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

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 Jaytown:

$$Y = (2.5)K^{1/2}L^{1/2}$$

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 Jaytown to produce real GDP. Initially K is equal to 16 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	16		---	---
1	16			
2	16			
.	.			
.	.			
.	.			
100	16			

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 Jaytown. 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 Jaytown increases to 25 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	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.

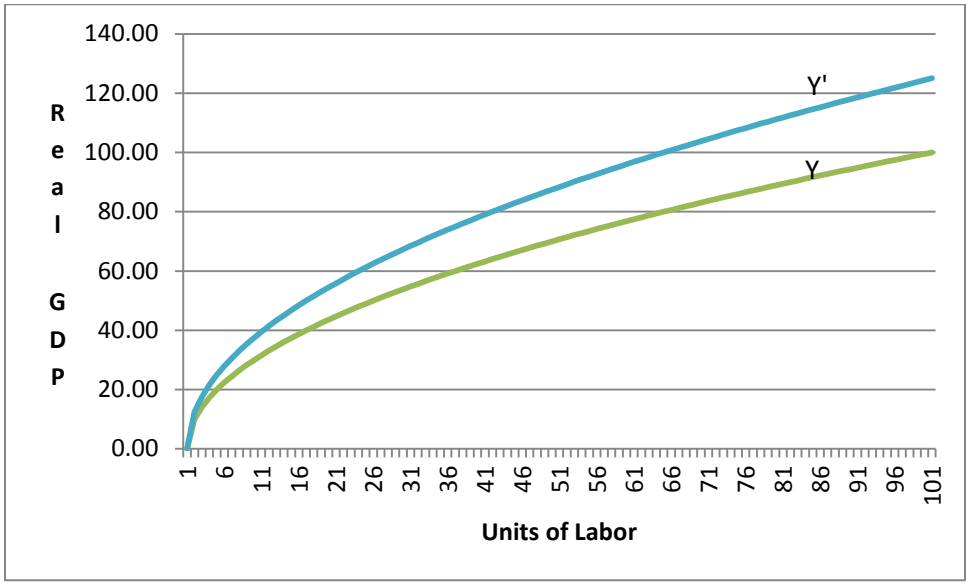
L	K	Y	MPl	Y/L
0	16	0.00		
1	16	10.00	10.00	10.00
2	16	14.14	4.14	7.07
3	16	17.32	3.18	5.77
4	16	20.00	2.68	5.00
5	16	22.36	2.36	4.47
6	16	24.49	2.13	4.08
7	16	26.46	1.96	3.78
8	16	28.28	1.83	3.54
9	16	30.00	1.72	3.33
10	16	31.62	1.62	3.16
11	16	33.17	1.54	3.02

12	16	34.64	1.47	2.89
13	16	36.06	1.41	2.77
14	16	37.42	1.36	2.67
15	16	38.73	1.31	2.58
16	16	40.00	1.27	2.50
17	16	41.23	1.23	2.43
18	16	42.43	1.20	2.36
19	16	43.59	1.16	2.29
20	16	44.72	1.13	2.24
21	16	45.83	1.10	2.18
22	16	46.90	1.08	2.13
23	16	47.96	1.05	2.09
24	16	48.99	1.03	2.04
25	16	50.00	1.01	2.00
26	16	50.99	0.99	1.96
27	16	51.96	0.97	1.92
28	16	52.92	0.95	1.89
29	16	53.85	0.94	1.86
30	16	54.77	0.92	1.83
31	16	55.68	0.91	1.80
32	16	56.57	0.89	1.77
33	16	57.45	0.88	1.74
34	16	58.31	0.86	1.71
35	16	59.16	0.85	1.69
36	16	60.00	0.84	1.67
37	16	60.83	0.83	1.64
38	16	61.64	0.82	1.62
39	16	62.45	0.81	1.60
40	16	63.25	0.80	1.58
41	16	64.03	0.79	1.56
42	16	64.81	0.78	1.54
43	16	65.57	0.77	1.52
44	16	66.33	0.76	1.51
45	16	67.08	0.75	1.49
46	16	67.82	0.74	1.47
47	16	68.56	0.73	1.46
48	16	69.28	0.73	1.44
49	16	70.00	0.72	1.43
50	16	70.71	0.71	1.41
51	16	71.41	0.70	1.40
52	16	72.11	0.70	1.39

53	16	72.80	0.69	1.37
54	16	73.48	0.68	1.36
55	16	74.16	0.68	1.35
56	16	74.83	0.67	1.34
57	16	75.50	0.67	1.32
58	16	76.16	0.66	1.31
59	16	76.81	0.65	1.30
60	16	77.46	0.65	1.29
61	16	78.10	0.64	1.28
62	16	78.74	0.64	1.27
63	16	79.37	0.63	1.26
64	16	80.00	0.63	1.25
65	16	80.62	0.62	1.24
66	16	81.24	0.62	1.23
67	16	81.85	0.61	1.22
68	16	82.46	0.61	1.21
69	16	83.07	0.60	1.20
70	16	83.67	0.60	1.20
71	16	84.26	0.60	1.19
72	16	84.85	0.59	1.18
73	16	85.44	0.59	1.17
74	16	86.02	0.58	1.16
75	16	86.60	0.58	1.15
76	16	87.18	0.58	1.15
77	16	87.75	0.57	1.14
78	16	88.32	0.57	1.13
79	16	88.88	0.56	1.13
80	16	89.44	0.56	1.12
81	16	90.00	0.56	1.11
82	16	90.55	0.55	1.10
83	16	91.10	0.55	1.10
84	16	91.65	0.55	1.09
85	16	92.20	0.54	1.08
86	16	92.74	0.54	1.08
87	16	93.27	0.54	1.07
88	16	93.81	0.53	1.07
89	16	94.34	0.53	1.06
90	16	94.87	0.53	1.05
91	16	95.39	0.53	1.05
92	16	95.92	0.52	1.04
93	16	96.44	0.52	1.04

94	16	96.95	0.52	1.03
95	16	97.47	0.51	1.03
96	16	97.98	0.51	1.02
97	16	98.49	0.51	1.02
98	16	98.99	0.51	1.01
99	16	99.50	0.50	1.01
100	16	100.00	0.50	1.00

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 25 units)and the lower line is Y (where capital is equal to 16 units).



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 $Y = 10L^{1/2}$ and the new aggregate production function can be written as $Y' = 12.5L^{1/2}$. 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.

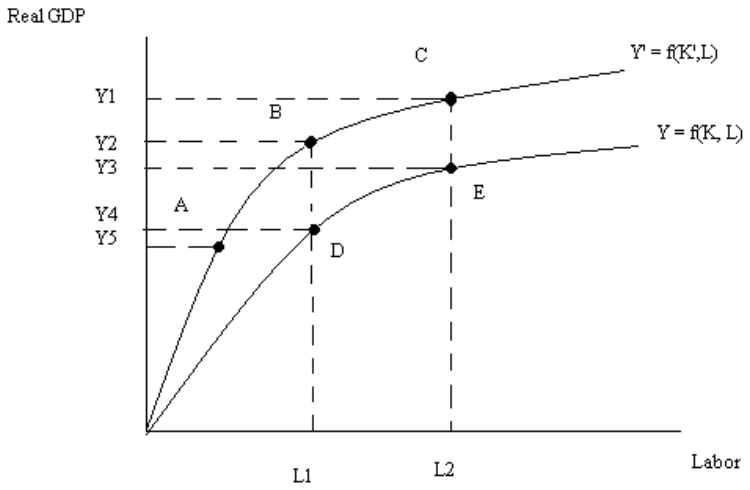
L	K'	Y'
0	25	0.00
1	25	12.50
2	25	17.68
3	25	21.65
4	25	25.00
5	25	27.95
6	25	30.62
7	25	33.07
8	25	35.36
9	25	37.50
10	25	39.53
11	25	41.46
12	25	43.30
13	25	45.07
14	25	46.77
15	25	48.41
16	25	50.00
17	25	51.54
18	25	53.03
19	25	54.49
20	25	55.90
21	25	57.28
22	25	58.63
23	25	59.95
24	25	61.24
25	25	62.50
26	25	63.74
27	25	64.95
28	25	66.14
29	25	67.31
30	25	68.47
31	25	69.60
32	25	70.71
33	25	71.81

34	25	72.89
35	25	73.95
36	25	75.00
37	25	76.03
38	25	77.06
39	25	78.06
40	25	79.06
41	25	80.04
42	25	81.01
43	25	81.97
44	25	82.92
45	25	83.85
46	25	84.78
47	25	85.70
48	25	86.60
49	25	87.50
50	25	88.39
51	25	89.27
52	25	90.14
53	25	91.00
54	25	91.86
55	25	92.70
56	25	93.54
57	25	94.37
58	25	95.20
59	25	96.01
60	25	96.82
61	25	97.63
62	25	98.43
63	25	99.22
64	25	100.00
65	25	100.78
66	25	101.55
67	25	102.32
68	25	103.08
69	25	103.83
70	25	104.58
71	25	105.33
72	25	106.07
73	25	106.80
74	25	107.53
75	25	108.25
76	25	108.97

77	25	109.69
78	25	110.40
79	25	111.10
80	25	111.80
81	25	112.50
82	25	113.19
83	25	113.88
84	25	114.56
85	25	115.24
86	25	115.92
87	25	116.59
88	25	117.26
89	25	117.92
90	25	118.59
91	25	119.24
92	25	119.90
93	25	120.55
94	25	121.19
95	25	121.83
96	25	122.47
97	25	123.11
98	25	123.74
99	25	124.37
100	25	125.00

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 E but then moves to point C. Explain verbally the change in the economy that results from this movement. Explain what caused this economy to move from E to C 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 C and then something changes in this economy so that the economy produces at point A. Describe verbally what changed and then comment on how this movement from point C to point A affects labor productivity.

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

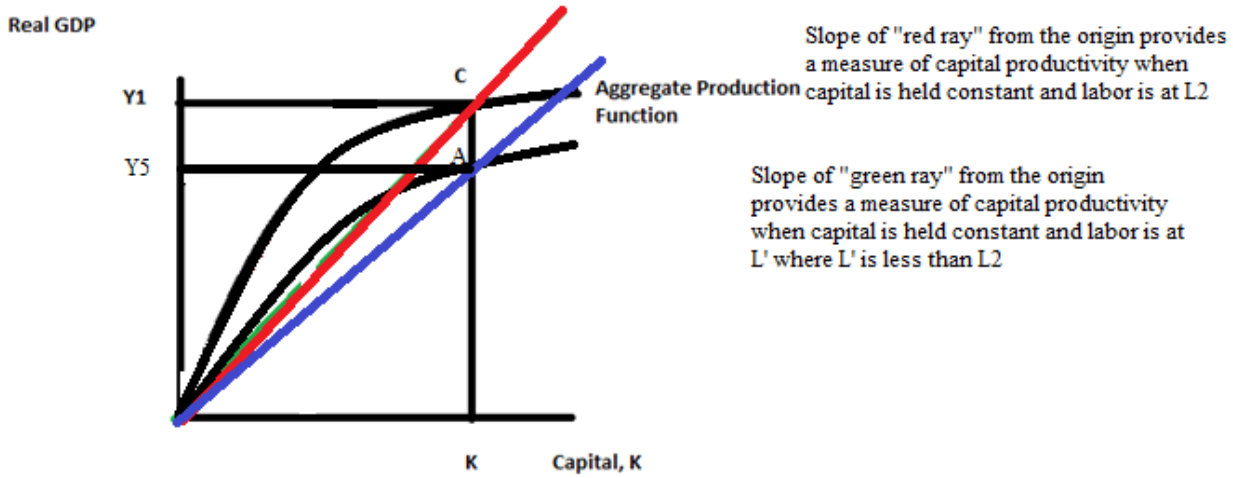
Answer:

a. When the economy moves from E to C the level of real GDP increases from Y3 to Y1. The level of real GDP increases because this economy has increased its use of capital from K to K' while holding its level of labor and technology constant.

b. Labor productivity increases as this economy moves from point E to point C. Recall that labor productivity is defined as Y/L and in this case both Y and K are increasing while the level of labor stays constant. As Y increases due to the availability of more capital, this causes each of the units of labor to have higher productivity: Y3/L is less than Y1/L. You can see this by drawing a straight line or ray from the origin through point E and then another line through the origin through point C: comparison of these two lines reveals that the slope of the line through point C is larger than the slope of the line through point E. The slope of this ray is equal to labor productivity: Y3/L.

c. When the economy moves from point C to point A we know from inspection of the graph that labor is decreasing while technology and capital are staying constant for this economy. Looking at the graph we see that capital is not changing because both points (C and A) are on the same aggregate production function. We see that labor is decreasing from L2 to an unmarked amount of labor that we can call L'. As the level of labor decreases while holding the level of capital constant, we find that the still employed labor is more productive because they have more capital per unit of labor to work with. Hence, labor productivity increases as this economy moves from point C to point A. We can see that by drawing the rays from the origin that pass through point C and pointA. Notice that the ray that goes through point A has a steeper slope than the ray that goes through point C: this tells us that labor productivity has risen when this economy moves from point C to point A.

d. Capital productivity is defined as Y/K: in this example we know that capital has remained unchanged from K'. From the provided graph we can see that real GDP, Y, has decreased as the level of labor employed falls: when labor is equal to L2, its initial level, Y is at Y1. When labor falls to L', then Y falls to Y5. Thus, capital productivity changes from Y1/K' to Y5/K'. The intuition here is that with less labor hired each unit of capital has less labor to work with and this makes each unit of capital less productive. 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 labor changes and we use this graph this results in a shift of the aggregate production function.



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 10%, $10,000 worth of loanable funds are demanded and at an interest rate of 8%, $14,000 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 3.75%, $5,000 worth of funds are supplied and when the interest rate is 3%, $4,000 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 $2000 while raising taxes by $3000. 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) = (5000, 3.75) and (4,000, 3) 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 = .75/1000 = 3/4000. And, r = (3/4000)Q + b or 3 = (3/4000)(4,000) + b or b = 0. Thus, the equation for the supply of loanable funds curve is r = (3/4000)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) = (10,000, 10) and (14,000, 8) both sit on the demand for loanable funds curve. Use these two points to find the slope. Thus, slope = -2/4000 = -1/2000. And, r = (-1/2000)Q + b or 10 = (-1/2000)(10,000) + b or b = 15 . And, the equation for the demand for loanable funds curve is r = (-1/2000)Q + 15.

c. Use the supply and demand curves that you found in (a) and (b) to answer this question.
(3/4000)Q = (-1/2000)Q + 15
(5/4000)Q = 15
Q = 15(4000/5) = 12,000

r = (3/4000)(12,000) = 9% or
r = (-1/2000)(12,000) + 15 = -6 + 15 = 9%

d. The government is now running a surplus since government spending is less than tax revenue. The government will have positive savings: you can model this as a rightward shift in the supply of loanable funds market or a leftward 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 left by 1000 at every interest rate or the supply of loanable funds curve shifting to the right by 1000 at every interest rate. With either modeling approach, this government surplus will result in lower interest rates in the loanable funds market holding everything else constant. With lower interest rates we can anticipate that investment spending will increase, private saving will decrease, and consumption spending will increase.

e. Analysis based on a leftward 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 left from the original demand for loanable funds curve. At every interest rate the quantity of loanable funds demanded has decreased by $1000 due to the government surplus. So, for example we know that the point (Q', r') = (11,000, 9) 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' = (-1/2000)Q' + b' and using the point (11,000, 9) we can find the value of b'. Thus, r' = (-1/2000)(Q') + b' or 9 = (-1/2000)(11,000) + b' or b' = 14.5. The new demand for loanable funds curve can be written as r' = (-1/2000)(Q') + 14.5.

Use this new demand curve and the original supply curve to find the new equilibrium. Thus,
(3/4000)Q' = (-1/2000)Q' + 14.5
(5/4000)Q' = 14.5
Q' = (14.5)(4000/5) = (14.5)(800) = 11,600 (Note this quantity is different from the quantity you get with the second method: it equates private saving of 11,600, and the sum of private investment plus the negative of government savings or 11,600)
r' = (3/4000)Q' = (3/4000)(11,600) = 8.7% or
r' = (-1/2000)Q' + 14.5 = (-1/2000)(11,600) + 14.5 = -5.8 + 14.5 = 8.7%
To find private savings: plug r = 8.7 into the initial supply of loanable funds curve:
r = (3/4000)Q or 8.7 = (3/4000)Q or Q = private saving = $11,600
To find private investment spending: plug r = 8.7 into the initial demand for loanable funds curve:
r = 15 – (1/2000)Q or 8.7 = 15 – (1/2000)Q or Q = private investment spending = $12,600

Analysis based on a rightward 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 right from the original supply of loanable funds curve. At every interest rate the quantity of loanable funds supplied has increased by $1000 due to the government surplus. So, for example we know that the point (Q', r') = (13,000, 9) 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' = (3/4000)Q' + b' and using the point (13,000, 9) we can find the value of b'. Thus, r' = (3/4000)(Q') + b' or 9 = (3/4000)(13,000) + b' or b' = -0.75. The new supply of loanable funds curve can be written as r' = (3/4000)(Q') – 0.75.

Use this new supply curve and the original demand curve to find the new equilibrium. Thus,
(3/4000)Q' – 0.75 = (-1/2000)Q' + 15
(5/4000)Q' = 15.75
Q' = (15.75)(4000/5) = (15.75)(800) = 12,600 (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 12, 600 with the level of private investment spending of 12,600)
r' = (3/4000)Q' – 0.75 = (3/4000)(12,600) = 9.45 – 0.75 = 8.7% or
r' = (-1/2000)Q' + 15 = (-1/2000)(12,600) + 15 = -6.3 + 15 = 8.7%

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 deficit. 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. Suppose that consumer confidence decreases and businesses anticipate that the next few quarters will be a hard time for their businesses. At the same time the government engages in an austerity program and has positive government savings. 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:

a. The government when it runs a budget deficit will have a deficiency of funds since the government is spending more than its tax revenue. This means that the government will be entering the loanable funds market as a demander of funds (this is modelling this problem with a demand shift) and this new demand for funds will shift the demand for loanable funds curve to the right. Modelling this on the demand side of the model makes it relatively easy to see that when the government runs a

deficit, the equilibrium interest rate in the loanable funds market will increase, the level of private investment spending will decrease, the level of private savings will increase, and the level of consumption spending will decrease.

If you want to model this government deficit on the supply of loanable funds side of the market, then the supply of loanable funds curve will shift to the left when the government runs a deficit. This leftward shift occurs because the government is essentially operating with negative government savings: at every interest rate there will be less saving available to the market. When the supply of loanable funds curve shifts to the left due to the government deficit, the equilibrium interest rate will increase, the level of private investment spending will decrease, the level of private savings will increase, and the level of consumption spending will decrease.

b. When businesses become pessimistic about the economic climate this decreases their demand for loanable funds at every interest rate: we can expect the demand for loanable funds curve to shift to the left due to this negative business climate. As consumers' confidence in the economy decreases we can anticipate that consumers will increase their savings at every interest rate. The supply of loanable funds curve will shift to the right. We can also model the positive government savings that results from the implementation of the austerity program as a rightward shift of the supply of loanable funds curve. So, the demand for loanable funds curve is shifting to the left and the supply of loanable funds curve is shifting to the right. These two shifts will result in a situation of indeterminancy since we do not know the magnitude of these two shifts relative to one another. We can note that the equilibrium interest rate in the loanable funds market will decrease relative to its initial level, while the equilibrium quantity of loanable funds may increase, decrease, or remain the same as the initial equilibrium quantity of loanable funds.

c. When the country runs a trade deficit this causes the supply of loanable funds to shift to the right. If the country increases its trade deficit this will cause the supply of loanable funds curve to shift to the right relative to its initial position. Holding everything else constant, we can predict that the equilibrium interest rate will decrease and the equilibrium quantity of loanable funds will increase when the country increases its trade deficit.

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 deficit. If we want to model this deficit on the demand side of the loanable funds market, then how will this deficit affect this curve? Explain your answer.

c. Suppose that exports equal $10,000 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 deficit and we model this on the demand for loanable funds side of the model, this means that the government will now be demanding more funds at every interest rate. Effectively the demand for loanable funds increases at every interest rate: that is, the demand for loanable funds curve shifts to the right.

c. In this example, net capital inflows are positive (M – X = 14,000 – 10,000 = 4,000) and this implies that the supply of loanable funds curve has shifted to the right. At every interest rate there is greater savings due to these net capital inflows. Effectively we are reminded that when a country runs a trade deficit that the country is now receiving savings from other countries.