Real and Nominal GDP Per Capita[1]
In-Class Problem[2]

Suppose we observe an economy in which we have the following:

- Nominal GDP_{2000} = $1.2 trillion
- $Population_{2000}$ = 100,000,000
- CPI_{2000} = 100
- Nominal GDP_{2010} = $1.6 trillion
- $Population_{2010}$ = 120,000,000
- CPI_{2010} = 130
- GDP Base Year = 2000

a) What is the average annual rate of inflation for this economy?

We'll examine the change in the CPI to obtain this value via a percentage change formula:

$$\frac{P_2 - P_1}{P_1}(100) = \frac{130 - 100}{100}(100) = 30\%$$

And then divide the outcome by the number of years, in this case ten: $\frac{30\%}{10} = 3\%$. So we have an average annual inflation rate of 3%

b) What is real GDP_{2000}?

Notice that the year 2000 is the base year, so we have 0% inflation to deal with. We would expect Real and Nominal GDP to be the same for the base year and can confirm this by taking the nominal GDP divided by 1+ the inflation rate (in this case 0%).

$\frac{Nominal\ GDP_{2000}}{1 + cummulative\ inflation} = \frac{\$1.2\ trillion}{1+0} = \$1.2\ trillion.$ This is exactly what we might expect; the real GDP of a base year is the same as the nominal GDP of that same year.

c) What is real GDP_{2010}?

We'll use the same method here, but now the accumulated inflation is 30%, which we need to express as .30 for this type of calculation:

$$\frac{Nominal\ GDP_{2010}}{1+.30} = \frac{\$1.6\ trillion}{1.30} = \$1.2307\ trillion$$

d) What is the percentage change in GDP from 2000 to 2010?

The reason we want to compare real GDP rates is to strip away the effects of inflation and compare like with like. In this case we see that real GDP$_{2010}$ is greater than real GDP$_{2000}$.   So we can further calculate the GDP growth rate for the 10 year period as follows:

$$\frac{Real\ GDP_{2010} - Real\ GDP_{2000}}{Real\ GDP_{2000}} * 100 = \frac{\$1.2307 - \$1.2}{\$1.2} * 100 = \frac{\$.0307}{\$1.2} * 100 = 2.56\%$$

e) What does the answer to part d) really tell us about the growth in this economy?

It tells us something of the overall growth rate, but doesn't help us see where this has come from: was it due to general economic expansion or was there simply population growth that pushed the economy to greater heights?   The results of the analysis in above don't extract the effects of population growth. To do this we would divide the real GDP figures by the population for that same year.

In this case we know that Population$_{2000}$ = 100,000,000 and Population$_{2010}$ = 120,000,000, which is a 20% growth in the population. To give ourselves a useful like versus like comparison we should compare Real GDP per Capita for each of the two periods:

$$Real\ GDP\ Per\ Capita\ _{2000} = \frac{Real\ GDP_{2000}}{Population_{2000}} = \frac{1,200,000,000,000}{100,000,000} = 12,000$$

$$Real\ GDP\ Per\ Capita\ _{2010} = \frac{Real\ GDP_{2010}}{Population_{2010}} = \frac{1,230,700,000,000}{120,000,000} = 10,255.83$$

$$\%\ \Delta\ Real\ GDP\ Per\ Capita = \frac{10,255.83 - 12,000}{12,000}\ (100) = -14.56\%$$

So, what looked like real economic expansion of 2.568% over the 10 year period from 2000 to 2010, now appears to be economic contraction per capita of 14.56%, which by most standards would spell *depression* or *general economic collapse*.