

Economics 102
Spring 2013
Homework #4
Due: 3/18/2013

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

1. GDP and CPI Review

In Hayekingdom, four goods are produced: strawberry, shrimp, shovels and sandals. The consumers only buy strawberries and shrimps. The table below summarises the quantities and prices for these four goods in years 2007-2009

	2007	2008	2009
$Q_{strawberry}$	10,000	15,000	18,000
$P_{strawberry}$	\$3	\$4	\$5
Q_{shrimp}	12,000	15,000	15,000
P_{shrimp}	\$5	\$6	\$8
Q_{shovel}	4,000	5,000	6,000
P_{shovel}	\$5	\$6	\$5
$Q_{sandals}$	2,500	2,500	3,000
$P_{sandals}$	\$6	\$8	\$10

a). Calculate the nominal GDP for all three years

$$2007: 3 \cdot 10,000 + 5 \cdot 12,000 + 5 \cdot 4,000 + 6 \cdot 2,500 = \$125,000$$

$$2008: 4 \cdot 15,000 + 6 \cdot 15,000 + 6 \cdot 5,000 + 8 \cdot 2,500 = \$200,000$$

$$2009: 5 \cdot 18,000 + 8 \cdot 15,000 + 5 \cdot 6,000 + 10 \cdot 3,000 = \$270,000$$

b). Using 2008 as the base year, calculate real GDP for all three years

$$2007: 4 \cdot 10,000 + 6 \cdot 12,000 + 6 \cdot 4,000 + 8 \cdot 2,500 = \$156,000$$

$$2008: 4 \cdot 15,000 + 6 \cdot 15,000 + 6 \cdot 5,000 + 8 \cdot 2,500 = \$200,000$$

$$2009: 4 \cdot 18,000 + 6 \cdot 15,000 + 6 \cdot 6,000 + 8 \cdot 3,000 = \$222,000$$

c). Calculate GDP deflator for all three years and the change in GDP deflator for 2007-2008 and 2008-2009

$$2007: (125,000/156,000) \cdot 100 = 80.12$$

$$2008: (200,000/200,000) \cdot 100 = 100$$

$$2009: (270,000/222,000)*100 = 121.62$$

$$2007-2008: (100 - 80.12) / 80.12 = 23.8\%$$

$$2008-2009: (121.62 - 100) / 100 = 21.62\%$$

d). Using 2008 as the base year, calculate the CPI for all three years, assuming the representative consumer consumes 50 strawberries and 50 shrimps each year. Compute the change in CPI for 2007-2008 and 2008-2009

First calculate the market basket value:

$$2007: 3*50 + 5*50 = \$400$$

$$2008: 4*50 + 6*50 = \$500$$

$$2009: 5*50 + 8*50 = \$650$$

Using 2008 as the base year, calculate the CPI

$$2007: (400 / 500)*100 = 80$$

$$2008: (500 / 500)*100 = 100$$

$$2009: (650 / 500)*100 = 130$$

$$2007-2008: (100 - 80) / 80 = 25\%$$

$$2008-2009: (130 - 100) / 100 = 30\%$$

e). Compare the change you found in c) and d). Are they the same? Why or why not?

The changes in GDP deflators and in CPI are not the same. This is usually the case. Even though both GDP deflator and CPI are price indices, they consider different baskets of goods. GDP deflator takes the prices of all final goods and services into consideration, while only prices of consumption goods are included in CPI. Since these two types of goods are not usually the same and have different prices, change in CPI is not the same as the change in GDP deflator.

f). Given the CPI you calculated in d), if a resident's nominal income in 2007 is \$50,000, what does his nominal income have to be in 2009 in order for his real income to stay the same?

Solve the following equation:

$$(50,000 / 80) = (x / 130), \text{ and } x = \$81,250, \text{ which is the nominal income required.}$$

2. Long-run Economic Growth

For this question, you may need to use Excel or a similar spreadsheet software. If you are not familiar with the software, there are lots of online resources and tutorials available. If you do not have such software installed on your computer, most computers in campus libraries have them available.

Imagine a simple economy in which there are only two factors of production: capital (K) and labour (L). The production function is given by $Y = 5\sqrt{KL}$. The capital stock in this economy is constant at

$K = 100$. Use Excel or a similar spread sheet software to generate the following table. Note that you need to generate output (Y), labour productivity and MPL for all values of labour between 1 and 100.

Labour (L)	Output (Y)	Labour Productivity	MPL
1.00	50.00	50.00	50.00
2.00	70.71	35.36	20.71
3.00	86.60	28.87	15.89
4.00	100.00	25.00	13.40
5.00	111.80	22.36	11.80
⋮			
96.00	489.90	5.10	2.56
97.00	492.44	5.08	2.54
98.00	494.97	5.05	2.53
99.00	497.49	5.03	2.52
100.00	500.00	5.00	2.51

a). With the table you just generated, plot Y against L. (i.e. with Y on the y-axis and L on the x-axis)

See attached pdf file.

b). How is marginal product of labour reflected on the graph you just plotted? How does it change as labour increase?

Marginal product of labour is the slope of the production function. As labour increases, MPL decreases.

c). How is labour productivity changing as labour increase?

Labour productivity decreases as labour increases when capital is fixed.

d). If there is an increase in the capital stock of the economy and now $K = 225$. Intuitively, what do you think will happen to labour productivity and marginal labour product? Briefly explain why.

Labour productivity and marginal labour product will both be higher when capital stock increases. Intuitively, this is because each worker will have more capital to work with.

e) Using the new capital stock level, generate a new table and/or plot a new graph to verify your intuition in d).

See attached pdf file.

3. Rule of 70

Suppose there are two countries, A and B. In 2012, real GDP per capita in A was about \$ 12,000, while it was about \$ 48,000 in country B. Furthermore, suppose the real GDP per capita in country A grows at the rate of 10 percent per year and that in country B is 5 percent per year.

a) How long will it take A's real GDP per capita to reach the level that B was at in the year of 2012?

By the rule of 70, the time it takes for doubling a variable equals to 70 divided by the rate of growth of that variable. So the time it takes 7 years for the real GDP per capita in A to reach 24,000 and 14 years to reach 48,000.

b) Now A has a target of catching up the level of B's real GDP per capita by 2038, can it be realized? Why or why not? (Hint: The real GDP per capita in both countries grow steadily at the 10 percent and 5 percent, respectively)

	2012	2019	2026	2033	2040
A	12,000	24,000	48,000	96,000	192,000
B	48,000		96,000		192,000

By the rule of 70, we have the above table for the GDP per capita for both countries. Since A will catch up with B by the year 2040, so its target cannot be realized by 2038.

c) Suppose in 2026 a shock take place in both countries such that the growth rate of real GDP per capita in country A is 14% and in country B is 7%. Will country A realize its target by 2038?

	2012	2019	2026	2031	2036
A	12,000	24,000	48,000	96,000	192,000
B	48,000		96,000		192,000

As shown in the above table, A will catch up with B by 2036, so it will realize its target in 2038.

4. CPI and Inflation Rate

Use the CPI data to calculate for inflation rate

Year	Index (1982-84 = 100)	Annual Percent Change
2004	188.9	---
2005	195.3	
2006	201.6	
2007	207.3	
2008	215.3	
2009	214.5	

a) What was the annual rate of inflation during 2006?

$3.2\% = (201.6 - 195.3) / 195.3 * 100$, expressed as a percentage

b) How much higher was the general level of prices in 2009 than 2005? How much higher were prices in 2009 than during the 1982-1984 base year?

$9.8\% = (214.5 - 195.3) / 195.3 * 100$, expressed as a percentage

$114.5\% = (214.5 - 100) / 100 * 100$, expressed as a percentage

c) How does unanticipated inflation in the U.S. negatively impact the economy? Consider its impact on people living on fixed incomes, business investments and the amount exported from and imported to the U.S.

Unanticipated squeezes the purchasing power of people living on fixed incomes. It hurts lenders locked into relatively low interest rates but benefits borrowers. It raises the cost of borrowing so investment falls as interest rises. Finally, it reduces exports and increases imports as U.S. prices rise unexpectedly higher than the rest of the world's prices.

5. Nominal Price and Real Price

Table : Price of a Gallon of Regular Unleaded Gasoline

	Nominal Price	CPI (1982–84 = 100)	Real Price
Year	(1)	(2)	(3)
1973	\$0.39	44.4	\$1.87
1976	\$0.61	56.9	
1980	\$1.25	82.4	\$3.23
1985	\$1.20	107.6	
1990	\$1.16	130.7	
1995	\$1.15	152.4	
2000	\$1.51	172.2	\$1.87
2005	\$2.30	195.3	
2009 (April)	\$2.31	212.7	\$2.31

Source: U.S. Energy Information Administration, *Monthly Energy Review* The data for regular unleaded gasoline were unavailable prior to 1976. Thus, the 1973 observation is for regular leaded gasoline, which was slightly cheaper during that period.

Both crude oil prices and gasoline prices rose sharply throughout the 1970s. By 1980, the nominal price of gasoline had risen to \$1.25. This would make the real price of gasoline measured in 2009 dollars equal to \$3.23 (\$1.25 times 2.6, the ratio of 212.7/82.4), even higher than the price in 2009.

a) Measured in terms of the general level of prices in April of 2009, derive the real price of a gallon of gasoline for the years 1976, 1985, 1990, 1995, and 2005. Show your calculations.

Table 1: Price of a Gallon of Regular Unleaded Gasoline

Year	Nominal Price (1)	CPI (1982–84 = 100) (2)	CPI _t /CPI ₂₀₀₉	Real Price (3)
1973	\$0.39	44.4	4.79 = 212.7/44.4	\$1.87
1976	\$0.61	56.9	3.74 = 212.7/56.9	\$2.28
1980	\$1.25	82.4	2.58 = 212.7/82.4	\$3.23
1985	\$1.20	107.6	1.98 = 212.7/107.6	\$2.38
1990	\$1.16	130.7	1.63 = 212.7/130.7	\$1.89
1995	\$1.15	152.4	1.40 = 212.7/152.4	\$1.61
2000	\$1.51	172.2	1.24 = 212.7/172.2	\$1.87
2005	\$2.30	195.3	1.09 = 212.7/195.3	\$2.51
2009 (April)	\$2.31	212.7	1=212.7/212.7	\$2.31

Source: U.S. Energy Information Administration, *Monthly Energy Review* The data for regular unleaded gasoline were unavailable prior to 1976. Thus, the 1973 observation is for regular leaded gasoline, which was slightly cheaper during that period.

To convert any nominal price in 1976, 1985, 1990, 1995, or 2005 to its real value in 2009 (April), just multiply the nominal price of a gallon of gas by the number that comes out taking the CPI in April 2009 and dividing it by the CPI in 1976, 1985, 1990, 1995, and 2005, respectively. Above, Column 2a has been added to help you with the math of dividing the CPI in the year of interest t by the CPI in April of 2009 where $t = 1976, 1985, 1990, 1995, \text{ or } 2005$. Take those figures calculated in 2a and simply multiple them by the nominal price of gas in each year to determine the real price of gas in April of 2009. Real prices are placed in bold in column.

b) Was the real price of a gallon of gas higher in April 2009 than in 1980?

No, the real price of gas in 1980 was \$3.23 per gallon and this is 39.8% higher than in 2009 (April).

Was the real price of gas higher in April 2009 than in 1973?

In April 2009 the real price of gas was 23.53% percent higher than in 1973.

$(2.31 - 1.87) / 1.87 = 23.53\%$

Why would you want to convert current prices into real prices when making comparisons over time?

This conversion helps you compare constant prices over time.