

A price index compares the cost of a basket of goods in the current year (year t) and the base year (year 0). I.e., it compares the cost of the basket at current and base year prices.

1. **(Traditional) GDP Deflator:**

Here the basket is all goods produced domestically in year t , i.e., all goods showing up in GDP in year t .

The GDP deflator for year t is thus¹

$$\begin{aligned}\text{GDP Deflator}_t &= \frac{\text{Nominal GDP}_t}{\text{Real GDP}_t} \\ &= \frac{\sum_i (P_t \times Q_t)_i}{\sum_i (P_0 \times Q_t)_i}\end{aligned}$$

This can be written as a weighted average of $(\frac{P_t}{P_0})_i$ over goods i

$$\sum_i w_{t,i} \times \left(\frac{P_t}{P_0}\right)_i$$

where the weight $(w_{t,i})$ for good i in year t is the share of good i in real GDP of year t . Since the weight changes from year to year (due to the basket of goods changing from year to year), this is called a *variable weight index* or **Paasche Index**.

2. **(Traditional) CPI:**

Here the basket is all **consumption** goods purchased in the **base year**.

The CPI for year t is

$$\text{CPI}_t = \frac{\sum_i (P_t \times Q_0)_i}{\sum_i (P_0 \times Q_0)_i}$$

This can also be written as a weighted average of $(\frac{P_t}{P_0})_i$ over goods i

$$\sum_i w_i \times \left(\frac{P_t}{P_0}\right)_i$$

where the weight (w_i) for good i is the share of good i in total **consumption** spending in the **base year**.

Since the weight for each good doesn't change from year to year (because the basket of goods is fixed at the base year basket and so does not change from year to year), this is called a *fixed weight index* or **Laspeyres Index**.

3. **Chain Weighted Indexes:**

Chain weighted indexes update the base year annually and typically also use an average of Paasche and Laspeyres methods (a Fisher index). We will not go into the details of how this index is calculated. However, both the BLS and the Commerce Department now publish chain-type price indexes for consumer expenditures. The Fed follows the Commerce Department's chain-weighted PCE (personal consumption expenditure) price index closely, and the Commerce Department's chain-type version of the GDP Deflator is now widely used in place of the traditional GDP Deflator above.

¹ Here, we assume, as with Mankiw 9e that the index is 1 in the base year. It is actually more conventional for price indexes to be scaled to 100 in the base year, as with the data in the Excel handout and most price index data in FRED, in which case all of the equations below would be multiplied by 100. With the exception of the Excel handout, we will stick with Mankiw's convention.