

# **The treatment of difficult-to-measure products and services in Japan**

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## **Abstract**

Japanese CPI will be revised on Aug. 2016. We will update procedures for calculating difficult-to-measure products and services and revise weights. For revising Japanese CPI, we analyzed changes of pricing mechanisms and consumption composition in the Japanese economy. Also we reviewed the calculating method for difficult-to-measure products and services, and investigated how to improve these methods. In this paper, we will introduce how we calculated the price indices and allocate weights for difficult-to-measure products and services, such as housing utilities, long distance transport, insurance, health, telecommunications, package holidays, educational fees, digital content, etc. Also we will introduce how we will update the procedure of these indices in the Aug. 2016 revision.

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## **1. Introduction -Revision and review for Japanese CPI to 2015 base-**

Japanese CPI will be revised on Aug. 2016. This is the 15th revision which has been conducted every 5 years. In this revision, we will perform the following five measures. (1) Revision of the CPI base period to 2015. (2) Weight revision<sup>2</sup> for the 2015 expenditure composition. (3) Revision of items based on the 2015 expenditure composition, which had been presented at the 2015 meeting of the Ottawa Group by Hirota (2015). (4) Expand the publication series; especially, we will release the series including fresh food calculated by chain index not annually but monthly, which had been presented at the 2015 meeting of the Ottawa Group by Shimakita (2015). And, (5) we will review and revise the calculating method for difficult-to-measure products and services. In this paper, we will introduce how we calculate the price indices and allocate weights for difficult-to-measure products/services and how we will update the procedure of these indices.

## **2. Viewpoints for the review and the revision**

We will compile the CPI based on the price indices of 585 items since the 2015 base revision. In many items, we calculate elementary indices based on the Dutot<sup>3</sup> index by surveyed municipality, and prices collected by enumerators on a face to face basis. But for about 90 items, we adopt a special estimation method or data collection method. It includes “Model based estimation”, “Hedonic method”, “Jevons index”, and “Web data collection”. These methods are adopted mainly on the estimation of the difficult-to-measure products/services such as housing utilities, long distance transport, insurance, health, telecommunications, package holidays, educational fees, digital content, etc. Some of these items have large weights and there are little scanner data which are useful on these categories. Moreover, because data of prices and for estimating weights are often highly commercially sensitive for data providers in these categories, collection of these data have to be performed by public organizations such as statistics bureaus of governments on a confidential basis. Therefore, we have to continue somewhat traditional efforts for improving the accuracy of these items indices.

When we review and revise these calculation methods, we consider economic changes in Japan. I think the long trend of households’ economic change in our country can be summarized with the following 5 issues; (1) Decreasing household size; (2) Aging population, (3) Increasing number of female workers with young children, (4) Introduction of IT, and (5) Preparing for huge disasters.

We also consider improving methods efficiently with limited resources for compiling indices.

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<sup>2</sup> The weights of our official indices are fixed for 5 years. We also release the annual chain indices with weights revised every year.

<sup>3</sup> For most surveyed items, our survey specifications are very tight, with the aggregation only being within municipalities for each item.

### **3. Revised items for adapting economic condition change**

#### **(1) Electricity, Gas supply, Water supply (COICOP 04.4-04.5)**

The power supply companies often charge high unit prices for heavy users but low unit prices for light users who possibly need security of life. We need to check the price movements for both light users and heavy users. We check prices of 5 model cases, and then it is compiled by weighted arithmetic mean of model cases prices.

The model cases and weights are established by consumption amount distribution of household, whose data is provided by the Family Income and Expenditure Survey.

Nowadays, electricity consumption per households has decreased due to the decreasing household size, technological innovation for decreasing electricity consumption such as LED, or our increased awareness toward decreasing energy consumption following the huge earthquake and subsequent crisis of power supply in 2011, and some other reasons. Especially, the persons per household have decreased from 2.46 in 2010 to 2.38 in 2015.

We will lower the model consumption amount in the 4 model cases.

(Old model cases)    180kWh   270kWh   350kWh   450kWh   700kWh

(New model cases)   160kWh   250kWh   330kWh   440kWh   720kWh

We allocate weights to each case corresponding to the consumption distribution by district, which reflected the differences in household size.

We also revise the model consumption for the gas supply and the water supply in the same way.

#### **(2) Cultural services (COICOP 09.4.2)**

For the CPI survey item “Cinema admissions”, we have researched standard admission fees only. Our enumerators surveyed the standard admissions in each regional theater.

In Japan, the cinema providers have discount fees for the elderly, women, etc. These days, the aging population is expanding the demands for the elderly who charged admission fees with a discount. The population share of elderly persons<sup>4</sup> has expanded from 23% in 2010 to 26% in 2014. Especially, the population of people 65-74 years old has increased by 12% in the last 4 years.

Also major cinema providers are spread all over the country. The screen shares of cinema-complexes to total providers raised from 81% in 2010 to 87% in 2015.

Due to the above, we decided to change the model including various admissions under special conditions such as the elderly, etc. and to check that the prices of major cinema providers are almost the same all over the country.

#### **(3) Nutritional supplementary foods (COICOP 06.1.1)**

We include the prices of some brands of “multi vitamins” into the CPI item “nutritional

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<sup>4</sup> Persons who are 65 years old or older

supplementary foods”. We investigated the price on the internet because the expenditures of 47% of these commodities are bought by mail order or on the internet. We calculate the price indices by weighted arithmetic mean on fixed baskets of brands.

The demand for nutritional supplementary foods has gradually increased. It looks like the progress of aging and/or expands of the desire for health or beauty pulls demand.

In order to improve the accuracy, we decided to divide the item “nutritional supplementary foods” into 2 items. One is the category with an importance on efficacy rather than taste, which shares the market with medicines. The other is the category with an importance on taste, which shares the market with foods.

Both items have multiple prices of brands respectively. There are high price variances within each item, so we adopt a weighted geometrical mean for calculating the price index of each item. In order to respond flexibly to changes in the sales of brands, we also adopt the annual chain method.

#### **(4) Nursery fees (COICOP 12.4)**

Although nurseries have been opened in all municipalities, we collect the prices in the largest 47 cities for simplification. We also set the sample model household of one specific income.

In reality, each local government has decided nursery fees in their municipalities considering each household income and age of children. The increasing number of women in the labor force with young children has expanded the demand for nurseries. Despite the decrease of households consisting of a couple with children under 7 years old (4.40 million in 2010 to 4.28 million in 2015), those whose female spouse is the labor force has increased from 1.93 million in 2010 to 2.30 million in 2015. This also expands the importance of nurseries.

We decided to collect various prices of model cases including various incomes, cities and multiple ages of children. This change will guarantee high precision in these price indices.

#### **(5) Educational services<sup>5</sup> (COICOP 10)**

We had collected the price of one case in all surveyed municipalities for each item in education, such as educational fees of high schools, universities, kindergarten, etc.

For public high schools, all students didn't need to pay educational fees from Apr. 2010 to Mar. 2014. However starting in Apr. 2014, students of high income households were required to pay their fees. Because of this, we decided to collect various prices of model cases including various incomes.

For public kindergarten, many local governments have introduced the price system depending on household income since Apr. 2015. Also we decided to collect various prices of model cases including various incomes.

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<sup>5</sup> We have reflected this issue for current CPI since the price change in Apr. 2014 for high school and in Apr. 2015 for kindergarten.

For both private high schools and private kindergartens, the subsidies<sup>6</sup> changed as in the public schools. We reflected these changes as well.

Now, we compile the price indices of these items by weighted arithmetic mean of model cases prices.

#### **(6) Telecommunication services (COICOP 08.3)**

The expenditures shares of cell phone fees to total consumption expenditures are over 2% in Japan. This has the 4th largest weight in Japanese CPI of the 2010 base.

The prices of cell phone fees mainly depend on uses for data traffic, time talking, smartphones or older-type mobile phones. Japanese cell phone carriers provide various price plans like many other countries. Based on the method proposed by the CPI manual (2004) 10.108-10.112 (titled “Customer profiles”), we set multiple model cases (XX GB data uses and YY minutes talking per month). In each model case, we estimated the cheapest fees and reflect it to the price index.

The expenditures of cell phone fees expanded in early 2000s with the distribution of cell phones. Then around 2010, the speed of expanding expenditures was relatively low. But around 2015, that speed re-accelerated due to the distribution of smartphones that charged higher unit prices than older-type phones. Regarding this weight expansion, we decided to expand the number of model cases<sup>7</sup> to maintain the precision of the price index.

We revise the setting of model cases reflecting increasing data traffic and decreasing time talking based on the latest results of temporary household survey. It may partially reflect the distribution of free talking applications which use data traffic for communication, and also various data-rich services for smartphones. We also review the scope of services or plans to select the cheapest fees.

There are some bundled prices related to cell phone fees. We consider the prices of bundles which are able to divide prices to each service clearly and those shares are so large now that they cannot be ignored.

#### **(7) Digital content (COICOP 09)**

We have collected the price of music content (charged by each download type) only. But in recent years, the distribution of smartphones has expanded demand for various digital content. This means we have to expand the surveyed coverage of digital content.

Digital content may include various intangible-goods and services. It may be difficult to distinguish between intangible-goods and services strictly. It would be ideal to distinguish those and divide surveyed items, but I think it is somewhat difficult at this time. Moreover, rapid distribution of new types of content makes checking the price movements difficult by tracing constant goods and

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<sup>6</sup> In some cases, households have to pay gross fees, and then receive subsidies by local governments. In that case, we treat the price indices of school fees on a net of payment basis.

<sup>7</sup> We have reflected this issue for current CPI since the price change in Oct. 2015.

services. Under these situations, we need a flexible model to trace the price movements for digital content.

When we started the calculation of 2015 base indices, we decided to collect the charges for 4 categories of content. Those are music content (both the charged by each download type and charged a constant amount monthly type), video distribution on the internet, charged application for smartphones including tools and games, digital books including novels and comics. This content is widely distributed in the Japanese digital market now, but we will continue to watch that market and will change the survey category in a timely manner.

For the time being, we regard this item as a service. But I think that we have to discuss further on how to distinguish intangible-goods and services in digital content.

#### **(8) Cameras (COICOP 09.1.2)**

We have collected the prices of compact cameras (integrated lens type cameras) only. We calculate the Hedonic indices for cameras as well as PCs.

The shares of compact cameras are falling due to the distribution of smartphones with relatively high spec cameras. But, the distribution of smartphones might also expand the demand for higher spec cameras for the purpose of distributing photos on SNS in Japan. In fact, the shares of single-lens reflex cameras and mirror-less interchangeable-lens cameras to total cameras are expanding.

We decided to add single-lens reflex camera and mirror-less interchangeable-lens camera to the survey items. Since these 3 categories have different constructions and needed a different explanatory variable for estimation on the Hedonic method, we adopted the Hedonic indices of each category and then integrate them to the camera price index.

#### **(9) Insurances connected with dwellings (COICOP 12.5.2)**

In Japanese CPI, prices of property insurance indices are treated as gross insurance premiums.

We have collected the service charges for insurance package of housing and furniture against fire, theft and water damage.

The huge earthquake in 2011 has caused people to be more aware of preparation for disasters in Japan. Insurance against earthquakes, along with optional services for fire insurance, are now distributed to households in Japan. In fact, the share of those who also have earthquake insurance among those who have fire insurance has grown from 48.1% in 2010 to 59.3% in 2014. We decided to collect the service charges of earthquake insurance. We also adopted the annual chain method for integrated earthquake insurance to reflect in a timely manner the increasing number of people purchasing the insurance.

The weights for this item are reflected on the gross premiums for fire and earthquake insurance.

We don't consider premium supplements, claims or charges in the actuarial provisions, continuously.

#### **4. Elaborated items by review**

##### **(1) Services for repair and maintenance of houses (COICOP 04.3.2)**

We reviewed services for repair and maintenance of houses in this base revision, but it was somewhat difficult to identify the expanding and shrinking services in recent years with the Family Income and Expenditure Survey because these expenses are low frequency, high unit price<sup>8</sup> expenses. We reviewed various data on supply side statistics or information and identified expanding and shrinking services in time series. We will add 3 items to the survey and delete 2 items in this category. For example, "Concrete placing for parking lots" may be reflected in the gradual increase of households that possess multiple cars in rural areas. Also including "Painting siding panels" and excluding "Plastering of the wooden house" may reflect the distribution of siding walls and the disappearing of mortar walls for Japanese wooden houses.

Allocations of weighting will also be revised.

##### **(2) Medical and dental services (COICOP 06.2-06.3)**

In Japan, we have a social protection system for medical and dental services for all people. When patients are provided medical/dental services, they pay 10-30% of the (self-pay ratios) total costs. Patients don't need to put up the payments by the insurance in most cases. The self-pay ratios were dependent on the age of patients and the kind of system such as for labor, business owner, the elderly, etc. But now those percentages are dependent on age of patients only.

We used to have to estimate the weights matrix of age and system, but it included some estimation errors due to the fact that there were no data about the expenditure matrix of that. Now, we don't have to estimate that matrix with some errors because the only factor of the self-pay ratio is age of patients.

Moreover, the self-pay ratios have been gradually picking up from 10% to 20% in the 70-74 years old group during 5 years since 2014. It has influenced the price index of the medical/dental price index strongly, so we need to estimate precise weights on the age of patients.

##### **(3) Airline fees (COICOP 07.3.3)**

On Japanese domestic airlines, many travelers use discount tickets by taking reservations and paying before boarding dates. Pricing airline fees depends on Departure and Arrival location, boarding date, date of reservation and pay. We compile the airline fees index by weighted arithmetic

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<sup>8</sup> Sample size of the Family Income and Expenditures is 9000 households per month. Because expenditures of items with a low frequency and high unit price sometimes bring high variance, we carefully check if the sample expenditures represent the universal expenditures sufficiently or not under the 9000 samples.

mean of regular tickets and discount tickets prices for 10 major airlines.

We select the 10 major airlines based on the number of passengers and total revenue. That led us to select the Tokyo-Sapporo, Tokyo-Fukuoka airlines etc. Major airlines have many flights in a single day. We designate one or more representative flights on each airline.

We estimate the cheapest fees among all reservation dates for each airline and each boarding date as the prices for discount tickets. We survey the fees of all boarding dates throughout one month since the prices of discounts tickets vary depending on the boarding date. For example, discount tickets are only a 30% discount in the crowded seasons like at year-end and the new-year holidays, but are 70% or more in slow seasons like mid-Dec. or mid-Jan.

Now we have collected the prices of flights departing from metropolitan cities to rural cities. By the way, many Japanese travel from metropolitan cities to rural cities at the end of Dec. Then, travelers come back from rural cities to metropolitan cities in the beginning of Jan. This causes an underestimation for prices in Jan. due to only detecting cheap vacant flights and not crowded flights with representative prices. Considering this, we will introduce the price collection of flights departing from rural cities to metropolitan cities for half of the surveyed flights. It should be noted that this will change along with the seasonal pattern of price indices.

To address the need to collect many prices data to compile the price index of airline fees, we have started the simplified web-scraping method to collect the airline fees. However, on some airline carriers' websites, we sometimes found irrelevant data such as the prices for tickets that couldn't be used to board, because those prices were for expired reservations. We carefully exclude such prices that are not suited for being included in our index.

#### **(4) Paper magazines (COICOP 09.5.2)**

We compile the paper magazine price indices by weighted arithmetic mean of major brands. We have allocated the weights based on the number of publications by brand of magazine. However since there are reliable data on the number of publications by category, we will change to allocate it based on that of category in the 2015 revision. We will also refresh survey categories.

It should be noted that digital-magazines might be included in "digital content". But we don't include digital-magazine prices into digital content price indices because they still have only a small market in 2015<sup>9</sup>. If the digital-magazine markets grows in the future, we will consider adding it into the indices.

#### **(5) Package holidays to foreign countries (COICOP 09.6)**

We compile the price index of package holidays by weighted arithmetic mean of each major

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<sup>9</sup> Digital "books" including novels and comics will be included in the price indices of digital content in the 2015 revision.

destination indices; those are compiled by weighted arithmetic mean of specific tours which packaged hotels and airline fees provided by multiple travel agencies. We select 6 major destinations with weights on the number of Japanese travelers.

We have allocated the weights based on travelers including persons traveling for business. However, we will change the weights and refresh the destination based on an estimation for the number of sightseeing travelers. It should be noted that this will change along with the seasonal pattern of price indices.

#### **(6) Restaurants and cafes (COICOP 11.1.1)**

We reviewed services for restaurants and cafes in this base revision. However, it was somewhat difficult to identify expanding and shrinking services in recent years by the Family Income and Expenditure Survey. In this survey, some respondents roughly report “lunch”, “dinner” despite the fact that we ask them what foods they ate for lunch or dinner in restaurants. Difficulties like these occur. We review various data on supply side statistics and identify expanding and shrinking services. We also check the items whose weights are relatively large and consider dividing those items. We will add 4 items to the survey and delete 2 items in this category. For example, including “cafes provided by self-services” may reflect the gradual increase of major cafes chains throughout Japan. For improving the accuracy of price indices related to bar expenditures, we will divide the item “beer provided by pubs” to 2 items of “beer provided by pubs” and “grilled chicken on a stick”<sup>10</sup> provided by pubs”.

Allocations of weighting will also be revised.

#### **(7) Brand-name handbags (COICOP 12.3.2)**

When we compile the price index of brand-name handbags, we have selected only 1 major commodity to check the price movements. However, this item has relatively large weight and there are many kinds of brand-name handbags. So, we decided to check multiple brand-name handbags. Because there are large price differences among each brand-name bag, it is not suitable to use the Dutot index for averaging the price. We also decided to introduce the Jevons index for calculating price indices of brand-name handbags.

We will continue to treat the unit price as the same all over the country and also check the prices on the internet because it seems that there are no price differences among outlets and districts.

#### **(8) Insurance connected with the motor cars<sup>11</sup> (COICOP 12.5.4)**

We compiled the price index of motor cars insurance by weighted arithmetic mean of fees indices

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<sup>10</sup> “Yakitori”, grilled chicken on a stick, is one of the most popular foods served with alcohol provided by many Japanese style pubs.

<sup>11</sup> We have reflected this issue for current CPI since the price change in Oct. 2015.

which are contracted under various conditions. Insurance fees depend on the length of driving experience, driver's age, experience of accidents, and car type. We ask the insurance company to estimate the insurance fees in each case because each insurance fee is confidential.

We had set the model cases depending mainly on the driver's age, and there was a little variety for other factors. We changed to set multiple model cases regarding various factors for improving indices.

## **5. Simplified items by review**

Unfortunately, we have limited resources for compiling indices. So, we have to review to determine if we make too many compiling estimation methods for items with a smaller influence on the total CPI. If we judge that this is the case, we should decide to simplify the compiling estimation methods for such items.

### **(1) Fees for administrative certificates (COICOP 12.7)**

For administrative certificates fees, we have collected two services on all surveyed municipalities. We checked time-series movements on these two fees, and it was clear that these items had high price correlation perhaps due to these two services having the same price maker, the local government. So we decided to collect only one target fee on all surveyed municipalities since the 2015 base revision.

### **(2) Admission fees for sports stadium<sup>12</sup> (COICOP 09.4.1)**

We collected the admission fees of multiple stadiums for soccer and baseball.

We introduced the soccer price index to CPI in the 1995 revision. In 1992, the professional soccer league established and they expected that the expenditures of sports stadiums would increase. Because of this, we decided to introduce precise estimation for these items at that time. However, the expenditures for the sports stadium haven't increased in the last 20 years and still have low weights. So we decided to simplify the estimation method and collect only one stadium fee for each item.

### **(3) Refuse collection for recycling durables<sup>13</sup> (COICOP 04.4.2)**

In Japan, households must pay fees when they dispose of some durables for the purpose of recycling. We introduced the model considering the disposal of multiple items and multiple makers of refuse durables. However, there are no price differences among makers, so we decided to simplify the estimation to collect the fees of one representative maker.

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<sup>12</sup> We have reflected this issue for current CPI since Jan. 2015.

<sup>13</sup> We have reflected this issue for current CPI since Jan. 2015.

## **6. Items not changed in this revision**

### **(1) Accommodation services of hotels and inns (COICOP 11.2)**

Indices of accommodation services are compiled by asking owners of hotels and inns directly for their prices. The weights are allocated by estimation of customers whose purpose of travel is sightseeing or personal. This will be updated in this base revision.

On the other hand, this method of survey is not efficient and it is difficult to expand the sample size. The number of people who reserve and pay for hotels and inns on the internet is increasing, so we recognize price collection on the internet would be very efficient for this item. We are considering how to introduce checking prices on the internet for purchases of some items like accommodation services. Now we plan to pilot the collection of prices on internet purchases from Aug. 2016 to Jan. 2017.

(Refer to the following Japanese site: <http://www.stat.go.jp/info/kenkyu/cpi/giji005.htm> )

We also are considering how to weigh purchases on the internet. We have been conducting two household budget surveys. One is the monthly simplified survey and the other is a large detailed survey conducted every 5 years. In 2015, 3% of total consumption expenditures were ordered on the internet; and about 20% of travel expenditures were ordered/reserved on the internet according to these surveys.

### **(2) Housing rents (COICOP04.1)**

Japanese indices of housing rents have been discussed. In the 2015 Ottawa Group Meeting, Tsukamoto (2015) analyzed how the years of construction of the rented dwellings supplied in the rental market in Japan relate to the contract rent levels and how the relationship changes between the times of observations. We are investigating how to improve those indices, and we will strive to provide the research results by the 2017 fiscal year.

### **(3) Inter-city high speed expresses railway fees (COICOP07.3.1)**

We survey the fees of regular tickets for multiple Shinkansen<sup>14</sup> trains. We compile this price index by weighted arithmetic mean of fees indices by line.

We reviewed introducing e-tickets provided by railway companies, since they have been recently providing some discount e-tickets. We roughly estimated the e-tickets share, but we couldn't specify precise share data because they are highly commercially sensitive data for railway companies. We also checked time-series movements but there are little differences between price movements of regular tickets and those of discount e-tickets except for the level of prices.

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<sup>14</sup> "Shinkansen" is the inter-city high speed express railway in Japan. It transports many passengers at about 300km/h and has networks covering the main cities throughout Japan.

At the 2015 revision, we concluded that there was no need to include e-tickets into price indices and there would be little influence on the price index if it was included. That said, we will continue to watch that market for future improvements.

#### **(4) Financial services of banks (COICOP12.6.2)**

Financial assets of Japanese households consisted of 63% deposits to banks, 21% insurance, and 15% securities at the end of Nov. 2014. In the COICOP12.6.2 (that means financial services excluding Insurance and FISIM), “actual charges for the financial services of banks” is the most important service for households in Japan.

We have been compiling the price indices of “charges for transfer on banks”. We set multiple model cases on transferred amount, internet or ATM, etc., then price indices were compiled by the arithmetic mean of each fee.

In addition, FISIM is not accounted for in Japanese CPI but rather, in the Japanese SNA.

### **7. Summary**

In the 2015 revision of Japanese CPI, we will update procedures for calculating difficult-to-measure products and services as well as revise weights. For revising Japanese CPI, we analyzed changes for pricing mechanisms and consumption composition in the Japanese economy. Also we reviewed the calculating method for difficult-to-measure products and services, and investigated how to improve these methods.

From the viewpoint of reflecting the shrinking size of households and the aging progress, we will conduct minor updates to compiling price indices for Electricity, Gas supply, Water supply, Cinema admissions and Nutritional supplementary foods. For reflecting the increase in female workers with young children, we will improve the compiling method of Nursery fees index. As for the introduction of IT, we will improve the Cellphone fees index and start to compile a Digital content index. The expanding of awareness for preparing for huge disasters has caused us to introduce the Earthquake insurance index.

We also will improve the methods for some price indices, such as Airline fees, Package holidays, Motor cars insurance, etc.

We will continue to watch the changing markets conditions, and if necessary, we will improve the methods in a timely manner.

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