**Problem Set #1 – ECON 3311, Fall 2024** **[Answer Key]**

Due: 9/10 at 11:59pm.

---

1) **Is all government spending included when using the expenditure approach to measuring GDP? Mention examples in your explanation.**
No, not all government spending is included in GDP, since GDP only includes goods and services—produced and subject to market transactions. Thus, if the government spends money on medical services, building bridges and ports, national defense, etc., these are going to be included in GDP. However, if the government is transferring money to individuals through social security payments, unemployment insurance, welfare, etc., no new goods and services are produced and therefore GDP is not affected.

2) **Suppose you are calculating the GDP of a country, and there has been a decrease in inventories of firms from last year. Which component of GDP is this counted in? Why is it important to account for changes in inventories when measuring GDP?**
Changes in inventory are counted in investment spending. It is important to take changes in inventory into account because this means that either more units were sold than were produced in that year, or fewer units were sold than were produced. By the end, we are interested in measuring what was actually produced in a given period.
For instance, suppose that Apple has $2,000,000 worth of computers in its inventory at the end of 2023, and that it has $1,000,000 worth of computers in its inventory at the end of 2024. This means that in 2024 consumers bought more computers than Apple produced (because the inventories decreased). Therefore, if we only looked at consumption (C), GDP would be overstated because not all of the computers purchased in 2024 and counted as part of consumption spending were produced in 2023. To be exact, $1,000,000 were produced in years prior to 2024. We must adjust GDP down by the $1,000,000 that inventory decreased in order measure the GDP of 2024 accurately.

3) **Suppose that in 1965 Japan had an initial per capita GDP of $12,000 per year and China had an initial per capita GDP of $5,000. Suppose China grew at a constant 5 percent per year and Japan grew at a constant 3 percent per year. What is the GDP of each country in 2016? Make sure to show all of your work.**

$$GDP_1 = GDP_0(1+\bar{g})^t$$

For Japan:

$$GDP_{2016} = GDP_{1965}(1+\bar{g})^t = \$12{,}000(1+0.03)^{51} = \$54{,}185$$

For China:

$$GDP_{2016} = GDP_{1965}(1+\bar{g})^t = \$5{,}000(1+0.05)^{51} = \$60{,}204$$

4) **Suppose that you are comparing GDP in 2010 to GDP in 2023. Smartphones became much more commonplace after the first Iphone was introduced in 2007, and have since become much more popular and less expensive (holding quality constant). How would this affect the rate of GDP growth that is calculated using 2010 prices (Laspeyres index) as the base year versus 2023 prices (Paasche index) as the base year? Explain.**

Due to technological progress, the price of smartphones decreased relative to other products between 2010 and 2023. Moreover, the quantity produced increased. Therefore, if we use the prices in 2010 as the base year, the increase in smartphone production would increase GDP by more than if we used 2023 prices as the base year. Using 2010 prices, the increase in smartphone production is getting a relatively greater weight in GDP than using 2022 prices.

For example, suppose the following:

| Item | Price (2010) | Quantity (2010) | Price (2023) | Quantity (2023) |
|---|---|---|---|---|
| Apples | $1.00 | 100,000 | $1.50 | 120,000 |
| Smartphones | $1,000 | 500 | $700 | 2,500 |

Real GDP using 2010 prices

$$GDP_{2010} = \$1.00 * 100{,}000 + \$1000 * 500 = \$600{,}000$$

$$GDP_{2023} = \$1.00 * 120{,}000 + \$1000 * 2500 = \$2{,}620{,}000$$

$$\bar{g} = \frac{2{,}620{,}000 - 600{,}000}{600{,}000} = 3.37 = 337\%$$

Real GDP using 2023 prices:

$$GDP_{2010} = \$1.50 * 100{,}000 + \$700 * 500 = \$500{,}000$$

$$GDP_{2023} = \$1.50 * 120{,}000 + \$700 * 2500 = \$1{,}930{,}000$$

$$\bar{g} = \frac{1{,}930{,}000 - 500{,}000}{500{,}000} = 2.86 = 286\%$$

*The increase in GDP is much higher using 2010 prices than 2023 prices.

5) **Suppose that the GDP of Thailand in 2017 was 200 trillion baht, while US GDP was $17.7 trillion. The exchange rate in 2017 was 40 baht per dollar. Moreover, prices are lower in Thailand: the price level in Thailand divided by the price level in the US is equal to 0.4 in 2017.**

a. **If we do not take into account the relative price differences in the two countries, but only the exchange rate, how much larger is US GDP relative to Thailand GDP? Show your work.**

We need to convert Thailand GDP to dollars (or US GDP to baht) in order to compare the GDP between the two countries.

Converting Thailand GDP to dollars:

$$200 \, trillion \, baht \, x \quad \frac{\$1}{40 \, baht} = \$5 \, trillion$$

Because US GDP is $17.7 trillion and Indian GDP is $5 trillion, then US GDP is 17.7/5 = 3.54 times the GDP of Thailand

Converting US GDP to baht:

$$\$17.7 \, trillion \ \ x \ \frac{40 \, baht}{\$1} = 708 \, trillion \, baht$$

Because US GDP is 708 trillion baht and Indian GDP is 200 trillion baht, then US GDP is 708/200 = 3.54 times the GDP of Thailand.

b. **If we take into account the relative price differences in the two countries, how much larger is US GDP relative to Thailand GDP? Show your work.**

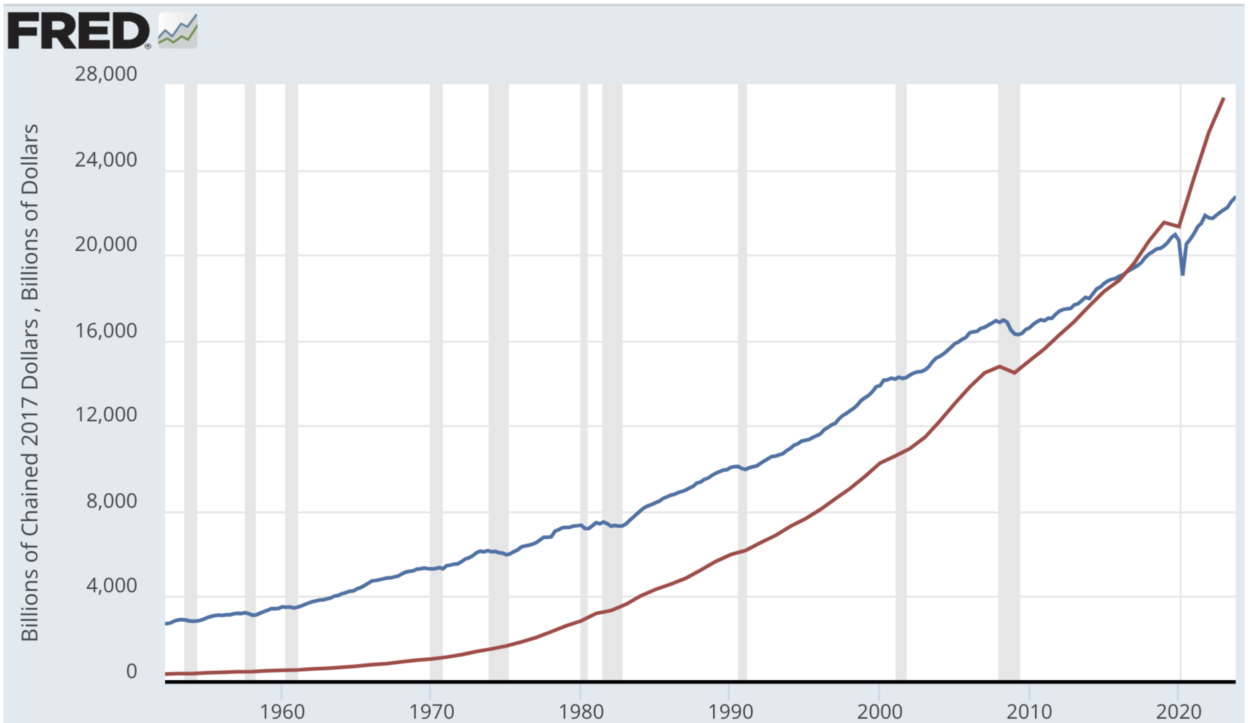
We need to take into account the fact that prices are lower in Thailand with the following calculation:

$$Thailand \, real \, GDP \, (US \, prices) = \frac{price \, level \, US}{price \, level \, Thailand} \ x \, Thailand \, nominal \, GDP \, in \, dollars$$

$$Thailand \, real \, GDP \, (US \, prices) = \frac{1}{0.40} x \ 5 = 12.5 \, trillion$$

Because US GDP is $17.7 trillion and **real** Thailand GDP is $12.5 trillion, then US GDP is 17.7/12.5 = 1.41 times the GDP of Thailand. This is much lower than what was found when we did not adjust for prices.

6) **The graph below shows nominal GDP and real GDP in the United States from 1952 to 2023.**




a. **Which line represents real GDP and which line represents nominal GDP? Explain how you arrived at your answer.**
The red line is the nominal GDP and the blue line the real. We can know this because prices are increasing over time, and thus the slope of nominal GDP, being affected by both is steeper as the nominal GDP increases due to higher prices and quantities. In contrast, the slope of real GDP is flatter as it is affected only by increases in quantities produced.

b. **What is the significance of the year where the two curves intersect? Briefly explain.**
When the two curves intersect is when real GDP is equal to nominal GDP. This means that the prices used for real and nominal GDP are the same and this occurs in the base year.

c. **How would the two lines look different relative to each other if the price level had increased by more than it actually increased by (e.g. if every year prices increased by 2% more than it actually did)? Explain how you arrived at your answer.**
If the price level had increased by more, then real GDP would not change. The nominal GDP line (the red line) would be steeper because it takes into account both changes in the quantities produced and the change in prices.

**7) Suppose *k, l,* and *A* grow at constant rates given, respectively, by $\bar{g}_k$, $\bar{g}_l$, and $\bar{g}_A$. What is the growth rate of *y* if $y = Ak^{\alpha} l^{1-\alpha}$, $\alpha > 0$?**

We use the different rules of converting to growth rates that we went over in class.

$$z = \frac{x}{y} \quad \rightarrow \quad g_z = g_x - g_y$$
$$z = xy \quad \rightarrow \quad g_z = g_x + g_y$$

$$z = x^a \quad \rightarrow \quad g_z = a g_x$$

We need to sum whatever is multiplied, and the exponents on *k* and *l* are going to be multiplied by *k* and *l*, so we end up with:

$$\bar{g}_y = \bar{g}_A + \alpha\bar{g}_k + (1-\alpha)\bar{g}_l$$