Economics 102
Spring 2012
Homework #4
Due 3/21/12

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!

1) The production function for an economy is $Y = xK^{1/2}L^{1/2}$, where Y is real GDP, K refers to units of capital, L refers to units of labor, x is a constant.
In time period 0, x = 1.
In time period 1, x changes and stays the same for time periods 2, 3, and 4.
K is fixed at 25 units for all time periods.
Answer the following questions based on the above information and the table below.

Time Period	Labor	Real GDP	Growth in real GDP (round to two places past the decimal)	Labor Productivity
0	4	10	----------	2.5
1	9	30	200%	3.33
2	25	50	66.66%	2
3	49	70	40%	1.43
4	64	80	14.29%	1.25

a) Find x.
In time period 0: Y = (1)(5)(2) = 10
In time period 1: Y = (x)(5)(3) = 15x
We know [(Y(1) – Y(0))/Y(0)]×100 = 200 ➔ [(15x – 10)/10)]×100 = 200 ➔ 15x – 10 = 20 ➔ x = 2

b) Fill in the missing values in the table.
Labor productivity = Y/L, so for example, for period 0, productivity = 10/4 = 2.5

c) How can you describe the change in x in words?
A change in x shifts the production function, so x represents technological change.

d) If instead there is a constant growth rate that is equal to the growth rate in period 4, how many time periods would it take for real GDP to double itself?
Doubling Time = 70/growth rate = 70/14.29 = 4.9 time periods

2) 1,000,000 people live in the small mythical island of Narnia.
Of the population that is 16 years old or older, 40% have retired and are not looking for work anymore. Furthermore, the number of people in Narnia below 16 years of age is always two and a half times the number of retired people.

Let's introduce some notation first:
y = number of people 16 years old or older
z = number of people less than 16 years of age
R = number of retired people
W = people of working age = y - R

a) Write an expression for the number of retired people as a function of the population that is 16 years old or older. Use y as the symbol for the population of people 16 years old or older.
R = 0.4y

b) Write an expression for the number of people below 16 years of age. Once you have this expression, determine whether the number of people below 16 years of age is equal to any other subset of the population of Narnia? If so, identify this subset as well as the number of members in both sub-groups. Also, identify the number of retirees in Narnia.
$z = 2.5\times(0.4y) = y$ ➔ the number of people aged 16 or above is equal to the number of people less than 16 years of age. Since these two groups cover the entire population of Narnia, which is 1,000,000, we have:
y = z
y + z = 1,000,000 ➔ 2y = 1,000,000 ➔ y = z = 500,000
Then: R = 0.4y = (0.4)(500,000) = 200,000

c) Given your calculations in (a) and (b), what is the number of people 16 years old or older that are not retired?
W = y – R = 500,000 – 200,000 = 300,000

You are now provided with some more information about the employment situation in Narnia. Currently Narnia is not at full employment and you know the following:

- Currently the number of people who are classified as discouraged workers is exactly equal to the number of people who are classified as cyclically unemployed people. (There are two separate groups here: the discouraged workers and the cyclically unemployed.)
- If Narnia was operating at the natural rate of unemployment, 80% of the unemployed would be frictionally unemployed.
- The recent unemployment survey has shown that the current structural unemployment rate is 10% of the overall current unemployment rate.
- The current number of employed people in Narnia is 150,000.
  Again, let's introduce some notation (previous notation still holds)
  D = number of discouraged workers
  C = number of cyclically unemployed
  F = number of frictionally unemployed

S = number of structurally unemployed
N = number of naturally unemployed
U = number of actually (currently) unemployed
E = number of employed = 150,000
LF = labor force

With this notation, let's rewrite the above information:

- D = C
- If U = N, then F = (80/100)*U. Therefore, F = (80/100)*N and since N = F + S, it must be true that S = (20/100)*N
- S/LF = (10/100)*(U/LF) ➔ S = (10/100)*U
- E = 150,000

d) Before you get started on all sorts of calculations, take a moment and write a definitional equation for natural unemployment and current unemployment.
N = F + S
U = F + S + C = N + C

e) Given your work in (a), (b), (c) and (d) and the above information, what is the number of discouraged workers in Narnia?
We know S = (20/100)*N (from second bullet point) and S = (10/100)*U (from third bullet point) ➔ (20/100)*N = (10/100)*U ➔ N = (1/2)*U
From d), we know U = N + C = ➔ U = (1/2)*U + C ➔ C = (1/2)*U
But then, N = C ➔ U = N + C = C + C = 2C

Now, in the entire population of working age (W), we have employed people, unemployed people, and discouraged workers. That is:
W = E + U + D
From first bullet point, we know D = C
From above calculations, we know U = 2C, W = 300,000
From fourth bullet point, we know E = 150,000
So, putting those together:
300,000 = 150,000 + 2C + C ➔ 3C = 150,000 ➔ C = 50,000
Then, the number of discouraged workers is D = C = 50,000

Also, we can see from these calculations: U = 2C = 100,000 and N = C = 50,000

f) Give a definition of the labor force and then calculate the value of the labor force in Narnia based upon your work in the previous parts of this question and the information you have been provided with.
LF = E + U = 150,000 + 100,000 = 250,000

g) What is the natural rate of unemployment in Narnia?

Natural rate = (N/LF)*100 = (50,000/250,000)*100 = 20%

h) How many people in Narnia are structurally unemployed?
From above, we have S = (20/100)*N = (20/100)*50,000 = 10,000 structurally unemployed people

i) What is the labor force participation rate in Narnia?
LF participation rate = (LF/Population)*100 = (250,000/1,000,000)*100 = 25%

j) In a strange Hollywood twist, Narnia forges an alliance with the Sith Lord Darth Sidious and goes to war with the Rebels. As a result, the labor force participation rate falls to 20% in the next demographic survey of Narnia, even though there has been no change in the employment or the population in Narnia. How is this drop in the labor force participation rate possible? Provide a verbal explanation of how this change could have occurred. (Hint: think about how Narnia will need people to be in the army in order to wage war against the Rebels.)
In order for the labor force participation rate to fall to 20% with no change in the population, the number in the numerator of the participation rate must fall from 250,000 to 200,000. Initially the 250,000 included the employed (no change here), the number of naturally unemployed and the number of cyclically unemployed. If the army recruits all 50,000 people who were cyclically unemployed to go to Death Star to fight the war this will result in the number of people in the labor force falling from 250,000 to 200,000. This change will result in the labor force participation rate falling to 20%.

3) You are given the following data about prices (P) and quantities (Q) that are produced in an economy in three different years. This economy produces three different goods: good A, good B, and good C. You are asked to use the data to compute the CPI using 2010 as the base year. The market basket for computing the CPI is composed of 10 units of good A, 10 units of good B, and 10 units of good C.

Years	P(A)	Q(A)	P(B)	Q(B)	P(C)	Q(C)
2010	$10	10	$10	10	$10	10
2011	$15	5	$10	20	$20	10
2012	$12	8	$5	15	$10	10

a) Compute the value of the market basket for each of the three years. Enter your calculations in the table below.
Note: For computing the cost of the market basket and CPI, you need the **quantities in the market basket**. Therefore, the quantities in the table are simply redundant information.

Year	Cost of Market Basket
2010	10(10) + 10(10) + 10(10) = $300
2011	15(10) + 10(10) + 20(10) = $450
2012	12(10) + 5(10) + 10(10) = $270

b) Compute the value of the CPI for each of the three years using 2010 as the base year. Enter your calculations in the table below.

Year	CPI
2010	100
2011	(450/300)*100 = 150
2012	(270/300)*100 = 90

c) Using your answers from (b) compute the rate of inflation from 2010 to 2011and the rate of inflation from 2011 to 2012. Enter your results in the table below.

Time Period	Rate of Inflation
2010	----------
2011	[(150 – 100)/100]*100 = 50%
2012	[(90 – 150)/150]*100 = -40%

d) Now, change the base year to 2012 and recompute the CPI for these three years using this new base year. Find the CPI in the three years with 2012 as the base year and enter your answers in the table below.

Year	CPI
2010	(300/270)*100 = 111.1
2011	(450/270)*100 = 166.67
2012	100

e) Now, calculate the rate of inflation using the CPI with base year 2012. Enter your results in the table below.

Time Period	Rate of Inflation
2010	----------
2011	[(166.67 – 111.1)/111.1]*100 = 50%
2012	[(100 – 166.67)/166.67]*100 = -40%

f) Compare the rates of inflation you calculated using the CPI with base year 2010 and the CPI with base year 2012.

The inflation rates are the same irrespective of the base year.

Note that CPI = (Cost of market basket in current year)/(Cost of Market Basket in the Base Year)

So, when we change the base year, the CPI's for all the years would change by the same proportion.

Hence, when we find the inflation levels with the new base year, we are finding the percentage change between two values that have changed by the same proportion.

As a result, the inflation rate is unchanged.

Note that this is ideal. When we are measuring inflation, we would ideally want the inflation rate to be unaffected by which base year we are using.

4) Suppose you are given the following Savings and Investment Curves for an economy where S is the amount of savings, I is the amount of investment, and i is the interest rate. The Savings Curve represents the supply of funds that are available in the loanable funds market while the Investment Curve represents the demand for funds from the loanable funds market.

$$S = 1000 + 800i$$
$$I = 5000 - 200i$$

a) Given the above information, calculate the equilibrium interest rate and the equilibrium quantity of loanable funds. In this setting, the equilibrium quantity of loanable funds will be that quantity where the supply of loanable funds (i.e, savings) is equal to the demand for loanable funds (i.e., investment).
At equilibrium, S(i) = I(i)
1000 + 800i = 5000 – 200i
4000 = 1000i
i = 4
S = I = 4200
The equilibrium interest rate is 4% and $4200 is saved and invested.

b) Suppose the Supply Curve shifts leftwards by 1000 units. What does this signify? Find the new supply of loanable funds curve given this information. What is the new equilibrium level of savings in the economy?
People are willing to save $1000 less at every interest rate.
Now, the new Supply Curve is given by: S = 800i
The Investment Curve is unchanged: I = 5000 – 200i
Solving for the equilibrium, we get: i = 5%, S = I = $4000
As a result of people saving less, the equilibrium interest rate increased and the equilibrium amount of saving/investment fell.

c) Suppose you are in the original situation (part a). Due to the recession, the Government has to spend more money on unemployment benefits. At the same time the Government's tax revenues are diminished because people are not earning as much as they did prior to the recession. As a result, the Government runs a fiscal deficit (it has to spend more than what it is earning). To finance this deficit, it borrows from the loanable funds market just like the investors do. As a result, there is a shift in the Investment Curve to I + Deficit = 6000 – 200i where the deficit is equal to the amount the government must finance by borrowing in the loanable funds market.

   i. What is the new equilibrium interest rate in the loanable funds market given this information?
   I + deficit = 6000 – 200i

S = 1000 + 800i
I + deficit = S in equilibrium
6000 – 200i = 1000 + 800i
1000i = 5000
i = 5%

ii. How much has the government borrowed in the loanable funds market?
I + deficit = 6000 – 200i = 6000 – 200(5) = $5000
I = 5000 – 200i = 5000 – 200(5) = $4000
So, the deficit is equal to $5000 – $4000 = $1000. The government is borrowing $1000 in the loanable funds market.

iii. What is the level of investment spending in the economy when the government finances its deficit by borrowing?
Private investment spending = $4000

iv. How much is private investment spending crowded out by the financing of the government deficit?
The initial level of private investment spending was $4200 and then private investment spending fell to $4000 when the government financed its deficit by borrowing. The government deficit crowded out $200 of private investment spending.