

Economics 102
Summer 2015
Answers to Homework #3
Due Thursday, July 9, 2015

Directions: The homework will be collected in a box **before** the lecture. Please place your name 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. Late homework will not be accepted so make plans ahead of time. **Please show your work.** Good luck!

Please realize that you are essentially creating “your brand” when you submit this homework. Do you want your homework to convey that you are competent, careful, and professional? Or, do you want to convey the image that you are careless, sloppy, and less than professional. For the rest of your life you will be creating your brand: please think about what you are saying about yourself when you do any work for someone else!

1. For each of the following scenarios you will be asked to evaluate the impact of this information on GDP for the economy.

a. Jose works twenty hours a week this year and earns \$10 per hour. He takes two weeks of unpaid vacation during the year. Yoshi works thirty hours a week this year and earns \$9 per hour. He takes four weeks of unpaid vacation during the year. Both Jose and Yoshi work in the U.S. What will be the total impact on U.S. GDP this year given this information? Explain how you found your answer and what method of GDP accounting you are using.

b. Century Tires located in the U.S. manufactures 10,000 tires during the year. Century sells 80% of its tires to Little Car Co. and these tires are put on the new cars being manufactured at the Little Car. Co. Little Car Co. is also located in the U.S. The other 20% of the tires are sold for \$100 each as replacement tires in the economy. The new cars being sold by Little Car Co. sell for \$10,000 each and they produce 2,000 cars this year. Assume that Little Car Co. sells their new cars with just four tires. What is the contribution to U.S. GDP this year given this information? Show how you found your answer.

c. Benedita goes to the grocery store in Boston, MA and purchases \$135 worth of groceries. In her grocery bags are \$25 of German made chocolate (she does love her chocolate!), \$35 of Wisconsin cheese, \$40 of Iowa-grown pork and chicken, \$20 of California grown fruit, and \$15 of Mexican tomatillos. How much did GDP in the U.S. go up this year due to these purchases? Assume that all goods purchased were produced during this year. Fully explain your answer.

d. Jerry goes to the grocery store in New York City, NY and purchases \$150 worth of groceries. In his grocery bags are \$10 of Wisconsin aged cheddar cheese that has been aged 10 years, \$10 of a young German wine that was produced this year, \$60 of

California-grown fruits and vegetables; \$20 of aged Scotch produced in Great Britain and aged for 5 years, and \$40 of Iowa-grown chicken and pork. Unless otherwise specified assume that all goods were produced this year. What is the contribution to this year's U.S. GDP from Jerry's purchase? Explain your answer fully and for any item that you do not include provide some clear and specific explanation of how this item relates to GDP.

Answer:

a. Jose will earn an annual income of: $(20 \text{ hours per week})(50 \text{ weeks})(\$10 \text{ per hour}) = \$10,000$. Yoshi will earn an annual income of: $(30 \text{ hours per week})(48 \text{ weeks})(\$9 \text{ per hour}) = \$12,960$. Total income for the year from Jose and Yoshi is therefore \$22,960. GDP will increase by \$22,960 using the factor income approach since this is the addition to wages in that equation.

b. Let's go through this calculation in two different ways and we should get the same number with either method:

i) There are 10,000 tires that are each worth \$100 so the total value of the tires is \$1,000,000.

There are 2,000 cars that are each worth \$10,000 so the total value of the cars is \$20,000,000.

If we add these two values together we get \$21,000,000. But, there is an error here since we are counting the tires on the new cars twice: once when they were manufactured and then again when they are sold with the new cars. So, let's subtract out the value of the tires that are on the new cars: 2000 cars with four tires each where each tire is valued at \$100 means that the value of the tires on the new cars is \$800,000 $[(2000 \text{ cars})(4 \text{ tires per car})(\$100 \text{ per tire})]$. So, total contribution to GDP from this information this year would be \$21,000,000 - \$800,000 or \$20,200,000.

ii) Here's another way to do the calculation:

We know that 20% of the tires are sold as replacement tires: $.20(10,000 \text{ tires})(\$100 \text{ per tire}) = \$200,000$ value for these tires. We also know that 2000 cars are produced and sold for \$10,000 a car: value of these cars is $(2000 \text{ cars})(\$10,000 \text{ per car}) = \$20,000,000$.

Total contribution to GDP this year given this information: $\$20,000,000 + \$200,000 = \$20,200,000$ which is the same answer as we got with the first method.

c. GDP in the U.S. went up \$95 this year due to these purchases: one way to see this is to sum up the value of all the goods and services that Benedita purchased that were produced in the U.S.: $(\$35 \text{ of Wisconsin cheese}) + (\$40 \text{ of Iowa-grown pork and chicken}) + (\$20 \text{ of California-grown fruit and vegetables}) = \95 of domestically produced goods and services purchased by Benedita in this trip to the grocery store.

An alternative method of measuring the contribution to U.S. GDP for this year: we know that $GDP = C + I + G + (X - M)$ from the expenditure approach to measuring GDP. Benedita spends a total of \$135 in this trip to the grocery store: this \$135 is consumption spending, C. But, within that \$135 there are \$40 of imported goods: \$25 of German chocolate and \$15 of Mexican tomatillos. So $M = \text{imports} = \$40$ from this trip to the

grocery store. We can think about the $(\text{change in GDP}) = (\text{change in consumption}) - (\text{change in imports}) = 135 - 40 = \95 .

d. Let's start by cataloging the items:

Item	Value	Where/When counted for GDP purposes
Wisconsin aged cheddar cheese	\$10	Counted in U.S. GDP when produced: counted in 2005
Young German wine	\$10	Counted in German GDP for 2015
California-grown fruits and vegetables	\$60	Counted in U.S. GDP for 2015
Aged Scotch produced in Great Britain	\$20	Counted in Great Britain's GDP when produced: counted in 2010
Iowa-grown chicken and pork	\$40	Counted in U.S. GDP for 2015
Unspecified expenditures	\$10	Assume this is U.S. stuff produced this year; counted in U.S. GDP for 2015

Looking at our table, we can note that Jerry's purchases increase U.S. GDP by \$110. Two of the items he purchased (the Wisconsin aged cheddar cheese and the aged Scotch) do not get counted in GDP for this year anywhere in the world since these items were produced in earlier years and were counted in GDP during the year in which they were produced. Jerry consumes \$120 of items produced this year, but \$10 of this amount is for the imported German wine: so his contribution to this year's GDP is $\$120 - \10 or $\$110$.

2. Suppose you are given the following information about an economy. This economy during 2014 could be described as follows:

Item	Amount
Rent	\$25 million
Consumption Spending	\$185 million
Wages	\$120 million
Government Spending	\$15 million
Interest	\$15 million
Investment Spending	\$10 million
Trade Deficit	-\$10 million

When a country has a trade deficit this implies that the value of its imports is greater than the value of its exports.

a. Given the above information, what is the value of GDP for this economy this year? Show how you found your answer and identify the GDP measurement method you are using.

b. Given the above information, what information are you missing in order to use the factor payments approach to measuring GDP? Now that you have calculated GDP in (a), can you find the value of this missing piece of data? Show your work!

Answer:

a. Using the expenditure approach to measuring GDP we have:

$$\text{GDP} = C + I + G + (X - M)$$

$$\text{GDP} = 185 + 10 + 15 + (X - M)$$

We are told that there is a trade deficit of -\$10 million: this implies that $(X - M) = -\$10$ million. When the country runs a trade deficit it is importing more than it is exporting. So, $\text{GDP} = 210 - 20 = \200 million

b. The factor payments approach to measuring GDP can be written as:

$$\text{GDP} = \text{wages} + \text{interest} + \text{rent} + \text{profit}$$

Looking at the table we have wages, interest, and rent; we do not have a value for profits. But, in (a) we were able to calculate GDP using the expenditure approach and from our class discussion we know that the different approaches should yield the same value of GDP. This means that we can write:

$$200 = 120 + 15 + 25 + \text{profits and solve for the missing value of profits.}$$

$$\text{Profits} = \$40 \text{ million}$$

3. Suppose you are given the following information about the economy of Grantland. In 2014 Grantland had rent payments of \$10 billion, interest payments of \$20 billion, consumption spending on goods and services of \$120 billion, investment spending on goods and services of \$40 billion, wages of \$100 billion, and net exports of \$20 billion. You also know that in Grantland in 2014 that profits were equal to three times the level of government spending on goods and services.

Given this information, calculate the level of GDP in Grantland in 2014. Show how you found your answer. In your calculations you will also need to find the value of profits and government spending on goods and services. Show how you found your answers to each of these values.

Answer:

Let's start by organizing the data we have:

Using the factor payments approach to measuring GDP:

$$\text{GDP} = \text{wages} + \text{interest} + \text{rent} + \text{profits}$$

$$\text{GDP} = 100 + 20 + 10 + \text{profits}$$

$$\text{GDP} = 130 + \text{profits}$$

Using this approach we have two unknowns and will therefore be unable to solve this equation without more information.

Using the expenditure approach to measuring GDP:

$$\text{GDP} = C + I + G + (X - M)$$

$$\text{GDP} = 120 + 40 + G + 20$$

$$\text{GDP} = 180 + G$$

Using this approach we have two unknowns and will therefore be unable to solve this equation without more information.

We do know that both measures should give us the same value for GDP: thus,

$$130 + \text{profits} = 180 + G$$

But, we still have two unknowns and will therefore be unable to solve this equation without more information.

In the prompt we are also told that profits are 3 times the level of government spending: we can write this in equation form as

$$\text{Profits} = 3G$$

Now, use this information to solve for profits, G, and GDP:

$$130 + 3G = 180 + G$$

$$2G = 50$$

$$G = \$25 \text{ billion}$$

$$\text{Profits} = 3G = 3(\$25 \text{ billion}) = \$75 \text{ billion}$$

$$\text{GDP} = 130 + \text{profits} = 130 + 75 = \$205 \text{ billion}$$

Or, $\text{GDP} = 180 + G = 180 + 25 = \205 billion [Note: that you should be getting the same value for GDP using either method.]

4. Suppose you are given the following information about the Grantland economy:

- The total population in Grantland this year is 5000 people
- 200 people in Grantland are at least 16 years old and have given up looking for work since they do not believe there are any jobs in Grantland for them
- 500 people in Grantland are less than 16 years old
- 200 people in Grantland are fully retired
- 100 people in Grantland are not currently working, they are available to work, but they have not filled out any job applications during the last four weeks
- 200 people in Grantland are at least 16 years old and are full-time students that are not working and are not interested in working at this time
- there are 200 people in the military in Grantland and they are all at least 18 years old
- there are 600 full-time homemakers in Grantland and they are not working for pay and are not interested in working for pay at this time (they clearly are working at home-but not for pay!)
- there are 1000 part-time workers in Grantland and 600 of these workers would like to work full-time but they have been unable to find full-time work
- there are 1000 full-time workers in Grantland

a. Given this information what is the civilian labor force? Show how you calculated this value.

b. Given this information, calculate the unemployment rate in Grantland. Show your work.

c. Given this information, suppose Grantland decides to count discouraged workers as part of the unemployed. What will the unemployment rate be in Grantland if the government makes this change in the way they calculate the unemployment rate? Show your work. Round your answer to two places past the decimal if necessary.

d. Given this information, suppose Grantland decides to count part-time workers who wish to work full-time but cannot find full-time work as unemployed workers. What will be the unemployment rate be in Grantland if the government makes this change in the way they calculate the unemployment rate? Assume that discouraged workers are given the standard treatment in the calculation of the unemployment rate. Show your work. Round your answer to two places past the decimal if necessary.

e. Given this information, suppose the government of Grantland reclassifies both discouraged workers and those part-time workers who want full-time work as unemployed workers. (We are combining the changed assumptions of (c) and (d) here.) What will be the unemployment rate given this change in government definitions of unemployment? Show your work. Round your answer to two places past the decimal if necessary.

Answer:

a. To get to the civilian labor force:

Total population = 5000 people

- population less than 16 years old = $5000 - 500 = 4500$
- fully retired = $4500 - 200 = 4300$
- military = $4300 - 200 = 4100$
- homemakers = $4100 - 600 = 3500$
- discouraged workers = $3500 - 200 = 3300$
- not actively seeking work = $3300 - 100 = 3200$
- full-time students = $3200 - 200 = 3000$

Total civilian labor force = 3000 people

b. Unemployment rate = $\{(\text{Number of unemployed}) / [(\text{Number of employed}) + (\text{Number of Unemployed})]\} * (100 \text{ percent})$

From the provided information we can calculate the number of employed:

Number of employed = Number of employed full-time + number of employed part-time

Number of employed = $1000 + 1000 = 2000$

Number of unemployed = Civilian Labor Force – Number of employed

Number of unemployed = $3000 - 2000 = 1000$

Unemployment rate = $[(1000)/(2000 + 1000)] * (100\%) = (1/3)(100\%) = 33\%$

c. New definition of unemployed = unemployed by standard definition + discouraged workers

New value of unemployed using this definition = $1000 + 200 = 1200$

Civilian labor force' = employed + unemployed using new definition = $2000 + 1200 = 3200$

Unemployment rate' = $[(1200)/(3200)] * (100\%) = 37.50\%$

d. New definition of unemployed = unemployed by standard definition + number of part-time workers who want to work full-time but can't find full-time work

New value of unemployed using this definition* = $1000 + 600 = 1600$

New value of employed using this definition* = full-time workers + part-time workers satisfied with part-time work = 1000 + 400 = 1400

Civilian labor force* = employed* + unemployed using new definition* = 1400 + 1600 = 3000

Unemployment rate* = $[(1600)/(3000)]*(100\%) = 53.33\%$

e. New definition of unemployed** = unemployed by standard definition + discouraged workers + number of part-time workers who want to work full-time but can't find full-time work

New value of unemployed using this definition** = 1000 + 200 + 600 = 1800

New value of employed using this definition** = employed full-time + part-time workers satisfied with part-time work = 1000 + 400 = 1400

Civilian labor force** = employed ** + unemployed using this new definition** = 1400 + 1800 = 3200

Unemployment rate** = $[(1800)/(3200)]*(100\%) = 56.25\%$

5. In Grantland the standard consumer basket of goods and services for purposes of calculating the CPI is given as two steaks, four potatoes, and five apples. You are given the following information about prices and quantities of these goods in Grantland.

	Quantity Produced in 2010	Quantity Produced in 2011	Quantity Produced in 2012	Price per unit in 2010	Price per unit in 2011	Price per unit in 2012
Number of Steaks	10	10	12	\$5	\$6	\$7
Number of Potatoes	20	25	18	\$2	\$1.50	\$2
Number of Apples	40	35	30	\$1	\$1	\$1.50

a. Given the above information, calculate the value of nominal GDP in Grantland for 2010, 2011 and 2012. Provide any general formula you use to calculate these values and identify any abbreviations in that formula. Show your work. Enter your final calculations in a table like the one below.

Year	Nominal GDP
2010	
2011	
2012	

b. Suppose that you are told that 2010 is the base year. Calculate the values of real GDP in Grantland for these three years. Provide any general formula you use to calculate these values and identify any abbreviations in that formula. Show your work. Enter your calculations in a table like the one below.

Year	Real GDP with base year 2010
2010	
2011	
2012	

c. Given your calculations describe what happens to the real level of production in Grantland over these three years. Be specific as to what measures you are going to use when describing this.

d. Suppose that you are told that 2012 is the base year. Calculate the values of real GDP in Grantland for these three years. Provide any general formula you use to calculate these values and identify any abbreviations in that formula. Show your work. Enter your calculations in a table like the one below. Do you get the same values for Real GDP when you change the base year?

Year	Real GDP with base year 2012
2010	
2011	
2012	

e. Calculate the GDP deflator using base year 2010 and then repeat this using base year 2012. Show any formulas you use. Place your calculations in the following summary table. Use a 100 point scale for your GDP deflators and round to two places past the decimal. [HINT: to do these calculations use a calculator or a spreadsheet program like EXCEL.]

Year	GDP deflator with base year 2010	GDP deflator with base year 2012
2010		
2011		
2012		

f. Calculate the annual rate of inflation using the GDP deflators with base year 2010 and base year 2012. Do you get the same annual rates of inflation or does choice of base year impact your measure of the inflation rate? Put your calculations in the following summary table. Show how you found your answers.

	Annual Rate of Inflation based on GDP deflator with 2010 as the Base Year	Annual Rate of Inflation based on GDP deflator with 2012 as the Base Year
2010 to 2011		
2011 to 2012		

Answer:

a. Nominal GDP = (price of item in the current year)(quantity of the item produced in the current year)

Nominal GDP for 2010 = (price of steaks in 2010)(quantity of steaks in 2010) + (price of potatoes in 2010)(quantity of potatoes in 2010) + (price of apples in 2010)(quantity of apples in 2010) = $(5)(10) + (2)(20) + (1)(40) = \130

Nominal GDP for 2011 = $(6)(10) + (1.5)(25) + (1)(35) = \132.50

Nominal GDP for 2012 = $(7)(12) + (2)(18) + (1.5)(30) = \165

Here's the table:

Year	Nominal GDP
2010	\$130
2011	\$132.50
2012	\$165

b. Real GDP = sum for all items of the products of (price of item in the base year)(quantity of the item produced in the current year)

Real GDP for 2010 with 2010 the base year = Nominal GDP for 2010 since the base year prices are the same as the current year prices = \$130

Real GDP for 2011 with 2010 the base year = $(5)(10) + (2)(25) + (1)(35) = \135

Real GDP for 2012 with 2010 the base year = $(5)(12) + (2)(18) + (1)(30) = \126

Here's the table:

Year	Real GDP with base year 2010
2010	\$130
2011	\$135
2012	\$126

c. If you want to describe what is happening to production in Grantland over this three year period of time you will want to use the real GDP values. The nominal values allow both price and quantity to vary over time and that means you cannot know with certainty whether the increase in the measure is due to increases in the overall price level or increases in the overall level of production. Using the real values of GDP we see that production in Grantland increased from 2010 to 2011 and then decreased from 2011 to 2012 (and the level of production in 2012 was even lower than that in 2010!).

d. Real GDP = sum for all items of the products of (price of item in the base year)(quantity of the item produced in the current year)

Real GDP for 2010 with 2012 the base year = sum for all items of the products of (prices of item in 2012)(quantity of item in 2010) = $(7)(10) + (2)(20) + (1.5)(40) = \170

Real GDP for 2011 with 2012 the base year = $(7)(10) + (2)(25) + (1.5)(35) = \172.50

Real GDP for 2012 with 2012 the base year = Nominal GDP for 2012 since the base year prices are the same as the current year prices = \$165

When you change the base year you get different values for real GDP: choice of base year matters here.

Here's the table:

Year	Real GDP with
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	base year 2012
2010	\$170
2011	\$172.50
2012	\$165

e. GDP deflator = [(Nominal GDP in current year)/(Real GDP in current year)](scale factor)

GDP deflator in 2010 with 2010 base year = 100 on a 100 point scale

GDP deflator in 2012 with 2012 base year = 100 on a 100 point scale

GDP deflator in 2011 with 2010 base year = $[(132.5)/(135)](100) = 98.15$

GDP deflator in 2012 with 2010 base year = $[(165/126)](100) = 130.95$

GDP deflator in 2010 with 2012 base year = $[(130/170)](100) = 76.47$

GDP deflator in 2011 with 2012 base year = $[(132.5/172.5)](100) = 76.81$

Year	GDP deflator with base year 2010	GDP deflator with base year 2012
2010	100	76.47
2011	98.15	76.81
2012	130.95	100

f. To find the annual rate of inflation use the following formula:

Annual rate of inflation = $\{[(\text{GDP deflator in current year}) - (\text{GDP deflator in previous year})]/\text{GDP deflator in previous year}\} * (100\%)$

Annual rate of inflation from 2010 to 2011 using 2010 as the base year = $[(98.15 - 100)/100] * 100\% = -1.85\%$

Annual rate of inflation from 2011 to 2012 using 2010 as the base year = $[(130.95 - 98.15)/98.15] * 100\% = 33.42\%$

Annual rate of inflation from 2010 to 2011 using 2012 as the base year = $[(76.81 - 76.47)/76.47] * (100\%) = 0.44\%$

Annual rate of inflation from 2011 to 2012 using 2012 as the base year = $[(100 - 76.81)/76.81] * (100\%) = 30.19\%$

	Annual Rate of Inflation based on GDP deflator with 2010 as the Base Year	Annual Rate of Inflation based on GDP deflator with 2012 as the Base Year
2010 to 2011	-1.85%	0.44%
2011 to 2012	33.42%	30.19%

Choice of base year affects the values of the annual rate of inflation. This is why the government does not use the GDP deflator as a means to calculate the change in the overall level of prices: the value you get for inflation using this measure is highly dependent on the choice of base year.

6. Let's continue with the example we started in the last problem. But this time let's work on calculating the CPI. You will need to go back and find where the basket for purposes

of the CPI was defined. And, you will need to return to the initial table to get the data this problem requires.

a. Calculate the cost of the market basket for each of the three years. Show how you calculated these values and then summarize your calculations in the following table.

Year	Cost of Market Basket
2010	
2011	
2012	

b. Calculate the CPI index using 2010 as the base year. Show how you calculated these values and then summarize your calculations in the following table. Use a 100-point scale. Calculate your values to two places past the decimal [Hint: use EXCEL or a calculator here.]

Year	CPI Index using 2010 as the base year using a 100-point scale
2010	
2011	
2012	

c. Calculate the annual rate of inflation using the CPI index with base year 2010. Show how you calculated these values and then summarize your calculations in the following table.

	Annual Rate of Inflation with Base Year 2010
2010 to 2011	
2011 to 2012	

d. Calculate the CPI index using 2012 as the base year. Show how you calculated these values and then summarize your calculations in the following table. Use a 500 point scale.

Year	CPI Index using 2012 as the base year using a 500-point scale
2010	
2011	
2012	

e. Calculate the annual rate of inflation using the CPI index with base year 2012. Show how you calculated these values and then summarize your calculations in the following table.

	Annual Rate of Inflation with Base Year 2012
2010 to 2011	
2011 to 2012	

f. Compare the annual rates of inflation you calculated in (c) and (e). Does choice of base year matter when using the CPI to calculate the annual rate of inflation? Does choice of scale factor (in this case 100-point scale versus 500-point scale) matter?

Answer:

a. Cost of market basket = (Number of steaks in market basket)(Price of steaks in current year) + (Number of potatoes in market basket)(Price of potatoes in current year) + (Number of apples in market basket)(Price of apples in current year)

Cost of market basket in 2010 = $(2)(5) + (4)(2) + (5)(1) = \23

Cost of market basket in 2011 = $(2)(6) + (4)(1.5) + (5)(1) = \23

Cost of market basket in 2012 = $(2)(7) + (4)(2) + (5)(1.5) = \29.50

Year	Cost of Market Basket
2010	\$23
2011	\$23
2012	\$29.50

b. CPI index number for year i = (Cost of market basket in year i)/(Cost of market basket in base year)(Scale factor)

CPI in 2010 using 2010 as the base year = $(23/23)(100) = 100$

CPI in 2011 using 2010 as the base year = $(23/23)(100) = 100$

CPI in 2012 using 2010 as the base year = $(29.5/23)(100) = 128.26$

Year	CPI Index using 2010 as the base year using a 100-point scale
2010	100
2011	100
2012	128.26

c. Calculate the annual rate of inflation using the CPI as:

Annual rate of inflation = $(\text{CPI in current year} - \text{CPI in previous year}) / (\text{CPI in previous year}) * 100\%$

Annual rate of inflation between 2010 and 2011 = $[(100 - 100)/100] * 100\% = 0\%$

Annual rate of inflation between 2011 and 2012 = $[(128.26 - 100)/100] * 100\% = 28.26\%$

	Annual Rate of Inflation with Base Year 2010
2010 to 2011	0%
2011 to 2012	28.26%

d. CPI index number for year i = (Cost of market basket in year i)/(Cost of market basket in base year)(Scale factor)

CPI in 2010 using 2012 as the base year = $(23/29.50)(500) = 389.85$

CPI in 2011 using 2012 as the base year = $(23/29.50)(500) = 389.85$

CPI in 2012 using 2012 as the base year = $(29.5/29.50)(500) = 500$

Year	CPI Index using 2012 as the base year and a 500-point scale
2010	389.85
2011	389.85
2012	500

e. Calculate the annual rate of inflation using the CPI as:

Annual rate of inflation = $(\text{CPI in current year} - \text{CPI in previous year}) / (\text{CPI in previous year}) * 100\%$

Annual rate of inflation between 2010 and 2011 using 2012 as the base year = $[(389.85 - 389.85)/389.85] * 100\% = 0\%$

Annual rate of inflation between 2011 and 2012 using 2012 as the base year = $[(500 - 389.85)/389.85] * 100\% = 28.25\%$

	Annual Rate of Inflation with Base Year 2012
2010 to 2011	0%
2011 to 2012	28.25%

f. Using the CPI and a fixed market basket to calculate the annual rate of inflation yields consistent measures of the annual rate of inflation no matter what the choice of base year or the scale factor. The CPI has the quality of consistency in measuring the rate of inflation and this is something that the GDP deflator lacks.

7. [Note: thanks to the website "money.cnn.com/calculator/pf/cost-of-living" for the data that went into this question: data from 1/28/15] Mariyana is looking for a job this year and has three offers from three different locations. Each job is identical to the others and Mariyana only cares about maximizing her purchasing power next year with respect to the job she takes. Her offers are as follows:

Job Location	Salary Offered
Denver, CO	\$103,000
Seattle, WA	\$108,000
Toledo, OH	\$100,000

She also knows the CPI for each of these cities:

Job Location	CPI
Denver, CO	105.677
Seattle, WA	120.617
Toledo, OH	100

a. Given this data, calculate the real salary for next year for each of these cities using Toledo as the base city (i.e. measure the real salaries in terms of Toledo dollars). Show your work. Put your final calculations into the table below. Round your calculations to the nearest whole number.

Job Location	Nominal Salary Offered	Real Salary using Toledo Dollars
Denver, CO	\$103,000	
Seattle, WA	\$108,000	
Toledo, OH	\$100,000	\$100,000

b. Given your calculations in (a), and Mariyana's preferences to maximize her purchasing power next year which job should Mariyana take? Explain your answer. What's the important idea behind this exercise?

c. Now suppose that these initial job offers come with projected annual growth rates for the nominal salary values. In Toledo, Mariyana's nominal income will grow by 2% a year; in Denver, her nominal income will grow by 5% a year; and in Seattle, her nominal income will grow by 4% a year. Given this information calculate the nominal values for Mariyana's

income in the three cities over the next five years. Here's a table for summarizing your calculations. Round your answers to the nearest whole number.

Location	Salary 1 st Year	Salary 2 nd Year	Salary 3 rd Year	Salary 4 th Year	Salary 5 th Year
Denver, CO	\$103,000				
Seattle, WA	\$108,000				
Toledo, OH	\$100,000				

d. Suppose that the CPI index numbers you were initially given continue to hold across the five year period of time. (That is, the CPI in Denver stays at 106.677-this simplifies the problem considerably!) If Mariyana is interested solely in selecting the job with the greatest purchasing power at the fifth year, which job would be best? Explain your answer.

Answer:

a. For Denver: real salary in Toledo dollars = $[(\text{nominal salary in Denver})/(\text{Price Index in Denver})] * (\text{scale factor}) = [(103,000)/(105.677)] * 100 = \$97,466$

For Seattle: real salary in Toledo dollars = $[(\text{nominal salary in Seattle})/(\text{Price Index in Seattle})] * (\text{scale factor}) = [(108,000)/(120.617)] * 100 = \$89,540$

Job Location	Nominal Salary Offered	Real Salary using Toledo Dollars
Denver, CO	\$103,000	\$97,466
Seattle, WA	\$108,000	\$89,540
Toledo, OH	\$100,000	\$100,000

b. Our calculations in (a) reveal that the offer from Toledo once we account for the differences in cost of living as measured by the CPI values yields the greatest purchasing power for Mariyana. She should therefore take the job in Toledo.

The key idea here is that there are different costs-of-living in different communities. It is important when making big decisions about where to live and what job to take, to be aware that there could be substantial differences in the costs associated with different locations.

c. Here's the calculation for Toledo:

First Year Salary in Toledo = \$100,000

Second Year Salary in Toledo = (First Year Salary)(1.02) = (\$100,000)(1.02) = \$102,000

Third Year Salary in Toledo = (Second Year Salary)(1.02) = (\$102,000)(1.02) = \$104,040

Fourth Year Salary in Toledo = (Third Year Salary)(1.02) = (\$104,040)(1.02) = \$106,121

Fifth Year Salary in Toledo = (Fourth Year Salary)(1.02) = (\$106,121)(1.02) = \$108,243

First Year Salary in Denver = \$103,000

Second Year Salary in Denver = (First Year Salary)(1.05) = (\$103,000)(1.05) = \$108,150

Third Year Salary in Denver = (Second Year Salary)(1.05) = (\$108,150)(1.05) = \$113,558

Fourth Year Salary in Denver = (Third Year Salary)(1.05) = (\$113,558)(1.05) = \$119,235

Fifth Year Salary in Denver = (Fourth Year Salary)(1.05) = (\$119,235)(1.05) = \$125,197

Third Year Salary in Denver = (Second Year Salary)(1.05) = (\$108,150)(1.05) = \$113,558

Fourth Year Salary in Denver = (Third Year Salary)(1.05) = (\$113,558)(1.05) = \$119,235

First Year Salary in Seattle = \$103,000

Second Year Salary in Seattle = (First Year Salary)(1.04) = (\$108,000)(1.04) = \$112,320

Third Year Salary in Seattle = (Second Year Salary)(1.04) = (\$112,320)(1.04) = \$116,813
 Fourth Year Salary in Seattle = (Third Year Salary)(1.04) = (\$116,813)(1.04) = \$121,485
 Fifth Year Salary in Seattle = (Fourth Year Salary)(1.04) = (\$121,485)(1.04) = \$126,345

Location	Salary 1 st Year	Salary 2 nd Year	Salary 3 rd Year	Salary 4 th Year	Salary 5 th Year
Denver, CO	\$103,000	\$108,150	\$133,558	\$119,235	\$125,197
Seattle, WA	\$108,000	\$112,320	\$116,813	\$121,485	\$126,345
Toledo, OH	\$100,000	\$102,000	\$104,040	\$106,121	\$108,243

Salary 3 rd Year
\$113,558
\$116,813
\$104,040

d. To figure out the best job we need to convert the Nominal Salaries from the fifth year in each of the cities to Real Salaries for the fifth year.
 Real Salary in Toledo in fifth year = Nominal Salary in Toledo in fifth year = \$108,243 since the price level is constant an equal to 100.
 Real Salary in Denver in fifth year = [(\$125,197)/(105.677)]*(100) = \$118,471
 Real Salary in Seattle in fifth year = [(\$126,345)/(120.617)]*(100) = \$104,749

Mariyana if she wants to maximize her purchasing power in the fifth year should take the job in Denver: the combination of cost-of-living and growth rate of her nominal salary over this time period yields the greatest purchasing power, or real income, with the Denver option.