How are the price indices calculated?

Two types of data are required to calculate the price indices: the weights and price change data. Take Consumer Price Index (CPI) for example.

1. The weights data

The CPI measures the changes in the price level of consumer goods and services generally purchased by households over time. However, there are many kinds of goods and services on the market, and their shares of household expenditures vary greatly. For instance, both the prices of edible rice and fresh flowers rise 10%, these price changes will have different effects on people's lives. Consequently, instead of the simple average method, the CPI should be calculated by the weighted average method. The weights are used to ensure the CPI reflects the relative importance of each item in the CPI basket.

2. Rebasing and Updating the items and weights

The major structure of weights is based on the Household Final Consumption Expenditure of National Income. The important and representative items are derived mainly from the Family Income/Expenditure Survey and then their price changes are collected periodically. The proportion of overall household expenditures for each item in the CPI basket is as the weight. In the 2016-based CPI, 368 items of goods and services are selected into to the CPI basket to price and are classified into seven groups which include Food, Clothing, Housing, Transportation & Communication, Health, Education & Entertainment and Miscellaneous. The 2020 weight for each group in turn is 24.8%, 5.2%, 23.5%, 13.5%, 4.7%, 12.0% and 16.3%. However, to reflect nation’s economic development and changes in consumer expenditure patterns, and maintain the representativeness in CPI, the weighting structure is updated annually.

3. How are price data collected?

The 2016-based CPI covers 368 items in 17 cities or counties. Approximately 20,000 specifications of goods and services are collected. The prices of specifications are collected 1-3 times per month depending on the features of the priced items. Price data obtained mostly by personal interview (or by telephone) survey and reviewed by the Budget, Accounting, and Statistics Office of the 17 cities or counties, and then sent to DGBAS for follow-up re-checking. DGBAS collects some public fees, such as transportation, electricity and medical care charges directly from the related agencies, as well as some prices of goods sold on online platforms through web scraping. DGBAS then disseminates the index on the fifth working day (subject to postponement due to Chinese Lunar New Year or other consecutive public holidays) after the end of the reference month. To ensure the quality of survey data, DGBAS irregularly assigns employees to perform random checks, and also holds consumer price survey workshops, aiming at strengthening the price collecting techniques of

enumerators to boost data quality and accuracy.

4. How is the index calculated?

The general index and group indices are computed according to the derived form of Laspeyres weighted aggregate formula, which employs quantities (Q_0) sold in the base period as the weight; this formula is as follows:

$$L_{t,0} = \frac{\sum P_t Q_0}{\sum P_0 Q_0} \times 100 = \sum \frac{P_t}{P_0} \bullet \frac{P_0 Q_0}{\sum P_0 Q_0} \times 100$$

Here $\frac{P_t}{P_0}$ is the ratio of prices at time t (i.e. price relatives) vs. the base period, and $\frac{P_0 Q_0}{\sum P_0 Q_0}$ is the consuming expenditures ratio in the base period.

For example:

To calculate the price relatives of the current-month and base period of each item (i1, i2, i3), and then multiply by the corresponding weights. To aggregate the index of the products for each item and divided by the sum of the weights of each group into the index for the i^{th} group.

Item	Weight	Index
i1	0.03	110
i2	0.06	105
i3	0.01	130

Index of i^{th} group = $\frac{0.03 \times 110 + 0.06 \times 105 + 0.01 \times 130}{(0.03 + 0.06 + 0.01)} = 109$