



## Methodological information – Impact of COVID-19 on the compilation of the consumer price indices in April 2020

### Summary

The extensive restrictions on public life to contain COVID-19 also affected the calculation of the consumer price index in April 2020. Some of the prices could not be collected as usual and were therefore replaced or imputed. Different methods and approaches were used to compensate for the survey failures and to limit their impact on the inflation rate.

This document provides detailed information on the principles, approaches and methods used to compensate for missing prices and the extent of data imputations required. It allows users of consumer price statistics to better interpret the development of the individual sub-indices of the consumer price index and to assess their impact on the overall index.

In total, measured by their weight, around 26% of the prices to be collected for goods and services for private consumption were affected by survey failures in April and had to be imputed using internationally accepted methods.

For the main expenditure group "Food and non-alcoholic beverages" (11.2% weight in the the CPI basket of goods), the price survey was completely replaced, since scanner data provided a good, alternative data source and could replace physical price collection in food shops and drugstores.

Among the most affected expenditure groups was "restaurants and hotels" (12.3% CPI weight), for which a share of approximately 93% of the prices had to be imputed due to the closure of businesses.

Other particularly affected, important groups were "culture and leisure" (11.3% weight; 48% imputed prices) and transport (13.1% weight; 24% imputed prices).

Questions regarding the topic are answered in the Directorate for Economics, Statistics Austria:  
Michaela MAIER, tel. +43 (1) 71128-7187 [michaela.maier@statistik.gv.at](mailto:michaela.maier@statistik.gv.at) , project management CPI  
Ingolf BÖTTCHER, tel. +43 (1) 71128-7917 [ingolf.boettcher@statistik.gv.at](mailto:ingolf.boettcher@statistik.gv.at) , head of price statistics

## 1 Background

The monthly price collection for the consumer price index is carried out in more than 3,500 shops and businesses in 19 index cities and regions and is supplemented by a central survey for a total of 768 different goods and services (market basket positions). To calculate the national consumer price index (CPI) and harmonized index of consumer prices (HICP) from the collected price data, a basket with a fixed weighting scheme, which is adjusted annually at the turn of the year in accordance with national and international requirements, is used.

### **Problems for the compilation of the consumer price index (CPI) caused by COVID-19 restrictions**

The challenges for calculating the consumer price index in the course of the COVID-19 crisis were manifold. On the one hand, a large part of the shops that are normally visited by the price collectors were closed. On the other hand, for security reasons, local price collectors were sometimes unable to personally collect prices in still open shops for health safety reasons. Furthermore, a number of services was not offered (such as personal services or cultural events) or were completely discontinued (such as air travel, hospitality and accommodation services).

The consumer price index is designed as a Laspeyres-type price index with a one-year fixed weighting scheme. It is therefore not possible to reduce the number of items in the basket of goods or to change the weighting of individual items and groups from one month to the other within a year. A number of methodological measures were therefore carried out to impute sub-indices for those goods and services that were not available or were only available to a limited extent in April.

### **European agreement on fundamental principles for the compilation of harmonised consumer price indices in the context of COVID-19**

Eurostat provided [RECOMMENDATIONS](#) for the compilation of harmonized indices of consumer prices (HICP) in the COVID-19 crisis, which were discussed and coordinated at a virtual meeting of European price statisticians in the HICP working group on March 25th. The guiding principles for the creation of the HICP, possible imputation procedures and changes to the transmission and publication process were agreed upon.

### **Principles/Guidelines**

Three principles set the methodological framework for the measures regarding possible problems that may arise from COVID-19 restrictions in individual countries for the calculation of HICP:

i. „Stability of HICP weights“: Weights of consumer price indices always refer to the private consumption of a whole year (for HICP approximately the previous year). The temporary elimination of entire consumer segments has no influence on the fundamental weighting scheme.

ii. „Stability of HVPI indices“: The continuity of all index series on which the consumer price index is based should be guaranteed. No index is abandoned. Appropriate imputation procedures and transparent labelling are carried out for indices regarding partially or completely eliminated consumption segments.

iii. „Minimization of the amount of price and sub-index imputations“: Missing price observations from manual price collection should, if possible, be replaced by price information from alternative sources. This is a clear principle that tries to ensure a consumer price index based on transaction prices as much as possible.

### **Fundamental measures for handling price collection problems**

Different methods and approaches were used to compensate for the price collection failures due to COVID-19 restrictions and to limit their impact on the inflation rate. Wherever possible, collection failures were compensated for using alternative collection methods and data sources. Missing price reports that still existed as well as sub-indices partially or completely affected by market failures had to be imputed using suitable procedures.

These measures comply with the principles agreed across Europe. Nevertheless, the consumer price indices published in April 2020 do not fully meet the usual standards. Mainly or fully imputed consumer price indices, which do not meet the desired quality standards, are labelled and footnoted in all publications, respectively.

## **2 Compensation of data collection failures through alternative price collection methods**

The restrictions on business activities due to the COVID-19 measures had hardly affected the price collection in March 2020, since the majority of the survey had already been completed on March 16, 2020. In April 2020, however, the planned price collections were in the week from 6-11 April 2020 and were therefore completely affected by the ordered business and operational closings.

### Switch to price collection via telephone or online research

Because of the branch closings, but also for health safety reasons, the regional price collection in April 2020 in shops and businesses was largely replaced by price collection methods via telephone or online. Prices from stores and businesses with closed outlets were still considered for price collection when they continued their offer and made their goods and services available to consumers online or by telephone. Prices previously collected on site were replaced with online prices from the website of the store/business. As a criterion for the price collection, it was specified that if the previously collected goods cannot be found online, the new online replacement-goods and their online prices (excluding delivery fee) should, if possible, differ only slightly from the previously collected goods and prices. Hereby, a significant part of the prices, especially for clothing, shoes and sporting goods, could be collected. Satisfactory price collection results were also possible for furniture and home textiles as well as for stationery and toys. For restaurants, on the other hand, there were insufficient numbers of companies in the business sample of the consumer price index that continued their offer by delivering food and beverages or by offering food pick up.

The central price collection, which is carried out by Statistics Austria each month for goods and services with uniform national prices (e.g. insurance) or with complex product characteristics (e.g. nursing homes, holiday package), is already based on surveys by telephone, email, fax and internet. As long as the shops and businesses were accessible and offered their services and goods to consumers, the price collection could continue to be carried out as usual.

### Switch to scanner data - food and drugstores

In addition to the classical methods of price collection, Statistics Austria has been receiving scanner data (cash register transaction data on individual products) from the largest food and drugstores on a regular basis every week since December 2019. So far, this data was only tested and had not been

used in ongoing statistical production processes. Due to the COVID 19 restrictions and the resulting difficulties in collecting data, it was decided to use of this new, alternative data source. For food and drugstores, rates of change were calculated based on scanner data to compile the indices for March 2020. To do so, a weighted, an average rate of change of the articles with the highest turn-over from March 2020 to April 2020 across all retailers was calculated at commodity group level, and afterwards applied to all physically recorded prices for the corresponding CPI basket of goods commodity group from March 2020.

#### Data validation with automatically collected price and article information - web scraping

In addition to the alternatively collected prices, web scraping data from the most important online retailers was used to check the plausibility of the prices for clothing. This was done primarily for analysis purposes and to check the surveys carried out in April by the regional price collectors. The web scraping prices were finally not used for index calculations.

### **3 Imputation methods for unusual price reports and market failures**

Imputation procedures were used for CPI basket of goods codes/commodity groups for which no regular or compensatory prices could be collected. Imputation procedures are used in price statistics to prevent a distorting influence of missing prices on the price indices. The imputation methods for the calculation of the consumer price index in April 2020 described below are in line with international standards<sup>1</sup> and Eurostat [RECOMMENDATIONS](#)<sup>2</sup>. Decisions about the application of imputation methods were based on predefined rules (see also diagram 1 on page 6).

The following imputation methods were applied:

**METHOD A: Imputation with price change rate within a code/CPI market basket position**  
(*Estimation based on available prices for the same product*)

This method was used when there were less than 50% of prices missing within one code/CPI basket commodity group. Missing prices were imputed by the applying the average rate of change of all non-missing prices within one code position.

**METHOD B: Carry forward of previous month's value**

For goods and services, which, based on an analysis of prices from previous years, show stable price patterns from March to April, prices from March were carried forward to April (in cases of more than 50% of prices were missing within the product group).

**METHOD C: Imputation with nearest higher aggregate**

For product groups where only few (<50%) or no prices were collected, the change rate of the nearest higher aggregate is used for data imputation. This way individual product groups are imputed based on price changes of similar goods (nearest higher aggregate: e.g. the price development of bananas is imputed using the rate of change of fruits).

---

<sup>1</sup> <https://statswiki.unece.org/display/CCD2/Compilation+of+CPI+in+times+of+COVID-19>

<sup>2</sup> All Eurostat Guidelines: <https://ec.europa.eu/eurostat/data/metadata/covid-19-support-for-statisticians>

**METHOD D: Imputation with overall index**

*(Estimation based on all reliable sub-indices – all item imputation)*

Instead of using the rate of change based on the nearest higher aggregate, the rate of change of the overall index is taken (compiled by using all reliable sub-indices that are not mainly relying on imputations). This method is used in cases where Method C is not appropriate, especially if:

- goods or services from the nearest higher aggregate differ too much from the goods or services within the product group to be imputed (e.g. imputing services with the price development of goods),
- the nearest higher aggregate consists of just one product code,
- all or most of the codes, forming the nearest higher aggregate, have been imputed already

**METHOD E: Imputation for seasonal patterns with a seasonal adjustment factor**

This method is used for goods and services that have a strong seasonal pattern. There are product codes and COICOP groups, such as package holidays and accommodation that show strong seasonal fluctuations in spring and autumn. Imputation methods A, B, C and D would disrupt the seasonal pattern in these cases, so that no seasonal price change would be visible in the current year in those months in which prices usually go up or down sharply. Expecting usual seasonal prices in April, this would underestimate the inflation rate in the current year and lead to an overestimation in the following year when the pattern reoccurs. To avoid this, the regularly measured rate of change from March 2019 to April 2019 is applied to the prices raised in March 2020, hereby maintaining the seasonal pattern.

Diagram 1 on page 6 displays the decision path and the rules applied for using the described imputation methods.

Diagram 1: Decision path for the treatment of CPI codes since April 2020 in the context of COVID-19

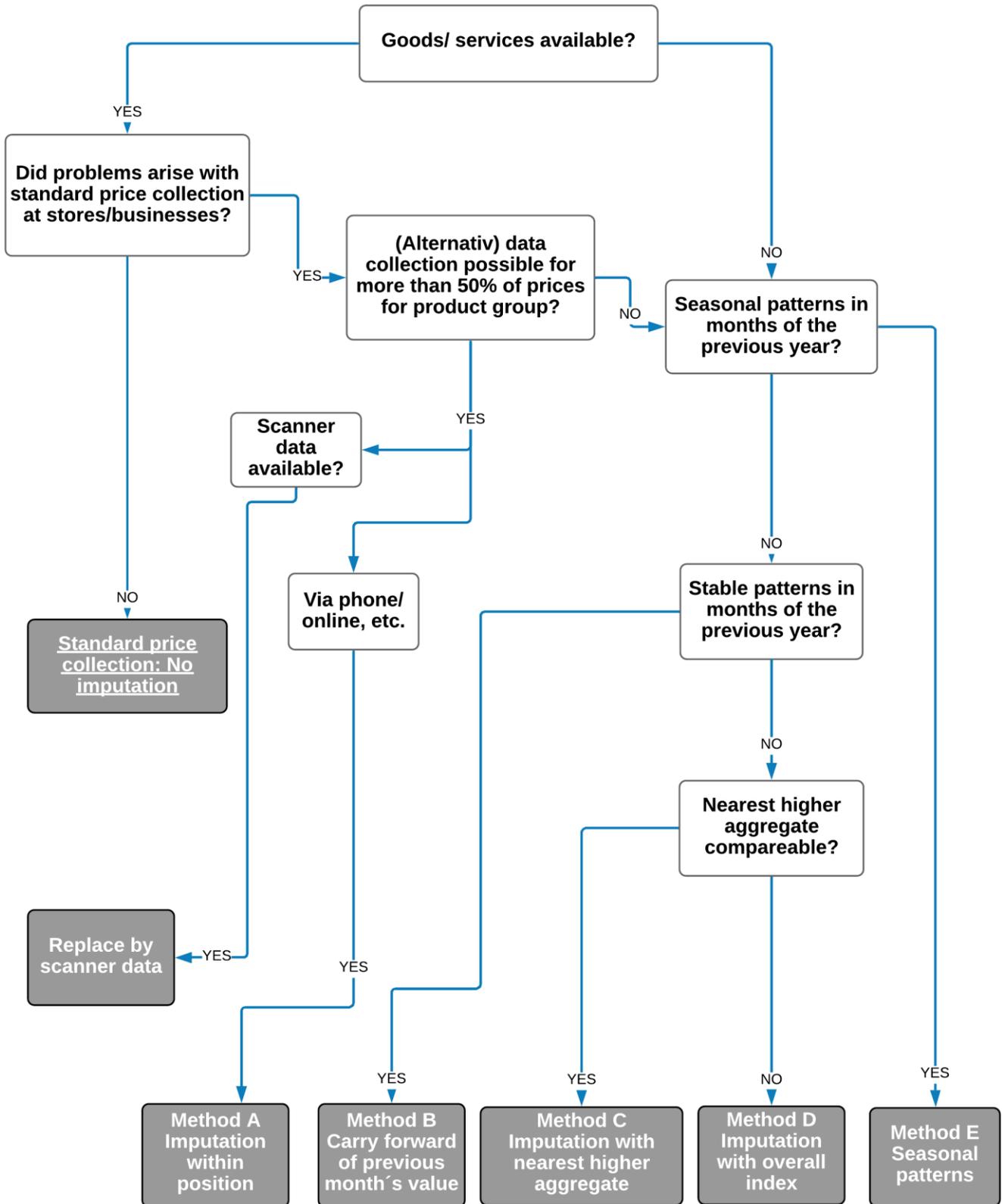


Table 1 lists the share of update methods used or the use of scanner data as an alternative data source for the shopping cart items in the 12 main CPI groups.

Table 2 on the next page provides an overview of the individual codes for which the seasonal pattern was imputed (method E).

*Table 1: share of weight of scanner data and imputation methods (All-item index and 12 main groups)*

| ECOICOP<br>Main groups<br><br>APRIL 2020  | CPI<br>weight | Scanner-<br>data<br>Share in<br>index % | Share of weight of imputation methods in % |                       |                           |                    |                        | share in % on weight                   |   |
|---|---------------|---|--|-----------------------|---------------------------|--------------------|------------------------|--|---|
|   |               |   | A<br>Available<br>prices                   | B<br>Carry<br>forward | C<br>Nearest<br>aggregate | D<br>Overall<br>in | E<br>Saison.<br>Muster | Share of<br>Imputations<br>(A+B+C+D+E) | Collected<br>Prices<br>incl.<br>Scanner |
| <b>GESAMT</b>   | <b>100,00</b> | <b>15,0</b>                             | <b>3,1</b>                                 | <b>2,7</b>            | <b>1,3</b>                | <b>14,0</b>        | <b>5,0</b>             | <b>26,1</b>                            | <b>73,9</b>                             |
| 1 FOOD AND NON-<br>ALCOHOLIC<br>BEVERAGES   | <b>11,18</b>  | <i>96,8</i>                             | 0,0  | 0,0                   | 2,7                       | 0,0                | 0,4                    | 3,2                                    | 96,8                                    |
| 2 ALCOHOLIC<br>BEVERAGES,<br>TOBACCO AND<br>NARCOTICS                               | <b>3,74</b>   | <i>43,0</i>                             | 0,0  | 0,0                   | 0,0                       | 0,0                | 0,0                    | 0,0                                    | 100,0                                   |
| 3 CLOTHING AND<br>FOOTWEAR  | <b>4,88</b>   | <i>0,0</i>                              | 22,2                                       | 0,0                   | 0,0                       | 1,1                | 0,0                    | 23,3                                   | 76,7                                    |
| 4 HOUSING,<br>WATER,<br>ELECTRICITY, GAS<br>AND OTHER FUELS                         | <b>19,28</b>  | <i>0,0</i>                              | 2,4  | 0,0                   | 0,8                       | 0,0                | 0,0                    | 3,2                                    | 96,8                                    |
| 5 FURNISHINGS,<br>HOUSEHOLD<br>EQUIPMENT AND<br>ROUTINE<br>HOUSEHOLD<br>MAINTENANCE | <b>6,87</b>   | <i>11,2</i>                             | 10,7                                       | 1,5                   | 0,0                       | 12,0               | 0,0                    | 24,2                                   | 75,8                                    |
| 6 HEALTH  | <b>5,55</b>   | <i>1,3</i>                              | 0,0  | 0,0                   | 0,0                       | 4,5                | 0,0                    | 4,5                                    | 95,5                                    |
| 7 TRANSPORT   | <b>13,08</b>  | <i>0,0</i>                              | 2,3  | 16,4                  | 0,9                       | 0,4                | 3,7                    | 23,7                                   | 76,3                                    |
| 8<br>COMMUNICATION  | <b>2,07</b>   | <i>0,0</i>                              | 0,0  | 0,0                   | 0,0                       | 0,0                | 0,0                    | 0,0                                    | 100,0                                   |
| 9 RECREATION AND<br>CULTURE   | <b>11,27</b>  | <i>4,6</i>                              | 3,4  | 0,4                   | 0,0                       | 18,2               | 26,2                   | 48,2                                   | 51,8                                    |
| 10 EDUCATION  | <b>1,19</b>   | <i>0,0</i>                              | 0,0  | 31,5                  | 7,2                       | 15,2               | 0,0                    | 53,9                                   | 46,1                                    |
| 11 RESTAURANTS<br>AND HOTELS  | <b>12,33</b>  | <i>0,0</i>                              | 0,7  | 0,0                   | 5,5                       | 75,2               | 11,9                   | 93,3                                   | 6,7                                     |
| 12 MISCELLANEOUS<br>GOODS AND<br>SERVICES   | <b>8,56</b>   | <i>14,0</i>                             | 0,7  | 0,5                   | 0,0                       | 15,3               | 0,0                    | 16,4                                   | 83,6                                    |
| <b>GESAMT</b>   | <b>100,00</b> | <b>15,0</b>                             | <b>3,1</b>                                 | <b>2,7</b>            | <b>1,3</b>                | <b>14,0</b>        | <b>5,0</b>             | <b>26,1</b>                            | <b>73,9</b>                             |

A more detailed version of Table 1 with shares of the various methods for all available CPI sub-indices (ECOICOP) during the course of the COVID-19 crisis is available as an Excel table:

[Table 3 - share of weight of scanner data and imputation methods](#)

*Table 2 – Seasonal Codes, for which Method E was applied (seasonal pattern imputation)*

| <b>COICOP</b> | <b>Code</b> | <b>Description</b>                          | <b>Weight VPI 2020</b> |
|---------------|-------------|---|------------------------|
| 01.1.6.1      | 008400      | Strawberries                                | 0,04962                |
| 07.3.2.1      | 072500      | Overland bus                                | 0,03300                |
| 07.3.3.2      | 072702      | Air ticket, international                   | 0,45326                |
| 09.4.1.2      | 084300      | Tickets for cable cars, chair- and skilifts | 0,47501                |
| 09.6.0.2      | 089700      | Bus package tour, abroad                    | 0,45536                |
| 09.6.0.2      | 089800      | City trip (by plane)                        | 0,12891                |
| 09.6.0.2      | 089900      | Holiday package (by plane)                  | 1,89245                |
| 11.2.0.1      | 096600      | Hotel, 4*5*                                 | 0,19626                |
| 11.2.0.1      | 096900      | Bed and breakfast (4* and 5* hotel)         | 0,50714                |
| 11.2.0.1      | 097000      | Bed and breakfast (3* hotel)                | 0,19603                |
| 11.2.0.1      | 097100      | Bed and breakfast (private, domestic)       | 0,05994                |
| 11.2.0.1      | 097400      | Spa hotel                                   | 0,08563                |
| 11.2.0.2      | 097200      | Holiday flat                                | 0,15329                |
| 11.2.0.2      | 097300      | Overnight stay abroad (apartment)           | 0,26513                |