Economics 102
Summer 2017
Answers to Homework #4
Due 6/19/17

Directions: The homework will be collected in a box **before** the lecture. Please place <u>your name</u>, <u>TA name</u> and <u>section number</u> 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 Meritville:

$$Y = (2)K^{1/3}L^{2/3}$$

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 Meritville to produce real GDP. Initially K is equal to 49 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. In your answer you may present the table for L from 0 to 10 units and from 80 to 100 units (that is, you can omit part of the table in the homework you turn in).

L	K	Y	Marginal Product of Labor (MPl)	Labor Productivity (Y/L)
0	49		---	---
1	49			
2	49			
.	.			
.	.			
.	.			
100	49			

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 Meritville. 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 Meritville decreases to 25 units due to the enactment of legislation by the government that discourages 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	25	
1	25	
2	25	
.	.	
.	.	
.	.	
100	25	

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.

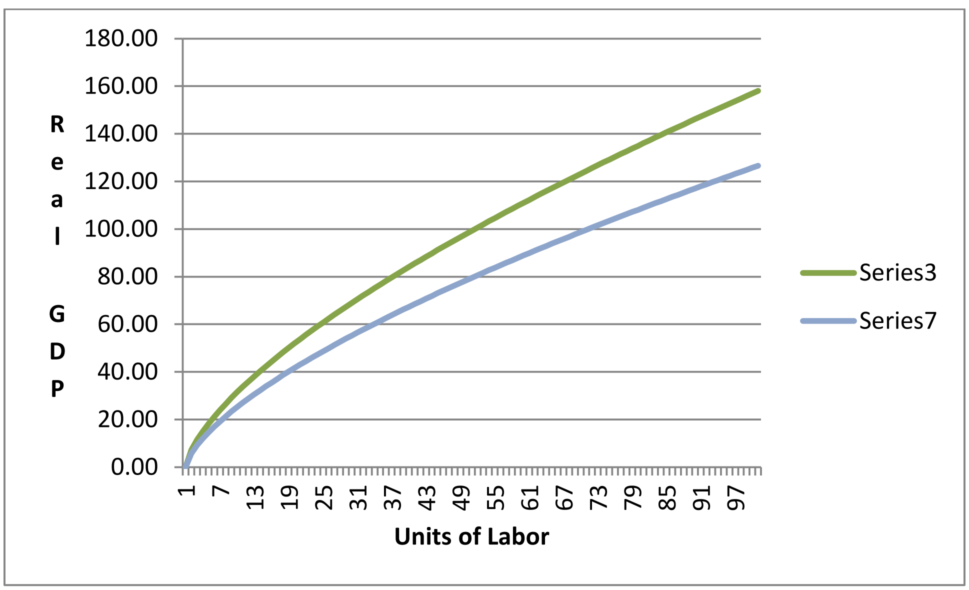
L	K	Y	MPl	Y/L
0	49	0.00		
1	49	7.22	7.22	7.22
2	49	11.49	4.27	5.75
3	49	15.08	3.59	5.03
4	49	18.29	3.21	4.57
5	49	21.24	2.95	4.25
6	49	24.00	2.76	4.00
7	49	26.61	2.61	3.80
8	49	29.10	2.49	3.64
9	49	31.49	2.39	3.50
10	49	33.79	2.30	3.38
80	49	136.10	1.14	1.70

81	49	137.24	1.14	1.69
82	49	138.37	1.13	1.69
83	49	139.50	1.13	1.68
84	49	140.62	1.12	1.67
85	49	141.74	1.12	1.67
86	49	142.86	1.12	1.66
87	49	143.97	1.11	1.65
88	49	145.08	1.11	1.65
89	49	146.18	1.10	1.64
90	49	147.28	1.10	1.64
91	49	148.37	1.09	1.63
92	49	149.46	1.09	1.62
93	49	150.55	1.09	1.62
94	49	151.63	1.08	1.61
95	49	152.71	1.08	1.61
96	49	153.79	1.08	1.60
97	49	154.86	1.07	1.60
98	49	155.93	1.07	1.59
99	49	156.99	1.06	1.59
100	49	158.05	1.06	1.58

L	K	Y	MPl	Y/L
0	49	0		
1	49	7.31861142	7.31861142	7.31861142
2	49	11.61757147	4.298960047	5.808785734
3	49	15.22332522	3.605753755	5.074441741
4	49	18.44174517	3.218419946	4.610436292
5	49	21.39974961	2.958004443	4.279949922
6	49	24.16552247	2.765772861	4.027587079
7	49	26.78103656	2.615514087	3.825862366
8	49	29.27444568	2.493409121	3.65930571
9	49	31.66579253	2.391346847	3.518421392
10	49	33.96998504	2.304192517	3.396998504
80	49	135.8799402	101.9099551	1.698499252
81	49	137.009927	1.129986819	1.69148058
82	49	138.1352731	1.125346085	1.684576501
83	49	139.2560537	1.120780661	1.67778378
84	49	140.3723422	1.116288434	1.671099312
85	49	141.4842096	1.111867374	1.664520112
86	49	142.5917251	1.107515531	1.658043315

87	49	143.6949561	1.103231031	1.651666162
88	49	144.7939682	1.099012072	1.645386002
89	49	145.8888251	1.094856917	1.639200282
90	49	146.979589	1.090763899	1.633106544
91	49	148.0663204	1.086731408	1.627102422
92	49	149.1490783	1.082757895	1.621185634
93	49	150.2279202	1.078841868	1.61535398
94	49	151.3029021	1.074981886	1.609605341
95	49	152.3740786	1.071176561	1.60393767
96	49	153.4415032	1.067424552	1.598348991
97	49	154.5052277	1.063724566	1.592837399
98	49	155.5653031	1.060075354	1.587401052
99	49	156.6217788	1.056475708	1.58203817
100	49	157.6747033	1.052924462	1.576747033

b. The graph below depicts the aggregate production function: output or Y is measured on the vertical axis and units of labor is measured on the horizontal axis. The top line is Y (where capital is equal to 49 units)and the lower line is Y' (where capital is equal to 25 units as in part g.).



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. This result is known as the diminishing marginal return and is present in many economic contexts.

d. As labor usage increases, (average) 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 $Y = 14L^{2/3}$ and the new aggregate production function can be written as $Y' = 10L^{2/3}$. 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.

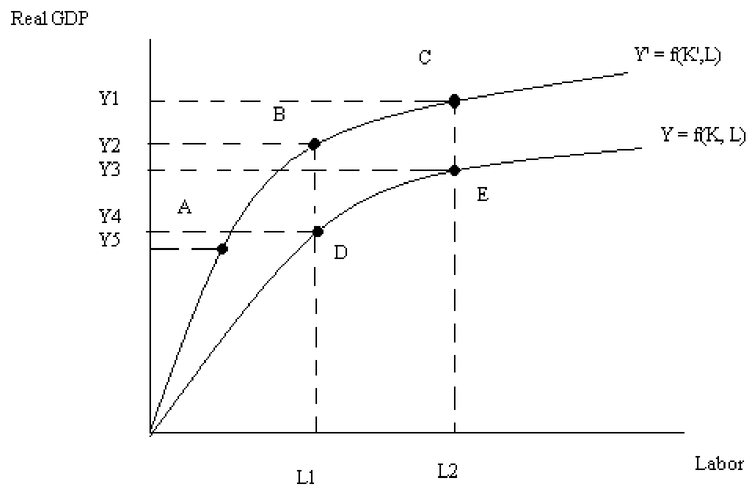
L	K'	Y'
0	25	0.00
1	25	5.79
2	25	9.21
3	25	12.08
4	25	14.65
5	25	17.01
6	25	19.22
7	25	21.31
8	25	23.30
9	25	25.22
10	25	27.06
80	25	109.00
81	25	109.91
82	25	110.82
83	25	111.72
84	25	112.62
85	25	113.52
86	25	114.41
87	25	115.30
88	25	116.19
89	25	117.07
90	25	117.95
91	25	118.83
92	25	119.70
93	25	120.57

94	25	121.44
95	25	122.30
96	25	123.16
97	25	124.02
98	25	124.87
99	25	125.73
100	25	126.58

L	K'	Y'
0	25	0
1	25	5.848035476
2	25	9.283177667
3	25	12.16440399
4	25	14.73612599
5	25	17.09975947
6	25	19.30978769
7	25	21.39974961
8	25	23.39214191
9	25	25.30297996
10	25	27.14417617
80	25	108.5767047
81	25	109.4796359
82	25	110.3788589
83	25	111.2744339
84	25	112.1664193
85	25	113.0548719
86	25	113.9398472
87	25	114.8213989
88	25	115.6995794
89	25	116.5744396
90	25	117.4460292
91	25	118.3143967
92	25	119.179589
93	25	120.0416522
94	25	120.900631
95	25	121.7565692
96	25	122.6095092
97	25	123.4594927
98	25	124.3065602
99	25	125.1507515

100	**25**	**125.992105**

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 E. Explain verbally the change in the economy that results from this movement. Explain what caused this economy to move from B to E given the above graph.

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

c. Suppose that the economy is initially at point D 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 D to point C affects labor productivity.

d. Given the change in (c), describe what happened to capital productivity as you moved from point D 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).]

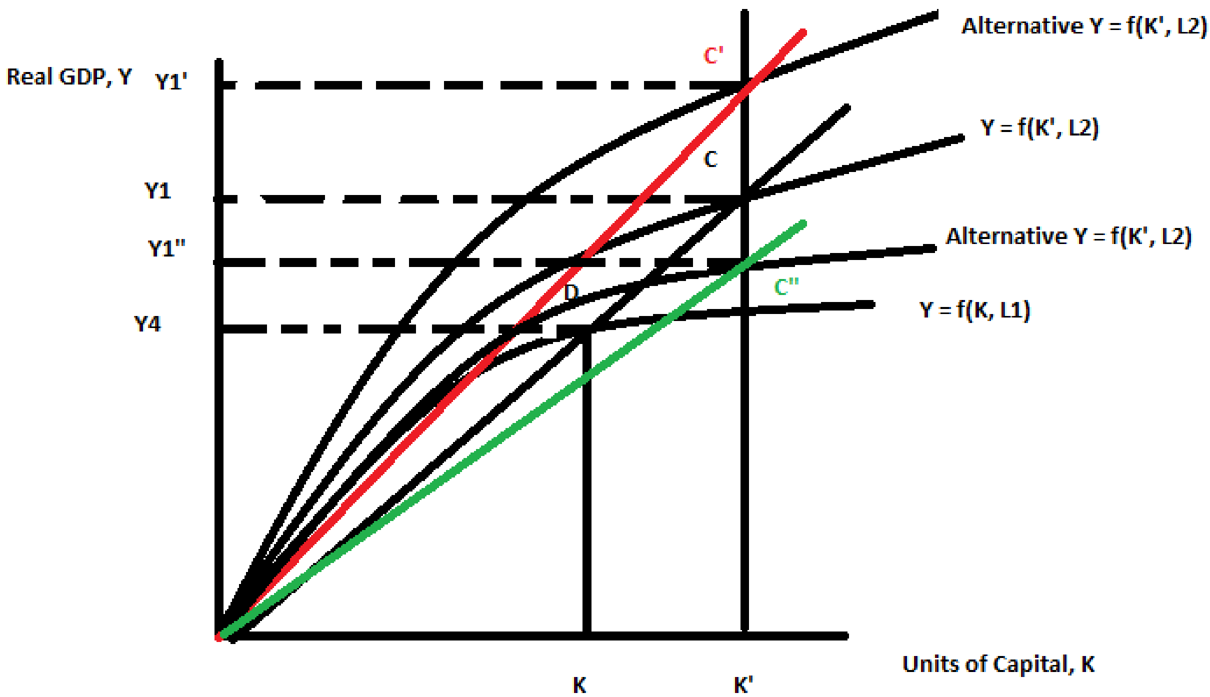
Answer:

a. When the economy moves from B to E the level of real GDP decreases from Y2 to Y3. The level of real GDP decreases because this economy has decreased its use of capital from K' to K while at the same time increasing its use of labor from L1 to L2. The decrease in capital for a given level of labor would decrease real GDP (this would be like going from point B to point D). The increase in labor for a given level of capital would increase real GDP (this would be like going from point B to C). We have two changes occurring with one change decreasing real GDP and the other increasing real GDP: we would typically view this as an example of indeterminancy-that is, we cannot predict with certainty what will happen to real GDP. But, in this example we have the graphs so we can predict: with these two changes the decrease in output due to less capital is greater than the increase in output due to more labor. Real GDP decreases when this economy moves from point B to point E.

b. Labor productivity decreases as this economy moves from point B to point E. Recall that labor productivity is defined as Y/L and in this case Y, K and L are all changing. As Y decreases due to the reduction in capital, this causes each of the units of labor to have lower productivity: Y2/L1 is greater than Y4/L1. But we also have L increasing: so you want to compare Y2/L1 to Y3/L2. From the graph we can see that Y2/L1 is greater than Y3/L2: this means that labor productivity is falling as this economy moves from point B to point E. 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 E: comparison of these two lines reveals that the slope of the line through point B is larger than the slope of the line through point E. The slope of this ray is equal to labor productivity: for point B the labor productivity is Y2/L1 and for point E the labor productivity is Y3/L2.

c. When the economy moves from point D to point C we know from inspection of the graph that labor is increasing and capital is increasing. Looking at the graph we see that capital is increasing because point D is on one aggregate production function with capital equal to K and point C is on a different aggregate production function with capital equal to K'. We see that labor is increasing from L1 to L2 as well. As the level of labor and capital increases, we see that real GDP increases from Y4 to Y1. If we draw a ray from the origin through point D and another ray from the origin through point C we can then compare the slopes of these two rays to determine what happens to labor productivity. With the provided graph the slope of the ray from the origin through point D is slightly steeper than the slope of the ray from the origin through point C: we can conclude that labor productivity in this example fell. <u>But, be careful here! This graph could be slightly redrawn so that we got the opposite conclusion. Labor productivity in this example in general would be indeterminate: see if you can draw a second graph that reverses the conclusion you got from the provided graph. Since we have no numeric values here our graphs can mislead us with regard to what is the answer. Labor productivity when both labor and capital increases is indeterminate unless we are given sufficient information to determine what happens. This graph is for illustration purposes only and hence is not drawn to scale.</u>

d. Capital productivity is defined as Y/K: in this example we know that capital and labor have both increased. From the provided graph we know that real GDP increases from Y4 to Y1. Can we actually determine whether capital productivity has increased or decreased? No, since both labor and capital are increasing we cannot predict without numeric data whether capital productivity increases, decreases, or remains the same. Here is a graph to illustrate this answer.



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 demand for loanable funds curve is linear and that at an interest rate of 8%, $14,000 worth of loanable funds are demanded and at an interest rate of 6%, $28,000 worth of loanable funds are demanded. You are also told that the supply of loanable funds curve is linear and when interest rates are at 6%, $98,000 worth of funds are supplied and when the interest rate is at 0%, $0 worth of funds are supplied. Assume that this economy is initially a closed economy.

a. 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. Assume that the interest rate is measured on the vertical axis and thus, provide your equation in slope-intercept form.

b. 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.

c. Given the above information, what is the equilibrium interest rate and the equilibrium quantity of loanable funds?

d. Suppose the government increases government spending by $20,000 while raising taxes by $13000. 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.

e. 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) = (0, 0) and (98,000, 6) 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 = 6/98,000 = 3/49,000. And, r = (3/49,000)Q + b or 0 = (3/49,000)(0) + b or b = 0. Thus, the equation for the supply of loanable funds curve is r = (3/49,000)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) = (14,000, 8) and (28,000, 6) both sit on the demand for loanable funds curve. Use these two points to find the slope. Thus, slope = -2/14,000 = -1/7000. And, r = (-1/7000)Q + b or 8 = (-1/7000)(14,000) + b or b = 10 . And, the equation for the demand for loanable funds curve is r = (-1/7000)Q + 10.

c. Use the supply and demand curves that you found in (a) and (b) to answer this question.
(3/49,000)Q = (-1/7000)Q + 10
(10/49,000)Q = 10
Q = 10(49,000/10) = 49,000
r = (3/49,000)(49,000) = 3% or
r = (-1/7000)(49,000) + 10 = -7 + 10 = 3%

d. The government is now running a deficit since government spending is greater than tax revenue by $7,000. The government will have negative savings: you can model this as a leftward shift in the supply of loanable funds market or a rightward shift in the demand for loanable funds market. When we model this change we can either model it as the demand for loanable funds curve shifting to the right by 7000 at every interest rate or the supply of loanable funds curve shifting to the left by 7000 at every interest rate.
With either modeling approach, this government deficit will result in higher interest rates in the loanable funds market holding everything else constant. With higher interest rates we can anticipate that investment spending will decrease, private saving will increase, and consumption spending will decrease. This is known as the "crowding out" effect.

e. Analysis based on a rightward shift of the demand for loanable funds curve: We need to start by finding the new demand for loanable funds curve: this curve has shifted right from the original demand for loanable funds curve. At every interest rate the quantity of loanable funds demanded has increased by \$7000 due to the government deficit. So, for example we know that the point (Q', r') = (56,000, 3) 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' = (-1/7000)Q' + b' and using the point (56,000, 3) we can find the value of b'. Thus, r' = (-1/7000)(Q') + b' or 3 = (-1/7000)(56,000) + b' or b' = 11. The new demand for loanable funds curve can be written as r' = (-1/7000)(Q') + 11.

Use this new demand curve and the original supply curve to find the new equilibrium. Thus,
(3/49,000)Q' = (-1/7000)Q' + 11
(10/49000)Q' = 11
Q' = (11)(49,000/10) = (11)(4900) = 53,900 (Note this quantity is different from the quantity you get with the second method: it equates private saving of 53,900, and the sum of private investment plus the negative of government savings or 53,900)
r' = (3/49.000)Q' = (3/49,000)(53,900) = 3.3% or
r' = (-1/7000)Q' + 11 = (-1/7000)(53,900) + 11 = -7.7 + 11= 3.3%
To find private savings: plug r = 3.3 into the initial supply of loanable funds curve:
r = (3/49,000)Q or 3.3 = (3/49,000)Q or Q = private saving = \$\$53,900
To find private investment spending: plug r = 3.3 into the initial demand for loanable funds curve:
r = 10 – (1/7000)Q or 3.3 = 10 – (1/7000)Q or Q = private investment spending = \$46,900
Note: if you add together the private investment spending of \$46,900 and the amount the government needs to finance due to running a deficit, \$7000, you get the total quantity of loanable funds demand which is \$53,900.

Analysis based on a leftward shift of the supply of loanable funds curve: We need to start by finding the new supply of loanable funds curve: this curve has shifted left from the original supply of loanable funds curve. At every interest rate the quantity of loanable funds supplied has decreased by \$7000 due to the government deficit. So, for example we know that the point (Q', r') = (42,000, 3) sits on this new supply of loanable funds curve. We also know that the new curve has the same slope as the initial loanable funds supply curve. Thus, r' = (3/49,000)Q' + b' and using the point (42,000, 3) we can find the value of b'. Thus, r' = (3/49,000)(Q') + b' or 3 = (3/49,000)(42,000) + b' or b' = 3/7. The new supply of loanable funds curve can be written as r' = (3/49,000)(Q') + (3/7).

Use this new supply curve and the original demand curve to find the new equilibrium. Thus,
(3/49,000)Q' + (3/7) = (-1/7000)Q' + 10
(10/49,000)Q' = (70/7) - (3/7)
(10/49,000)Q' = (67/7)
Q' = (67/7)(49,000/10) = (67)(700) = 46,900 (note: this is a different Q than you got with the first method-this Q equates the sum of private saving plus government saving or 46.900 with the level of private investment spending of 46,900)

$r' = (3/49,000)Q' + (3/7) = (3/49,000)(46,900) + (3/7) = 3(76)/70 + 30/70 = 231/70 = 3.3\%$ or
$r' = (-1/7000)Q' + 10 = (-1/7000)(46,900) + 10 = -6.7 + 10 = 3.3\%$

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

a. Suppose the loanable funds market is initially in equilibrium. Suppose that the government after several years of running a balanced budget passes a budget that results in a budget surplus. 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 the loanable funds market is initially in equilibrium. You are told that the government has engaged in fiscal policy that results in the equilibrium interest rate in the loanable funds market increasing. First, describe what this fiscal policy must look like given this information and assuming everything else is held constant. Then, make a prediction about what will happen to private investment spending, private savings, and consumption spending given this change in fiscal policy.

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

Answers:

a. The government when it runs a budget surplus will have an excess funds since the government is spending less than its tax revenue. This means that the government will be entering the loanable funds market as a supplier of funds (this is modelling this problem with a supply shift) and this new supply of funds will shift the supply of loanable funds curve to the right. Modelling this on the supply side of the model makes it relatively easy to see that when the government runs a surplus, the equilibrium interest rate in the loanable funds market will decrease, the level of private investment spending will increase, the level of private savings will decrease, and the level of consumption spending will increase.

   If you want to model this government surplus on the demand for loanable funds side of the market, then the demand for loanable funds curve will shift to the left when the government runs a surplus. This rightward shift occurs because the government is essentially reducing the overall demand for loanable funds since it is now running a budget surplus. When the demand for loanable funds curve shifts to the left due to the government surplus, the equilibrium interest rate will decrease, the level of private investment spending will increase, the level of private savings will decrease, and the level of consumption spending will increase.

b. Government fiscal policy, their taxing and spending decisions, result in interest rates rising in the loanable funds market. This can be explained by either a leftward shift in the supply of loanable funds curve or a rightward shift in the demand for loanable funds curve. Either scenario is the outcome of the government running a budget deficit holding everything else constant: that is, the government deciding to spend more than their tax revenue. When the interest rate increases in the loanable funds market private savings will increase, private investment spending will decrease, and consumption spending will decrease holding everything else constant.

c. When the country runs a trade surplus (net capital outflow) this causes the supply of loanable funds to shift to the left. If the country moves from balanced trade to a trade surplus, the country can anticipate that its interest rate in the loanable funds market will increase. This will cause private investment spending to fall, private savings to increase, and consumption spending to decrease holding everything else constant.

5. 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 $30,000 and imports equal $14,000. Given this information, what is the impact of net capital inflows on the supply of loanable funds curve?

Answer:

a. Private savings, government savings, and foreign savings in the form of net capital inflows.

b. When the government runs a surplus this means that at every interest rate there is now more savings. Effectively the supply of loanable funds increases at every interest rate: that is, the supply of loanable funds curve shifts to the right.

c. When the government runs a surplus and we model this on the demand for loanable funds side of the model, this means that the government will now be demanding fewer funds at every interest rate. Effectively the demand for loanable funds decreases at every interest rate: that is, the demand for loanable funds curve shifts to the left.

d. In this example, net capital inflows are negative (M – X = 14,000 – 30,000 = -16,000) 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 (negative) net capital inflows. Effectively we are reminded that when a country runs a trade surplus that the country is now providing savings to other countries.