Problem sets 1: Data and measuring business cycles

EE312: Intermediate macroeconomics

Semester 1/2018

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Due on August 24th ,2018 at the BE office. (before 3 pm)

1. (Moderate) In year 1 and year 2, there are two products produced in a given economy, computers and bread. Suppose that there are no intermediate goods. In year 1, 20 computers are produced and sold at $1,000 each, and in year 2, 25 computers are sold at $1,500 each. In year 1, 10,000 loaves of bread are sold for $1.00 each, and in year 2, 12,000 loaves of bread are sold for $1.10 each.

Price and quantity data are given as the following.

Year 1		
Good	**Quantity**	**Price**
Computers	20	$1,000
Bread	10,000	$1.00

Year 2		
Good	**Quantity**	**Price**
Computers	25	$1,500
Bread	10,000	$1.00

(a) Year 1 nominal GDP $= 20 \times \$1,000 + 10,000 \times \$1.00 = \$30,000$.

Year 2 nominal GDP $= 25 \times \$1,500 + 12,000 \times \$1.10 = \$50,700$.

With year 1 as the base year, we need to value both years' production at year 1 prices. In the base year, year 1, real GDP equals nominal GDP equals $30,000. In year 2, we need to value year 2's output at year 1 prices. Year 2 real GDP $= 25 \times \$1,000 + 12,000 \times \$1.00 = \$37,000$.

The percentage change in real GDP equals ($37,000 – $30,000)/$30,000 □ 23.33%.

We next calculate chain-weighted real GDP. At year 1 prices, the ratio of year 2 real GDP to year 1 real GDP equals g_1 = ($37,000/$30,000) = 1.2333. We must next compute real GDP using year 2 prices. Year 2 GDP valued at year 2 prices equals year 2 nominal GDP = $50,700. Year 1 GDP valued at year 2 prices equals (20 × $1,500 + 10,000 × $1.10) = $41,000. The ratio of year 2 GDP at year 2 prices to year 1 GDP at year 2 prices equals g_2 = ($50,700/$41,000) = 1.2367. The chain-weighted ratio of real GDP in the two years therefore is equal to $g_c = \sqrt{g_1 g_2} = 1.23496$. The percentage change chain-weighted real GDP from year 1 to year 2 is therefore approximately 23.5%.

If we (arbitrarily) designate year 1 as the base year, then year 1 chain-weighted GDP equals nominal GDP equals $30,000. Year 2 chain-weighted real GDP is equal to (1.23496 × $30,000) = $37,048.75.

(b) To calculate the implicit GDP deflator, we divide nominal GDP by real GDP, and then multiply by 100 to express as an index number. With year 1 as the base year, base year nominal GDP equals base year real GDP, so the base year implicit GDP deflator is 100. For the year 2, the implicit GDP deflator is ($50,700/$37,000) × 100 = 137.0. The percentage change in the deflator is equal to 37.0%.

With chain weighting, and the base year set at year 1, the year 1 GDP deflator equals ($30,000/$30,000) × 100 = 100. The chain-weighted deflator for year 2 is now equal to ($50,700/$37,048.75) × 100 = 136.85. The percentage change in the chain-weighted deflator equals 36.85%.

(c) We next consider the possibility that year 2 computers are twice as productive as year 1 computers. As one possibility, let us define a "computer" as a year 1 computer. In this case, the 25 computers produced in year 2 are the equivalent of 50 year 1 computers. Each year 1 computer now sells for $750 in year 2. We now revise the original data as:

Year 1

Good	**Quantity**	**Price**
Year 1 Computers	20	$1,000
Bread	10,000	$1.00

Year 2

Good	Quantity	Price
Year 1 Computers	50	$750
Bread	12,000	$1.10

First, note that the change in the definition of a "computer" does not affect the calculations of nominal GDP. We next compute real GDP with year 1 as the base year. Year 2 real GDP in year 1 prices is now $50 \times \$1{,}000 + 12{,}000 \times \$1.00 = \$62{,}000.$ The percentage change in real GDP is equal to ($62,000 – $30,000)/$30,000= 106.7%.

We next revise the calculation of chain-weighted real GDP. From above, g_1 equals ($62,000/$30,000) = 206.67. The value of year 1 GDP at year 2 prices equals $26,000. Therefore, g_2 equals ($50,700/$26,000) = 1.95. 200.75. The percentage change chain-weighted real GDP from year 1 to year 2 is therefore 100.75%.

If we (arbitrarily) designate year 1 as the base year, then year 1 chain-weighted GDP equals nominal GDP equals $30,000. Year 2 chain-weighted real GDP is equal to (2.0075 × $30,000) □ $60,225. The chain-weighted deflator for year 1 is automatically 100. The chain-weighted deflator for year 2 equals ($50,700/$60,225) × 100 = 84.18. The percentage rate of change of the chain- weighted deflator equals –15.8%.

When there is no quality change, the difference between using year 1 as the base year and using chain weighting is relatively small. Factoring in the increased performance of year 2 computers, the production of computers rises dramatically while its relative price falls. Compared with earlier practices, chain weighting provides a smaller estimate of the increase in production and a smaller estimate of the reduction in prices. This difference is due to the fact that the relative price of the good that increases most in quantity (computers) is much higher in year 1. Therefore, the use of historical prices puts more weight on the increase in quality-adjusted computer output.

2. (Tedious) Working with the real DATA

This question requires obtaining data from various sources. For the latest data of GDP, you can access the data from NESDB website.

http://www.nesdb.go.th/main.php?filename=QGDP_report

Click to the only one excel file that appears in the page. You can access the data of price indexes from

2.1) Write down the series of real and nominal GDP (with seasonal adjustment) during the past eight quarters.

Production-based GDP

(Table 5) GDP at Current Market Prices (Seasonally Adjusted)

(Table 6) GDP, chain volume measures (Seasonally Adjusted)

		Nominal GDP	Real GDP
Year	Quarter	GDP at Current Market Prices (Seasonally Adjusted)	GDP, chain volume measures [reference year = 2002] (Seasonally Adjusted)
2016	Q3	3663587.000	2463756.000
2016	Q4	3708247.000	2482747.000
2017	Q1	3779784.000	2512305.000
2017	Q2	3823768.000	2544300.000
2017	Q3	3898783.000	2570715.000
2017	Q4	3949781.000	2582309.000
2018	Q1	4003811.000	2635406.000
2018	Q2	4075226.000	2661705.000
Millions of Baht			

2.2) Calculate the Y-o-Y growth of real GDP during the past 4 quarters. Compare and contrast your calculation using both seasonally-adjusted and seasonally-unadjusted. Are they the same? **Show your work**!

(Table 4) GDP, chain volume measures (original)

(Table 6) GDP, chain volume measures (Seasonally Adjusted)

[reference year = 2002]

		GDP, chain volume measures (original)	Y-O-Y growth rate (percent)		GDP, chain volume measures (Seasonally Adjusted)	Y-O-Y growth rate (percent)		Difference between column 3 and column 6
2016	Q3	2352555.000			**2463756.000**			
2016	Q4	2543224.000			**2482747.000**			
2017	Q1	2629056.000			**2512305.000**			
2017	Q2	2479231.000			**2544300.000**			
2017	Q3	2454497.000	4.333246		**2570715.000**	4.341298		-0.00805
2017	Q4	2644705.000	3.99025		**2582309.000**	4.010155		-0.0199
2018	Q1	**2758332.000**	4.917202		**2635406.000**	4.899923		0.01728
2018	Q2	**2593739.000**	4.61869		**2661705.000**	4.614432		0.004258

Notice the difference in growth between s.a. and n.s.a data. (s.a. = seasonally adjusted / n.s.a = non-seasonally adjusted). They are pretty small. Y-o-Y partially takes care of the seasonal factors.

2.3) Write down the (seasonally-adjusted) series of real private investment and real public investment. Calculate the weight of real private investment and real public investment in GDP. **Show your work!**

(Table 16) Gross fixed capital formation (GFCF) seasonally adjusted

(Table 6) GDP, chain volume measures (Seasonally Adjusted)

[reference year = 2002]

Unit: Millions of baht

		Gross fixed capital formation (sa)	Private (sa)	Public (sa)	weight of real private investment in GDP (sa), percent	weight of real public investment in GDP (sa), percent
2016	Q3	**592937.00**	**432773.00**	**155794.00**	17.56558	6.323435
2016	Q4	**616282.00**	**446446.00**	**172356.00**	17.98194	6.942149
2017	Q1	**614188.00**	**444648.00**	**167070.00**	17.69881	6.650068
2017	Q2	**604430.00**	**449216.00**	**151451.00**	17.65578	5.952561
2017	Q3	**602421.00**	**445642.00**	**154012.00**	17.33533	5.991018
2017	Q4	**616798.00**	**455747.00**	**161308.00**	17.64882	6.246658
2018	Q1	**633177.00**	**458136.00**	**172498.00**	17.38389	6.545405
2018	Q2	**628096.00**	**464267.00**	**160142.00**	17.44247	6.016519

Having each subcategories of the real investment divided by GDP that was reported in the previous questions.

2.4) Calculate the Y-o-Y growth of GDP deflator and private consumption deflator during the past 4 quarters. **Show your work!**

Production-based GDP

(Table 5) GDP at Current Market Prices (Seasonally Adjusted)

(Table 6) GDP, chain volume measures (Seasonally Adjusted)

Unit: Millions of baht

		Nominal GDP	Real GDP	GDP deflator	growth rate of GDP deflator
		GDP at Current Market Prices (Seasonally Adjusted)	GDP, chain volume measures [reference year = 2002] (Seasonally Adjusted)		(Y-O-Y, percent)
2016	Q3	**3663587.000**	**2463756.000**	148.6993	
2016	Q4	**3708247.000**	**2482747.000**	149.3606	
2017	Q1	**3779784.000**	**2512305.000**	150.4508	
2017	Q2	**3823768.000**	**2544300.000**	150.2876	
2017	Q3	**3898783.000**	**2570715.000**	151.6614	1.540417
2017	Q4	**3949781.000**	**2582309.000**	152.9554	1.664701
2018	Q1	**4003811.000**	**2635406.000**	151.9239	1.088749
2018	Q2	**4075226.000**	**2661705.000**	153.1058	0.952399

(Table 9) Nominal private consumption expenditure

(Table 10) Real private consumption expenditure

Unit: Millions of baht

		Nominal C	Real C	PCE deflator	growth rate of PCE deflator
		PCE at Current Market Prices (Seasonally Adjusted)	PCE, chain volume measures [reference year = 2002] (Seasonally Adjusted)		(Y-O-Y, percent)
2016	Q3	**1816366.00**	**1257062.00**	144.493	
2016	Q4	**1837273.00**	**1265167.00**	145.2198	
2017	Q1	**1853279.00**	**1280871.00**	144.689	
2017	Q2	**1871059.00**	**1293893.00**	144.6069	
2017	Q3	**1896981.00**	**1299423.00**	145.9864	0.527896
2017	Q4	**1915036.00**	**1309506.00**	146.2411	1.07274
2018	Q1	**1932464.00**	**1327981.00**	145.5189	0.630686
2018	Q2	**1971328.00**	**1351827.00**	145.8269	-0.10923

3. (Hard) As we discussed in class, the CPI is calculated for a fixed market basket. It measures the change in the cost of the market basket from the base year until the current year. An index with the market basket fixed in the first year, like the CPI, is technically called a *Laspeyres index*. An alternative index, the *Paasche Index*, is based on a market basket in the end year. It measures the change in the cost of a market basket fixed in the end year. Suppose that the base is 20016, and further that the market basket contains only two items, wine and cheese, and the quantities consumed and prices in 20016 and 20017 are

Original table

Year	Wine		Cheese	
	price	units	price	units
2016	1	50	0.5	100
2017	1.2	45	2	150

Correct table

Year	Wine		Cheese	
	price	units	price	units
2016	0.5	50	1	100
2017	2	45	1.2	150

I made a serious mistake when I wrote the question. The prices given in the original table were inadvertently switched between the two designated columns. The correct one should be that I put wine's price equal to (0.5, 2) and chess price equal to (1,1.2). If I use the original numbers given, it wouldn't make sense because wine consumption decreases, despite that the relative of wine drops. (Using original number. 2016 relative price = pw/pc = 2. Moving to 2017, relative price = 1.2/2 = 0.6. This implies a drop in relative price of wine. But, how possibly it could be that wine consumption decreases when its relative price is dropping. So, this doesn't make sense. That's why the numbers given in the two columns were switched.)

My solution will be based on the revised table. I apologize for the mistake!

a. Calculate the rate of inflation for the Laspeyres (CPI) index and the Paasche Index.

		2016 bundle	CPI	CPI inflation
Lasperyes	2016 expenditure	125	100	
	2017 expenditure	220	176	76%
		2017 Bundle	CPI	CPI inflation
Pasche	2016 expenditure	172.5	100	
	2017 expenditure	270	156.5217	56.52%

Laspeyres uses the bundle in 2016 as the basket; meanwhile Passhce uses the bundle in 2017 as the basket. In each case, they will be using their current-period price.

b. Will inflation calculated using the Laspeyres index always exceed inflation calculated with the Paasche index? (Hint: Use standard indifference curve analysis.)

See the accompanied slide posted.

c. Workers often receive an adjustment in their wages equal to only a fraction of inflation as calculated using the CPI. In view of the preceding analysis, explain why workers would likely be better off than they were before if they were fully compensated for inflation. Would this also be the case if inflation was calculated using the Paasche index?

Given that Laspeyres index overestimating the COL, consumer will likely be better off if workers' offer is fully indexed to Laspeyres-based inflation. This goes opposite if worker's offer is instead fully indexed to Paasche-based inflation. The latter underestimates the true COL.