**Nominal GDP** = Real GDP * Price Level

| | **Apples** | **Oranges** |
|---|---|---|
| Q_1 | 50 | 100 |
| P_1 | $1 | $0.80 |
| Q_2 | 80 | 120 |
| P_2 | $1.25 | $1.60 |

Nominal GDP_1 = $(50*1 + 100*0.80) = $130
Nominal GDP_2 = $(80*1.25 + 120*1.60) = $292
The ratio of nominal GDP = 292/130 = 2.25
Change in nominal GDP = (292/130-1) = **125%**

**Real GDP Calculation:**

- Assume base year = year 1 ➔

| | **Apples** | **Oranges** |
|---|---|---|
| P_1 | $1 | $0.80 |

Real GDP_1 = $(50*1 + 100*0.80) = $130
Real GDP_2 = $(80*1 + 120*0.80) = $176
The ratio of real GDP, g_1 = (176/130) = 1.354 ➔ Change in real GDP = 35.4%

- Assume base year = year 2 ➔

| | **Apples** | **Oranges** |
|---|---|---|
| P_2 | $1.25 | $1.60 |

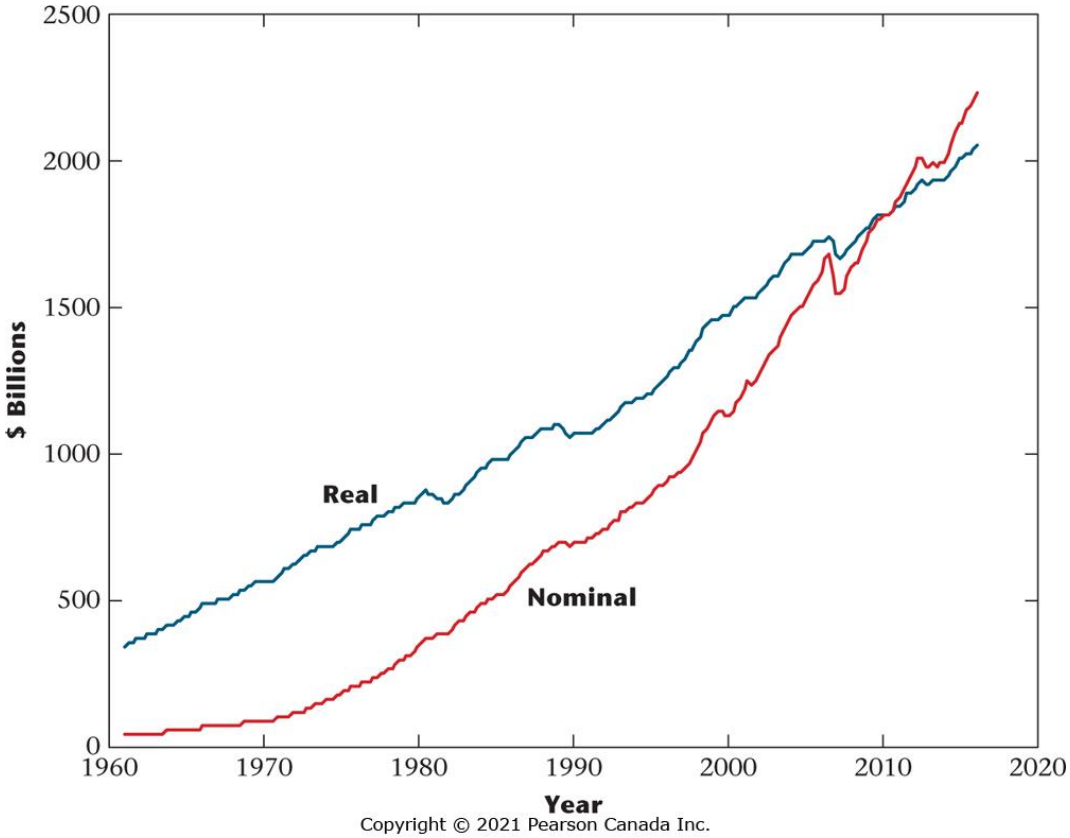
Real GDP_1 = $(50*1.25 + 100*1.60) = $222.50
Real GDP_2 = $(80*1.25 + 120*1.60) = $292
The ratio of real GDP, g_2 = (292/222.50) = 1.312 ➔ Change in real GDP = 31.2%

- The base year matters in this case because the relative price of apple/orange changes from year 1 to year 2. For instance, RP_1 = 1/0.80 = 1.25 versus RP_2 = 1.25/1.60 = 0.78.

**Chain-Weighted Real GDP:**

The chain-weighted ratio = (g_1*g_2)^1/2 = (1.354*1.312)^1/2 = 1.333 ➔
Change in real GDP = 33.3%

If base year = year 1, then
Real GDP_1 = $130
Real_GDP_2 = $130*1.333 = $173.29
If base year = year 2, then
Real GDP_2 = $292
Real_GDP_1 = $292/1.333 = $219.05





**Measures of the Price Level:**

1. Implicit Price Deflator = Nominal GDP/Real GDP * 100
2. CPI = Cost of base year quantities at current prices/ Cost of base year quantities at base year prices * 100

| | **Apples** | **Oranges** |
|---|---|---|
| Q_1 | 50 | 100 |
| P_1 | $1 | $0.80 |
| Q_2 | 80 | 120 |
| P_2 | $1.25 | $1.60 |

**Quantity in Year 1:**

Year 1 = base year >> P_1 ➔ Nominal GDP_1 = Real GDP_1 = $(50*1 + 100*0.80) = $130
Year 2 = base year P_2 ➔ Real GDP_1 = $(50*1.25 + 100*1.60) = $222.50

**Quantity in Year 2:**

Year 1 = base year >> P_1 ➔ Real GDP_2 = $(80*1 + 120*0.80) = $176
Year 2 = base year P_2 ➔ Nominal GDP_2 = Real GDP_2 = $(80*1.25 + 120*1.60) = $292

**Implicit Price Deflator = Nominal GDP/Real GDP * 100**

| | **Year 1** | **Year 2** | **% Increase** |
|---|---|---|---|
| Year 1 = base year | 130/130*100 = 100 | 292/176*100 = 165.9 | [165.9/100 -1]*100 = 65.9 |
| Year 2 = base year | 130/222.50*100 = 58.4 | 292/292*100 =100 | [100/58.4 -1]*100 = 71.2 |
| Chain-weighting | 100 | 100*1.685 = 168.5 | [(1.659*1.712)^0.50-1]*100 = 68.5 |

CPI = Cost of base year quantities at current prices/ Cost of base year quantities at base year prices * 100

CPI = 222.5/130 = 171.2 ➔71.2%