

### III Calculation of the Consumer Price Index

#### Chapter 1 Calculation of the prices in the comparison period ( $P_t$ )

##### 1 Calculation of the prices in the comparison period

###### (1) Basic formulas

Prices in the comparison period ( $P_t$ ) were calculated as the simple arithmetic mean for each month, item, and municipality for prices by store<sup>14</sup> principally obtained from the Retail Price Survey (Trend Survey).

$$\bar{P}_{t,i,j} = \frac{1}{n} \sum_{k=1}^n P_{t,i,j,k}$$

( $t$ : Comparison period,  $i$ : Item,  $j$ : Municipality,  $k$ : Store,  $n$ : Number of surveyed)

For fresh food and cut flowers, whose daily price changes are significant, surveys are conducted three times a month (beginning, middle, and end of month (every 10 days)) to determine the exact price for the month. These items are hereinafter referred to as 10-day survey items. Refer to “IV 1 List of information for items of the 2020-Base Consumer Price Index” for details of these items. The average price for each 10-day period is calculated by simply averaging the prices for 10 days. The prices for three 10-day periods are simply averaged to find the price in the comparison period of the month.<sup>15</sup>

$$\bar{P}_{t,i,j,s} = \frac{1}{n} \sum_{k=1}^n P_{t,i,j,s,k}$$

$$\bar{P}_{t,i,j} = \frac{1}{3} \sum_{s=1}^3 \bar{P}_{t,i,j,s}$$

( $s$ : Season (10-day period))

As for the following changes in the Retail Price Survey (Trend Survey), it is assumed that price fluctuations attributed to the above include factors other than commodity price fluctuations, and adjustments are made to eliminate those fluctuations where necessary.

<sup>14</sup> For details of price survey, refer to “VII Outline of Retail Price Survey (Trend Survey)”.

<sup>15</sup> When the mean value at the beginning or end of the month cannot be collected, the price in the comparison period in that month is calculated without the mean value of that period. However, when the mean value at the middle of the month is omitted, the price in the comparison period of the month is not calculated even if the mean values for the beginning and end of the month are given. The mean value at the middle of the month is used as the price in the comparison period for the quick estimation of the middle season value in the Ku-area of Tokyo.

a) Change of surveyed stores

When a surveyed store is changed due to a decrease in the representativity of a conventional surveyed store caused by the opening of a new store, etc., or due to the temporary disappearance of survey specifications.

b) Changes in trademarks, etc. (excluding changes in survey specifications)

When a trademark, etc. that differs from that of the previous month is observed within the scope of survey specifications.

c) Difference in the number of prices collected

When an individual price is unavailable and there is a difference in the number of prices collected because survey specifications cannot be observed at a designated store and that the store cannot be changed.

d) Change in setting for price survey areas

When the setting of a price survey area is changed in order to promptly respond to the emergence of a new commercial agglomeration area and a large suburban store.

(2) Estimation of prices in the comparison period without using the basic formula

a) Calculation using scanner data from the POS information

Price indices for seven items of “TV sets”, “Video recorders”, “Personal computers (desktop)”, “Personal computers (notes)”, “Tablet computers”, “PC printers”, and “Cameras” are calculated by the hedonic approach or the fixed specification method using scanner data on sales prices, sales volume, and other characteristics of all models provided by the POS information. For details of the calculation method, refer to “III Appendix 2 Calculation of price indices of items using POS information”.

b) Calculation using web scraping technology

For the three items, “Airplane fares”, “Hotel charges”, and “Charges for package tours to overseas”, price indices are calculated using web scraping technology. For details of the calculation method, refer to “III Appendix 3 Calculation of price indices of items by web scraping”.

c) Calculation of items with complicated fare structures

Some items such as “Electricity”, “Medical treatment”, and “Telephone charges (mobile phone)” have various fare structures, with prices that vary according to the purchased conditions. To accurately reflect the price fluctuation in the price index, monthly indices for these items are calculated with a special formula (model formula) which is designed by using a typical utilization case of each item as a model. Prices surveyed by the RPS (Trend) are used

to calculate these indices. The results of other statistics are used for ratios to aggregate the prices of model cases. For the model formula for each item, refer to “III Appendix 1 Calculation of model items”.

## 2 Carry-forward process for seasonal items, less fresh food in non-surveyed months

Of the survey items, some of them are not sold at all or only a few is sold in a certain period of the year, making survey difficult when they are absent or few in the market. These items are classified as seasonal survey items, and their prices are surveyed in the months they are normally sold (for details, refer to “IV 1 List of information for items of the 2020-Base Consumer Price Index”).

In the months in which the survey of these seasonal items is not conducted, calculating the index of an upper level group, without these seasonal items, causes the weight of the excluded items to be distributed proportionally to other items in the group, and this causes a problem that makes the annual average of monthly weights differ from the actual annual average weight<sup>16</sup>.

Therefore, for seasonal items such as clothes and heating & cooling appliances, their average prices in the previous survey are substituted in non-surveyed months to carry them forward to the month before the next survey.

## 3 Substitution of the prices in the comparison period

Of the items surveyed by municipalities, some of them are surveyed only in large cities in consideration of the actual situation of the purchase by consumers or sales in stores. For these items, the surveyed prices in a neighboring city are used as a substitute for the unobserved prices of municipalities in each month for calculating the index.<sup>17</sup>

Also, for some items which are surveyed not in municipalities but in prefectures or nationwide, the surveyed prices are substituted for the unobserved prices in the municipalities in each month.

As for methods of substitution for prices in the comparison period and substitution type for each item, refer to “IV 1 List of information for items of the 2020-Base Consumer Price Index”.

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<sup>16</sup> Although monthly weights are used for fresh food, it is not appropriate for use for items other than fresh food, because of the restriction on available data and complication in practical work.

<sup>17</sup> Whether prices are surveyed in municipalities is determined by the scale of population of municipalities for each item. However, some items may not be circulated in some municipalities because representative stores gather in a close city and consumers often visit the close city to purchase such items. In this case, the prices surveyed in the close city are substituted when necessary.