**Problem Set 1**

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**solutions**

**Problem 1**

An economy produces three goods: cars, computers, and oranges. Quantities and prices per unit for years 2009 and 2010 are as follows:



A) What is nominal GDP in 2009 and in 2010? By what percentage does nominal GDP change from 2009 to 2010?

Nominal GDP in 2009 = 10 x $2000 + 4 x $1000 + 1000 x $1 = $25000

Nominal GDP in 2010 = 12 x $3000 + 6 x $500 + 1000 x $1 = $40000

Percentage change in Nominal GDP =

B) Using the prices for 2009 as the set of common prices, what is real GDP in 2009 and in 2010? By what percentage does real GDP change from 2009 to 2010?

Since the base year is set to be 2009, the nominal and the real GDP in 2009 are the same. So, real GDP in 2009 is $25000.

To calculate the real GDP in 2010, we use the prices of 2009 and quantities of 2010. So, real GDP in 2010 = 12 x $2000 + 6 x $1000 + 1000 x $1 = $31000.

Percentage change in Real GDP = .

C) Using the prices for 2010 as the set of common prices, what is real GDP in 2009 and in 2010? By what percentage does real GDP change from 2009 to 2010?

Since the common price year is set to be 2010, the nominal and the real GDP in 2010 are the same. So, the real GDP in 2010 is $40000.

To calculate the real GDP in 2009, we use the prices of 2010 and quantities of 2009.

So, real GDP in 2009 = 10 x $3000 + 4 x $500 + 1000 x $1 = $33000

Percentage change in Real GDP = .

D) Why are the two output growth rates constructed in B) and C) different? Which one is correct? Explain your answer.

The output growth rates constructed in (B) and (C) are different because we are measuring real GDP growth in different units. Neither answer is incorrect, just as measurement in inches is not more or less correct than measurement in centimeters.

Remember that real GDP aims to measure the amount of goods produced in the economy. But since we cannot add cars and oranges, we need to weight these different goods. Essentially, we weight the goods by their price, which represents their value. Since we are using different base years in (B) and (C), we are using different weights on the goods included in real GDP, which then yields slightly different growth rates.

E) As in B), use the prices for 2009 as the set of common prices for the purpose of computing real GDP in 2009 and in 2010. Compute the GDP deflator for 2009 and for 2010. Infer the rate of inflation from 2009 to 2010.

By definition, the GDP deflator is calculated as .

Therefore, since the base year is 2009, GDP deflator in 2009 is equal to 1 (since the real and nominal GDP are the same for the base year).

GDP deflator in 2010 is equal to .

Thus, the rate of inflation from 2009 to 2010 is .

F) As in C), use the prices for 2010 as the set of common prices for the purpose of computing real GDP in 2009 and in 2010. Compute the GDP deflator for 2009 and for 2010. Infer the rate of inflation from 2009 to 2010.

Since the base year is 2010, GDP deflator in 2010 is equal to 1 (since the real and nominal GDP are the same for the base year).

GDP deflator in 2009 is equal to

Thus, the rate of inflation from 2009 to 2010 is .

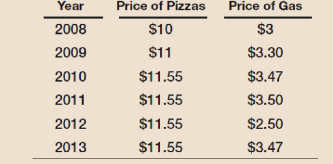
G) Why are the two rates of inflation computed in E) and F) different? Which one is correct? Explain your answer.

Once again the two answers are different due the difference in base years and thus units of measurement. Both answers are correct; they simply represent things.

**Problem 2**

The Consumer Price Index represents the average price of goods that households consume. Many thousands of goods are included in such an index. Here consumers are represented as buying only pizza and gas as their basket of goods. Here is a representation of the kind of data the Bureau of Economic Analysis collects to construct a consumer price index. In the base year, 2008, both the prices of goods purchased and the quantity of goods purchased are collected. In subsequent years, only prices are collected.

The data: In an average week in 2008, the Bureau of Economic Analysis surveys many consumers and determines that the average consumer purchases 2 pizzas and 6 gallons of gas in a week. Prices change over time. The price per pizza and per gallon in subsequent years are found below.



A) What is the cost of the consumer price basket in 2008?

Cost of consumption basket in 2008 = 2 x $10 + 6 x $3 = $38

B) What is the cost of the consumer price basket in 2009 and in subsequent years?

Cost of consumption basket in 2009: 2 x $11 + 6 x $3.30 = $41.80

Cost of consumption basket in 2010: $43.92

Cost of consumption basket in 2011: $44.10

Cost of consumption basket in 2012: $38.10

Cost of consumption basket in 2013: $43.92

C) Represent the cost of the consumer price basket as an index number in the years 2008 to 2013. Set the value of the index number equal to 100 in 2008.

Since the base year is 2008, we set the CPI for that year to be equal to 100. The the index for year is calculated as . Therefore, the indexes are:

2008: 100.0

2009: 110.0

2010: 115.6

2011: 116.1

2012: 100.3

2013: 115.6

D) Calculate the annual rate of inflation using the percent change in the value of the index number between each year from 2009 through 2013.

The rate of inflation for year using CPI is calculated as .

Thus, the rates of inflation are

2009:

2010: 5.1%

2011: 0.4%

2012: -13.6%

2013: 15.3%

E) Is there a year where inflation is negative? Why does this happen?

Inflation is negative in 2012: there is deflation, meaning that overall the cost of a fixed consumption basket has decreased in 2012 compared to 2011. Deflation in 2012 is due to a decrease in the prices of gas, while the price of pizzas remained unchanged.

F) What is the source of inflation in the year 2011? How is that different than inflation in the years 2009 and 2010?

In 2011, pizza prices remained the same, but gas prices rose. Thus inflation is just because gas prices increased thus making the value of the index larger and generating positive inflation. In 2009 both the price of pizza and the price of gasoline rose by 10% from their 2008 values. This is the more usual idea of inflation, sometimes called pure inflation where all prices rise by the same percentage amount.

G) If I have $100 in 2008. How many baskets of goods can I buy with $100 in 2008?

With $100 in 2008, I can buy 100/38 = 2.63 baskets (you have to imagine buying only part of a pizza and a part gallon of gasoline).

H) If I have $100 in 2013, how many baskets can I buy with that money in 2013?

With $100 in 2013, I can buy only 100/43.92 = 2.28 baskets.

I) What is the percentage decline in the purchasing power of my money from 2008 to 2013? How does the percentage decline in the purchasing power of money relate to the change in the value of the price index between 2008 and 2013?

The percentage decline in the purchasing power of money from 2008 to 2013 is given by . You can see that the price index increased by 15.6% between 2008 and 2013. The larger the increase in the price index, the larger the decline in the purchasing power of money. In fact, the percentage increase in the price index is approximately the same as the percentage decrease in the purchasing power of money.

J) From 2009 to 2011, the price of a pizza remains the same. The price of gas rises. How might consumers respond to such a change?

As the price of gas rises relative to the price of pizzas, economists expect that consumers would purchase less gas.

K) Then in 2012, the price of gas falls. What are the implications of such changes in relative prices for the construction of the Consumer Price Index?

When the price of gas falls, consumers purchase more gas. This means that using the 2008 basket to construct the Consumer Price Index could be misleading in both 2011 (gas prices rise a little bit) and especially in 2012, when gas prices fall a lot, because of the need to update the quantities in order to get the right "weights" for each price.

The Consumer Price Index basket is changed every two years to try and keep up with both new goods – think the latest model of your phone – as well as large changes in prices of items like gasoline. (See <https://www.bls.gov/cpi/questions-and-answers.htm> for more details about how the CPI is constructed.)

L) Suppose the Bureau of Economic Analysis determines that in 2013, the average consumer buys 2 pizzas and 7 gallons of gas in a week. Using the 2013 basket in the years from 2008 to 2013, calculate the Consumer Price Index set equal to 100 in 2013 and moving back in time.

By definition, the CPI in 2013 is equal to 100. The price of the consumer basket in 2013 is equal to $11.55 x 2 + $3.47 x 7 = $47.39

Then, in 2012, we use the prices of 2012 and quantities of the "consumer basket" (now measured in 2013), which gives us $11.55 x 2 + $2.50 x 7 = $40.6

And so, using the same formula for the CPI as above, namely, , we get that .

Using the same technique, we get:

2011: 100.4

2010: 100

2009: 95.1

2008: 86.5

Once again, the rate of inflation for year using CPI is calculated as .

Therefore, the inflation rates are equal to:

2009: 10%

2010: 5%

2011: 0.4%

2012: -14.7%

2013: 16.7%

M) Why are the inflation rates slightly different in D) and L)?

The inflation rates are slightly different because we use different quantities to construct the consumers basket. This leads to the fact that we assign different "weights" to the changing prices, which eventually changes the CPI and hence inflation.