



Intersecretariat Working Group on Price Statistics

Consumer Price Index: Business Continuity Guidance

1. Background

The outbreak of COVID-19 (Coronavirus) and measures implemented to limit its spread have impacted the routine compilation and dissemination of consumer price indices (CPI). In particular, the collection of prices has become increasingly difficult because of the restrictions on movement. Issues and challenges include increased numbers of missing items in sampled outlets, the temporary closure of retail outlets, and reduced number of transactions. For many national statistical organizations (NSOs), staff are working remotely, and data collectors are being asked to remain at home. Annex I provides an overview of issues to consider when preparing for remote work.

The COVID-19 crisis presents unique challenges to the continued collection of prices. CPI programs should remain dynamic and flexible in order to adapt to the ever-changing situation and ensure the continued dissemination of a reliable index, while ensuring that collection activities do not contravene emergency rules and/or recommendations issued by authorities and do not place staff at risk.

This note provides guidance to NSOs on the alternative data collection methods, the treatment of missing prices to ensure the continued compilation and dissemination of the CPI, and the publication of the index. Individual country circumstances will drive decisions on which method may be most appropriate. It will be updated as needed to reflect future developments and country experiences.

2. Data collection

Under the present circumstances, routine price collection can fail because of restrictions that do not allow price collectors to visit sampled outlets, because outlets have either closed or because it is impossible to offer certain services (e.g. flights, hotels, package holidays, etc.). As a general principle, every effort should be made to replace missing price observations with price quotes obtained from other sources.

Below are suggestions to deal with the current challenges for collecting prices:

- **Collecting prices from outlets selling food and other essential items that remain open**
Outlets selling essential items such as food, medicine, medical supplies, and petrol remain open. In lieu of in-store collection, prices can be collected using alternative methods, including:

- **Outlets' website:** If the outlet has an online presence, prices could be collected via the internet in lieu of collecting prices in person. In some cases, outlets that have closed their physical locations continue to sell their products via their websites. Prices from websites should be used only if the products are readily available for purchase at displayed prices. The prices collected online can be compared directly to those collected in person in the previous month.
- **Email and/or telephone:** If the outlet does not have an online presence or if the sampled varieties are not available online, prices could be collected by email or phone. While generally not ideal for collecting prices because of increased respondent burden, these methods can be employed temporarily. The preferred mode and timing for reporting can be agreed with the respondent.
- **In-person collection:** In some cases, data collectors and CPI staff collect available prices when doing their personal shopping. While normally not considered a best practice, data collectors and CPI staff ask friends and relatives to report the prices of sampled varieties while they do their personal shopping. Data collection forms are used to collect the prices and the data are validated by CPI staff to ensure reliability. Extreme care must be taken to ensure the reliability of the price data.
- **Newspaper advertisements:** Supermarkets and other sampled outlets may advertise prices of selected items in newspapers and other published circulars. Care must be taken to ensure that the advertised price not only refers to a sampled variety, but also reflects the detailed variety specification.
- **Scanner data:** Some NSOs may have access to scanner data that, although not yet integrated into the CPI production system, could be used for the replacement of the missing prices. However, the replacements using scanner data should be done with care as this could entail a change of outlet to a different category or market segment.
- **Restaurants and cafes –** In many areas, restaurants and cafes are closing their sit-down dining services and offering only delivery or take-away services. In some cases, the menus for these delivery and take-away items are available online or can be collected via phone or email. However, the prices for delivery or take-away services should only be used if the outlet is providing this type of service during the lockdown. If the outlet is not open for business, the online prices should not be used and the sampled varieties should be treated as temporarily missing. It is important to determine whether the take-away or delivery services provided by the restaurant are a reasonable substitute for the sit-down dining services. For example, if a restaurant normally serving steaks and seafood now sells only pizza for take-away and delivery, this would not be considered as replacements and the prices normally collected should be considered temporarily missing and imputed. Alternatively, if the restaurant or café is providing roughly the same types of food, but on a more limited basis, these prices for delivery and take-away could be considered comparable replacements. If considered non-comparable,

the usual replacement and quality adjustment methods can be applied, as outline in Chapter 6 of *Consumer Price Index Manual: Concepts and Practice*¹.

- **Airlines and hotels** – Many airlines and hotels have temporarily ceased operations, and in several countries, airports have been closed until further notice. Different methods are used when collecting prices for airlines and hotels. Depending upon which method is used will guide the treatment of these prices.

One approach uses the prices paid for airline and hotel services in the month that the expenditure is made, without any consideration of when the service is delivered.

An alternative approach is to use airline and hotel prices for CPI compilation in the month that the service is provided, even if these prices have been collected in advance. For example, prices are collected in advance for airline services provided during March, and those prices are then used in the calculation of the March index. Another method is to collect data on revenue per passenger by class of service for pre-defined routes. This approach takes into account all of the different fares paid for a single route, as well as all fees paid, in the month the service is delivered. One advantage of this method is that it would reflect any fees paid to change travel dates. However, the use of this method depends entirely upon whether the airline provides these data.

Many countries use travel agents to collect the prices of airline tickets, package holidays, and hotel bookings. With the closure of travel agents, prices can be collected online using the defined specifications. For example, London to Male, Maldives, two-week advanced purchase, economy class, 1 passenger. It is possible to enter these details into the airline's website and collect a price for that ticket. While it is very likely that the travel will not occur in two weeks given the current circumstances, the acquisitions approach does not depend on the time of the delivery of the service and because a price is available for collection in the current month, it can be used in the CPI. This method would not capture the fees, if any, passengers currently pay to exchange tickets for travel today for travel at a future date.

In the case where airline and hotel prices enter the CPI compilation in the month that the corresponding services are provided, and lockdown measures currently prevent these services to be provided, the prices collected in advance cannot be used. If an airline is closed, it will not be possible to collect the data needed to calculate the revenue per passenger from the airline. In these cases, the prices should be treated as temporarily missing and imputed using one of the methods described in Section 3.2 below.

Whichever alternative means of collection are used, it is important to work closely with respondents to identify the preferred method for reporting and the timing, especially if collecting via phone. NSOs should make greater effort to communicate with retailers and service providers to stress the importance of their continued cooperation and their critical role in the dissemination of a reliable index.

¹ Hereafter referred to as the Manual.

Prices collected during part of the month can be used to impute prices not collected in other parts of the month. For example, if data collectors are able to physically collect prices for the first week of the month and not during later weeks, the prices collected during the first week are used as the basis for imputing the prices of those varieties that should have been collected later in the month.

If none of these replacement solutions are possible, the variety has to be treated as a temporarily missing and an imputation needs to be done. In such a case, the imputation should follow one of the procedures described in the next section.

3. Imputation and index calculation

To the extent possible, calculations and imputations should follow the methods provided in the Manual. Methods should be self-correcting to ensure the index reaches the correct level when again it becomes possible to collect prices and include them in the index. This is important so that the CPI continues to provide a reliable estimate of price change. The CPI is a critical input to economic policy making, particularly during periods of economic uncertainty. Also, methods and procedures must be documented to assist continuing production of the CPI and for information of users.

Many countries have a limit on the number of periods a non-seasonal variety can be considered temporarily missing before asking a data collector to select a replacement variety. For example, a number of NSOs allow a non-seasonal variety to be missing for three months. In the third month, a replacement variety is identified, and price collection begins for that new variety. It may be necessary to consider relaxing these rules given the current circumstances.

3.1 Imputation for products that are available in the market

In those cases where prices could not be collected but products continue to be transacted, a price must be imputed. In practice, the imputed price is obtained by multiplying the price collected in the previous period with an appropriate price change.

The recommendation is to impute the missing prices using the price changes of similar products or of the nearest higher aggregate ('nearest aggregate estimation'). This approach is analogous to the one used to impute price changes of seasonal products when they are out-of-season. It is based on the idea that such products and product groups can be considered the closest substitutes for the non-available products; and they are therefore next to each other in the classification structure used for the CPI.

For example, it may be possible to collect prices of the same or similar commodities in other outlets or other areas of the country, on which to base the imputation. The prices of missing varieties should be imputed by multiplying the previous period price with the average price change of the available varieties of the same elementary aggregate. If an entire elementary aggregate is missing, its prices should be imputed based on the average price change of similar elementary aggregates or the nearest available higher-level price index.

To illustrate this imputation approach, consider a class for which one out of three subclasses is missing. The monthly price change is first compiled using subclasses 1 and 2 which are available: $103.25/101.83 - 1 = 1.39\%$. This monthly rate of change is then used to impute the index of subclass 3: $105.00 * 1.0139 = 106.46$. Note that the monthly rate of change at the level of the class is the same as the monthly rate of change of the two subclasses that are available. This shows that the imputation of the

missing subclass indices by its parent class index is equivalent to restricting the calculations for the class index only to its underlying available subclasses.

Table 1: Imputation using next level up in aggregation

	Weight	Index 100=2019-12			monthly change in April 2020
		2019-12	2020-03	2020-04	
Subclass 1	0.50%	100.00	103.00	105.00	1.94%
Subclass 2	0.70%	100.00	101.00	102.00	0.99%
Subclasses 1 and 2			101.83	103.25	1.39%
Subclass 3	1.20%	100.00	105.00	106.46	1.39%
Class	2.40%	100.00	103.42	104.86	1.39%

Source: Eurostat, *Guidance on the Compilation of the HICP in the Context of the COVID-19 Crisis*, April 3, 2020.

While normally not recommended or considered best practice, as a last resort, prices could be kept constant from the previous month (i.e. imputing no price change). For further discussion, see under “Carry forward” in section 3.2.2 below.

3.2 Imputation for products where there are no transactions

The guidance provided in the previous section applies to situations where there is still consumption expenditure, but it is difficult or impossible to observe prices. The methods proposed are similar to usual imputation procedures when products are temporarily missing.

In the COVID-19 crisis, however, there are large segments of consumption expenditure that no longer take place due to national restrictions. Examples are travel related services (e.g. flights, hotels, package holidays), personal services (e.g. hairdressers) and cultural and sporting services. The imputation techniques discussed in the previous section may not apply here.

In such cases, choices regarding imputations must be made on a case-by-case basis. One approach consists in applying the standard imputation methods described in the previous section. Using established methods for imputation avoids affecting credibility issues that could result from implementing methods not normally used. However, another view is that if there is no appropriate price or higher-level aggregate to use for imputation because no similar commodity is transacted, these methods may not be suitable. Although there is no optimal method for this situation, alternative imputation methods are described below. Countries will need to decide on the best approach given their circumstances.

3.2.1 Impute with all items CPI

Missing elementary aggregates could be imputed by the all items index calculated using the price movements of those sub-indices for which there are data. First, all sub-indices which have been calculated based on a majority of observed prices are used to compile the all item index. Second, the short-term change of the all items index is then used as the basis for imputing the missing indexes. This may be the preferred option if households' expenditures on an elementary aggregate is assessed to be

zero or close to zero. Imputation with the all items CPI corresponds to leaving the elementary aggregate out of the calculation of the CPI.

In this approach, the same monthly price change of the all items CPI is used to estimate the monthly price change for elementary aggregates for which there are no transactions. The advantage of this approach is that, if applied to all sub-indices for which there is no market, the monthly price change of the all-items index is driven only by the price changes of those sub-indices compiled based on observed prices. In that sense, this imputation rule is neutral to the monthly price change at the all-items level.

The decision on which of these methods to use will depend upon current practice, capacity to adjust current index calculation systems, and the intended use of the index. For some countries, for example, the index should reflect only observed prices. In this case, it makes sense to impute missing indexes using the all items index directly. For others, imputations based on the next level up in aggregation reflect current compilation and calculation practices.

3.2.2 Carry Forward

Under normal circumstances, carrying forward or repeating the last available price is not recommended or considered best practice; however, given the need to balance practical constraints with the importance of meeting dissemination deadlines, carrying forward the previous period price could be considered a last resort option. Although carry forward is a transparent method that is easy to explain, its use will make the index converge towards no price change. Unlike the imputation method based on reliable sub-indices, the carry forward method is not neutral to the monthly price change at the all-items level. The more sub-indices are imputed with carry forward, the more the all-items monthly price change converges to zero.

In duly justified circumstances, the last observed price could be repeated or carried forward. For example, for some products (e.g. social or cultural services), where there is reasonable expectation that their prices will be the same once the situation returns to normal, carry forward could be considered.

3.3 Products with strong seasonal price variation

For products with pronounced seasonal patterns (e.g. accommodation services, flights, package holidays, etc.) two options could be considered.

One option is to treat this as any other product and base the imputation on the short-term monthly change using one of the methods described above. Using this method would reflect current circumstances but does not preserve the seasonal pattern and distorts the annual rate of change.

A second option is to impute prices so that the seasonal pattern of the series is preserved. The imputation could be based on the annual rate of change observed for other products. A variant would be to estimate the monthly change of the seasonal index using the monthly change of the same index observed one year ago, or, if possible, using seasonal factors estimated with an econometric model. The objective of these methods is to avoid overly distorting the annual rates of change for these products.

NSOs should carefully consider both options and decide based on their circumstances and whether it is more important to reflect the current situation or preserve the seasonal patterns of the series. In the example below, accommodation services are missing in April 2020. Table 2 illustrates each of the different methods that could be used to impute this missing index.

Table 2: Imputation for items with strong seasonal pricing patterns

	2019		2020	
	March	April	March	April
All-items excl. accommodation services	100.0	100.5	102.0	103.5
<i>Monthly rate of change</i>				1.5%
<i>Annual rate of change</i>				3.0%
Option 1: Imputing with the monthly rate of change of all items excl. accommodation services				
				101.0*
				103.5/102.0
Accommodation services	100.0	112.0	101.0	= 102.5
<i>Monthly rate of change</i>				1.5%
<i>Annual rate of change</i>				-8.5%
Option 2a : Imputing with the annual rate of change of all items excl. accommodation services				
				112.0*
				103.5/100.5
Accommodation services	100.0	112.0	101.0	= 115.3
<i>Monthly rate of change</i>				14.2%
<i>Annual rate of change</i>				3.0%
Option 2b: Imputing with the monthly rate of change of accommodation services one year ago				
				101.0*
				112.0/100.0
Accommodation services	100.0	112.0	101.0	= 113.1
<i>Monthly rate of change</i>				12.0%
<i>Annual rate of change</i>				1.0%

4. Other Issues

4.1 Regional indices

For regional indexes, missing prices within each region should be imputed using the available prices and indices within the region following one of the approaches discussed above. If an entire region is missing, the missing regional index could be imputed using the all items index at the national level as the basis for making the imputation. Alternatively, the missing regional index can be imputed using the relative change of a neighboring or similar region.

4.2 Weights

CPI weights are fixed for a defined period of one, two, or more years. The CPI sub-indices are aggregated using weights reflecting the household consumption expenditure patterns from a household expenditure survey or the national accounts. Most NSOs follow a regular schedule for updating index weights. When the weights are updated, they are kept fixed throughout the period. While COVID-19 has affected expenditure patterns, current expenditure data are not available, and ad hoc adjustments to the weighting structure are therefore not recommended. Ad hoc weight adjustments are not consistent with the fixed basket approach used as the basis for compiling consumer price indexes.

4.3 Seasonal products

To the extent possible, prices missing due to seasonal factors should be treated as they normally are. Prices of out of season products should be imputed using one of the imputation methods described in Chapter 11 of the Manual.

5. Publication

Users will continue to need data at the most detailed level. All indexes should continue to be published, even if they are imputed. All imputed indexes should be flagged and clearly noted for users. It is important for transparency that users can access the full set of data that are normally disseminated.

Metadata on the number of missing and imputed prices is considered a best practice. These data are especially important given the current circumstances as they will enhance transparency and build user confidence. It could be useful if the NSO would identify the number of collected versus imputed prices for each major group or to identify the proportion of the weights that are impacted by imputations. When reporting the number of prices imputed, one must consider the characteristics of the different data sources because the number of prices collected in the field may not be comparable to the number of prices included in scanner data, web scraped data, or administrative data. For purposes of transparency, it would also be important to identify the number of closed versus open outlets. Finally, the metadata should describe what methods have been implemented to collect all available prices and impute missing prices. These metadata should be made available to users on demand and posted on the NSO website.

When disseminating the index, it is important to flag those indexes with significant imputations resulting from COVID-19 restrictions and temporary closures. Significant imputations imply lower quality and users should be made aware of these issues. The flagging can also facilitate the calculation of analytical index aggregates, which could help users to further assess the impact of COVID-19.

For more information, please see the following resources:

CPI Manual: <https://www.imf.org/en/Data/Statistics/cpi-manual>

Eurostat: https://ec.europa.eu/eurostat/documents/10186/10693286/HICP_guidance.pdf

ILO: <https://ilostat.ilo.org/topics/covid-19/> (and https://ilo.org/wcmsp5/groups/public/---dgreports/---stat/documents/publication/wcms_742968.pdf)

IMF: <https://www.imf.org/en/Publications/SPROLLs/covid19-special-notes#stats>

OECD: <https://community.oecd.org/community/official-stats-workspace-covid19>

UNECE: <https://statswiki.unece.org/x/roKSE>

Annex I: Issues to Consider – Preparing to Work Remotely

A number of NSOs have begun to work remotely as part of broader efforts to limit the spread of COVID-19. Individual country circumstances will dictate remote work arrangements in practice. NSOs should develop plans to support working remotely to ensure continued dissemination of the CPI. Country-specific circumstances with regard to staff and budgetary resources will drive decisions regarding plans to work remotely.

Some issues to consider include:

- Laptops – staff will require access to laptops to allow them to work from home
- Software – laptops should be equipped with any necessary software to support CPI compilation
- Data security – protocols developed to ensure CPI data remain secure and confidentiality (prices and respondents) not at risk.
- Designation of key staff (limited) needed to access headquarters to process and release the index.
- Some countries compile the CPI using Excel or some other spreadsheet. Protocols should be developed to ensure final worksheets are shared with more than one staff to limit any problems resulting from equipment failure or illness if only one staff has access.
- Data release – develop protocols for the remote approval and dissemination of data releases.
- Establish channels for communication – organize a messenger group (for example, WhatsApp, Viber, etc.) for CPI staff to communicate.

For those NSOs that do not have the capacity to connect to IT systems remotely from home, CPI compilation would be affected and, in these cases, Excel or similar spreadsheets can be used as a temporary solution. Staff can develop spreadsheets that will compile the CPI from home. Once staff return to the office, the data can be entered into the IT system and normal compilation procedures would continue.

In those cases where index compilation is not possible, it will be important to continue collecting all available prices as described above. These prices can be used to compile the index once staff return to the office and have access to the IT systems. This will ensure index continuity and minimize any disruptions to the CPI dissemination schedule.