Economics 102
Summer 2018
Homework #1 with Answers
Due June 20, 2018

Directions: This homework will be collected in a box **before** the lecture. Please place your name on top of the stapled pages you submit. Make sure you write your name as it appears on your ID so that you can receive the correct grade. **Please show your work.** Good luck!

Please remember to

- Staple your work before submitting it.
- Do work that is at a professional level: you are creating your "brand" when you submit this work!
- Do not submit messy, illegible, sloppy work.

1. Consider the aggregate production function for Snead's Ferry:

$$Y = (4)K^{1/3}L^{2/3}$$

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 Snead's Ferry 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. 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	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 Snead's Ferry. 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 Snead's Ferry 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.

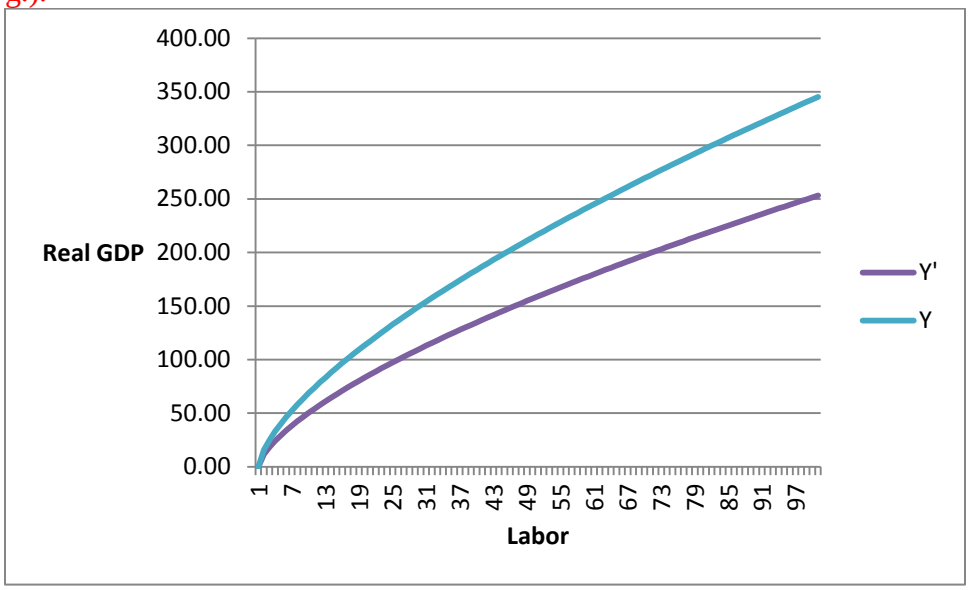
L	K	Y	MPl	Y/L
0	64	0.00		
1	64	15.78	15.78	15.78
2	64	25.11	9.33	12.55
3	64	32.94	7.84	10.98
4	64	39.95	7.00	9.99
5	64	46.39	6.44	9.28
6	64	52.42	6.03	8.74
7	64	58.12	5.70	8.30
8	64	63.56	5.44	7.94
9	64	68.78	5.22	7.64
10	64	73.81	5.03	7.38
11	64	78.67	4.87	7.15
12	64	83.40	4.72	6.95
13	64	87.99	4.59	6.77
14	64	92.47	4.48	6.61
15	64	96.85	4.37	6.46
16	64	101.13	4.28	6.32
17	64	105.32	4.19	6.20

18	64	109.43	4.11	6.08
19	64	113.47	4.04	5.97
20	64	117.43	3.97	5.87
21	64	121.34	3.90	5.78
22	64	125.18	3.84	5.69
23	64	128.96	3.78	5.61
24	64	132.69	3.73	5.53
25	64	136.37	3.68	5.45
26	64	140.00	3.63	5.38
27	64	143.59	3.59	5.32
28	64	147.13	3.54	5.25
29	64	150.63	3.50	5.19
30	64	154.09	3.46	5.14
31	64	157.51	3.42	5.08
32	64	160.90	3.39	5.03
33	64	164.25	3.35	4.98
34	64	167.57	3.32	4.93
35	64	170.85	3.29	4.88
36	64	174.11	3.26	4.84
37	64	177.34	3.23	4.79
38	64	180.53	3.20	4.75
39	64	183.70	3.17	4.71
40	64	186.84	3.14	4.67
41	64	189.96	3.12	4.63
42	64	193.05	3.09	4.60
43	64	196.12	3.07	4.56
44	64	199.16	3.04	4.53
45	64	202.19	3.02	4.49
46	64	205.19	3.00	4.46
47	64	208.16	2.98	4.43
48	64	211.12	2.96	4.40
49	64	214.06	2.94	4.37
50	64	216.97	2.92	4.34
51	64	219.87	2.90	4.31
52	64	222.75	2.88	4.28
53	64	225.61	2.86	4.26
54	64	228.46	2.84	4.23
55	64	231.28	2.83	4.21
56	64	234.09	2.81	4.18
57	64	236.88	2.79	4.16
58	64	239.66	2.78	4.13
59	64	242.42	2.76	4.11
60	64	245.17	2.75	4.09

61	64	247.90	2.73	4.06
62	64	250.61	2.72	4.04
63	64	253.31	2.70	4.02
64	64	256.00	2.69	4.00
65	64	258.67	2.67	3.98
66	64	261.33	2.66	3.96
67	64	263.98	2.65	3.94
68	64	266.61	2.63	3.92
69	64	269.23	2.62	3.90
70	64	271.84	2.61	3.88
71	64	274.44	2.60	3.87
72	64	277.02	2.58	3.85
73	64	279.59	2.57	3.83
74	64	282.15	2.56	3.81
75	64	284.70	2.55	3.80
76	64	287.24	2.54	3.78
77	64	289.77	2.53	3.76
78	64	292.28	2.52	3.75
79	64	294.79	2.51	3.73
80	64	297.28	2.49	3.72
81	64	299.77	2.48	3.70
82	64	302.24	2.47	3.69
83	64	304.71	2.46	3.67
84	64	307.16	2.45	3.66
85	64	309.61	2.45	3.64
86	64	312.04	2.44	3.63
87	64	314.47	2.43	3.61
88	64	316.89	2.42	3.60
89	64	319.29	2.41	3.59
90	64	321.69	2.40	3.57
91	64	324.08	2.39	3.56
92	64	326.47	2.38	3.55
93	64	328.84	2.37	3.54
94	64	331.20	2.36	3.52
95	64	333.56	2.36	3.51
96	64	335.91	2.35	3.50
97	64	338.25	2.34	3.49
98	64	340.58	2.33	3.48
99	64	342.91	2.32	3.46
100	64	345.22	2.32	3.45

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 64 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 diminishing marginal returns: it ix a result that occurs 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 $Y = aL^{2/3}$ and the new aggregate production function can be written as $Y' = bL^{2/3}$, where $a > b$ since $4K^{1/3}$ when K is 64 is bigger than when K' is 25. 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	11.57

2	25	18.41
3	25	24.16
4	25	29.29
5	25	34.02
6	25	38.44
7	25	42.62
8	25	46.61
9	25	50.43
10	25	54.12
11	25	57.69
12	25	61.15
13	25	64.52
14	25	67.81
15	25	71.02
16	25	74.16
17	25	77.23
18	25	80.24
19	25	83.20
20	25	86.11
21	25	88.97
22	25	91.79
23	25	94.57
24	25	97.30
25	25	100.00
26	25	102.66
27	25	105.29
28	25	107.89
29	25	110.46
30	25	112.99
31	25	115.50
32	25	117.99
33	25	120.44
34	25	122.88
35	25	125.29
36	25	127.67
37	25	130.04
38	25	132.38
39	25	134.71
40	25	137.01
41	25	139.30
42	25	141.57
43	25	143.81
44	25	146.05

45	25	148.26
46	25	150.46
47	25	152.65
48	25	154.81
49	25	156.97
50	25	159.11
51	25	161.23
52	25	163.34
53	25	165.44
54	25	167.53
55	25	169.60
56	25	171.66
57	25	173.71
58	25	175.74
59	25	177.77
60	25	179.78
61	25	181.78
62	25	183.77
63	25	185.75
64	25	187.72
65	25	189.68
66	25	191.63
67	25	193.58
68	25	195.51
69	25	197.43
70	25	199.34
71	25	201.24
72	25	203.14
73	25	205.02
74	25	206.90
75	25	208.77
76	25	210.63
77	25	212.49
78	25	214.33
79	25	216.17
80	25	218.00
81	25	219.82
82	25	221.63
83	25	223.44
84	25	225.24
85	25	227.03
86	25	228.82
87	25	230.60

88	25	232.37
89	25	234.14
90	25	235.90
91	25	237.65
92	25	239.40
93	25	241.14
94	25	242.87
95	25	244.60
96	25	246.32
97	25	248.04
98	25	249.75
99	25	251.45
100	25	253.15

2. You are given the following information about an economy. Use the Keynesian Model discussed in class to analyze this model. Y is real GDP, T is taxes, TR is transfers, C is consumption spending, G is government spending, I is investment spending, and X – IM is net foreign expenditure.

Y	T – TR	C	G	I	X - IM
0	10	15	20	5	-10
100	10	65	20	5	-10
200	10	115	20	5	-10
300	10	165	20	5	-10

a. Examine the data:

i. Describe this economy's budget balance.

Since government spending, G, is greater than net taxes, (T – TR), we know that this government is operating with a budget deficit.

ii. Describe this economy's trade situation.

Since X – IM is a negative number this tells us that this country is importing more goods than it is exporting. This indicates that this country is running a trade deficit.

b. Using the above information derive this economy's consumption function with respect to disposable income, (Y- (T- TR)). Then derive this economy's consumption function with respect to aggregate income, (real GDP or Y). Show all your work.

From the data in the table it will be helpful to add a column that includes disposable income:

Y	T – TR	Y – (T – TR)	C	G	I	X - IM
0	10	-10	15	20	5	-10
100	10	90	65	20	5	-10
200	10	190	115	20	5	-10
300	10	290	165	20	5	-10

Now we can see that when disposable income changes from -10 to 90, a change of 100, consumption spending changes from 15 to 65, a change of 50. Thus, the marginal propensity to consume or MPC can be calculated as (the change in consumption spending)/(the change in disposable income) = 50/100 = .5. The MPC is the slope of the consumption function. Thus,

$C = a + b(Y – (T – TR))$

$C = a + .5(Y – (T – TR))$

To find the value of a, autonomous consumption, we can use any of the pairs of (disposable income, consumption spending) we have in the table. Thus,

$65 = a + .5(90)$

$a = 20$

The consumption function with respect to disposable income is therefore:

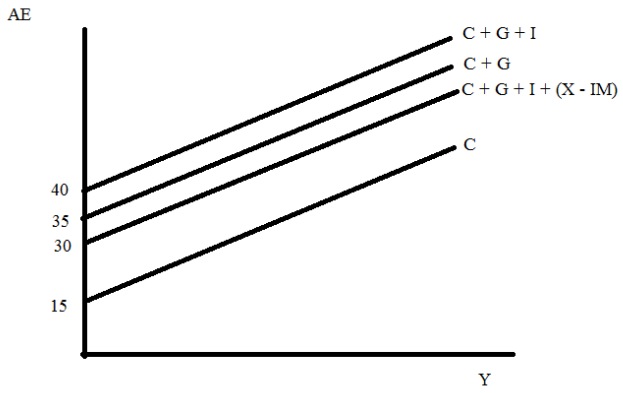
$C = 20 + .5(Y – (T – TR))$

The consumption function with respect to real GDP can be found by plugging in the value for the autonomous net taxes. Thus,

$C = 20 + .5(Y – 10)$

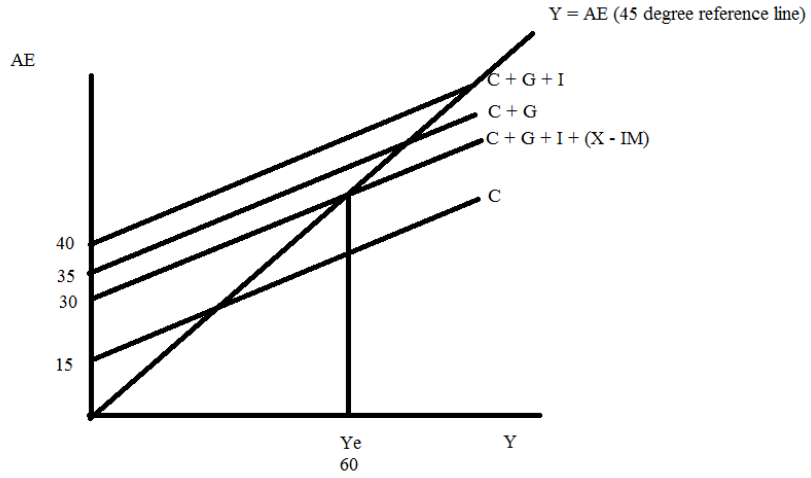
$C = 15 + .5Y$

c. Now that you have the consumption function, graph this country's consumption function, government spending, investment spending, net exports and aggregate expenditure in a graph with real GDP or Y measured on the horizontal axis, and aggregate expenditure measured on the vertical axis.



d. Find the equilibrium level of output for this economy. Show your work. Then illustrate this equilibrium level of output for this economy with a Keynesian cross diagram. Make sure you label the axis and any lines that you have in the graph as well as the equilibrium level of output.

Y = AE in equilibrium
Y = C + I + G + (X – IM)
Y = 15 + .5Y + 5 + 20 + (-10)
.5Y = 30
Ye = 60



e. Suppose that the full employment level of real GDP (Yfe) is equal to 100. How much would government spending need to change by in order for this economy to reach Yfe? Show your work and then provide a check that illustrates that your answer is correct.

Ye = 60
Yfe = 100
Change in Y needed to reach full employment = Yfe – Ye = 100 – 60 = 40
Change in Y = (multiplier)(change in government spending)
40 = (1/(1 – b))(change in government spending)
40 = (1/(1 - .5))(change in government spending)
40 = 2(change in government spending)
Change in government spending = 20

Check: if G increases from G = 20 to G' = 40, what happens to Y?
Y' = C + I + G' + (X – IM)
Y' = 15 + .5(Y') + 5 + 40 + (-10)
.5Y' = 50
Y' = Yfe = 100

f. Suppose that the full employment level of real GDP (Yfe) is equal to 100. How much would net taxes need to change by in order for this economy to reach Yfe? Show your work and then provide a check that illustrates that your answer is correct.

Ye = 60
Yfe = 100
Change in Y needed to reach full employment = Yfe – Ye = 100 – 60 = 40
Change in Y = (tax expenditure multiplier)(change in net taxes)
40 = (-b/(1 – b))(change in net taxes)

40 = (-.5/(1 - .5))(change in net taxes)
40 = -1(change in net taxes)
Change in net taxes = -40

Check: if (T – TR) decreases from T - TR = 10 to (T – TR)' = -30, what happens to Y?
Y" = C + I + G + (X – IM)
Note: the consumption function is changing here:
C = 20 + .5(Y – (T – TR))
C = 20 + .5(Y" –(-30))
C = 20 + .5(Y" + 30)
C = 35 + .5Y"
Note: that G is back to its original level where G = 20:
Y" = 35 + .5(Y") + 5 + 20 + (-10)
.5Y" = 50
Y" = Yfe = 100

g. Suppose that the full employment level of real GDP (Yfe) is equal to 100. Suppose the government is committed to a policy that holds the deficit constant at its current level. Given this assumption, how much would government spending and net taxes need to change by in order for this economy to reach Yfe? Show your work and then provide a check that illustrates that your answer is correct.

Ye = 60
Yfe = 100
Change in Y needed to reach full employment = Yfe – Ye = 100 – 60 = 40
Change in Y = (multiplier)(change in government spending) + (tax expenditure multiplier)(change in net taxes)
40 = (1/(1 – b))(change in government spending) + (-b/(1 – b))(change in net taxes)
Recall that the change in government spending must equal the change in net taxes
40 = (1/(1 – b))(change in government spending) + (-b/(1 – b))(change in government spending)
40 = (1/(1 – b) + (-b/(1 – b))(change in government spending)
40 = ((1-b)/(1 – b))(change in government spending)
40 = change in government spending = change in net taxes

Check: if G increases by 40 to g* = 60 and (T – TR) increases from T - TR = 10 to (T – TR)* = 50, what happens to Y?
Y* = C + I + G* + (X – IM)
Note: the consumption function is changing here:
C = 20 + .5(Y – (T – TR))
C = 20 + .5(Y* – 50)
C = -5 + .5Y*
Note: that G is now equal to G* = 60:
Y* = -5 + .5(Y*) + 5 + 60 + (-10)
.5Y* = 50
Y* = Yfe = 100

3. Suppose you are given the following information about an economy:

Required reserve ratio is 10%
Money Supply (Ms): Ms = 52,000
Money Demand (Md): Md = 56,000 – 1000r where r is the interest rate (When the interest rate is 3%, it means r = 3)
Investment Spending (I): I = 340 – 10r
Consumption Spending (C): C = 2400 + 0.5(Y – (T- TR)) - 100P where P is the aggregate price level
Government Spending (G): G = 500
Net Exports (NX): NX = X – IM = -100
Autonomous Taxes (T): T = 300
Transfers (TR) =100
AD: Y = C + I + G + (X – IM)
Long run Aggregate Supply (LRAS): LRAS = Yfe = 4,500
Short run Aggregate Supply (SRAS): Y = 500P – 1,000

a. Given the above information, what is the equilibrium interest rate in this economy?

Answer:
To find the equilibrium interest rate you need to find the interest rate that equates money supply to money demand. Hence,
52,000 = 56,000 – 1000r
r = 4 or 4%

b. Given the above information, what is the level of investment spending in this economy?

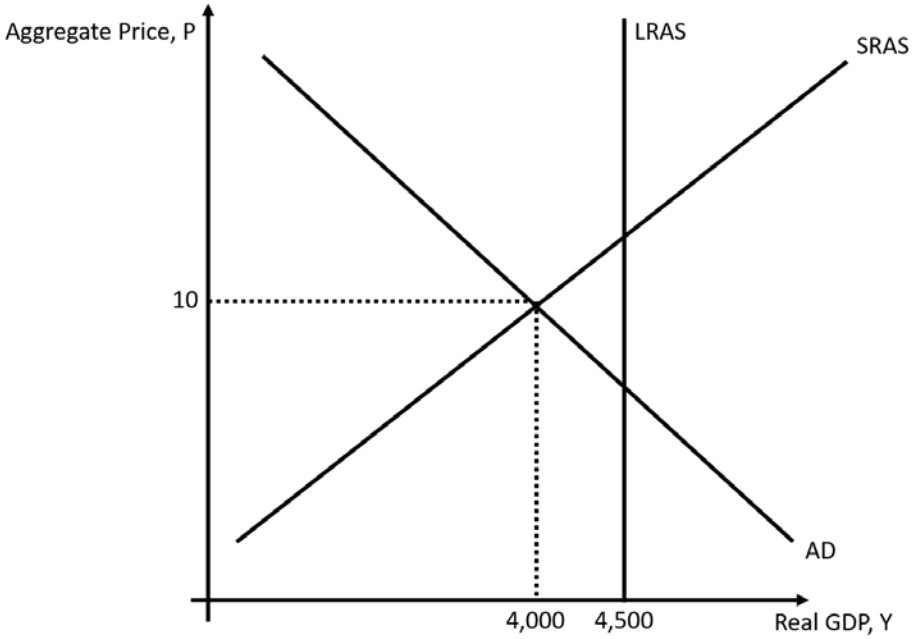
Answer:
We know that I = 340 – 10r and we just calculated that r = 4%. So,
I = 340 – (10)(4) = $300

c. Given the above information, calculate an equation that expresses this economy's aggregate demand for goods and services.

Answer:
We know that AD = AE = Y and AE = C + I + G + (X – IM). Hence,
Y = C + I + G + (X – IM)
Y = 2400 + 0.5(Y – (T-TR)) – 100P + I + G + (X – IM)
Y = 2400 + 0.5(Y – (300-100)) – 100P + 300 + 500 + (-100)
Y = 6,000 – 200P
The equation for AD can be written as Y = 6,000 – 200P.

d. Find the short run equilibrium level of real GDP (Y) and the short run aggregate price level (P). Then draw a graph illustrating this short run equilibrium. In your graph include the LRAS curve as well. In your graph measure the aggregate price level on the vertical axis and real GDP on the horizontal axis.

Answer:
To find the short run equilibrium we will want to see where the AD curve intersects the SRAS curve. Thus,
6,000 – 200P = 500P – 1,000
7,000 = 700P
Pe = 10
Ye = 6,000 – 200P = 6,000 – 200(10) = 4,000



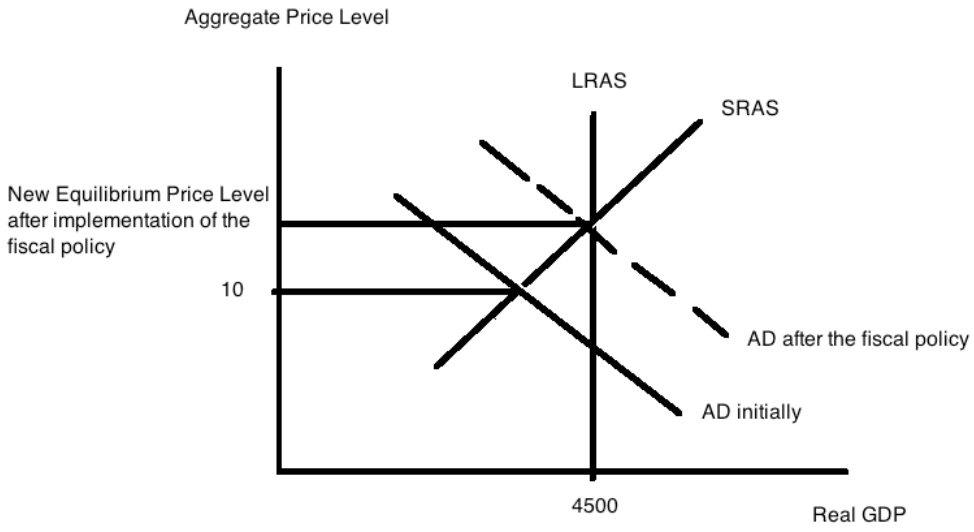
e. The government now sets a goal of using monetary policy to reach full employment. Can the government reach this goal using only monetary policy? In your answer remember that it is not possible to have the nominal interest rate go below 0% (the "Zero Lower Bound").
HINT: Holding everything else constant, what is the highest level of real GDP in the short run this economy can attain if the government engages in activist monetary policy?

Answer:
The conduit for monetary policy in this model is the interest rate and its impact on the level of investment. So, let's start with thinking about the maximum amount of investment spending that will occur in this economy. This maximum level of investment spending is that level associated with a nominal interest rate of 0%. So, I = 340 - 10r and if r = 0% then we have:
I = 340
When the interest rate is 0% this will result in investment spending being equal to $340. So, given this policy and its impact, new AD curve is given by:
Y = C + I' + G + NX
Y = 2400 + 0.5(Y – (T-TR)) – 100P + I' + G + NX
Y = 2400 + 0.5(Y – (300-100)) – 100P + 340 + 500 + (-100)
Y = 6,080 – 200P
Use the SRAS curve and this new AD curve to find the new equilibrium aggregate price level and the new equilibrium real GDP. Thus,

6,080 – 200P = 500P – 1,000
700P = 7,080
P = 10.11
Y = 6,080 – 200(10.11) = 4,058 < 4,500 = Yfe
Since the equilibrium output level when the interest rate is equal to 0% is below the full employment level of output, it is not possible for this economy to reach full employment solely through monetary policy.

f. The government now sets a goal of using fiscal policy (assume the government is not using any monetary policy) to reach full employment. Can the government reach this goal using only fiscal policy? To make this as simple as possible, assume that the fiscal policy is a change in the level of government spending holding everything else constant? Calculate what the new level of government spending would need to be if this economy was to reach full employment using fiscal policy only. Show your work. Hint: do NOT use the multiplier here since you will get the wrong answer!

Answer:
Looking at a graph we know that we are looking to shift the AD curve to the right through fiscal policy so that Y = 4500 and the aggregate price level is at the level where the SRAS and the LRAS intersect. Here's the graph that will guide the work we need to do:



We know that Yfe = 4500. When Y = Yfe = 4500 and the LRAS = SRAS, what is the aggregate price level, P'? Equate the SRAS to the LRAS:
500P' – 1000 = 4500
500P' = 5500
P' = 11
We also know that AD can be found as Y = C + I + G + (X – IM). We are only planning on changing G from its initial level of $500 to some new level that we will call G'. We also know that P' if we are at the FE level of output and also on the SRAS is going to equal P' = 11.
Y = 2400 + .5(Y – (T-TR)) – 100P + 300 + G' + (-100)

Y = 2400 + .5(Y – (300-100)) – 100(11) + 300 + G’ + (-100)
.5Y = 2600 – 100 - 1100 + G’
Y = 2800 + 2G’
But, we know that we want Y = Yfe = 4500. So,
4500 = 2800 + 2G’
2G’ = 1700
G’ = 850
So, if this economy increases government spending from $500 to $850, this economy will be at the FE level of output, Y = $4500. Let’s check to make sure this works:
AD’: Y’ = C + I + G’ + (X – IM)
AD’: Y’ = 2400 + .5(Y’ – T) – 100P’ + 300 + 850 + (-100)
AD’: .5Y’ = 2400 - .5(200) – 100P’ + 1050
AD’: Y’ = 6700 – 200P’
SRAS: Y’ = 500P’ – 1000
Set AD’ equal to SRAS: 6700 – 200P’ = 500P’ – 1000
7700 = 700 P’
P’ = 11
Y’ = 6700 – 200(11) = 4500 or
Y’ = 500(11) – 1000 = 4500