93 |
| 85 | 81 | 331.90 | 1.96 | 3.90 |
| 86 | 81 | 333.85 | 1.95 | 3.88 |
| 87 | 81 | 335.79 | 1.94 | 3.86 |
| 88 | 81 | 337.71 | 1.92 | 3.84 |
| 89 | 81 | 339.62 | 1.91 | 3.82 |
| 90 | 81 | 341.53 | 1.90 | 3.79 |
| 91 | 81 | 343.42 | 1.89 | 3.77 |
| 92 | 81 | 345.30 | 1.88 | 3.75 |
| 93 | 81 | 347.17 | 1.87 | 3.73 |
| 94 | 81 | 349.03 | 1.86 | 3.71 |
| 95 | 81 | 350.88 | 1.85 | 3.69 |
| 96 | 81 | 352.73 | 1.84 | 3.67 |
| 97 | 81 | 354.56 | 1.83 | 3.66 |
| 98 | 81 | 356.38 | 1.82 | 3.64 |
| 99 | 81 | 358.20 | 1.81 | 3.62 |
| 100 | 81 | 360.00 | 1.80 | 3.60 |

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.

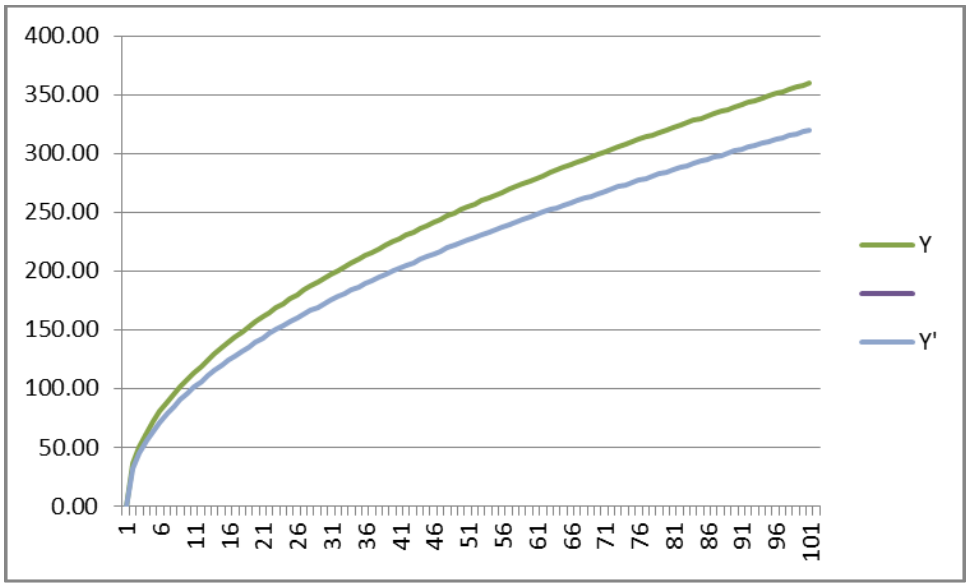
e. Holding everything else constant, a decrease in capital should cause the aggregate production function to shift down at every level of labor usage. We can quickly see that the original aggregate production function could have been written as $Y = 4(9)L^{1/2}$ and the new aggregate production function can be written as $Y' = 4(8)L^{1/2}$. Clearly the second equation will result in smaller levels of real GDP for any given level of labor when compared to the first equation.

f. [Note: break in table represents the truncation of the table and the values that were omitted.]]

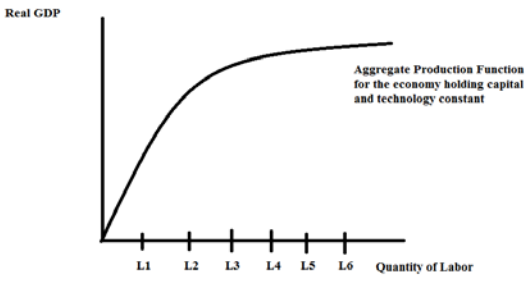
| L' | K' | Y' |
|---|---|---|
| 0 | 64 | 0.00 |
| 1 | 64 | 32.00 |
| 2 | 64 | 45.25 |
| 3 | 64 | 55.43 |
| 4 | 64 | 64.00 |

| | | |
|---|---|---|
| 5 | 64 | 71.55 |
| 94 | 64 | 310.25 |
| 95 | 64 | 311.90 |
| 96 | 64 | 313.53 |
| 97 | 64 | 315.16 |
| 98 | 64 | 316.78 |
| 99 | 64 | 318.40 |
| 100 | 64 | 320.00 |

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




2. Use the graph below of an economy's aggregate production function to answer the following set of questions. Assume that capital and the level of technology is held constant in the graph.



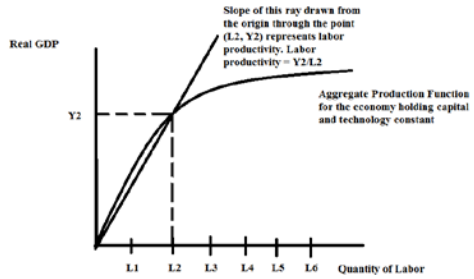
a. Suppose that labor usage in the economy is L2. Determine the level of real GDP, Y2, and also illustrate on a graph of this economy's aggregate production this level of output, this level of labor usage, and the economy's labor productivity when it hires this level of labor.

b. Suppose that the full employment level of output for this economy is L3 units of labor. But, suppose this economy is currently only employing L2 units of labor. Using the provided graph analyze the amount of real GDP this economy is giving up during this time period given this scenario. Illustrate this using the graph, but also provide a numeric answer (note: this will be written in terms of Y values and not number values).

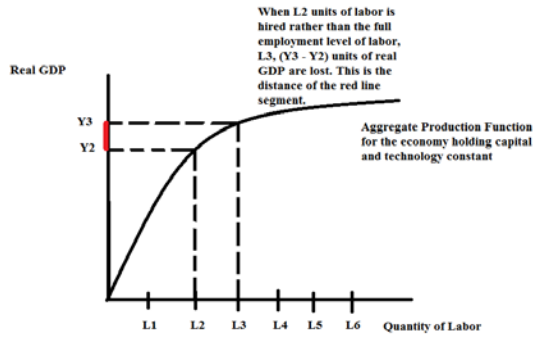
c. Suppose that the economy is currently hiring L4 units of labor. Identify the level of real GDP the economy is producing given this information: call this level of output Y4. Then in the same graph illustrate what happens to this economy if a hurricane blows through and destroys a significant fraction of the capital stock. Assume that the economy is still hiring L4 units of labor. Identify this new post-hurricane level of output in your graph as Y5. Given this scenario what happens to labor productivity? Describe the impact on labor productivity and also illustrate this in your graph.

Answer:

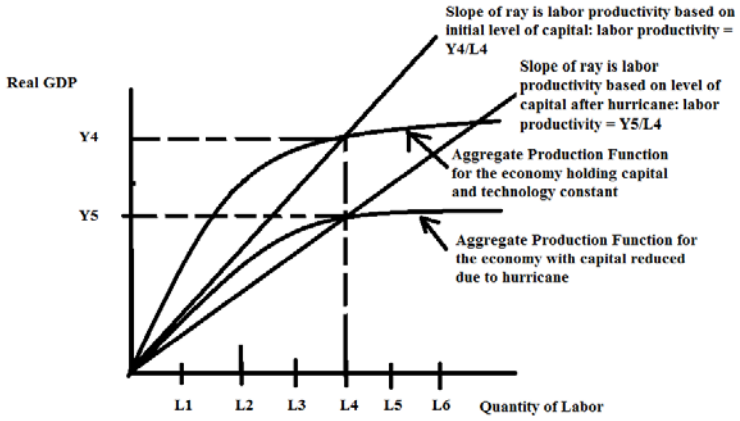
a.




b. When the economy hires only L2 units of labor instead of the full employment level of labor, L3, the economy will give up real GDP. When less labor is hired for a given amount of capital and technology, less output will be produced. We can measure this loss of real GDP as Y3 – Y2. The graph below depicts this loss.



c. The graph below illustrates the level of real GDP the economy can produce when it hires L4 units of labor: this level of real GDP is labeled Y4. When the hurricane blows through destroying the stock of capital the aggregate production function shifts downward and the economy now finds that when it hires L4 units of labor it can only produce real GDP equal to Y5. Labor productivity decreases after the hurricane since each unit of labor now has less capital on average to work on: this means that output per unit of labor is decreasing. The slopes of the two rays drawn from the origin and going through (L4, Y4) versus (L4, Y5) illustrate what is happening to labor productivity.




3. Consider the loanable funds market. Suppose that this market is initially in equilibrium, then analyze the impact on the quantity of loanable funds available for investment in this market and the interest rate for these loanable funds for each of the following scenario.
a. Assume that the government has increased the size of its deficit relative to the initial level of the deficit.

b. Assume that the government increases its tax collections while reducing its government expenditures.

c. Assume that the initially the economy had a trade balance but now the economy runs a large trade surplus.

d. Assume the government runs a budget surplus and at the same time the economy has a trade deficit. Does the way you analyze this scenario alter your analysis? Be specific in your answer.

e. Assume that private savings increases at every interest rate and at the same time the government moves from a balanced budget to a budget deficit (model this budget deficit on the demand side of the model).

Answer:
a. An increase in the size of the government's deficit can be analyzed as either a rightward shift in the demand for loanable funds curve (the government has a bigger deficit and will finance that deficit through greater borrowing at every interest rate) or as a left ward shift

in the supply of loanable funds curve (the government when it has a bigger deficit must have a smaller amount of government saving). Modeling the enlarged government deficit with either shift will result in a higher interest rate for loanable funds and a smaller amount of loanable funds available for investment. (When the graph is analyzed in terms of rightward shift in the demand, the equilibrium quantity of loans increases. However, this increase in loans is not enough to compensate for the increase in government spending. This suggests that some of the loans for private investment are diverted to finance government spending.) Make sure you can see this doing either version of the analysis!

b. An increase in tax collections accompanied by a reduction in government spending will cause government savings to increase (if Sg is a negative number initially, it will now be a smaller negative number or even a positive number; if Sg is a positive number initially, it will now be an even bigger positive number). We can model this as a rightward shift in the supply of loanable funds curve. This shift will cause a movement along the demand for loanable funds curve: the interest rate in the loanable funds market will decrease and the amount of funds available for investment will increase.

c. A trade surplus for a country will result in large capital outflows (or negative capital inflows). We can model this as a leftward shift in the supply of loanable funds curve (we have negative foreign savings for this economy that has a trade surplus). This shift will cause a movement along the demand for loanable funds curve: the interest rate in the loanable funds market will increase and the amount of funds available for investment will decrease.

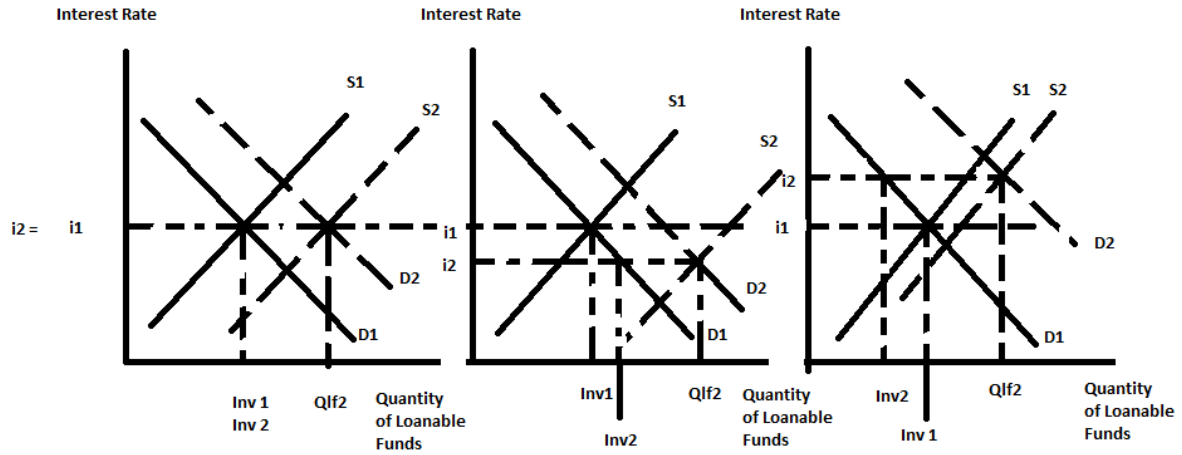
d. Here are two different analyses of this situation. And, we will find they give us different outcomes.

First Analysis: The budget surplus means that the demand for loanable funds from the government is now smaller than it was initially and we can model this as a leftward shift in the demand for loanable funds curve. The trade deficit implies that we have foreign saving entering this economy and we can model this as a rightward shift in the supply of loanable funds curve. Since both curves are shifting and we do not know the magnitude of the shift, then we can expect a situation of indeterminancy: in this case, we know with certainty that the interest rate decreases but the quantity of loanable funds for investment may increase, decrease, or remain at its initial level.

Second Analysis: The budget surplus can be modeled as positive government savings and we can model this as a rightward shift in the supply of loanable funds curve. The trade deficit implies that we have foreign saving entering this economy and we can model this as a rightward shift in the supply of loanable funds curve. Now, we have the supply curve for loanable funds curve shifting to the right due to both effects and we can expect the interest rate to fall (same result as in our first analysis) and the quantity of loanable funds for investment increasing (no longer indeterminate).

e. The supply of loanable funds curve will shift to the right if private savings increases at every interest rate. The demand for loanable funds curve will shift to the right if the

government runs a budget deficit. Since both curves are shifting and we do not know the magnitude of the shift, then we can expect a situation of indeterminancy: in this case, we will find that both the quantity of loanable funds for investment and the interest rate may increase, decrease, or remain at their initial levels. This is tricky....so here are some graphs to illustrate the idea:




In the first graph the level of investment does not change nor does the interest rate; in the second graph the interest rate decreases while the level of investment increases; and in the third graph the interest rate increases while the level of investment decreases.

4. Suppose that the loanable funds market in an economy is initially described by the following equations where i is the interest rate and Q is the quantity of loanable funds measured in millions of dollars:

Demand for loanable funds: $i = 8 - 0.8Q$

Supply of loanable funds: $i = 2 + 0.8Q$

Furthermore assume that this economy's government is currently running a balanced budget.

a. Given the above information, calculate the equilibrium quantity of loanable funds and the equilibrium price in this market. Show your work.

b. Draw a graph representing the loanable funds market given the above information. Measure the interest rate on the vertical axis and the quantity of loanable funds in millions of dollars on the horizontal axis. Label all curves. Identify the equilibrium quantity of loanable funds and the equilibrium interest rate in this market.

Suppose that the government passes a budget that results in this government running a $1 million budget deficit.

c. Given this budget deficit and modeling this budget deficit on the demand for loanable funds side of the market, describe verbally how this budget deficit will impact the demand for loanable funds curve. Predict what will happen to the interest rate in this market and to the level of investment in this economy given this government deficit and holding everything else constant.

d. Find the new equilibrium interest rate in the loanable funds market given this government deficit and modeling the deficit on the demand side of the market. Then, calculate the change in the level of investment in this economy due to this government budget deficit. Show your work.

e. Draw a graph representing the loanable funds market given the above information and the deficit the government is running. Model the government deficit on the demand for loanable funds side of the market. Measure the interest rate on the vertical axis and the quantity of loanable funds in millions of dollars on the horizontal axis. Label all curves. Identify the equilibrium quantity of loanable funds and the equilibrium interest rate in this market.

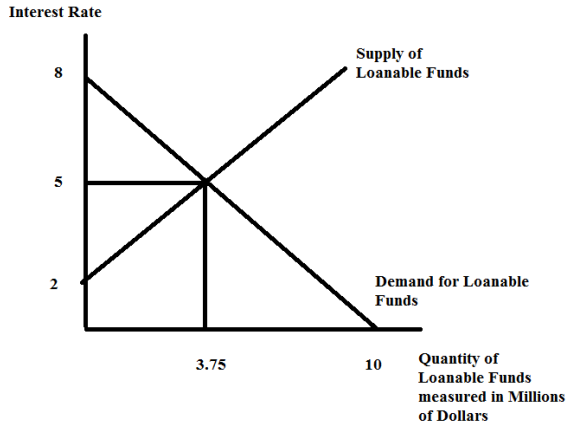
f. Let's redo the analysis of this government budget deficit, but this time, we will model it on the supply side of the loanable funds market. Given this budget deficit and modeling this budget deficit on the supply of loanable funds side of the market, describe verbally how this budget deficit will impact the supply of loanable funds curve. Predict what will happen to the interest rate in this market and to the level of investment in this economy given this government deficit and holding everything else constant.

g. Find the new equilibrium interest rate in the loanable funds market given this government deficit and modeling the deficit on the supply side of the market. Then, calculate the change in the level of investment in this economy due to this government budget deficit. Show your work.

h. Draw a graph representing the loanable funds market given the above information and the deficit the government is running. Model the government deficit on the supply of loanable funds side of the market. Measure the interest rate on the vertical axis and the quantity of loanable funds in millions of dollars on the horizontal axis. Label all curves. Identify the equilibrium quantity of loanable funds and the equilibrium interest rate in this market.

Answer:
a. To find the equilibrium quantity of loanable funds in this market set the demand curve equal to the supply curve:
$8 - 0.8Q = 2 + 0.8Q$
$6 = 1.6Q$
$Q = \$3.75$ million
Then, substitute this quantity of loanable funds into either the demand or the supply equation to find the equilibrium interest rate:
$i = 8 - 0.8(3.75) = 8 - 3 = 5\%$
Or, $i = 2 + 0.8(3.75) = 5\%$

b.



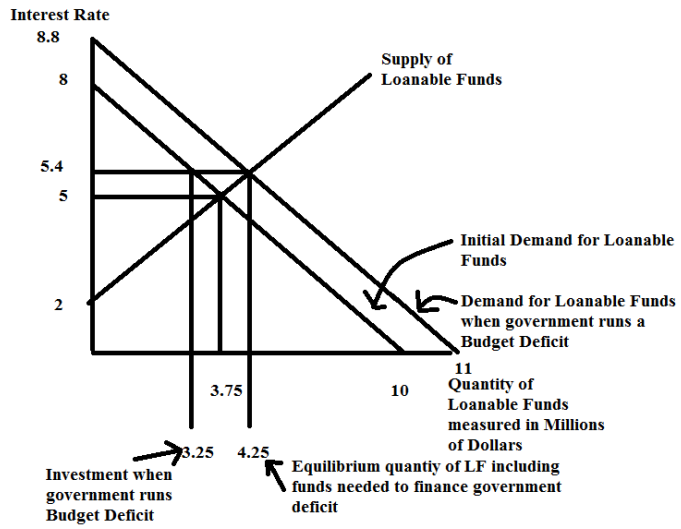

c. When the government runs a budget deficit and this deficit is modeled on the demand side of the loanable funds market this causes the demand for loanable funds curve to shift to the right: at every interest rate there will now be greater demand for loanable funds due to the government needing to borrow to finance its deficit. This rightward shift will result in a higher interest rate in the market for loanable funds and it will result in a lower amount of investment since the cost of that investment has now risen.

d. To find the new equilibrium in this market we need to first find the equation for the new demand for loanable funds curve. We know that at every interest rate there will be an increased demand for loanable funds of $1 million. So, one point on the new demand for loanable funds curve would be (4.75, 5); another point would be (11, 0). The new demand for loanable funds curve will have the same slope as the initial demand curve so we can use this slope and one of these points to find the new equation. Thus,
$i = b - 0.8Q$
$0 = b - 0.8(11)$
$b = 8.8$
New Demand for Loanable Funds Curve: $i = 8.8 - 0.8Q$

Now, to find the new equilibrium: use the new demand for loanable funds equation and the initial supply of loanable funds equation. Thus,
$2 + 0.8Q' = 8.8 - 0.8Q'$
$1.6Q' = 6.8$
$Q' = 4.25$ (note this quantity includes the loanable funds demanded by the government as well as the loanable funds demanded for investment)
Investment = (Equilibrium quantity of loanable funds) – (government deficit to be financed)
Investment = 4.25 – 1 = $3.25 million
Change in the level of investment = (Original level of investment) – (Level of investment with government deficit) = 3.75 – 3.25 = $0.5 million
To find the interest rate, substitute Q' into either the initial supply curve or the new demand for loanable funds curve:
$i' = 2 + 0.8(4.25) = 5.4\%$

Or, i' = 8.8 – 0.8(4.25) = 5.4%

e.



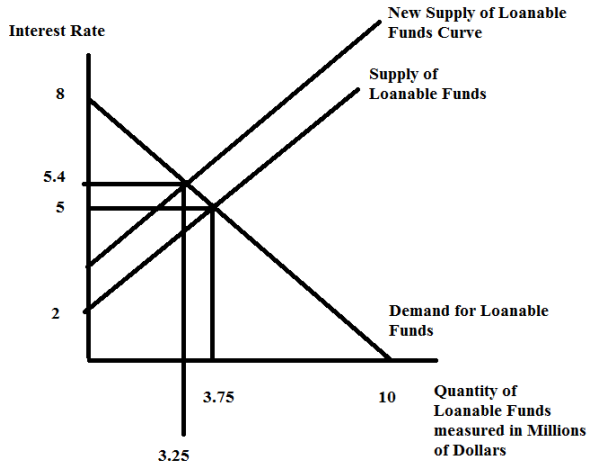

f. When the government runs a budget deficit and this deficit is modeled on the supply side of the loanable funds market this causes the supply of loanable funds curve to shift to the left: at every interest rate there will now be less government saving (in this case, there will be negative government saving) and therefore a lower supply of loanable funds due to the government running a deficit. This leftward shift in the supply of loanable funds curve will result in a higher interest rate in the market for loanable funds and it will result in a lower amount of investment since the cost of that investment has now risen.

g. First, this analysis should give us the same answers as we got from our earlier analysis: if we get different answers in the two analyses that result suggests that our analyses are in error. To find the new equilibrium in this market we need to first find the equation for the new supply of loanable funds curve. We know that at every interest rate there will be an decreased supply of loanable funds of $1 million. So, one point on the new supply for loanable funds curve would be (2.75, 5); another point would be (-1, 2). The new supply of loanable funds curve will have the same slope as the initial supply curve so we can use this slope and one of these points to find the new equation. Thus,
i = b + 0.8Q
5 = b + 0.8(2.75)
b = 2.8
New Supply of Loanable Funds Curve: i = 2.8 + 0.8Q

Now, to find the new equilibrium: use the new supply of loanable funds equation and the initial demand for loanable funds equation. Thus,
2.8 + 0.8Q' = 8 – 0.8Q'
1.6Q' = 5.2
Q' = 3.25 (note this quantity is the quantity of loanable funds for investment)

Change in the level of investment = (Original level of investment) – (Level of investment with government deficit) = 3.75 – 3.25 = $0.5 million
To find the interest rate, substitute Q' into either the initial supply curve or the new demand for loanable funds curve:
i' = 2.8 + 0.8(3.25) = 5.4%
Or, i' = 8 – 0.8(3.25) = 5.4%

h.




5. Suppose you are given the following information about an economy where all numbers are in millions of dollars:

| Y (or GDP) | 50 | 100 | 200 | 400 | 600 | Ye = |
|---|---|---|---|---|---|---|
| Taxes, T | | 40 | | | | |
| Disposable Income, Y - T | | | | | | |
| Consumer Spending, C | | 60 | | 285 | | |
| Investment Spending, I | | | 100 | | | |
| Government Spending, G | | | | | 50 | |
| Net Exports, (X – M) | 60 | | | | | |
| Aggregate Expenditure, AE | | | | | | |
| Direction of Change in Inventories | | | | | | |
| Direction of | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Change in Production | | | | | | |

In this economy assume that taxes, investment spending, government spending, and net exports are all exogenously (autonomously) determined and that they do not change no matter what happens to GDP.

a. Given the above information, calculate the marginal propensity to consume, MPC, for this economy. Show how you got your answer. Put the values you found while calculating this value into the appropriate place in the provided table.

b. Once you have the MPC from (a), find the consumption equation including the value of autonomous consumption. Show how you found this equation. Once you have the consumption function fill in the values for the consumer spending row in your table. Fill in any other values you can now that you have your consumption function. Note: in the last column of the table we will be eventually finding the equilibrium level of output for this economy. Fill in what is happening to the direction of change in inventories and the direction of change in production as well (these answers will be "no change", "increase", or "decrease").

c. Calculate the equilibrium level of GDP for this economy. Show your work and complete the missing values in the last column of your table.

Answer:
a. To find the MPC we need to know the (change in consumption) and (the change in disposable income). So we first start by calculating the disposable income: we know that taxes are autonomously given to us and that tells us that taxes are equal to $40 million throughout the table. Once we have the value for taxes then it is a simple matter to calculate the disposable income values. Thus,

| Y (or GDP) | 50 | 100 | 200 | 400 | 600 | Ye = |
|---|---|---|---|---|---|---|
| Taxes, T | 40 | 40 | 40 | 40 | 40 | 40 |
| Disposable Income, Y - T | 10 | 60 | 160 | 360 | 560 | |
| Consumer Spending, C | | 60 | | 285 | | |
| Investment Spending, I | | | 100 | | | |
| Government Spending, G | | | | | 50 | |
| Net Exports, (X – M) | 60 | | | | | |
| Aggregate Expenditure, AE | | | | | | |
| Direction of | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Change in Inventories | | | | | | |
| Direction of Change in Production | | | | | | |

Now, we can calculate the (change in consumption) as (285 – 60) or 225. The (change in disposable income at these two levels of consumption is (360-60) or 300. MPC is equal to (change in consumption)/(change in disposable income) = 225/300 = .75.

b. We know that the consumption function in general is C = a + b(Y – T) where b is the MPC. So, we can write the consumption function as C = a + .75(Y – T). We have two ((Y – T), C) coordinate points in our table: (360, 285) and (60, 60). Use one of these points to find the value of "a", autonomous consumption. Thus,
60 = a + .75(60)
15 = a
The consumption function for this economy is therefore: C = 15 + .75(Y – T).
Here is the table with more cells filled in:

| Y (or GDP) | 50 | 100 | 200 | 400 | 600 | Ye = |
|---|---|---|---|---|---|---|
| Taxes, T | 40 | 40 | 40 | 40 | 40 | 40 |
| Disposable Income, Y - T | 10 | 60 | 160 | 360 | 560 | |
| Consumer Spending, C | 22.5 | 60 | 135 | 285 | 435 | |
| Investment Spending, I | 100 | 100 | 100 | 100 | 100 | 100 |
| Government Spending, G | 50 | 50 | 50 | 50 | 50 | 50 |
| Net Exports, (X – M) | 60 | 60 | 60 | 60 | 60 | 60 |
| Aggregate Expenditure, AE | 232.5 | 270 | 345 | 495 | 645 | |
| Direction of Change in Inventories | decrease | decrease | decrease | decrease | decrease | no change |
| Direction of Change in Production | increase | increase | increase | increase | increase | no change |

c. In equilibrium Ye = AE. So,
Ye = C + I + G + (X – M)
Ye = 15 + .75(Ye – T) + 100 + 50 + 60
.25Ye = 15 - .75(40) + 210
.25Ye = 225 - 30
.25Ye = 195
Ye = 780

C when Ye = 780 is equal to: C = 15 + .75(780 – 40) = 15 + .75(740) = 15 + 555 = 570
So, here is the completed table:

| Y (or GDP) | 50 | 100 | 200 | 400 | 600 | Ye = 780 |
|---|---|---|---|---|---|---|
| Taxes, T | 40 | 40 | 40 | 40 | 40 | 40 |
| Disposable Income, Y - T | 10 | 60 | 160 | 360 | 560 | 740 |
| Consumer Spending, C | 22.5 | 60 | 135 | 285 | 435 | 570 |
| Investment Spending, I | 100 | 100 | 100 | 100 | 100 | 100 |
| Government Spending, G | 50 | 50 | 50 | 50 | 50 | 50 |
| Net Exports, (X – M) | 60 | 60 | 60 | 60 | 60 | 60 |
| Aggregate Expenditure, AE | 232.5 | 270 | 345 | 495 | 645 | 780 |
| Direction of Change in Inventories | decrease | decrease | decrease | decrease | decrease | no change |
| Direction of Change in Production | increase | increase | increase | increase | increase | no change |

6. Suppose you are using a Keynesian model to analyze an economy and you are given the following information about this economy.

Aggregate Expenditure = C + I + G + (X - M)
C = consumption spending = 20 + .5(Y - T)
T = autonomous taxes = $10 million
I = investment spending = $100 million
G = government spending = $20 million
(X - M) = net exports = $10 million
Yfe = Full employment GDP = $320 million
P = aggregate price level = is constant and does not change

a. Given this information, is the government of this economy running a balanced budget, a budget surplus, or a budget deficit? Explain your answer.

b. Given this information, describe this country's trade balance. Explain your answer.

c. Given this information, determine the current equilibrium level of GDP, Y, for this economy. Show how you found your answer.

d. Describe this economy's performance relative to Yfe. In your description be sure to describe the level of production relative to the full employment level of production as well as describing the unemployment situation relative to the natural rate of unemployment.

Then, provide a graph illustrating Ye, Yfe, and the aggregate expenditure function. Your graph should also include the 45 degree reference line. Make sure your graph is completely and carefully labeled.

e. Suppose you are an economic advisor to the President of this country and she wants to see the economy operating at full employment. She asks you how large the stimulus package would need to be in order to get this economy to full employment if the only thing that changes is the level of government spending. Provide her with the answer and show her how you got this answer. Once you calculate the value, then provide a proof that this is actually the correct value. Also, provide the President with a new figure for the government budget balance once this spending change is implemented.

f. Suppose you are an economic advisor to the President of this country and she wants to see the economy operating at full employment. She asks you how large the stimulus package would need to be in order to get this economy to full employment if the only thing that changes is the level of autonomous taxes. Provide her with the answer and show her how you got this answer. Once you calculate the value, then provide a proof that this is actually the correct value. Also, provide the President with a new figure for the government budget balance once this tax change is implemented.

g. Suppose you are an economic advisor to the President of this country and she wants to see the economy operating at full employment. But, she is also working with a Legislature that insists that any increase in government spending must be accompanied by an equal increase in autonomous taxes (this is like a balanced budget amendment). She asks you how large the stimulus package would need to be in order to get this economy to full employment given this requirement that any increase in G be balanced by an equivalent increase in T. Provide her with the answer and show her how you got this answer. Once you calculate the value, then provide a proof that this is actually the correct value. Also, provide the President with a new figure for the government budget balance once this stimulus policy is implemented.

h. Given the three stimulus programs discussed in (e), (f), and (g), if getting the economy back to the full employment level of GDP at lowest cost to the government (and hence, the taxpayer) is the goal, which program is the best choice? Explain your answer.

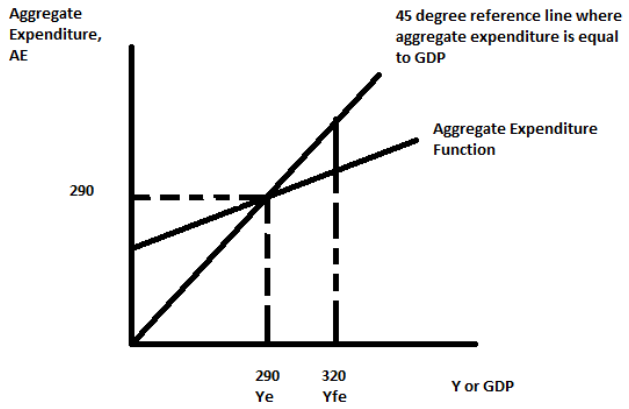
Answer:
a. The government is running a budget deficit since government spending, G, is greater than taxes, T. The government deficit is equal to 10: this implies that the government needs to borrow $10 million.

b. The country has a trade surplus since its exports are greater than its imports. This implies that this country is selling a higher dollar amount of its goods and services to foreign buyers than the value of the goods and services it is getting from foreign producers.

c. In equilibrium, GDP or Y is equal to aggregate expenditure. Thus,
Ye = C + I + G + (X - M)

We can substitute from the given information into this equilibrium equation to solve for Ye, the equilibrium level of GDP for this economy.
Ye = 20 + .5(Ye - T) + 100 + 20 + 10
Ye = 150 + .5(Ye - 10)
.5Ye = 145
Ye = 290

d. Since Ye is less than Yfe we can conclude that this economy is operating in a recession. This implies that output is lower than the full employment level of output and that unemployment is higher than the natural rate of unemployment.




e. From our calculation of Ye and the information we were given about Yfe we know that we need GDP to increase by $30 million in order for this economy to be operating at the full employment level of output. We can use the multiplier to calculate what the change in government spending will need to be in order to reach Yfe by increasing government expenditure.
ΔY = (1/(1 - MPC)) ΔG
30 = (1/.5) ΔG
15 = ΔG
So, an increase of $15 million in government spending will get this economy to the full employment level of output. Let's show that this will work for this economy:

Ye' = 20 + .5(Ye' - T) + 100 + 35 + 10 (note: that G has increased from 20 to 35, a $15 million increase)
.5Ye' = 165 - .5(10)
.5Ye' = 160
Ye' = 320 = Yfe!

The government budget balance will change to a budget deficit of $25 million: the government will increase its deficit, but it will have restored the economy to full employment and gotten the unemployment rate back to the natural rate of unemployment by pursuing this stimulus policy.

f. From our calculation of Ye and the information we were given about Yfe we know that we need GDP to increase by $30 million in order for this economy to be operating at the full employment level of output. We can use the tax expenditure multiplier to calculate what the change in autonomous taxes will need to be in order to reach Yfe by increasing government expenditure.
ΔY = (-MPC/(1 - MPC)) ΔT
30 = (-.5/.5) ΔT
-30 = ΔT
So, a decrease of $30 million in autonomous taxes will get this economy to the full employment level of output. Let's show that this will work for this economy:

Ye" = 20 + .5(Ye" - T) + 100 + 20 + 10
Ye" = 20 + .5(Ye" + 20) + 100 + 20 + 10 (note: that T has decreased from 10 to -20, a $30 million decrease and that when you have -(-20) that leaves you with + 20)
.5Ye" = 150 + .5(20)
.5Ye" = 160
Ye" = 320 = Yfe!

The government budget balance will change to a budget deficit of $40 million: the government will increase its deficit, but it will have restored the economy to full employment and gotten the unemployment rate back to the natural rate of unemployment by pursuing this stimulus policy.

g. From our calculation of Ye and the information we were given about Yfe we know that we need GDP to increase by $30 million in order for this economy to be operating at the full employment level of output. We can use the regular multiplier and the tax expenditure multiplier to calculate what the change in government spending and autonomous taxes will need to be in order to reach Yfe by a stimulus program that requires any increase in G to be offset by an increase in T.
ΔY = (1/(1 - MPC)) Δ G + (-MPC/(1 - MPC)) ΔT
30 = (1/.5) Δ G + (-.5/.5) ΔT
30 = 2ΔG - ΔT (note that ΔG = ΔT so given the Legislative position)
30 = ΔG = ΔT
So, an increase of $30 million in government spending along with an increase of $30 million in autonomous taxes will get this economy to the full employment level of output. Let's show that this will work for this economy:

Ye" = 20 + .5(Ye" - T) + 100 + 50 + 10
Ye" = 20 + .5(Ye" - 40) + 100 + 50 + 10 (note: that T has increased from 10 to 40, a $30 million increase and government spending has increased from 20 to 50, a $30 million increase)
.5Ye" = 180 + .5(-40)
.5Ye" = 160
Ye" = 320 = Yfe!

The government budget balance will keep the budget deficit at $10 million: the government will not change its deficit, and it will have restored the economy to full employment and gotten the unemployment rate back to the natural rate of unemployment by pursuing this stimulus policy. But, the government will have substantially increased its level of spending and its level of taxes. Households will have less disposable income than before the implementation of this policy.

h. All three programs get the economy back to the full employment level of GDP, but the government spending stimulus is the cheapest at $15 million.