

Macro Problem Set 1 solutions

Q1

- a. Harford uses the term “consumption of shelter” to denote the value of living in a home for a year. When the household is renting the home, the value is captured in GDP statistics as rent payable. When the household is an owner-occupier, the value is not immediately measurable. If it is omitted from GDP, then measured GDP will be changed if people switch from renting their residence to owning it, or vice-versa, even though there is no change in the services enjoyed. Thus, the value of housing services enjoyed by owner-occupiers must be included in GDP. The statistical authorities must estimate the rent that the owner-occupier would have paid if he was instead renting the same home. Estimation of this so-called **imputed rent** is done by using observed rents paid on similar homes and making adjustments to differences in home characteristics.
- b. A reason to include the value of household production in GDP is that it can readily be estimated, since there are market prices for domestic help. A reason not to include it is that the amount of unpaid home production is not well-measured since statistical authorities do not track it. Another reason not to include it is that household production is not heavily influenced by macroeconomic policies, so the link between measurement and policy is weakened by its inclusion.
- c. The building up of physical capital assets such as buildings is included in GDP but the wearing down (depreciation) or outright destruction of the same assets is not subtracted from GDP. The environment can also be seen as an asset whose destruction is not subtracted from GDP, but arguably should be.

Q2

- a. The \$200 million cash grant is a transfer payment from government to households and does not in itself affect GDP. When households spend the grant on purchasing goods and services, consumption and GDP will then rise.
- b. The \$100,000 that Waffen pays for shares in DBS Bank stock is not included in GDP. The stock shares are financial assets, being claims to a share of ownership of DBS Bank. They are neither goods nor services. However, the 1% commission is payment for a service, and thus \$1,000 is included in GDP as consumption.
- c. Consumption rises by $2,000 \times \$50 = \$100,000$. Investment falls by $500 \times \$50 = \$25,000$ due to the fall in textbook inventories. GDP rises by \$75,000.
- d. Investment rises by \$30 million, consisting of \$10 million of tools and \$20 million addition to inventory of motors. GDP rises by just \$10 million because the \$20 million of motors was imported.

Q3

Refer to the table below for the answers. Numbers computed with 2015 prices are coloured blue, while numbers computed with 2016 prices are coloured red. Note that real GDP computed using the fixed-base approach is called “GDP at base year prices”. As for the chain-linked method, the real GDP computed is called “GDP in chained (reference year) dollars”.

	2015	2016	2017
(a) Nominal GDP (\$'000)	1,100	1,860	2,460
(b) GDP at 2015 prices (\$'000)	1,100	1,240	1,420
		$(1,240 - 1,100) / 1,100$	$(1,420 - 1,240) / 1,240$
Growth rate (2 dec. pl.)	N.A.	= 12.73%	14.52%
(c) GDP at 2016 prices (\$'000)	1,675	1,860	2,120
		$(1,860 - 1,675) / 1,675$	$(2,120 - 1,860) / 1,860$
Growth rate (2 dec. pl.)	N.A.	= 11.05%	= 13.98%
(d) Growth rate, using previous year prices (2 dec. pl.)	N.A.	12.73%	13.98%
GDP in chained (2015) dollars (\$'000, 2 dec. pl.)		$112.73\% \times 1,100$	$113.98\% \times$ $112.73\% \times 1,100$
	1,100	= 1,240	= 1,413.3

With the fixed-base method, the real GDPs are referred to as “GDP at base-year prices”. The 2016 growth rate is 12.73% when 2015 is used as the base year but is 11.05% when 2016 is used as the base year. Thus, **the growth rates change when the base year is changed.**

With the chain-linking approach, each year’s growth rate is calculated by using the previous year’s prices, no matter what the reference year is. Hence, **the growth rates do not change when the reference year is changed.** The real GDP for 2016 and 2017 is computed by “chaining” them to the reference year 2015 GDP by using the growth rates.

Why are statistical agencies moving from the fixed-base approach to the chain-linked approach? One reason is seen in the calculations above. Having growth rates be altered merely by changing base years makes it difficult to assess the economy's economic performance.

Another reason stems from structural changes in the economy. **GDP is a weighted average of quantities, with prices used for weights.** In any period, the prices reflect the importance of different goods and services. For example, a unit of clothing is relatively more important to the economy in 2016 (with a clothing-food relative price of $\$150/\$110 = 1.36$) than in 2015 (where the relative price was $\$80/\$100 = 0.8$). The fixed-base method's weights reflect only the base year's economic structure. This may not be appropriate when the economic structure is undergoing rapid shifts. Thus, another reason to use the chain-linking approach is that it allows the weights to change as the economic structure changes.

Q4

a.

Cost of the CPI basket in 2017 = $6(\$20) + 6(\$15) = 210(\$)$.

Cost of the CPI basket in 2018 = $6(\$20) + 6(\$25) = 270(\$)$.

Since 2017 is the base year,

- CPI 2017 = 100.
- CPI 2018 = $100 \times \$270/\$210 \approx 100 \times 9/7 \approx 128.57$.

Thus, 2018 CPI inflation rate = $(128.57 - 100)/100 = 28.57\%$ per year.

b.

Since 2018 is now the base year,

- CPI 2018 = 100
- CPI 2017 = $100 \times \$210/\$270 = 100 \times 7/9 \approx 77.78$.

Thus, 2018 CPI inflation rate = $(100 - 77.78)/77.78 = 28.57\%$ per year.

The CPI inflation rate does not change when the base year is altered. This is because the quantities in the CPI basket do not change when the base year is changed.

c.

The cost of the actual basket in 2017 is $8(\$20) + 8(\$15) = \$280$.

In 2018 the price of a shirt remained unchanged, but the price of a pencil increased to \$25. The typical household responded by increasing shirt purchase and reducing pencil purchases. The resultant cost of the actual basket in 2018 is $11(\$20) + 5(\$25) = \$345$.

The true percent rise in cost of living in 2018 is thus $(\$345 - \$280)/\$280 = 23.24\%$ a year. This is quite a bit less than the 28.57% rise in the CPI. The CPI overestimates the rise in cost of living because the CPI basket is fixed, thereby failing to capture the reduction in cost of living due to substitution behavior. This is a demonstration of the CPI's **substitution bias**.

Q5

- The 2018 meals inflation rate is 50% (per year). The suits inflation rate is 20%.
- The cost of meals in the CPI basket is $\$20 \times 300 = \$6,000$ in 2020, and $\$30 \times 300 = \$9,000$ in 2021. Similarly computed, the cost of suits in the CPI basket is \$8,000 in 2020 and \$9,600 in 2021. Thus, the cost of the CPI basket in 2020 is $\$6,000 + \$8,000 = \$14,000$ in 2020, and $\$9,000 + \$9,600 = \$18,600$ in 2021. The 2018 CPI inflation rate is thus $100 \times (18,600 - 14,000)/14,000 = 32.86$ percent.
- The proportionate cost of meals in the CPI basket in 2020 is $\$6,000/\$14,000 = 3/7$. The proportionate cost of suits in the CPI basket in 2020 is $4/7$.
- The overall inflation rate can be seen as the weighted average of individual inflation rates of the goods, with the weights given by their proportionate cost in the CPI basket in the base year. Meals contributed $3/7 \times 50\% = 21.43\%$, while suits contributed $4/7 \times 20\% = 11.43\%$. Together, the CPI inflation rate is $21.43\% + 11.43\% = 32.86\%$.

Q6

- The nominal interest rate is $\$7,000/\$100,000 = 7\%$ per year.
- The expected inflation rate is $\text{CPI}_{\text{Jan2019}} / \text{CPI}_{\text{Jan2018}} - 1 = 0.02 = 3\%$ (per year).
- Using the Fisher Equation, expected real interest rate \approx nominal interest rate – expected inflation rate = $7\% - 3\% = 4\%$ per year.
- Expected interest in Jan 2018 dollars = $(\$107,000 \times 100/103) - \$100,000 = \$3,883$. Thus, expected real interest rate (actual) = $\$3,883/\$100,000 = 3.9\%$ per year. The approximation is off by about 0.1 percentage points.
- Actual inflation rate = 5% per year. Hence, actual real interest rate (approximation) = $7\% - 5\% = 2\%$ per year.
- Chaeyeon has gained purchasing power unexpectedly, while Ray has lost purchasing power unexpectedly.

- g. They could have set the nominal interest rate to be 4% a year + annual CPI inflation rate. That way, whether the actual inflation rate was 3% a year or 5% a year, the real interest rate would stay at 4% a year. This is an example of an **indexed** loan.