### Economics 102 Spring 2013 Answers to Homework #5 Due: 4/15/13

**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 eligibly and neatly**; otherwise you will not receive full credit. Good luck!

### 1. Market of Loanable Funds

Consider the country Romanovia. In 2012 this country is a closed economy and that implies that capital inflows (KI) are therefore equal to zero. The loanable funds market is characterized by the following demand function  $D_{LF}$  where the demand for loanable funds curve includes only investment demand for loanable funds: r = 10 - (1/2000)Q where r is the real interest rate expressed as a percent (e.g., if r = 10 then the interest rate is 10%) and Q is the quantity of loanable funds. The relationship between the supply of private savings (Sp) and the interest rate can be expressed by the equation: r = 2 + (1/2000)Q. In 2012 the government of Romanovia had government expenditures (G) of \$8000, transfer payments (TR) of \$2000, and collected taxes (T) equal to \$14,000.

a) Calculate the value of government savings (Sg)? Is the government running a budget deficit or a budget surplus? Show how you got your answer.

Sg = T - TR - G

Thus, Sg = 14,000 - 2,000 - 8,000 = 4,000

Since Sg is a positive number, this tells us that the government is running a budget surplus since the government's tax collections exceeds its expenditures.

b) Derive an equation that expresses this economy's supply of loanable funds curve. Make sure that you include not only private savings but also government savings in this equation.

Suppose you think of the initial loanable funds curve as the supply of private savings equation that you are given. When the government runs a budget surplus this effectively shifts this supply of loanable funds curve to the right by the amount of the government savings. Thus, the new supply of loanable funds curve that includes not only the private saving but also the government saving will be parallel to the initial supply of loanable funds curve and shifted to the right by 4000. The two curves will have the same slope but a different y-intercept. Thus, r = b + 0.0005Q and we know that when r = 2, Q is now

4000. Use this point to find the value of "b": 2 = b + .005(4000) or b = 0. The supply of loanable funds curve can be written as r = 0.0005Q.

c) Given the demand for loanable funds curve you were given and the supply of loanable funds curve you derived in (b) calculate the equilibrium interest rate and the equilibrium quantity of loanable funds in this market. Show your work.

Use r = 10 - .0005Q and r = .0005Q to find the equilibrium. Thus, 10 - .0005Q = .0005Q or Q = 10,000. And, r = 10 - 5 = 5 or 5%.

d) What is the level of private investment (I) in this economy when the loanable funds market is in equilibrium? Is there any crowding out of private investment in this market? Explain your answer.

The level of private investment can be calculated using the demand for loanable funds equation: r = 10 - .0005Q and since r = 5% in equilibrium, we have that private investment is equal to 10,000. There is no crowding out of private investment in this economy because the government is running a budget surplus and is therefore not demanding any loanable funds in this market.

2013 starts with a natural disaster in Romanovia. A flood brings destruction in the south of the country. The government decides to take care of the reconstruction. The government expenditure (G) in 2013 increases to \$14000, the level of transfers (TR) is unchanged from 2012 and the level of taxes (T) is equal to \$12,000. There is no change in the supply of loanable funds from private savings and there is no change in the demand for loanable funds for private investment.

e) Calculate the value of government savings (Sg) for 2013 in this economy. Is the government running a budget surplus or a budget deficit?

To calculate government savings use the formula Sg = T - TR - G. Thus, Sg = 12,000 - 2,000 - 14,000 = -4000. The negative number tells us that the government's tax collections are less than its expenditures: the government is running a budget deficit.

f) Consider your answer in (e). If you wanted to model the government's budget situation on the supply of loanable funds side of the market would your answer in (e) cause the supply of loanable funds curve to shift to the left or to the right? Explain your answer.

When the government runs a budget deficit and you wish to model this on the supply of loanable funds side of the market, this effectively shifts the supply of loanable funds curve to the left since at every interest rate the government is effectively supplying fewer loanable funds to this market. g) Consider your answer in (e). If you wanted to model the government's budget situation on the demand for loanable funds side of the market would your answer in (e) cause the demand for loanable funds curve to shift to the left or to the right? Explain your answer.

When the government runs a budget deficit and you wish to model this on the demand for loanable funds side of the market, this effectively shifts the demand for loanable funds curve to the right since at every interest rate the government is effectively demanding more loanable funds in this market.

h) Write an equation expressing the new demand for loanable funds curve in this market assuming that you are modelling both the demand for loanable funds for private investment as well as the demand for loanable funds to finance the government budget deficit.

The new demand for loanable funds curve will have the same slope as the initial demand for loanable funds curve for private investment but will be shifted to the right by 4000. Thus, r = b - .0005Q is the general equation and then we can plug in a point that we know is on this equation. We know that (10,000; 5) was on the original demand for loanable funds curve: that implies that (14,000; 5) will be on the new demand for loanable funds curve. Thus, 5 = b - .0005(14,000) or b = 12. The new loanable funds curve equation can be written as r = 12 - .0005Q.

i) Given your equation in (h) and the information you have about private savings, find the new equilibrium interest rate in the loanable funds market as well as the new equilibrium level of loanable funds in this market. Identify how much of the equilibrium quantity in the loanable funds market goes to finance private investment.

Use r = 12 - .0005Q and r = 2 + .0005Q to find the equilibrium. Thus, 12 - .0005Q = 2 + .0005Q or Q = \$10,000 and r = 7%. Of the 10,000 in loanable funds demanded, \$4000 is to finance the government deficit and \$6000 is to finance private investment.

j) What is the level of private investment in this market in 2013? Is there crowding out of private investment in this market? Explain your answer. In your answer provide a numerical measure of the amount of crowding out that occurs if there is crowding out.

There is crowding out in this market because the government is running a budget deficit and this raises the interest rate and reduces the amount of private investment that occurs in this economy. If the government had a balanced budget then the equilibrium in the loanable funds market would occur at an interest rate of 6% and the equilibrium quantity of loanable funds would be \$8,000. The government deficit crowds out \$2000 worth of private investment.

k)Suppose that all of the changes described for 2013 occurred but in addition Romanovia decides to open its borders to capital inflows. In 2013 capital inflows into Romanovia equal to \$4,000. Use this information to calculate the equilibrium interest rate, the

equilibrium quantity of loanable funds and then compare the level of private investment in 2013 with the level of private investment in 2012.

The capital inflows will effectively shift the supply of loanable funds curve to the right by \$4000 at every interest rate. So, this implies that both the demand for loanable funds curve and the supply of loanable funds curve are shifting to the right by \$4,000. We can write the supply of loanable funds curve equation as r = .0005Q. We can write the demand for loanable funds curve equation as r = 12 - .0005Q. The new equilibrium interest rate would therefore be r = 6% and the equilibrium level of loanable funds would be \$12,000. \$4,000 of these loanable funds would go to finance the government deficit and \$8,000 would go to finance private investment.

#### 2. Aggregate Consumption

The following chart reports the aggregate consumption, savings, taxes and transfers in Macronesia in billions of dollars for 2011 and 2012.

Year	GDP	Consumption	Savings	Taxes	Transfer
	(Y)	(C)	(S)	(T)	(TR)
2011	200	108	32	150	90
2012	400	255	95	100	50

a) We know that the aggregate consumption function of Macronesia can be written as a linear equation of the form C = a + b(Y - (T - TR)) where a is autonomous consumption and b is the marginal propensity to consume. Assume that autonomous consumption and the marginal propensity to consume are both constant. From the table derive the equation for this economy's consumption function.

Given that the consumption function is linear and we have two points of this function we can calculate that:

$$108 = a + b^*(200 - 150 + 90)$$
$$255 = a + b^*(400 - 100 + 50)$$

b = 0.7 and a = 10

Therefore the consumption function will be:

$$C = 10 + 0.7*(Y - (T - TR))$$

b) What is the Marginal Propensity to Consume (MPC)? What is the Marginal Propensity to Save (MPS)?

The MPC is the slope of the consumption function and is equal to 0.7. The MPS is equal to 1 - MPC = 1 - 0.7 = 0.3.

c) Suppose in 2013 GDP will be \$500 billion and Taxes and Transfer are the same as in 2012. Given this information, calculate the change in consumption between 2012 and 2013.

Using the aggregate consumption function we can get that:

$$C = 10 + 0.7*(500 - (100 - 50)) = $325$$
 billion

Therefore the change in consumption will be 325 - 255 = \$70 billion

d)Suppose in 2013 GDP and Transfers are the same as in 2012 but that Taxes are increased to \$150 billion. There is no change in the consumption function. Calculate the change in consumption between 2012 and 2013.

Using the aggregate consumption function we can get that:

$$C = 10 + 0.7*(400 - (150 - 50)) = $220$$
 billion

Therefore the change in consumption will be 220 - 255 = -\$35 billion (that is, consumption decreases by \$35 billion between 2013 and 2012).

#### 3. Data Analysis

Let's work a bit with real data. We produced a graph using FRED, the data center of the St. Louis Fed. Your goal is to try to get a graph similar to ours, following our instructions. First, go on the St. Louis Fed data tools page:

• <u>http://research.stlouisfed.org/datatools.html</u>.

Select "create your own graph". Then select the following series (see instructions following this list).

- The growth rate of Real GDP (GDPC1)
- The growth rate of Real Private Investment (GPDIC96)
- The growth rate of Real Consumption (PCECC96)
- The growth rate of Real Government Expenditure and investment (GCEC96)

We've included the term you should search for in parentheses after each item. You can look for each series using the search box at the bottom of the page. Once you find the series you can adjust multiple options. We suggest the following setup:

- Frequency: Quarterly
- Units: Percentage Change
- Observation Date Range: from 1-1-1955 to 01-10-2012

You can also select additional options like color, width and type of the marker. You can change this setup, as you prefer. Once you are satisfied with your work, you can print out your graph or save it in pdf format (second and third option at the top of your graph).

- a) Print the graph.
- b) Given the data you found at FRED can you say anything about the relationship between private investment and GDP? What about the relationship between GDP and consumption? What about government expenditure and investment?

We can observe that consumption and GDP follow the same general behavior and the rate of change is pretty similar. In contrast, investment is way more volatile increasing dramatically during booms and dropping dramatically during recessions. In the end the government expenditure seems less correlated to GDP, however we can see that the behavior of the government expenditure is smoother than that of GDP.

# 4. Keynesiam Model

Say that consumption is determined by C = a + b(Y-T) for some constant value of a and b. We have the following data on consumption and disposable income.

	Consumption	Disposable Income (Y – T)
2008	8	6
2009	10	10

a) Find a and b using the above data.

The consumption function is linear in (Y-T) (disposable income). So, let's find the slope: (10-8) /  $(10-6) = \frac{1}{2} = b$ . Then:  $8 = a + (\frac{1}{2}) 6 => a = 5$ .

b) Suppose that in this economy the government must always run a balanced budget (that is, T = G and for the sake of simplicity TR = 0). Suppose also that this is a closed economy and that the level of investment spending is autonomous, constant, and equal to 5. Given this information calculate the equilibrium level of consumption (C), and the equilibrium level of saving (S) for this economy.

 $Y = C + I + G = 5 + (\frac{1}{2}) (Y - G) + 5 + G => (\frac{1}{2}) Y - (\frac{1}{2}) G = 10 => Y - G = 20$ . Consumption is equal to:  $C = 5 + (\frac{1}{2}) (Y - G) = 5 + 10 = 15$ . Savings is then: 5.

c) What happens to the equilibrium quantities in (b) if the marginal propensity to consume (b) increases? What is the effect of increasing autonomous consumption (a) in the consumption function?

In general, we would have: Y = (1/(1-b))(a - bT + I + G). So when the marginal propensity to consume (b) increases this results in larger levels of equilibrium real GDP. If the marginal propensity to consume (b) increases, this results in higher levels of consumption. If the marginal propensity to consume (b) increases, this result in lower levels of saving.

An increase in autonomous consumption (a) will result in higher levels of equilibrium real GDP (Y) and equilibrium consumption (C) and lower levels of equilibrium saving (S).

# 5. Investment/Depreciation

a. Suppose that an economy currently has a level of capital stock equal to 100 units. But, each year 10% of the capital stock depreciates. Suppose this economy does not engage in any investment spending: in the table below calculate what happens to this economy's capital stock over the next seven years. Round your answers to the nearest hundredth of a unit.

Year	Level of Capital Stock
1	100 units
2	
3	
4	
5	
6	
7	

Year	Level of Capital Stock
1	100 units
2	90 units
3	81 units
4	72.90 units
5	65.61 units
6	59.05 units
7	53.14 units

b. Given the information in (a), what is happening to this economy's labor productivity over these seven years holding labor and the aggregate production function constant? Explain your answer.

Holding labor constant we can recognize that labor productivity must fall as the level of capital available in this economy decreases. If you are having trouble seeing this you should review your notes on labor productivity, the aggregate production function, and what happens to the aggregate production function when the level of capital changes.

c. Given the information in (a), what is happening to this economy's capital productivity over these seven years holding labor and the aggregate production function constant? Explain your answer.

Holding labor constant we recognize that capital productivity must rise as the level of capital available in this economy decreases. Capital becomes relatively scarce compared to labor: capital productivity will rise.

d. Suppose that this economy decides to increase investment spending so that it is equal to 20% of the current year's capital stock. Calculate the level of capital in this economy given this decision and incorporating the depreciation that is occurring. Put your calculations in the following table. Show how you calculated your values. Round your answers to the nearest hundredth.

Year	Level of Capital Stock
1	100 units
2	
3	
4	
5	
6	
7	

Year	Level of Capital Stock
1	100 units
2	(100)(1+.2) - 100(.1) = 110 units
3	(110)(1+.2) - 110(.1) = 121 units
4	(121)(1+.2) - 121(.1) = 133.1 units
5	(133.1)(1 + .2) - 133.1(.1) = 146.45 units
6	(146.45)(1 + .2) - 146.45(.1) = 161.10 units
7	(161.10)(1 + .2) - 161.10(.1) = 177.21 units

If investment spending is less than depreciation in an economy the capital stock will shrink over time. If investment spending is equal to depreciation in an economy the capital stock will stay constant and not grow over time. If investment spending is greater than depreciation in an economy the capital stock will grow over time: this implies that the economy will be able to increase its production of real GDP for a given level of labor and technology: the economy will experience economic growth.