

Chapter 2 Quality adjustment during calculation of the prices in the comparison period

1 Necessity of quality adjustment for calculating prices in the comparison period

The CPI should be calculated from the price movement of the commodities having equal quality. Therefore, the price of the same commodity is continuously traced in principle. Considering the constant changes in corporate strategies and consumer behaviors, which will change the hot-selling line of products, an appropriate and timely revision of survey specifications is also necessary.

When the specification is revised (specification revision), a different price is set to reflect differences in the quality and package size, including function and characteristics, between the new and old specifications, but it should not affect the index in terms of the measuring price fluctuations. Therefore, differences in quality between the old and new specifications are quantitatively evaluated to reflect it in the CPI. This is called the quality adjustment.

2 Method of quality adjustment

It is necessary to apply the most appropriate method to calculate prices in the comparison period after carefully considering the factors such as the existence of differences in quality between the new and old specifications and variations of differences in quality and price formations in the market.¹⁴

The methods of quality adjustment used are as follows:

(1) Overlap method

If the new and old specifications are sold at the same time under equivalent conditions, the price differences between them can be regarded as reflecting differences in quality. In this case, price in the comparison period is adjusted by the ratio of both prices observed in the same period. This method is called the “overlap method.”

Adjusting prices by the overlap method is as follows:

¹⁴ The quality adjustment methods used for individual specification revisions are indicated in the Annual Report on Consumer Price Index published every spring.

| 《Example 1》 | | | |
|--------------------------------|-------------------------------------------------------------------------------------------|--------------------|------------------------------------------|
| | Two months before | Last month | This month |
| Product A | ¥120 | ¥130 | — |
| Product B | — | ¥160 | ¥165 |
| Link coefficient = | $\frac{\text{Price of product A in last month}}{\text{Price of product B in last month}}$ | | |
| | $= \frac{¥130}{¥160}$ | | |
| | $= 0.8125$ | | |
| Price in the comparison period | Two month before ¥120 | Last month ¥130 | This month ¥134.06 [¥165 × 0.8125] |

(2) Adjustment by the ratio of quantity

When there is no difference in quality between the new and old specifications except for quantity and price is nearly proportional to quantity, the price of the new specification is adjusted to the price proportional to the quantity of the old specification.

Adjusting prices by the ratio of quantity is as follows:

| 《Example 2》 | | |
|--------------------------------|---------------------------------------------------------------------|----------------------------------------------------|
| | Last month | This month |
| Product A | 150g ¥135 | — |
| Product B | — | 160g ¥150 |
| | $\frac{\text{Quantity of product A}}{\text{Quantity of product B}}$ | |
| | $= \frac{150\text{g}}{160\text{g}}$ | |
| | $= 0.9375$ | |
| Price in the comparison period | Last month 150g ¥135 | This month 150g ¥140.63 [160g ¥150 × 0.9375] |

Note that weight (quantity) is used as the unit of survey in some items including some kinds of food. The unit weight (quantity) price is the price in the comparison period for these items. The price changed in conjunction with changes in the weight (quantity) is reflected in changes in the index. For example, the price of potato chips is determined by converting the price of a bag of potato chips to the price per 100g. If the weight of a bag of potato chips is increased from 70g to 80g and the price for a bag is not changed, the unit weight price decreases, causing the index to decrease.

(3) Adjustment by the regression equation

Applying the price of the new specification into the regression equation, the price of the new specification is estimated when quality is equivalent to the old one, and price in the comparison period is adjusted by the ratio of both prices.

The following example uses single regression equation with quantity as an explanatory variable.

《Example 3》

| | | |
|-----------|---------------|-------------------------------------------|
| | Last month | This month |
| Product A | 1,200g ¥1,800 | — |
| Product B | — | 1,120g ¥1,760 (when 720g costs ¥1,210) |

[Estimation by a regression model]

$$1,760 = 1,120a + b$$

$$1,210 = 720a + b \quad \therefore a = 1.375, b = 220.0$$

$$y = 1.375x + 220.0$$

Hence, the price of product B for 1,200g is estimated to be $1.375 \times 1200 + 220.0 = ¥1,870$.

$$\begin{aligned} \text{Link coefficient} &= \frac{\text{Estimated price of product B for 1,200g}}{\text{Price of product B for 1,120g}} \\ &= \frac{¥1,870}{¥1,760} \\ &= 1.0625 \end{aligned}$$

| | | |
|--------------------------------|---------------|-----------------------------------------|
| | Last month | This month |
| Price in the comparison period | 1,200g ¥1,800 | 1200g ¥1,870 [1120g ¥1,760 × 1.0625] |

(4) Option cost method

When equipment which is an option in an old specification is installed as a standard in the new specification, the price increase along with such quality improvement is equal to the purchase cost of the option. However, the cost for standard equipment is considered to be lower than that for an option because of the increase of the production. In addition, consumers lose the opportunity to select or not select the option. Therefore, the price of the quality improvement is estimated by adjusting this part (in general, it is estimated as one half of the option price). This is called “Option cost method.”

Adjusting prices by the option cost method is as follows:

| 《Example 4》 | | |
|-------------|------------|------------|
| | Last month | This month |
| Product A | ¥2,400,000 | — |
| (Option) | ¥200,000 | |
| Product B | — | ¥2,550,000 |
| (Standard) | | |

Hence, quality improvement by the standardization of the option is estimated to be ¥200,000 × 1/2 = ¥100,000.

$$\begin{aligned} \text{Link coefficient} &= \frac{\text{Price of product A}}{\text{Price of product A} + \text{Quality improvement by standardization}} \\ &= \frac{¥2,400,000}{¥2,400,000 + ¥200,000 \times 1/2} \\ &= 0.9600 \end{aligned}$$

| | Last month | This month |
|--------------------------------|------------|-------------------------------------|
| Price in the comparison period | ¥2,400,000 | ¥2,448,000 [¥2,550,000 × 0.9600] |

(5) Class mean imputation

When the new and old specifications of an item are unable to compare in the last month, prices are linked by assuming that the price change of the item is equal to the average price change of all the other items classified into the same group. This method is called “Class mean imputation.”

This method is used when the new and the old specifications are unable to be priced at the same period. In general, it is not appropriate to apply this method, but it is exceptionally used for items sold in the market only for limited season, such as clothes.

Adjusting prices by the class means imputation is as follows:

| 《Example 5》 | | | | |
|--------------------------|---------------------------------|-------|------------|------------|
| | Same month of the previous year | | Last month | This month |
| Product A | ¥1,500 | | — | — |
| Product B | — | | — | ¥1,200 |
| Upper level group index* | 100.2 | | | 99.8 |

*Calculated excluding the item in question.

$$\text{Link coefficient} = \frac{\text{Price of product A in the same month of the previous year} \times \frac{\text{Index of an upper level group in this month}}{\text{Index of an upper level group in the same month of the previous year}}}{\text{Price of product B in this month}}$$

$$= \frac{¥1,500 \times \frac{99.8}{100.2}}{¥1,200}$$

$$= 1.2450$$

| Price in the comparison period | Same month of the previous year | | Last month | This month |
|--------------------------------|---------------------------------|-------|------------|-------------------|
| | ¥1,500 | | — | ¥1,494 |
| | | | | [¥1,200 × 1.2450] |

(6) Hedonic approach

A number of characteristics (performance) that compose the quality of a product are broken down, and the relationships between these characteristics and price of the product are estimated through the multiple linear regression analysis, and the price is adjusted by recalculating according to the change in quality. There are two ways of adjusting the price: 1) The price of new specification is applied to the multi-regression formula to estimate the price of the new specification equivalent to the old specification, and the price is determined in proportion to the new and old prices, or 2) the quality adjusted price change is directly calculated by the hedonic approach.

For three items, “Personal computers (desktop)”, “Personal computers (notebook)” and “Cameras,” quality adjusted price changes are calculated every month using method 2). For details of the quality adjustment using method 2), refer to “III Appendix 1 Calculation of the price indices for PCs and cameras by hedonic approach.”

(7) Direct comparison

When the new specification can be regarded as equivalent to the old specification, the surveyed prices are adopted directly, in which case no special calculation for the link coefficient is needed. However, it is necessary to investigate the qualities of both new and old specifications and judge them to be equivalent.