Lecture 1 - Recommended Problems Solutions

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☆☆ Problem 4, Chapter 2

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

	2009		2010	
	Quantity	**Price**	**Quantity**	**Price**
Cars	**10**	**$2000**	**12**	**$3000**
Computers	**4**	**$1000**	**6**	**$500**
Oranges	**1000**	**$1**	**1000**	**$1**

a. **What is nominal GDP in 2009 and in 2010? By what percentage does nominal GDP change from 2009 to 2010?**
Nominal GDP is the sum of nominal spending, or the sum of price times quantity for every good in the economy. Thus, the two nominal GDP levels are:

$$NGDP_{2009} = 25000 = 10 * 2000 + 4 * 1000 + 1000$$
$$NGDP_{2010} = 40000 = 12 * 3000 + 6 * 500 + 1000$$

The growth rate is the percentage change from 2009 to 2010, or:

$$\%\Delta NGDP = 60\% = 100 * \left(\frac{40000}{25000} - 1\right)$$

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?**
To construct the constant-price quantity index, we multiply the year t quantities by the prices in the base year. In this case, we are using 2009 prices. By definition, if we are using 2009 prices, then in 2009 $RGDP = NGDP$. Thus, we only need to calculate $RGDP_{2010}$ (constant $2009)

$$RGDP_{2010} \text{ (constant \$2009)} = 31000 = 12 * 2000 + 6 * 1000 + 1000$$

This gives a growth rate of:

$$\%\Delta RGDP_{2010} \text{ (constant \$2009)} = 24\% = \left(\frac{31000}{25000} - 1\right) * 100$$

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?**
Now that we are using constant 2010 prices, $RGDP = NGDP$ for 2010. Calculating RGDP for 2009 using constant 2010 prices, we have:

$$RGDP_{2009} \text{ (constant \$2010)} = 33000 = 10 * 3000 + 4 * 500 + 1000$$

and calculating the real GDP growth rate, we have:

$$\%\Delta RGDP(\text{constant \$2010}) = 21.2\% = \left(\frac{40000}{33000} - 1\right) * 100$$

d. **Why are two output growth rates constructed in (b) and (c) different? Which one is correct? Explain your answer.**
The growth rates differ because of the different choice of base year. Real GDP in each period is a sum of quantities with the quantities weighted by some prices. When the prices (i.e. the weights) in our calculation change, we get a different result. There is no single answer for how to calculate real GDP, or what the "right" base year to use might be.

☆☆ Problem 5, Chapter 2

Consider the economy described in Q2-4 above.

a. **Use the prices for 2009 as the set of common prices to compute real GDP in 2009 and in 2010. Compute the GDP deflator for 2009 and for 2010, and compute the rate of inflation for 2009 to 2010.**
We already calculated real GDP in the previous question. The GDP deflator for year t is defined as:

$$\text{GDP Deflator}_t = \frac{NGDP_t}{RGDP_t} \times 100$$

Using the constant \$2009 estimates of real GDP, since $RGDP = NGDP$ in 2009 we know the deflator in 2009 will be 100. Calculating the deflator for 2010, we have:

$$\text{Deflator}_{2010} \text{ (constant \$2009)} = 129.0 = \left(\frac{40000}{31000}\right) * 100$$

In turn, this means that inflation according to this estimate is:

$$\pi_{2010} \text{ (constant \$2009)} = 29\% = \left(\frac{129}{100} - 1\right) 100$$

b. **Use the prices for 2010 as the set of common prices to compute real GDP in 2009 and in 2010. Compute the GDP deflator for 2009 and for 2010 and compute the rate of inflation for 2009 to 2010.**
Now that we are using 2010 prices, we know the deflator in 2010 will be equal to 100. Next, calculating the deflator in 2009 we have:

$$\text{Deflator}_{2009} \text{ (constant \$2010)} = 75.8 = \left(\frac{25000}{33000}\right) * 100$$

Then, using these deflators to calculate inflation, we have:

$$\pi_{2010} \text{ (constant \$2010)} = 32\% = \left(\frac{100}{75.8} - 1\right) * 100$$

c. **Why are the two rates of inflation different? Which one is correct? Explain your answer.**
Just as there is no clear "right" way to calculate real GDP, there is no single "right" way to estimate inflation.

☆☆ Problem 6, Chapter 2

Consider the economy described in exercise 4.

a. **Construct real GDP for years 2009 and 2010 by using the average price of each good over the two years.**

$$RGDP_{2009} \text{ (\$ average 2009-2010)} = 29000 = 10 * 2500 + 4 * 750 + 1000$$
$$RGDP_{2010} \text{ (\$ average 2009-2010)} = 35500 = 12 * 2500 + 6 * 750 + 1000$$

b. **By what percentage does real GDP change from 2009 to 2010?**

$$\%\Delta RGDP_{2010} \text{ (\$ average 2009-2010)} = 22.4\% = \left(\frac{35500}{29000} - 1\right) * 100$$

c. **What is the GDP deflator in 2009 and 2010? Using the GDP deflator, what is the rate of inflation for 2009 to 2010?**

$$\text{Deflator}_{2009} \text{ (\$ average 2009-2010)} = 86.2 = \left(\frac{25000}{29000}\right) * 100$$
$$\text{Deflator}_{2010} \text{ (\$ average 2009-2010)} = 112.7 = \left(\frac{40000}{35550}\right) * 100$$
$$\pi_{2010} \text{ (\$ average 2009-2010)} = 30.7\% = \left(\frac{112.7}{86.2} - 1\right) * 100$$

d. **Is this an attractive solution to the problem pointed out in Problems 4 and 5 (i.e., two different growth rates and two different inflation rates, depending on which set of prices is used)?**
The answer is yes and is the basis for the construction of chained-type deflators. See the appendix to Chapter 2 for more discussion.

☆ Problem 3, Chapter 2

During a given year, the following activities occur:

- **A silver mining company pays its workers $200,000 to mine 75 pounds of silver. The silver is then sold to a jewelry manufacturer for $300,000.**
- **The jewelry manufacturer pays its workers $250,000 to make silver necklaces, which the manufacturer sells directly to consumers for $1,000,000.**

Based on this information, answer the following questions:

a. **Using the production-of-final-goods approach, what is GDP in this economy?**
The silver mine makes no final sales, while the jewelry manufacturer sells $1,000,000 to consumers. GDP is $1,000,000.

b. **What is the value added at each stage of production? Using the value-added approach, what is GDP?**
The silver mine has no inputs, so all of its $300,000 of revenue is "value added." The jewelry manufacturer has sales of $1,000,000 but has inputs of $300,000, so its value added is $700,000 (alternatively, $1,000,000 - $300,000).
Adding up value added, we have $300,000 + $700,000 = $1,000,000 of GDP.

c. **What are the total wages and profits earned? Using the income approach, what is GDP?**
Total wages are just the sum of wages in the two firms: $200,000 + $250,000 = $450,000. Profits (or gross operating surplus) for each firm is revenue minus intermediate inputs minus wages. For the jewelry manufacturer, profits are: $1,000,000 - $300,000 - $250,000 = $450,000. For the silver mine, profits are: $300,000 - $200,000 = $100,000. Thus, total profits are $450,000 + $100,000 = $550,000.
Adding up income, we have output of: $450,000 + $550,000 = $1,000,000.