Econ 522: Intermediate Macroeconomics, Spring 2018

Chapter 2 Practice Problems - *Solutions*

1. ***Production, Value Added, and Income Based GDP.* The following activities occur during a given year:**

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

   (a) **Using the "production of final goods" approach, what is GDP?**

   $\boxed{1{,}000{,}000}$ from the direct sale to consumers

   (b) **What is the value added at each stage of production? Using the "value-added" approach, what is GDP?**

   300,000 is the value added by the mining company

   1,000,000 - 300,000 = 700,000 is the value added by the jewelry manufacturer

   The total value added is 300,000 + 700,000 = $\boxed{1{,}000{,}000}$

   (c) **What are the total wages and profits earned? Using the income approach, what is GDP?**

   200,000 is earned in wages and 100,000 in profit (profit = revenue - cost = 300,000 - 200,000 = 100,000) from the first part

   250,000 is earned in wages and 1,000,000 - 250,000 - 300,000 = 450,000 in profit from the second part

   The total income is

$$\begin{array}{r} 200,000 \\ 100,000 \\ 250,000 \\ +\ 450,000 \\ \hline \boxed{1{,}000{,}000} \end{array}$$

2. ***Nominal GDP, Real GDP, and Growth Rates.* Any economy produces three goods: cars, computers, and apples. Quantities and prices per unit for years 2015 and 2016 are as follows:**

	Q_{2015}	P_{2015}	Q_{2016}	P_{2016}
Car	10	$2,000	12	$3,000
Computer	4	$1,000	6	$500
Apple	1,000	$1	1,000	$1

(a) **What is nominal GDP in 2015 and 2016? What is the growth rate in nominal GDP?**

$$\begin{aligned}
\text{Nominal GDP}_{2015} &= Q_{\text{cars, 2015}} \times P_{\text{cars, 2015}} + Q_{\text{computers, 2015}} \times P_{\text{computers, 2015}} + Q_{\text{apples, 2015}} \times P_{\text{apples, 2015}} \\
&= 10 \times 2,000 + 4 \times 1,000 + 1,000 \times 1 \\
&= 20,000 + 4,000 + 1,000 \\
&= \boxed{25{,}000}
\end{aligned}$$

$$\begin{aligned}
\text{Nominal GDP}_{2016} &= Q_{\text{cars, 2016}} \times P_{\text{cars, 2016}} + Q_{\text{computers, 2016}} \times P_{\text{computers, 2016}} + Q_{\text{apples, 2016}} \times P_{\text{apples, 2016}} \\
&= 12 \times 3,000 + 6 \times 500 + 1,000 \times 1 \\
&= 36,000 + 3,000 + 1,000 \\
&= \boxed{40{,}000}
\end{aligned}$$

The growth rate is:

$$\frac{\text{Nominal GDP}_{2016} - \text{Nominal GDP}_{2015}}{\text{Nominal GDP}_{2015}} = \frac{40,000 - 25,000}{25,000} = \boxed{0.6}$$

(b) **Using 2015 as the base year, what is real GDP in 2015 and 2016? What is the growth rate in real GDP when 2015 is used as the base year?**

With 2015 as the base year, real GDP for 2015 will be the same as nominal GDP for 2015. From above that is $\boxed{25{,}000}$.

$$\begin{aligned}
\text{Real GDP}_{2016,\text{base}=2015} &= Q_{1,\ 2016} \times P_{1,\ 2015} + Q_{2,\ 2016} \times P_{2,\ 2015} + Q_{3,\ 2016} \times P_{3,\ 2015} \\
&= 12 \times 2,000 + 6 \times 1,000 + 1,000 \times 1 \\
&= 24,000 + 6,000 + 1,000 \\
&= \boxed{31{,}000}
\end{aligned}$$

The growth rate is:

$$\frac{\text{Real GDP}_{2016,\ \text{base}=2015} - \text{Real GDP}_{2015,\ \text{base}=2015}}{\text{Real GDP}_{2015,\ \text{base}=2015}} = \frac{31,000 - 25,000}{25,000} = \boxed{0.24}$$

(c) **Using 2016 as the base year, what is real GDP in 2015 and 2016? What is the growth rate in real GDP when 2016 is used as the base year?**

With 2016 as the base year, real GDP for 2016 will be the same as nominal GDP for 2016. From above that is $\boxed{40{,}000}$.

$$\begin{aligned}
\text{Real GDP}_{2015,\text{base}=2016} &= Q_{1,\ 2015} \times P_{1,\ 2016} + Q_{2,\ 2015} \times P_{2,\ 2016} + Q_{3,\ 2015} \times P_{3,\ 2016} \\
&= 10 \times 3,000 + 4 \times 500 + 1,000 \times 1 \\
&= 30,000 + 2,000 + 1,000 \\
&= \boxed{33{,}000}
\end{aligned}$$

The growth rate is:

$$\frac{\text{Real GDP}_{2016,\ \text{base}=2016} - \text{Real GDP}_{2015,\ \text{base}=2016}}{\text{Real GDP}_{2015,\ \text{base}=2016}} = \frac{40,000 - 33,000}{33,000} = \boxed{0.2121}$$

(d) **Why are the two output growth rates constructed in (b) and (c) different? Is one more correct than the other?**

The value we get for real GDP in each year depends on which set of prices are used (i.e., on what base year is used). When relative prices change in between years, we get distorted measures of real GDP, which leads to the growth rates here depending on which year is used as base year. In practice, chain weighted measures of GDP are used to resolve this problem. With the chain weighted approach, prices are gradually updated over time.

3. ***Deflator and Inflation Rate.*** **The following table contains measures of nominal and real GDP for the US in 2014-2016. (Numbers are in billions). Use the numbers to calculate the GDP deflator for 2014, 2015, 2016, and the inflation rate for 2015 and 2016.**

Year (t)	Nom. GDP	Real GDP	GDP Deflator	Inflation Rate (π)
2014	17,393.1	15,982.3		
2015	18,036.6	16,397.2		
2016	18,566.9	16,660		

For the GDP deflator:

$$\text{Deflator}_t = \frac{\text{Nominal GDP}_t}{\text{Real GDP}_t} \times 100$$

$$\begin{aligned}
\text{Deflator}_{2014} &= \frac{\text{Nominal GDP}_{2014}}{\text{Real GDP}_{2014}} \times 100 = \frac{17,393.1}{15,982.3} \times 100 = \boxed{108.827} \\
\text{Deflator}_{2015} &= \frac{\text{Nominal GDP}_{2015}}{\text{Real GDP}_{2015}} \times 100 = \frac{18,036.6}{16,397.2} \times 100 = \boxed{109.998} \\
\text{Deflator}_{2016} &= \frac{\text{Nominal GDP}_{2016}}{\text{Real GDP}_{2016}} \times 100 = \frac{18,566.9}{16,660} \times 100 = \boxed{111.446}
\end{aligned}$$

For the inflation rate (π):

$$\pi_t = \frac{\text{Deflator}_t - \text{Deflator}_{t-1}}{\text{Deflator}_{t-1}} \times 100$$

$$\begin{aligned}
\pi_{2015} &= \frac{\text{Deflator}_{2015} - \text{Deflator}_{2014}}{\text{Deflator}_{2014}} \times 100 = \frac{109.998 - 108.827}{108.827} \times 100 = \boxed{1.076} \\
\pi_{2016} &= \frac{\text{Deflator}_{2016} - \text{Deflator}_{2015}}{\text{Deflator}_{2015}} \times 100 = \frac{111.446 - 109.998}{109.998} \times 100 = \boxed{1.316}
\end{aligned}$$

4. ***Computing the CPI and Inflation Rate.*** **Assume the CPI basket is composed on 20 pizzas and 10 basketballs. Using the prices in the table below, and a base year of 2013, for each year - compute the CPI for that year and the inflation rate from the preceding year.**

Year	P_{pizza}	$P_{\text{basketball}}$
2013	\$10	\$15
2014	\$11	\$15
2015	\$12	\$16
2016	\$15	\$15

To calculate the CPI in each year, you need the price of the basket in the base year (2013) and in all of the other years:

$$\begin{aligned}
\text{Basket}_{2013} &= P_{\text{pizza, 2013}} \times 20 + P_{\text{basketball, 2013}} \times 15 = 10 \times 20 + 15 \times 10 = 200 + 150 = 350 \\
\text{Basket}_{2014} &= P_{\text{pizza, 2014}} \times 20 + P_{\text{basketball, 2014}} \times 15 = 11 \times 20 + 15 \times 10 = 220 + 150 = 370 \\
\text{Basket}_{2015} &= P_{\text{pizza, 2015}} \times 20 + P_{\text{basketball, 2015}} \times 15 = 12 \times 20 + 16 \times 10 = 240 + 160 = 400 \\
\text{Basket}_{2016} &= P_{\text{pizza, 2016}} \times 20 + P_{\text{basketball, 2016}} \times 15 = 15 \times 20 + 15 \times 10 = 300 + 150 = 450
\end{aligned}$$

Then compute the CPI using the following formula:

$$\text{CPI}_t = \frac{\text{Basket}_t}{\text{Basket}_{\text{base}}} \times 100$$

$$\begin{aligned}
\text{CPI}_{2013} &= \frac{\text{Basket}_{2013}}{\text{Basket}_{\text{base}}} \times 100 = \frac{350}{350} \times 100 = \boxed{100} \\
\text{CPI}_{2014} &= \frac{\text{Basket}_{2014}}{\text{Basket}_{\text{base}}} \times 100 = \frac{370}{350} \times 100 = \boxed{105.714} \\
\text{CPI}_{2015} &= \frac{\text{Basket}_{2015}}{\text{Basket}_{\text{base}}} \times 100 = \frac{400}{350} \times 100 = \boxed{114.286} \\
\text{CPI}_{2016} &= \frac{\text{Basket}_{2016}}{\text{Basket}_{\text{base}}} \times 100 = \frac{450}{350} \times 100 = \boxed{128.571}
\end{aligned}$$

For the inflation rate (π):

$$\pi_t = \frac{\text{CPI}_t - \text{CPI}_{t-1}}{\text{CPI}_{t-1}} \times 100$$

$$\begin{aligned}
\pi_{2014} &= \frac{\text{CPI}_{2014} - \text{CPI}_{2013}}{\text{CPI}_{2013}} \times 100 = \frac{105.714 - 100}{100} \times 100 = \boxed{5.714} \\
\pi_{2015} &= \frac{\text{CPI}_{2015} - \text{CPI}_{2014}}{\text{CPI}_{2014}} \times 100 = \frac{114.286 - 105.714}{105.714} \times 100 = \boxed{8.109} \\
\pi_{2016} &= \frac{\text{CPI}_{2016} - \text{CPI}_{2015}}{\text{CPI}_{2015}} \times 100 = \frac{128.571 - 114.286}{114.286} \times 100 = \boxed{12.499}
\end{aligned}$$

5. ***Labor Force Statistics.***

Number Employed	152,111
Number Unemployed	7,529
Adult Civilian Noninstitutional Population	254,742

Use the above numbers, reported in thousands from the Bureau of Labor Statistics website for December 2016, to calculate:

(a) **The size of the labor force**

(b) **The unemployment rate**

(c) **The labor force participation rate**

$$\text{Labor Force} \;=\; \text{Number Employed} \;+\; \text{Number Unemployed} \;=\; 152,111 + 7,529 \;=\; \boxed{\text{159,640}}$$

$$\text{Unemployment Rate} \;=\; \frac{\text{Number Unemployed}}{\text{Number in Labor Force}} \;=\; \frac{7,529}{159,640} \;=\; \boxed{0.0472}$$

$$\text{Labor Force Participation Rate} \;=\; \frac{\text{Number in Labor Force}}{\text{Number in Population}} \;=\; \frac{159,640}{254,742} \;=\; \boxed{0.6267}$$