

## Methodological note

# GUIDANCE ON THE COMPILATION OF THE HICP IN THE CONTEXT OF THE COVID-19 CRISIS

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## 1. Background

The COVID-19 outbreak in Europe has led governments to impose several measures, such as restrictions in the movement of people and the closure of outlets, which have a direct or indirect impact on household consumption and thus consumer price indices. In particular, the situation has negatively affected the collection of prices that are needed to compile the harmonised index of consumer prices (HICP). Eurostat and the national statistical institutes (NSIs) in the EU are committed to continue the dissemination of HICP data to the best of their abilities.

Eurostat is monitoring the situation in close contact with the Member States' NSIs. In a number of countries, field price collection has become impossible either because the statistical office stopped it or because shops are closed. Member States are encouraged to replace field price collection by online and other sources of information, such as scanner data, where possible. For products that are no longer offered to consumers, the prices are to be replaced by imputations in the HICP.

This note describes the guidance to NSIs on the replacement and imputation techniques to be used with the aim to have, to the maximum extent possible, a harmonised approach across EU Member States. It will be updated when needed, in the light of any future developments.

## 2. General principles

The compilation of the HICP in the context of the COVID-19 crisis is guided by the following three principles:

- Stability of the HICP weights,
- Compilation of indices covering the full structure of the European version of the Classification of Individual Consumption According to Purpose (ECOICOP),
- Minimizing the number of imputed prices and sub-indices.

The first principle ensures that there will be no change in the sub-index weights used in the compilation of the HICP during the year, which is the standard practice. The HICP sub-indices are aggregated using weights reflecting the household consumption expenditure patterns of the previous year. The HICP weights are updated at the beginning of each year and are kept

constant throughout the year. Thus, the weights will not change this year as a result of the impact of the COVID-19 on expenditures.

The second principle means that all sub-indices for the full ECOICOP structure will be compiled even when for some categories no products are available on the market. In such cases prices do not exist and they should be replaced with imputed prices. Sub-indices consisting of both imputations and observed prices should be compiled and aggregated using the standard HICP compilation procedures.

Finally, the third principle underlines the idea that, whenever possible, missing price observations should be replaced by price quotes obtained from other sources. Price collection can fail because of restrictions that do not allow price collectors to visit sampled outlets, because outlets have been closed down or because it is impossible to offer certain services (e.g. flights). Possible sources to replace the missing prices in case manual price collection activities are restricted are the following:

- Outlets' websites,
- Telephone and email enquiries.

Some NSIs may also have access to scanner data that, although not yet integrated into the HICP 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.

In the case where the outlets have physically closed their doors the internet and on-line trade may also be sources for the temporary replacement of missing prices. In this situation, consumers may have the possibility to continue purchasing the same products using online platforms or from the websites of outlets that have closed their physical outlets. In such cases, prices from websites should be used only if the products are possible to be purchased at displayed prices.

However, if none of these replacement solutions are possible, the product-offer has to be treated as a missing product and an imputation needs to be done. In such a case, the imputation should follow one of the procedures described in the next sections.

### **3. Imputation rules for products that are available in the market**

In those cases where prices cannot be replaced but products continue to be transacted, a price must be imputed. In practice, the imputed price is obtained by multiplying the previously collected price 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 HICP.

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 product-offers should be imputed by multiplying the previous price with the average price change of the available product-offers 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.

If an entire ECOICOP sub-index cannot be observed due to limitations on price collection, one should impute with the price change of the sub-index of the nearest higher aggregate in the classification. For example, imputations for a subclass could be based on the next class to which the subclass belongs.

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 only subclasses 1 and 2:  $103.25/101.83-1=1.39\%$ . 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.

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

As a last option, prices can be kept constant from the previous month (i.e. imputing no price change). For further discussion, see under “Carry forward” in section 4.2.

## 4. Imputation rules for products that are not transacted anymore

The guidance provided in the previous section applies to situations where there is still consumption expenditure, but it is difficult or impossible to observe the 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), cultural and sporting services, etc. 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. However, if there is no appropriate price or higher-level aggregate to use for imputation, these methods may not be suitable anymore.

Although there is no optimal method for this situation, the following two alternative approaches are discussed below.

1. Impute with all reliable price indices,
2. Carry forward.

### 4.1. IMPUTE WITH ALL RELIABLE PRICE INDICES

An index based on all reliably estimated sub-indices, for which products are available on market and a sufficient number of prices were observed, could be used as a basis for imputation. In practice, the ECOICOP categories (5-digit subclasses) considered to be reliable (e.g. imputed

for less than 50% of its weight) need to be identified. The aggregate monthly price change of these categories is used to estimate the monthly price change for a subclass for which no better imputation could be made.

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 all reliable sub-indices. In that sense, this imputation rule is neutral to the monthly price change at the all-items level. Moreover, it is consistent with the principle that the HICP should only be based on observed prices. The same monthly rate of change derived from all the reliable sub-indices will be assigned to the missing sub-indices.

It should also be noted that the aggregate of reliable sub-indices may consist of only a limited number of product categories, including some that may exhibit increased volatility such as food and energy. The impact of these categories will be transmitted to other parts of the basket and thus amplified.

## 4.2. CARRY FORWARD

An alternative way of imputing the missing prices is to carry forward the last observed prices. 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, it may be reasonable to carry forward the last observed prices. For example, for some products (e.g. social or cultural services), where there are reasons to expect that their prices will be the same once the situation will revert back to normal, carry forward is an acceptable imputation method.

Carry forward may also be applied by some countries if it is not possible to implement the more advanced imputation approach described under 4.2.

## 5. Series with seasonal patterns

The prices of some products are known to follow pronounced seasonal patterns. Examples are flights, package holidays, or accommodation services. When no transactions of such products are taking place (cf. the situation in section 4), NSIs should ensure that the imputations do not break the seasonal pattern of the series. The annual rates of change of the respective sub-indices could be severely impacted by non-respecting the seasonal pattern of the series. If the weight of the sub-index is important, this could also distort the annual rates of the higher level aggregates, including the all-items index. A consequence of repeating past seasonal behaviour is that the monthly price changes during the COVID-19 crisis will reflect market developments seen under normal circumstances.

In practice, the following options can be considered:

1. Impute with the annual rate of change of all reliable price indices,
2. Carry forward with a seasonal correction factor.

### 5.1. IMPUTE WITH THE ANNUAL RATE OF CHANGE OF ALL RELIABLE PRICE INDICES

The estimation with the monthly price change of all reliable price indices (cf. section 4.1) will not properly capture the seasonality. Therefore, for products with prices that follow a seasonal pattern, it is preferable to adjust the imputation method by applying the annual rate of change of all reliable price indices to the prices observed one year ago. For example, the yearly price

change between April 2019 and April 2020 of an index derived from reliable price indices corresponds to +1.0%. The prices for, say flights, for April 2020 are then obtained by multiplying the prices for flights of April 2019 with 1.01.

## 5.2. CARRY FORWARD WITH A SEASONAL CORRECTION FACTOR

Assuming that seasonal factors have been estimated using an econometric model, the imputed prices are obtained by multiplying the prices of the previous month with these seasonal factors. For example, based on a time series spanning over several years, the seasonal factor for flights for the month of March is estimated to be 0.9 and for the month of April is estimated to be 1.3. The prices of April 2020 can be obtained by multiplying the prices of March 2020 with  $1.3/0.9=1.44$ . As this approach ignores any trend in price, this imputation method essentially corresponds to a carry forward approach adjusted by the seasonality of the index.

If seasonal factors are not available, an easier solution is to apply the monthly price change observed one year ago. For example, the monthly price change between March 2019 and April 2019 for flights was +5%. The prices for April 2020 are then obtained by multiplying the prices of March 2020 with 1.05.

The prices for flights, package holidays and accommodation services are often collected in advance. In the current circumstances, it may happen that, although a price has been collected, the service may eventually not be supplied. It is preferable to treat this as a missing product and impute a price using any of the techniques outlined above.

## 6. Flagging of estimated sub-indices

In order to provide information on the impact of the COVID-19 crisis on the HICP, NSIs will flag indices that are considered having lower than usual quality. The flagging can also facilitate the calculation of analytical HICP aggregates, which could help users to further assess the impact.

In particular, any sub-index that is based on a significant number of imputed prices will be flagged using the 'u' flag (low reliability). The flag will be shown in Eurostat's database next to the sub-index value so that users are made aware of the low reliability. The 'u' flag is used when the share of imputations for an aggregate exceeds 50%. As outlined in section 2, all sub-indices – also those flagged – will be used in the calculations of the higher-level aggregates, including the all-items index.

Eurostat and the Member States will provide, in additional tables, information on the extent and methods of imputation for each flagged sub-index.