

# Outline of the 2010-Base Consumer Price Index\*

## 1 Characteristics of the Index

The Consumer Price Index (CPI) is calculated to measure the average price movements of goods and services purchased by households throughout the country. It reflects changes of the cost of purchasing goods and services in a fixed “market basket”, but is not designed to measure changes of the cost of living attributed to changes in the consumption structure of households.

## 2 Index formula

The index is calculated as the weighted arithmetic mean with a fixed basket in the reference period preceding the observation period (Laspeyres formula). The formula to calculate the index of the observation period ( $I_t$ ) is shown below.

where  $i$  : item

$n$  : number of items

$P_{0,i}$  : average price of item “ $i$ ”  
in the price reference period  
“0”

$P_{t,i}$  : average price of item “ $i$ ”  
in the observation period “ $t$ ”

$W_{0,i}$  : weight assigned to item “ $i$ ”  
in the weight reference period  
Index in the reference period: 100

$$I_t = \frac{\sum_{i=1}^n \frac{P_{t,i}}{P_{0,i}} W_{0,i}}{\sum_{i=1}^n W_{0,i}} \times 100$$

## 3 Index reference period of the index and weight reference period

Both the index reference period and the weight reference period are the calendar year 2010.

## 4 Items to be priced

The number of items priced for the calculation of the index is 588 consisting of 587 items and an item of imputed rent of owner-occupied housing (including 5 items priced only in Okinawa Prefecture).

Items are selected in consideration of the relative importance of each item to the total consumption expenditures, representativeness of price movements and feasibility of price data collection, in order to represent the price movements of all the goods and services purchased by households.

## 5 Price data

Prices of index items are derived from the Retail Price Survey (RPS) conducted by the Statistics Bureau, Ministry of Internal Affairs and Communications in principle.

As it is difficult to collect prices of products with an equivalent quality continuously because of rapid quality changes, for three items “personal computers (desktop)”, “personal computers (laptop)” and “cameras”, average price and number of units sold for each product derived from scanner data, collected from major electric appliance shops across the country are used for compiling price indices instead of the RPS. Hedonic method is applied to compile price indices for the three items.

### 5.1 Municipalities surveyed

The whole country is stratified and a total of 167 municipalities are selected. However, for the purpose of the hotel charges survey, 99 municipalities are separately selected to obtain data.

### 5.2 Survey districts and outlets

Firstly, in each selected municipality, the “survey districts for prices”, where the prices of goods and services are surveyed, and the “survey districts for house rent”, where rent of privately-owned houses and rooms to let are surveyed, are established.

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\* See “2010-Base Explanation of the Consumer Price Index” for more information.  
URL: <http://www.stat.go.jp/english/data/cpi/1586.htm>

Secondly, representative outlets and service establishments judged to have the largest sales within the district are selected for each item group in principle. Most prices are collected at those outlets and service establishments. All privately-owned houses and rooms to let in the survey districts for house rent. However, there are specific goods and services, including the rents of publicly-managed houses whose prices are collected either for the whole country, all prefectures or municipalities instead of survey municipalities or districts.

The total number of outlets and establishments thus selected is about 27,000 and the number of households for rent survey is about 26,000.

### **5.3 Collected prices**

Collected prices are retail prices or service charges at which the items are actually sold at the outlets or establishments on the survey date, and price data are collected mostly through the fieldwork of price collectors. Excluded from the price collection are temporary bargain prices and prices for installment sales.

As some items are not sold in some districts, items to be collected are specified according to the size of population, taking into account the modalities of purchase by consumers, variation of prices among outlets, etc. As a result, the number of prices collected every month is about 239,000 (including about 26,000 house rents) for the whole country and about 16,000 prices for the Ku-area of Tokyo as of December 2012.

### **5.4 Specifications**

For each item surveyed, the exact description of the relevant goods and services (basic specifications) are given in detail according to such characteristics as brand, size, quality, etc. so that the equivalent goods and services can be constantly priced every month. In case an item of basic specification is no longer commonly found in the market and the representativeness of the price of that item is lost, a new representative specification replaces the former specification (specification change).

### **5.5 Survey date**

Prices are surveyed in principle once a month on Wednesday, Thursday or Friday of the week including the 12th of each month. About 40 items included in fresh food – i.e. fresh fish and seafood, fresh vegetables, fresh fruits – and cut flowers, price data are collected three times a month: Wednesday, Thursday or Friday of the week including the 5th, 12th or 22nd of each month. The middle prices during the three consecutive days ending on the survey dates are selected each time.

### **5.6 Execution of the Survey and Tabulation**

About items surveyed by enumerators, prices to be collected for the survey are retail prices or service charges for the specified item at stores or establishments surveyed on the survey date. About house rents survey, the data on monthly rents and total floor spaces are collected from all households in rented houses in survey districts. Supervisors and the staffs of the Statistics Bureau also collect retail prices or service charges from price reporters.

After the data are checked by the Statistics Bureau and the National Statistics Center, they are tabulated at the National Statistics Center.

## **6 Prices in the observation period**

The average price for each item is calculated using the prices collected in each surveyed municipality, and then used as the price of the observation period for the calculation of indices. The methods of calculating the price of the observation period are as follows.

### **6.1 Basic calculation method**

Average price for each item is calculated, in principle, as a simple arithmetic mean of prices collected. As for prices of fresh food and cut flowers collected three times a month, the average prices, which are calculated as simple arithmetic means of those middle

prices for each time, are then aggregated into the monthly average price on the basis of the simple mean of the average prices.

## **6.2 Other calculation methods**

Although average price in observation period for each item is calculated by simple arithmetic mean in principle, there are some items whose average prices are calculated by other calculation methods.

### **6.2.1 Personal computers and Cameras**

As for “personal computers (desktop)”, “personal computers (laptop)” and “cameras”, price indices are calculated by the hedonic approach using the characteristics of all kinds of models, sales prices and quantities obtained from scanner data, etc.

### **6.2.2 Models**

Some items such as airplane fares, electricity and mobile telephone charges 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 Retail Price Survey are used to calculate these indices. The results of other statistics are used for ratios to formulate the prices of model cases.

## **6.3 Substitution of prices**

As mentioned above, it is not always the case that all items are surveyed in all municipalities for the purpose of price collection, but there are some municipalities where some items are not surveyed. In most cases, the prices in the geographically nearest city are to be used as substitutes for the missing prices.

## **6.4 Treatment of specification changes**

When a specification is changed, the index is calculated by excluding factor other than of price movement, such as quality changes.

The methods of quality adjustment for the index calculation are as follows:

### **6.4.1 Overlap**

In the case price difference between new and old specifications, which are sold at an outlet at the same time on the equivalent condition, can be regarded as reflecting differences in quality, the index concerned is adjusted by the ratio of both prices observed in the same period.

### **6.4.2 Adjustment by quantity-ratio**

In the case no difference exists between the new and old specifications except difference in quantity, and price difference can be regarded to be proportional to quantity difference, the index is adjusted by the ratio of quantity between the two specifications.

### **6.4.3 Regression and Hedonic method**

In the case quality difference can be characterized explicitly, and the relationship between price and quality can be estimated by a regression model, the index is adjusted by the ratio of quality derived from an estimated regression model.

### **6.4.4 Option cost**

In the case new features of the new specification were available as options previously; quality change – i.e. addition of the new features – can be inferred from prices of options in the previous period.

### **6.4.5 Class mean imputation**

In the case the new and old specifications are unable to be priced at the same period,

the prices for the old specification are extrapolated from those in the previous period by using an average price index among items classified into the same item group. Then, the same procedure as the overlap method is applied if appropriate.

#### 6.4.6 Direct comparison

In the case the replacement can be regarded as almost equivalent to the old specification, prices for the two specifications are compared directly.

### 7 Prices in the price reference period

Prices in the price reference period used for the calculation of the 2010-base indices are simple arithmetic means of monthly price data from January to December 2010, which are calculated in the same manner as “6 prices in the observation period”. However, the prices of fresh food (fresh fish & seafood, fresh vegetables, fresh fruits) are calculated as weighted arithmetic means using monthly weights.

### 8 Weights

For the purpose of index calculation, weights assigned to items are obtained by the following methods:

#### 8.1 Data for weights

The weights assigned to items are calculated on the basis of average household expenditures of two-or-more-person households, derived from the 2010 average statistics of the Family Income and Expenditure Survey (FIES) conducted by the Statistics Bureau, Ministry of Internal Affairs and Communications. For fresh food, however, monthly weights are calculated from not only the expenditure by item in 2010, but also the quantity purchased in each month of 2010 and 2009. (The total weights for three categories of fresh food – i.e. fresh fish and seafood, fresh vegetables, fresh fruits – are fixed throughout the year.)

The FIES is conducted monthly with a sample of about 9,000 households (of which two-or-more-person households is about 8,000) in 168 municipalities across the country.

#### 8.2 Scope of FIES items used for weights

As the CPI is designed to measure changes in prices of goods and services consumed by households throughout the country, the scope of FIES items used for the calculation of weights is limited to the household consumption expenditures. The CPI does not cover non-consumption expenditures (such as income taxes and social security payments) nor disbursements other than expenditures (such as savings including deposits and security purchases, and property purchases).

Furthermore, among the consumption expenditures, remittance, money gifts, religious contribution (donations and offerings to temples, churches, offertory, etc) and other obligation fees (fees paid to neighborhood association, alumni and union dues, etc) are also excluded because markets do not generally exist for such items, the relationship between payment and service is not clear, or that is an income transfer to other households.

The shelter service provided by owned houses is incorporated in the index through the imputed rent approach. As for the procedure for calculating weights assigned to imputed rent, see 8.4 below.

#### 8.3 Correspondence between items of CPI and the FIES

If CPI items correspond to FIES items 1 to 1, correspondence is maintained, in principle, as they are. When FIES items and CPI items do not correspond 1 to 1, the following procedures are taken:

8.3.1 In the case one FIES item corresponds to plural CPI items, the expenditures for FIES item is divided and assigned to the plural CPI items.

8.3.2 In the case plural FIES items correspond to one CPI item, the expenditures for

FIES items are totaled and allocated to the CPI item.

8.3.3 As for the item “others” in each item subgroup of the FIES, the weight is calculated only in the case that the “others” includes CPI items; the rest of expenditure for “others” is distributed to the CPI items in the subgroup.

8.3.4 Pocket money and social expenses are allocated to CPI items by the rates of allocation on the basis of “individual expenditure” in the 2009 National Survey of Family Income and Expenditure (NSFIE).

#### **8.4 Weights of imputed rent**

The purchase of houses is not considered as consumption but as capital formation. However, shelter services derived from houses purchased instead of renting houses are considered to account for large portion of actual consumption, it may not be reasonable that it is not included only because of lack of monetary transaction. Therefore, the housing services of owner-occupied housings are incorporated into the CPI considering they are equivalent to house rents of the similar housings, which is called “imputed rent” approach. The weight of the imputed rent is calculated as described in the next paragraph on the assumption that the owner-occupier of the house pays the rental equivalent. The price index is substituted by indices for private house rent.

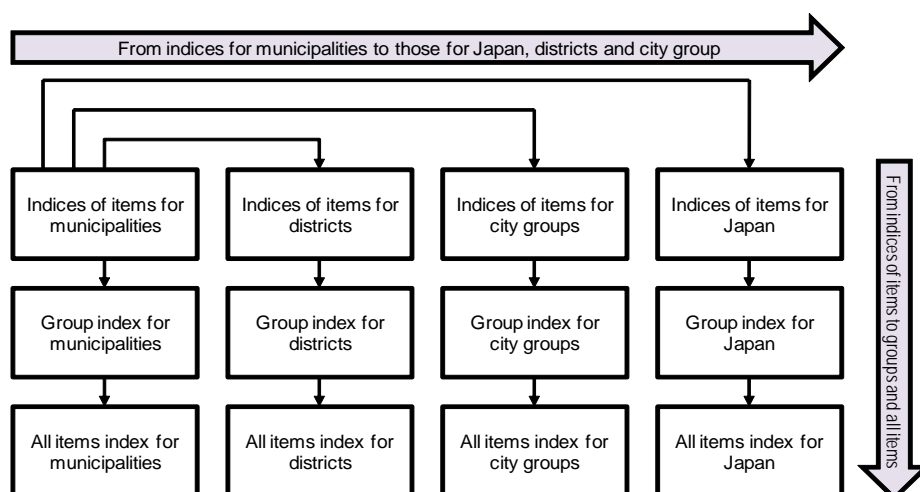
First, to avoid conceptual duplication, the costs of “repairs & maintenance” and “rents for dwelling & land” are deducted from “imputed rent for owned houses” estimated for the NSFIE in 2009. Second, this amount is adjusted to the FIES in 2009. Then it is adjusted to 2010 average by multiplied by the rate of change of the CPI for “imputed rent”. After that, it is multiplied by the ratio of owned houses obtained by the Housing and Land Survey in 2008. Finally, as the “imputed rent” index is calculated from four classes of “small wooden house”, “medium wooden house”, “small non-wooden house” and “medium non-wooden house”, the imputed rent for owned houses is divided into these four classes using the rate of division computed from the results of the Housing and Land Survey 2008, and weights by the classes are calculated.

### **9 Index calculation**

#### **9.1 Aggregation**

Index aggregation begins from the calculation for the smallest groups. Namely, the price index for each item ( $P_{t,i}/P_{0,i}$ ) is averaged with weight assigned to each item to obtain indices for the smallest groups. Then the index thus obtained is averaged with weight for each group, the sum of weights assigned to items in the group, to obtain the index for the groups immediately above the smallest groups. Repeating the same procedure, the indices for the subgroups, the 10 major groups, and the all items index are obtained in succession.

In the case of the all items index for the whole country, the index is computed as follows (the same procedure is also taken for the municipality groups and districts). First, price relative by item for each municipality ( $P_{t,i}/P_{0,i}$ ) is calculated and then averaged with the respective weight for each municipality to obtain the average price index by item for the whole country. Then this index is averaged with weight for each item for the whole country to obtain indices for item groups including the all items index.



## 9.2 Calculation of average indices for calendar year, fiscal year, quarter, and half-year

The annual average indices for all items other than fresh food and sub-indices are calculated as simple averages of monthly indices from January to December, while for fresh food, annual indices are calculated as weighted arithmetic means using monthly weights. Fiscal year, quarterly and half-year indices are also calculated in the same way.

## 9.3 Calculation of change in price index, contribution and rate of the contribution

### 9.3.1 Change in price index

Change in price index represents the fluctuation of prices between two periods. Change from the previous month, over the year, and from the previous year, etc., are calculated as follows:

$$\text{change (\%)} = \frac{\text{current index} - \text{previous index}}{\text{previous index}} \times 100$$

### 9.3.2 Contribution, rate of the contribution

Contribution of an item represents what points the change in the item index contributed to the change in all items index. It is calculated as follows:

$$\text{contribution of item A} = \frac{\left( \frac{\text{current index of item A} - \text{previous index of item A}}{\text{previous index of all items}} \right) \times \frac{\text{weight of item A}}{\text{weight of all items}}}{\text{previous index of all items}} \times 100$$

However, the contribution to total change over the year of items categorized as fresh food is computed using the following formula:

$$\text{contribution of item A} = \frac{\left( \frac{\text{current index of item A} \times \text{current weight of item A}}{\text{previous index of all items} \times \text{weight of all items}} \right) - \left( \frac{\text{previous index of item A} \times \text{previous weight of item A}}{\text{previous index of all items} \times \text{weight of all items}} \right)}{\text{previous index of all items} \times \text{weight of all items}} \times 100$$

Rate of contribution represents the contribution of each item to the change of all items index by percentage. It is calculated as follows:

$$\text{rate of contribution of item A (\%)} = \frac{\text{contribution of item A}}{\text{change of all items index (\%)}} \times 100$$

## **10 Seasonally adjusted series**

Seasonally adjusted indices are calculated in order to see general price trends in the economy. The X-12-ARIMA Seasonal Adjustment Method developed by the U.S. Census Bureau is employed. Seasonally adjusted series are revised annually as follows. Namely, for the current month, seasonally adjusted series are made from the original indices for the current month divided by projected seasonal factors derived from the data till December of the previous year. When the indices for December of the current year are finalized, seasonally adjusted series is recalculated including the monthly data for the current year.

## **11 Index series available**

### **11.1 Indices by basic classification**

The following indices are available. The all items index, sub-indices for 10 major groups, sub-indices for lower groups. Index for each individual item is also released for Japan and for Ku-area of Tokyo.

Indices are compiled for 69 regional groups, that is, city groups, districts (including 4 major metropolitan areas), cities with prefectural governments are seated (excluding ku-area of Tokyo), Kawasaki-shi, Hamamatsu-shi, Sakai-shi and Kitakyushu-shi (as for region, refer to “Appendix 2 Cities, Towns and Villages Surveyed”).

“All items, less fresh food”, “all items, less imputed rent”, “all items, less imputed rent & fresh food”, “all items, less food (less alcoholic beverages) and energy”, etc. are also released.

### **11.2 Indices by goods and services classification**

All items are classified into two categories: goods or services. Then index for each item is aggregated into index for goods and that for services for Japan and for Ku-area of Tokyo.

### **11.3 Indices aggregated based on baskets of the specific household groups**

The indices by the basic classification and the indices by goods and services classification are both based on the average consumption pattern of all households. As the impact of price fluctuations may vary according to household income, the age of the household head or other household characteristics, indices for the specific household groups are compiled in order to analyze price fluctuation among the different household groups. Weights used for the computation of the indices are obtained from the expenditure data of the FIES on the household groups concerned in a manner similar to the procedure for compiling weights for main index series. For the aggregation, the national average index for each item is used.

The following series are released:

11.3.1 Subgroup index for total households<sup>1</sup> for Japan: monthly and annually

11.3.2 Subgroup index by yearly income quintile groups of workers' households for Japan: monthly and annually

11.3.3 Subgroup index for retired elderly households for Japan: monthly and annually

11.3.4 10 major group index by age groups of household head for Japan: annually

11.3.5 10 major group index by occupation of household head for Japan: annually

11.3.6 10 major group index by types of tenure of dwelling of household head for Japan: annually

### **11.4 Indices by the characteristic of items**

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<sup>1</sup> “Total households” includes two-or-more-person households and one-person households.

Indices for item groups classified according to elasticity to consumption expenditure and classified according to annual purchase frequency are also released.

As regards the calculation of the sub-indices based on elasticity to consumption expenditure, CPI items are classified into two categories based on elasticity estimated from the results of the FIES: namely, items whose elasticity stands less than 1 are regarded as basic expenditures and 1 or over regarded as selective expenditures.

For the calculation of the sub-indices based on annual purchase frequency, CPI items are classified according to the annual purchase frequency per household based on the results of the FIES.

The following series are released:

11.4.1 Indices of goods groups classified according to elasticity to living expenditure for Japan: monthly and annually

11.4.2 Indices of annual purchase frequency classes for Japan: monthly and annually

### **11.5 Reference indices**

In order to respond to changes of consumption pattern more rapidly than the Laspeyres index, Laspeyres' chain index and midpoint-year basket index are compiled for reference. The chained Laspeyres index is year-to-year chaining of Laspeyres indices based on the preceding year. The weights are revised annually. The indices are chained using indices in December for monthly indices, and yearly average indices for annual indices. As the weights in the previous year are not available, provisional indices calculated with weights two years before are released on January. Then the weights are revised after the release of the FIES (yearly average results of previous year), and the indices from January are recalculated with revised weights. Monthly indices are calculated in the series excluding fresh food, and the series including fresh food are only calculated annually.

The midpoint-year basket index is calculated based on the basket in the middle year between the weight reference year and the observation year. The following series are released:

11.5.1 Consumer price index calculated by Laspeyres' chain index method for Japan: monthly and annually

11.5.2 Consumer price index calculated by midpoint-year basket method for Japan: annually

## **12 Calculation and publication of consumer price indices**

The calculation is conducted by the National Statistics Center. The results are compiled by the Statistics Bureau. The monthly consumer price index is released, in principle, at 8:30 A.M. on Friday of the week including the 26th of each month. The index figures of the preceding month for Japan, and the preliminary figures of the current month for Ku-area of Tokyo are released. The average index figures for the calendar year and the fiscal year are released when the monthly figures for December and March are released respectively.

The following reports are published and available on the internet periodically.

12.1 Summary Report on the CPI (only on the internet)

It is released on the date of public announcement. It contains major indices for Japan and for Ku-area of Tokyo.

12.2 Monthly Report on the CPI (only on the internet)

12.3 Annual Report on the CPI



## History of the CPI in Japan

Calculation of the Consumer Price Index (CPI) was started in August 1946. The index in those days was calculated using Fisher's formula, with its reference period of somewhat irregular 8-month duration from August 1946 to March 1947 in order to meet the urgent need for measuring the postwar price hike. In addition, to cope with the existence of dual price channels, official and black market, the index was calculated using the "effective prices" (average prices weighted according to the quantity of the good purchased at official prices and that of goods purchased at black market prices), and weights, which were based on the Consumer Price Survey (CPS, replaced later by the Family Income and Expenditure Survey (FIES)). Thereafter, as more detailed data for the CPS became available, the 1st revision was made in August 1949, with the calendar year 1948 as the reference period, and at the same time the index formula was changed to Laspeyres type, with earlier series being recalculated retroactively to August 1946. As the economic situation became stable, the Retail Price Survey (RPS) was started from June 1950. Accordingly, in September 1952 the reference period of the index was changed to the calendar year of 1951, and the old effective prices were replaced by retail prices obtained from the RPS. As a result, index calculation became more complete. In and after 1955, the base periods have been revised every five years, so as to take account of the changes in consumption patterns.

For the period from August 1946 to December 1950, only two series of indices were calculated, namely those for "all cities" and for the "Ku-area of Tokyo". Following the change to the 1951-base, the indices were calculated, besides the above-mentioned two series, for 27 cities where the RPS and the FIES were conducted, bringing the total of the 29 series. Then, with the enlargement of the coverage of the RPS and the FIES from urban areas to the whole country, including rural areas in July, 1962, a total of 68 series were compiled on the 1965-base, consisting of the indices for the whole country, city groups, districts and cities where prefectural governments are seated. Following the change to the 1975-base, the indices were added for the municipalities in Okinawa prefecture, as it was reverted to Japan in 1972 and included in the national average, making the total of the index series up to 72. Following the change to the 2010-base, the total of the index series is up to 71 owing to the revision to city groups.

Although the index items had been classified into 5 major groups since the calculation of the CPI began, the 1980-base indices were compiled on the basis of a new classification system, i.e. a 10 major expenditure group system in accordance with the revision of the income and expenditure classification system used for the FIES in January 1981.

The calculation of the index for "imputed rent" was started following the change to the 1970-base, and the "all items index including imputed rent" was calculated as a supplementary index series. At the 1985 revision, "all items index including imputed rent" became the main index series.