

Economics 102
Fall 2017
Homework #4
Due 11/14/2017

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!
- Do not submit messy, illegible, sloppy work.
- Show your work to get full credit.

1. Consider the aggregate production functions for Wisconsin and Minnesota:

Production Function for Wisconsin	
$Y_{WI} = \alpha K_{WI}^{1/2} L_{WI}^{1/2}$	
Y _{WI} :	Real GDP of Wisconsin
α:	The state of the technology
K _{WI} :	Units of capital
L _{WI} :	Units of labor (in this case, the number of workers)
Production Function for Minnesota	
$Y_{MN} = \beta K_{MN}^{1/3} L_{MN}^{2/3}$	
Y _{MN} :	Real GDP of Wisconsin
β:	The state of the technology
K _{MN} :	Units of capital
L _{MN} :	Units of labor (in this case, the number of workers)

Labor and capital are the only inputs used in both states to produce real GDP. Initially, K is equal to 25 units in both states. In Wisconsin, the state of the technology is represented by $\alpha = 2.5$ and in Minnesota the technology is $\beta = 2.5$. Answer the following questions based on the above information (**you are required to utilize Excel when answering this question**).

Direction for this problem: You don't need to submit the whole simulated data tables with your homework, but you do need to submit the graphs drawn from these tables. **The graphs must be generated by using Excel, NOT by your hands.**

a. Fill in the following table (you will need to expand it from the truncated form provided here when using Excel). Round all your answers to the nearest hundredth.

Marginal Product of Labor (MPL): The marginal product of a factor of production is generally defined as the change in output associated with a change in that factor, holding other inputs (in this case, K which is capital) into production constant. The marginal product of labor is then the change in output (Y) per unit change in labor (L).

$$\text{Marginal Product of Labor} = \Delta Y / \Delta L$$

Labor Productivity (LP): The labor productivity is a measure of economic performance that compares the amount of goods and services produced (output) with the number of workers in this example to produce those goods and services.

$$\text{Labor Productivity} = Y / L$$

Wisconsin ($\alpha = 2.5$)				
L	K	Y	MPL	LP
1	25		---	
2	25			
3	25			
4	25			
5	25			
.
.
.
.
96	25			
97	25			
98	25			
99	25			
100	25			

Minnesota ($\beta = 2.5$)				
L	K	Y	MPL	LP
1	25		---	
2	25			
3	25			
4	25			
5	25			
.
.
.

.
96	25			
97	25			
98	25			
99	25			
100	25			

b. Use Excel to describe both states' real GDP (= value of each state's production function) **on the same graph**: measure L on the horizontal axis and Y on the vertical axis. Briefly compare the two states' real GDP level depending on the amount labor.

c. Use Excel to describe both states' marginal product of labor **on the same graph**: measure L on the horizontal axis and the marginal product of labor on the vertical axis.

d. Use Excel to describe both states' labor productivity **on the same graph**: measure L on the horizontal axis and the labor productivity on the vertical axis.

e. Based on the results from (c) and (d), explain the different real GDP patterns of the two states by using your economic intuition.

f. Suppose that the technology of Wisconsin increases from 2.5 to 3.5 while the amount of capital decreases from 25 units to 16 units. Use Excel to describe the initial real GDP of Wisconsin (which is the same as the answer from (b)) and the final real GDP of Wisconsin (considering the changes mentioned in this problem) **on the same graph**: measure L on the horizontal axis and Y on the vertical axis.

g. Based on (f), use Excel to describe the initial marginal product of labor in Wisconsin (which is the same as the answer from (c)) and the final marginal product of labor in Wisconsin (considering the changes mentioned in (f)) **on the same graph**: measure L on the horizontal axis and the marginal product of labor on the vertical axis.

h. Suppose that the technology of Minnesota decreases from 2.5 to 2 while the amount of capital increases from 25 units to 64 units. Use Excel to describe the initial real GDP of Minnesota (which is same as the answer from (b)) and the final real GDP of Minnesota (considering the changes mentioned in this problem) **on the same graph**: measure L on the horizontal axis and Y

on the vertical axis.

i. Based on (h), use Excel to describe the initial marginal product of labor in Minnesota (which is the same as the answer from (c)) and the final marginal product of labor in Minnesota (considering the changes mentioned in (h)) **on the same graph**: measure L on the horizontal axis and the marginal product of labor on the vertical axis.

j. From the results of the previous four questions ((f) to (i)) we can check whether there is economic growth or not in each state. If real GDP increases regardless of the amount of labor, we can say there is economic growth. Now, explain the change in real GDP in each state. From the two states' scenarios, what kind of similarity can you find with regard to the economic growth?

2. Suppose we have the following data from two hypothetical towns: Gryffindor and Slytherin.

Year	Gryffindor		Slytherin	
	Real GDP	Population	Real GDP	Population
2019	\$50,000	200	\$40,000	150
2020	\$51,400	202	\$42,240	155

Express your answers in percentage terms to *two* places past the decimal.

a. Calculate the growth rate of real GDP for each town.

b. At these rates of growth, approximately how many years will pass before each town's real GDP doubles?

c. Find each town's real GDP per capita in each of the two years. Calculate the growth rate of real GDP per capita in each town.

Year	Gryffindor			Slytherin		
	Real GDP	Population	Real GDP Per capita	Real GDP	Population	Real GDP Per capita
2019	\$50,000	200		\$40,000	150	
2020	\$51,400	202		\$42,240	155	

d. At these rates of growth, approximately how many years will pass before each town's real GDP per capita doubles?

e. Suppose each town's growth rate of real GDP is constant over time. In this situation, which town has the larger amount of real GDP in 2045 and what is the difference between the two towns in terms of real GDP in 2045? Give the absolute value of the difference.

3. For the following questions it may be helpful to draw the aggregate production function for each situation described.

a. Suppose that while holding its capital and labor constant, an economy experiences an increase in technology. What happens to real GDP? What happens to labor productivity?

b. Now suppose the economy increases the amount of labor it employs, while holding capital and technology constant. What happens to real GDP? What happens to labor productivity?

c. Suppose the economy simultaneously experiences an increase in technology and a decrease in the amount of labor it employs. What happens to real GDP? What happens to labor productivity?

d. Suppose an economy simultaneously experiences an increase in capital and an increase in the amount of labor it employs. What happens to real GDP? What happens to labor productivity? What happens to capital productivity?

e. Suppose an economy experiences an increase in technology, but at the same time also decreases the amount of labor and the amount of capital it employs. What happens to real GDP? What happens to labor productivity?

4. The following table gives the annual growth rate of real GDP for 4 countries in 2017. Assume there is no population growth in any of the four countries.

	Country A	Country B	Country C	Country D
Real GDP Annual growth rate	6%	5%	15%	-3%

a. To which countries can we apply the Rule of 70 to determine how long it will take their real GDP to double?

b. For the countries you specified in part (a), in which years will their real GDPs have doubled? (Round to the nearest year where necessary.)

5. Suppose that the loanable funds market is initially in equilibrium and the country has zero net exports and is currently operating with a balanced budget. Provide your analysis about the market equilibrium for each of the following scenarios.

a. Holding everything else constant, what do you predict about the equilibrium interest rate, the level of private investment and the equilibrium level of private saving if the country runs a trade surplus? Explain your answer verbally and provide a graph of the loanable funds market to support your analysis. Make sure your graph is clearly labeled.

b. Holding everything else constant, what do you predict about the equilibrium interest rate, the level of private investment and the equilibrium level of private investment spending if the government increases the size of its surplus? Explain your answer verbally and provide a graph of the loanable funds market to support your analysis. Make sure your graph is clearly labeled.

c. Holding everything else constant, what do you predict about the equilibrium interest rate, the level of private investment and the equilibrium level of loanable funds if the country runs a trade deficit and at the same time loses funds that a major foreign company is providing as a source of funds to this economy? Explain your answer verbally and provide a graph of the loanable funds market to support your analysis. Make sure your graph is clearly labeled.

d. Holding everything else constant, what do you predict about the equilibrium interest rate, the level of private investment, the level of consumption spending and the equilibrium level of loanable funds if the country runs a trade surplus and at the same time increases the size of government deficit? Explain your answer verbally and provide a graph of the loanable funds

market to support your analysis. Make sure your graph is clearly labeled.

6. Consider an economy where the demand for loanable funds from businesses is given by the following equation where Q is the quantity of loanable funds and r is the interest rate:

$$\text{Demand for loanable funds from businesses: } Q = 5,800 - 500r$$

Suppose that the supply of loanable funds from households (private savings) is given by the following equation where Q is the quantity of loanable funds and r is the interest rate:

$$\text{Supply of loanable funds from households: } Q = 200r - 500$$

In both the demand and supply for loanable funds equations the interest rate is expressed as a percentage (thus, if the interest rate is 3%, then the r in the equation would be 3).

a. If the economy is closed to the international trade and that the government runs a balance budget, what is the equilibrium level of interest rate and investment spending?

b. Holding everything else constant, suppose the government runs a budget deficit of \$1,400. How will this change the equilibrium level of private investment spending? Be specific with your answer.

c. In the scenario specified in part (b), what is the equilibrium level of private saving? Are private saving and private investment spending equal to each other in this scenario? Show your work and how you came to your conclusion.

d. Suppose the economy rebalances the government budget (the budget is now balanced). When this economy opens to international trade, the resulting trade surplus is \$1,050. What will be the equilibrium level of interest rate and private saving in this economy given this information and holding everything else constant?

e. In the scenario specified in part (d), what is the equilibrium level of private investment spending? Are private saving and private investment spending equal to each other?