Economics 102
Summer 2016
Answers to Homework #4
Due 7/11/16

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 Oscarville:

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

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 Oscarville to produce real GDP. Initially K is equal to 64 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	64		---	---
1	64			
2	64			
.	.			
.	.			
.	.			
100	64			

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 Oscarville. 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 Oscarville increases to 81 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	81	
1	81	
2	81	
.	.	
.	.	
.	.	
100	81	

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:

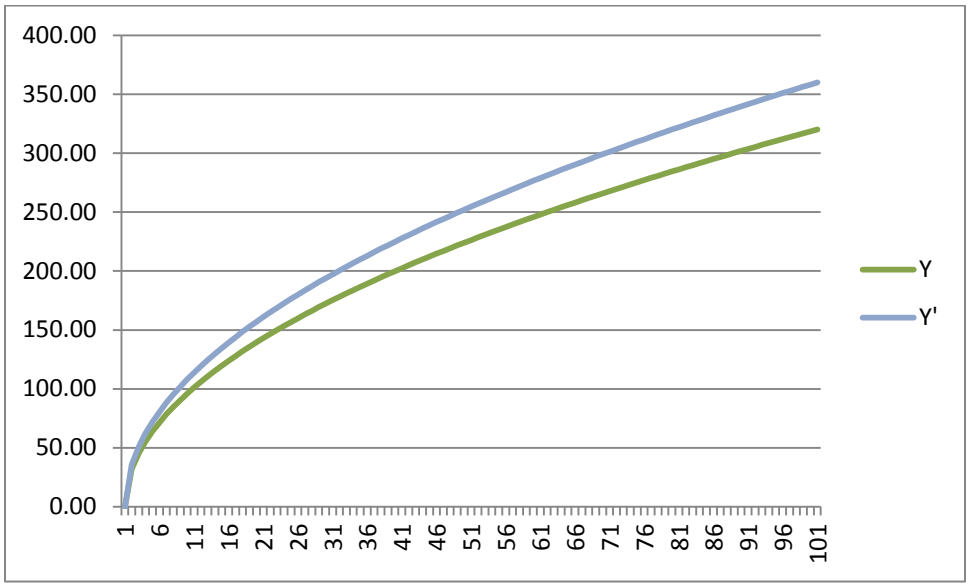
a.

L	K	Y	MPl	Y/L
0	64	0.00		
1	64	32.00	13.25	32.00
2	64	45.25	10.17	22.63
3	64	55.43	8.57	18.48
4	64	64.00	7.55	16.00
5	64	71.55	6.83	14.31
6	64	78.38	6.28	13.06
7	64	84.66	5.85	12.09
8	64	90.51	5.49	11.31
9	64	96.00	5.19	10.67
10	64	101.19	4.94	10.12
11	64	106.13	4.72	9.65
12	64	110.85	4.53	9.24
13	64	115.38	4.36	8.88
14	64	119.73	4.20	8.55
15	64	123.94	4.06	8.26
16	64	128.00	3.94	8.00

17	64	131.94	3.83	7.76
18	64	135.76	3.72	7.54
19	64	139.48	3.62	7.34
20	64	143.11	3.53	7.16
21	64	146.64	3.45	6.98
22	64	150.09	3.37	6.82
23	64	153.47	3.30	6.67
24	64	156.77	3.23	6.53
25	64	160.00	3.17	6.40
26	64	163.17	3.11	6.28
27	64	166.28	3.05	6.16
28	64	169.33	3.00	6.05
29	64	172.33	2.95	5.94
30	64	175.27	2.90	5.84
31	64	178.17	2.85	5.75
32	64	181.02	2.81	5.66
33	64	183.83	2.76	5.57
34	64	186.59	2.72	5.49
35	64	189.31	2.69	5.41
36	64	192.00	2.65	5.33
37	64	194.65	2.61	5.26
38	64	197.26	2.58	5.19
39	64	199.84	2.55	5.12
40	64	202.39	2.51	5.06
41	64	204.90	2.48	5.00
42	64	207.38	2.45	4.94
43	64	209.84	2.43	4.88
44	64	212.26	2.40	4.82
45	64	214.66	2.37	4.77
46	64	217.03	2.35	4.72
47	64	219.38	2.32	4.67
48	64	221.70	2.30	4.62
49	64	224.00	2.27	4.57
50	64	226.27	2.25	4.53
51	64	228.53	2.23	4.48
52	64	230.76	2.21	4.44
53	64	232.96	2.19	4.40
54	64	235.15	2.17	4.35
55	64	237.32	2.15	4.31
56	64	239.47	2.13	4.28
57	64	241.59	2.11	4.24
58	64	243.70	2.09	4.20
59	64	245.80	2.07	4.17

60	64	247.87	2.06	4.13
61	64	249.93	2.04	4.10
62	64	251.97	2.02	4.06
63	64	253.99	2.01	4.03
64	64	256.00	1.99	4.00
65	64	257.99	1.98	3.97
66	64	259.97	1.96	3.94
67	64	261.93	1.95	3.91
68	64	263.88	1.93	3.88
69	64	265.81	1.92	3.85
70	64	267.73	1.91	3.82
71	64	269.64	1.89	3.80
72	64	271.53	1.88	3.77
73	64	273.41	1.87	3.75
74	64	275.27	1.85	3.72
75	64	277.13	1.84	3.70
76	64	278.97	1.83	3.67
77	64	280.80	1.82	3.65
78	64	282.62	1.81	3.62
79	64	284.42	1.79	3.60
80	64	286.22	1.78	3.58
81	64	288.00	1.77	3.56
82	64	289.77	1.76	3.53
83	64	291.53	1.75	3.51
84	64	293.28	1.74	3.49
85	64	295.03	1.73	3.47
86	64	296.76	1.72	3.45
87	64	298.48	1.71	3.43
88	64	300.19	1.70	3.41
89	64	301.89	1.69	3.39
90	64	303.58	1.68	3.37
91	64	305.26	1.67	3.35
92	64	306.93	1.66	3.34
93	64	308.60	1.65	3.32
94	64	310.25	1.65	3.30
95	64	311.90	1.64	3.28
96	64	313.53	1.63	3.27
97	64	315.16	1.62	3.25
98	64	316.78	1.61	3.23
99	64	318.40	1.60	3.22
100	64	320.00	3.20	3.20

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.



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 $Y = 4(8)L^{1/2}$ and the new aggregate production function can be written as $Y' = 4(9)L^{1/2}$. 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.

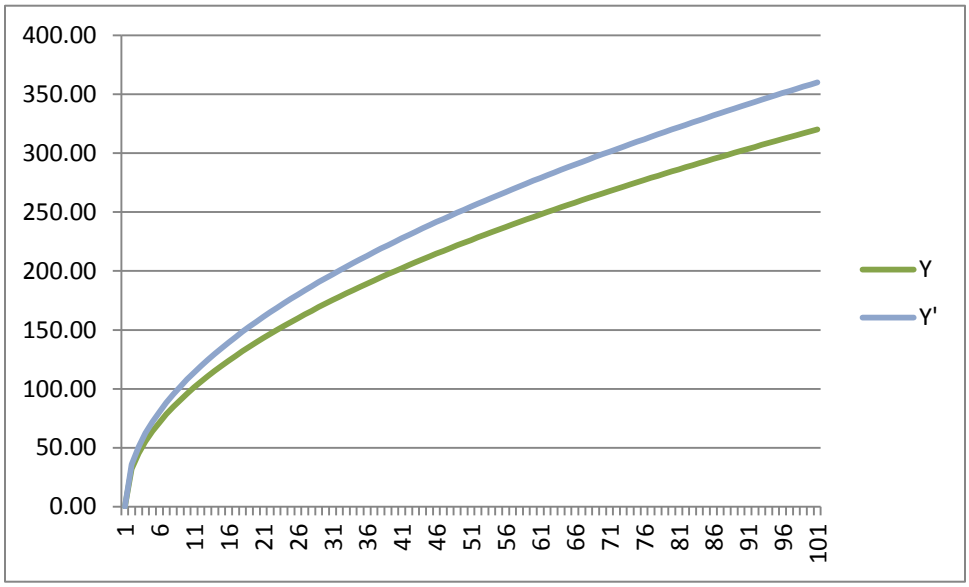
L	K'	Y'
0	81	0.00
1	81	36.00
2	81	50.91
3	81	62.35

4	81	72.00
5	81	80.50
6	81	88.18
7	81	95.25
8	81	101.82
9	81	108.00
10	81	113.84
11	81	119.40
12	81	124.71
13	81	129.80
14	81	134.70
15	81	139.43
16	81	144.00
17	81	148.43
18	81	152.74
19	81	156.92
20	81	161.00
21	81	164.97
22	81	168.85
23	81	172.65
24	81	176.36
25	81	180.00
26	81	183.56
27	81	187.06
28	81	190.49
29	81	193.87
30	81	197.18
31	81	200.44
32	81	203.65
33	81	206.80
34	81	209.91
35	81	212.98
36	81	216.00
37	81	218.98
38	81	221.92
39	81	224.82
40	81	227.68
41	81	230.51
42	81	233.31
43	81	236.07
44	81	238.80
45	81	241.50
46	81	244.16

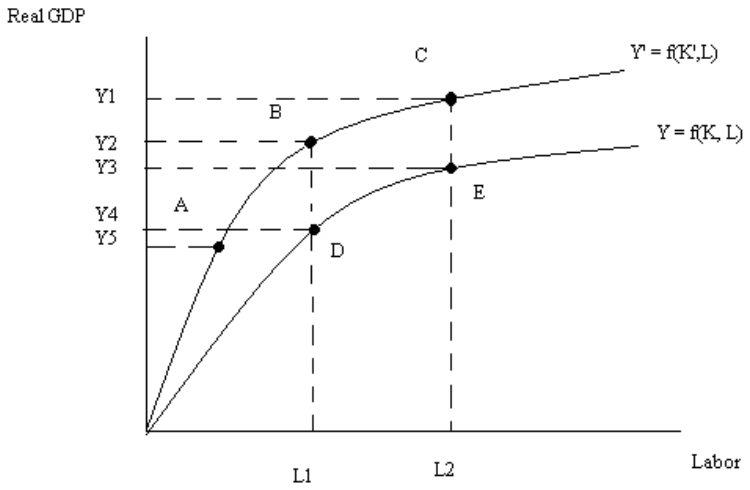
47	81	246.80
48	81	249.42
49	81	252.00
50	81	254.56
51	81	257.09
52	81	259.60
53	81	262.08
54	81	264.54
55	81	266.98
56	81	269.40
57	81	271.79
58	81	274.17
59	81	276.52
60	81	278.85
61	81	281.17
62	81	283.46
63	81	285.74
64	81	288.00
65	81	290.24
66	81	292.47
67	81	294.67
68	81	296.86
69	81	299.04
70	81	301.20
71	81	303.34
72	81	305.47
73	81	307.58
74	81	309.68
75	81	311.77
76	81	313.84
77	81	315.90
78	81	317.94
79	81	319.97
80	81	321.99
81	81	324.00
82	81	325.99
83	81	327.98
84	81	329.95
85	81	331.90
86	81	333.85
87	81	335.79
88	81	337.71
89	81	339.62

90	81	341.53
91	81	343.42
92	81	345.30
93	81	347.17
94	81	349.03
95	81	350.88
96	81	352.73
97	81	354.56
98	81	356.38
99	81	358.20
100	81	360.00

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 D. Explain verbally the change in the economy that results from this movement. Explain what caused this economy to move from E to D 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 E. Describe verbally what changed and then comment on how this movement from point C to point E affects labor productivity.

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

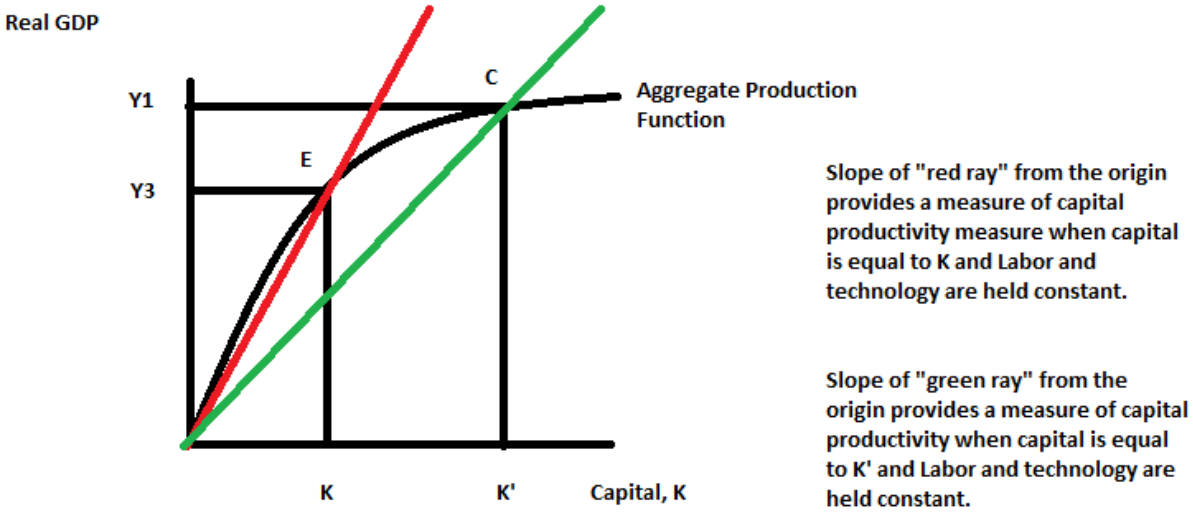
Answer:

a. When the economy moves from E to D the level of real GDP decreases from Y3 to Y4. The level of real GDP decreases because this economy has reduced its use of labor from L2 to L1 while holding its level of capital and technology constant.

b. Labor productivity increases as this economy moves from point E to point D. 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 D and then another line through the origin through point E: comparison of these two lines reveals that the slope of the line through point D is larger than the slope of the line through point E. The slope of this ray is equal to labor productivity: Y/L.

c. When the economy moves from point C to point E 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 decreases then labor will be less productive: hence, labor productivity decreases as this economy moves from point C to point E. We can see that by drawing the rays from the origin that pass through point C and point E. 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 fallen when this economy moves from point C to point E.

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 Y1 and when capital is K, the level of output is Y3.Thus, capital productivity changes from Y1/K' to Y3/K. But, how do we know with certainty that capital productivity has increased? This is intuitively true because we know that capital is decreasing but labor is not changing: thus, each unit of capital is now having to work with more labor and that will mean that capital productivity must be rising. 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 2%, $1,000 worth of loanable funds are supplied and at an interest rate of 4%, $2,000 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 4%, $1,000 worth of funds are demanded and when the interest rate is 2%, $2,000 worth of funds are demanded. 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 $200 while raising taxes by $100. 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) = (1000, 2) and (2,000, 4) 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 = 2/1000 = 1/500. And, $r = (1/500)Q + b$ or $2 = (1/500)(1{,}000) + b$ or $b = 0$. Thus, the equation for the supply of loanable funds curve is $r = (1/500)Q$.

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) = (1000, 4) and (2,000, 2) both sit on the demand for loanable funds curve. Use these two points to find the slope. Thus, slope = -2/1000 = -1/500. And, $r = (-1/500)Q + b$ or $2 = (-1/500)(2000) + b$ or $b = 6$. And, the equation for the demand for loanable funds curve is $r = (-1/500)Q + 6$.

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

(1/500)Q = (-1/500)Q + 6
(2/500)Q = 6
Q = 6(500/2) = 1500
r = (1/500)(1500) = 3% or
r = (-1/500)(1500) + 6 = -3 + 6 = 3%

d. The government is now running a deficit since government spending exceeds tax revenue. The government will need to finance this deficit of $100 by borrowing funds from the loanable funds market. Effectively this will shift the demand for loanable funds curve to the right by $100 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 $100 in order to finance the government deficit. So, for example we know that the point (Q', r') = (2100, 2) 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' = (-1/500)Q' + b' and using the point (2100, 2) we can find the value of b'. Thus, r' = (-1/500)(Q') + b' or 2 = (-1/500)(2100) + b' or b' = 6.2. The new demand for loanable funds curve can be written as r' = (-1/500)(Q') + 6.2.

Use this new demand curve and the original supply curve to find the new equilibrium. Thus,
(1/500)Q' = (-1/500)Q' + 6.2
(2/500)Q' = 6.2
Q' = (6.2)(500/2) = (3.1)(500) = 1550
r' = (1/500)Q' = (1/500)(1550) = 3.1% or
r' = (-1/500)Q' + 6.2 = (-1/500)(1550) + 6.2 = -3.1 + 6.2 = 3.1%

4. 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 the next few quarters will be a great time for 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 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.

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

Answers:

a. When businesses become optimistic about the economic climate this increases their demand for loanable funds at every interest rate: we can expect the demand for loanable funds curve to shift to the right due to this positive business climate. As consumers' confidence in the economy increases we can anticipate that consumers will decrease their savings at every interest rate. The supply of loanable funds curve will shift to the left. 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 increase 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.

b. The government when it runs a budget surplus will have excess funds that it is not spending that it can then funnel into the loanable funds market. You can model this either with a shift of the supply of loanable funds curve to the right indicating that the amount of funds supplied to the market is increased at every interest rate due to the government's running a surplus; or, you can model this as a leftward shift in the demand for loanable funds curve indicating that at every interest rate the government is now demanding fewer funds since it is running a budget surplus. Modelling this on the supply side of the loanable funds market it is relatively easy to see that when the government runs a surplus, the equilibrium interest rate in the loanable funds market will decrease and the equilibrium quantity of loanable funds will increase.

c. When the country runs a trade surplus this causes the supply of loanable funds to shift to the left. If the country reduces its trade surplus this will cause the supply of loanable funds curve to shift to the right relative to its position when the country was running a bigger trade surplus. 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 reduces its trade surplus.

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 $1000 and imports equal $400. 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 = 400 – 1000 = -600) and this implies that the supply of loanable funds curve has shifted to the left. At every interest rate there is lower savings due to these net capital inflows. Effectively we are reminded that when a country runs a trade surplus that there are also providing savings to other countries.