

Suggested Solutions to Practice Problems (Chapter 02)

2. Coal producer, steel producer, and consumers.

- a) i) Product approach: Coal producer produces 15 million tonnes of coal at \$5/tonne, which adds \$75 million to GDP. The steel producer produces 10 million tonnes of steel at \$20/tonne, which is worth \$200 million. The steel producer pays \$125 million for 25 million tonnes of coal at \$5/tonne. The steel producer's value added is, therefore, \$75 million. GDP is equal to \$75 million + \$75 million = \$150 million.
- ii) Expenditure approach: Consumers buy 8 million tonnes of steel at \$20/tonne, so consumption is \$160 million. There is no investment and no government spending. Exports are 2 million tonnes of steel at \$20/tonne, which is worth \$40 million. Imports are 10 million tonnes of coal at \$5/tonne, which is worth \$50 million. Net exports are, therefore, equal to \$40 million – \$50 million = –\$10 million. GDP is, therefore, equal to \$160 million + (–\$10 million) = \$150 million.
- iii) Income approach: The coal producer pays \$50 million in wages and the steel producer pays \$40 million in wages, so total wages in the economy equal \$90 million. The coal producer receives \$75 million in revenue for selling 15 million tonnes at \$5/tonne. The coal producer pays \$50 million in wages, so the coal producer's profits are \$25 million. The steel producer receives \$200 million in revenue for selling 10 million tonnes of steel at \$20/tonne. The steel producer pays \$40 million in wages and pays \$125 million for the 25 million tonnes of coal that it needs to produce steel. The steel producer's profits are, therefore, equal to \$200 million – \$40 million – \$125 million = \$35 million. Total profit income in the economy is therefore \$25 million + \$35 million = \$60 million. GDP is therefore equal to wage income (\$90 million) plus profit income (\$60 million). GDP is therefore \$150 million.
- b) There are no net factor payments from abroad in this example. Therefore, the current account surplus is equal to net exports, which is equal to (–\$10 million).

3. Wheat and Bread

- a) Following the product approach, value added by firm A is total revenue from wheat sales (note that the inventory accumulation is treated as if the firm sold the wheat to itself), or \$150 000. For firm B, value added is revenue from sales of bread minus the value of wheat purchased from firm A, or \$100 000 – \$60 000 = \$40 000. Therefore, total GDP = \$150 000 + \$40 000 = \$190 000.

- b) For the expenditure approach, consumption expenditure on bread, $C = \$100\,000 + \$15\,000 = \$115\,000$ (note that imports of bread are included), investment in inventories is $I = \$15\,000$, and net exports are $NX = \$75\,000 - \$15\,000 = \$60\,000$. Government expenditures are $G = 0$. Therefore,

$$GDP = C + I + G + NX = \$115\,000 + \$15\,000 + 0 + \$60\,000 = \$190\,000.$$
- c) For the income approach, in this case GDP is the sum of profits and wage income. Profits for firm A are $\$150\,000 - \$50\,000 = \$100\,000$ (revenue minus wage costs, where inventory accumulation is included as a positive amount) and profits for firm B are $\$100\,000 - \$20\,000 - \$60\,000 = \$20\,000$ (revenue minus wage costs minus the cost of the intermediate input). Total wages are $\$50\,000 + \$20\,000 = \$70\,000$. Therefore, $GDP = \text{profits} + \text{wages} = \$100\,000 + \$20\,000 + \$70\,000 = \$190\,000$.

4. Price and quantity data are given as the following:

Year 1

<i>Good</i>	<i>Quantity</i>	<i>Price</i>
<i>Computers</i>	20	\$1000
<i>Bread</i>	10 000	\$1.00

Year 2

<i>Good</i>	<i>Quantity</i>	<i>Price</i>
<i>Computers</i>	25	\$1500
<i>Bread</i>	12 000	\$1.10

- a) Year 1 nominal GDP = $20 \times \$1000 + 10\,000 \times \$1.00 = \$30\,000$.
 Year 2 nominal GDP = $25 \times \$1500 + 12\,000 \times \$1.10 = \$50\,700$.
- b) 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
 $= 25 \times \$1000 + 12\,000 \times \$1.00 = \$37\,000$. The percentage change in real GDP equals
 $[(\$37\,000 - \$30\,000)/\$30\,000] \times 100 = 23.3\%$.

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 $(20 \times \$1500) + (10\,000 \times \$1.10) = \$41\,000$. 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 $(1.23496 \times \$30\,000) = \$37\,049$, approximately.

Alternatively, we could use the average price method. To perform a calculation using this method, we first compute average prices. The average price for computers equals $(\$1000 + \$1500)/2 = \$1250$. The average price for bread equals $(\$1.00 + \$1.10)/2 = \$1.05$. Year 1 output valued at average prices equals $20 \times \$1250 + 10\,000 \times \$1.05 = \$35\,500$. Year 2 output valued at average prices equals $25 \times \$1250 + 12\,000 \times \$1.05 = \$43\,850$. The percentage change in chain-weighted GDP is therefore equal to $[(\$43\,850 - \$35\,500)/\$35\,500] \times 100 = 23.5\%$.

- c) To calculate the implicit GDP deflator, we divide nominal GDP by real GDP, and then multiply by 100 to express GDP deflator 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 year 2, the implicit GDP deflator is $(\$50\,700/\$37\,000) \times 100 = 137.0$. The percentage change in the deflator is equal to 37.0%.

With chain weighting, the base year is now the midpoint between the two years. The year 1 GDP deflator equals $(\$30\,000/\$30\,000) \times 100 = 100$. The chain-weighted deflator for year 2 equals $(\$50\,700/\$37\,049) \times 100 = 136.9$. The percentage change in the chain-weighted deflator equals $[(136.9 - 100)/100] \times 100 = 36.9\%$.

5. Price and quantity data are given as the following:

Year 1

<i>Good</i>	<i>Quantity (million kgs.)</i>	<i>Price (per kgs.)</i>
<i>Broccoli</i>	1500	\$0.50
<i>Cauliflower</i>	300	\$0.80

Year 2

<i>Good</i>	<i>Quantity (million kgs.)</i>	<i>Price (per kgs.)</i>
<i>Broccoli</i>	2400	\$0.60
<i>Cauliflower</i>	350	\$0.85

- a) Year 1 nominal GDP = Year 1 real GDP
 $= 1500\text{m.} \times \$0.50 + 300\text{m.} \times \$0.80 = \$990\text{m.}$
 Year 2 nominal GDP = $2400\text{m.} \times \$0.60 + 350\text{m.} \times \$0.85 = \$1737.5\text{m.}$
 Year 2 real GDP = $2400\text{m.} \times \$0.50 + 350\text{m.} \times \$0.80 = \$1480\text{m.}$

Year 1 GDP deflator equals 100.

Year 2 GDP deflator equals $(\$1737.5/\$1480) \times 100 = 117.4$.

The percentage change in the deflator equals 17.4%.

- b) Year 1 production (market basket) at year 1 prices equals year 1 nominal GDP = \$990m. The value of the market basket at year 2 prices is equal to $\$900 + \$255 = \$1155$.
 Year 1 CPI equals 100.
 Year 2 CPI equals $(\$1155/\$990) \times 100 = 116.7$.
 The percentage change in the CPI equals 16.7%.

The relative price of broccoli has gone up. The relative quantity of broccoli has also gone up. The CPI attaches a smaller weight to the price of broccoli, and so the CPI shows less inflation.

8. Corn producer, consumers, and government.

- a) i) Product approach: There are no intermediate goods inputs. The corn producer grows 3 million tonnes of corn. Each tonne of corn is worth \$50. Therefore, GDP equals \$150 million.
- ii) Expenditure approach: Consumers buy 2 million tonnes of corn, so consumption equals \$100 million. The corn producer adds 0.5 million tonnes to inventory, so investment equals \$25 million. The government buys 0.5 million tonnes of corn. Consequently, government spending equals \$25 million. GDP equals \$150 million.
- iii) Income approach: Wage income is \$60 million, paid by the corn producer. The corn producer's revenue equals \$150 million, including the value of its addition to inventory. Additions to inventory are treated as purchasing one's own output. The corn producer's costs include wages of \$60 million and taxes of \$20 million. Therefore, profit income equals $\$150\text{ million} - \$60\text{ million} - \$20\text{ million} = \70 million . Government income equals taxes paid by the corn producer, which equals \$20 million. Therefore, GDP by income equals $\$60\text{ million} + \$70\text{ million} + \$20\text{ million} = \150 million .
- b) Private disposable income equals GDP (\$150 million) plus net factor payments (0) plus government transfers (\$5 million in Canada Pension Plan benefits) plus interest on the government debt (\$10 million) minus total taxes (\$30 million), which equals \$135 million. Private saving equals private disposable income (\$135 million) minus consumption (\$100 million), which equals \$35 million. Government saving equals government tax income (\$30 million) minus transfer payments (\$5 million)

minus interest on the government debt (\$10 million) minus government spending \$25 million), which equals – \$10 million. National saving equals private saving (\$35 million) plus government saving – \$10 million), which equals \$35 million. The government budget balance equals government borrowing (\$10 million). Since the budget surplus is deficit, the government budget is in deficit. The government deficit is, therefore, equal to \$10 million.

11.

a) By definition:

$$S^p = Y^d - C = Y + NFP + TR + INT - T - C$$

Next, recall that $Y = C + I + G + NX$. Substitute into the equation above and subtract I to obtain:

$$\begin{aligned} S^p - I &= C + I + G + NX + NFP + INT + TR - T - C - I \\ &= (NX + NFP) + (G + INT + TR - T) \\ &= CA + D \end{aligned}$$

b) Private saving, which is not used to finance domestic investment, is either lent to the domestic government to finance its deficit (D) or is lent to foreigners (CA).

12. Assume the following:

$$D = 10, INT = 5, T = 40, G = 30, C = 80, NFP = 10, CA = -5, S = 20.$$

$$\begin{aligned} \text{a) } Y^d &= S^p + C \\ &= S + D + C \\ &= 20 + 10 + 80 = 110 \end{aligned}$$

$$\begin{aligned} \text{b) } D &= G + TR + INT - T \\ TR &= D - G - INT + T = 10 - 30 - 5 + 40 = 15 \end{aligned}$$

$$\begin{aligned} \text{c) } S &= GNP - C - G \\ GNP &= S + C + G = 20 + 80 + 30 = 130 \end{aligned}$$

$$\text{d) } GDP = GNP - NFP = 130 - 10 = 120$$

$$\text{e) } \textit{Government Surplus} = S^g = -D = -10$$

$$\begin{aligned} \text{f) } CA &= NX + NFP \\ NX &= CA - NFP = -5 - 10 = -15 \end{aligned}$$

$$\begin{aligned} \text{g) } GDP &= C + I + G + NX \\ I &= GDP - C - G - NX = 120 - 80 - 30 + 15 = 25 \end{aligned}$$

13. If the unemployment rate is 5% and the number of unemployed is 2.5 million, therefore the labour force must be $2\,500\,000 / .05 = 50$ million. The participation rate is then $(50/100) \times 100\% = 50\%$. The number of employed $= 0.95 \times 50 = 47.5$ million, and the employment/population ratio $= (47.5/100) \times 100\% = 47.5\%$.