

How to compute a Consumer Price Index in the context of the Covid-19 crisis ?

Definitive estimate-April 2020

Erratum this version was modified the 15th of June: a mistake was corrected in figure 3.

The health crisis and the lockdown measures in the context of the Covid-19 crisis have important impacts on the measures of short term statistics such as the Consumer Price Index (CPI). These statistics are all the more important to understand economic stakes during this period.

On the one hand, **in order to preserve price collectors but also consumers and salesmen, INSEE has adjourned the collection of prices by INSEE collectors in physical outlets since March the 16th**. These prices collected on the field are only one data source among others used to compute the CPI; however, they represent more than four tenth of the CPI, in term of consumption share.

On the other hand, CPI aims to describe an average measure of price changes for all the purchased items. The basket of products is renewed yearly but it remains fixed during a year; the slow changes in the consumption structure ensure that this basket fixity is globally neutral on the inflation measure. **The current health crisis disrupts deeply and suddenly the household consumption structure during the lockdown** either because the consumption is prevented by the impossible move of households (transport, tourism), or because outlets are closed (the implementing order of 15 March 2020 related to measures for the struggle against the Covid-19 spreading defines the first necessary outlets that were allowed to remain opened during the lockdown), or because confronted to the crisis, the households decide to adapt their consumption habits (food, for instance).

In compliance with Eurostat guidelines, shared with the different European countries, INSEE carried out new collection methods and adapted imputation methods.

The current note details the consequences on the inflation measure of the important shock that impacts the household consumption and then, gives an overview of the quality of data in a context of partial price collection in April.

1 – How to measure inflation when whole parts of the consumption disappear? An alternative consumer price index.

The implementing order of 15 March 2020 related to measures for the struggle against the Covid-19 spreading defined the first necessary outlets that were allowed to remain opened during the lockdown. If a part of the consumption that was purchased in the closed outlets might be purchased online, some other consumption segments simply disappeared (shows, tourism, restaurants, hairdresser, cars, guiding lessons...)

Moreover, even if they did not disappear, the share of numerous consumption segments in the consumption decreased heavily, like fuel or more generally transport services. However, the consumer price index which is a fixed-basket index (a Laspeyres-type index) uses a fixed consumption structure, updated each year. The

assumption is that this structure slowly evolves and is usually true. But it does not fit the huge shock that occurred on consumption structure during the health crisis.

In compliance with [the methodological guidance note of the compilation of the HICP in the context of the covid-19 crisis](#) by Eurostat,

- The CPI remains a fixed-basket index and the weights for each consumption segments remain unchanged (that is to say the one observed for the year 2019): for instance, whereas the household food expenditures increase with the lockdown, the food weight remains the one observed before the health crisis.
- When a consumption segment is not transacted any more, its price cannot be observed; the sub-index is consequently imputed (i) either with the price changes of similar product or of the nearest higher aggregate (ii) or with the all-item index, (iii) or scarcely, in duly justified circumstances, by carrying forward the last observed price. Moreover, when the price of a product follows a highly seasonal pattern, the imputation reproduces the past seasonality. The three methods were used.

This consumer price index that is consistent with the past habits of consumption enables to describe the inflationary / deflationary pressure in the economy, in particular the scarce drop in the fuel and transport prices. However, it could be quite far from the consumer feelings who, because of the health crisis, are no more able or no more eager to purchase some products. For that reason and in order to illustrate the consequences of this major shock on household consumption, an alternative price index was built for exploratory motivation. Contrary to the CPI that is a chained Laspeyres-type index (built on the past structure of the consumption, yearly updated), this index is a Paasche-type index (built on the current structure of the consumption). This kind of index is usually not produced monthly because the consumption structure is known with a delay, not compatible with the CPI production. In order to compute this Paasche-type index for April, **the nowcasting exercise carried out on May 7 by INSEE on household consumption** was used. Although the exercise was performed at a lower detailed level than the one used for CPI weight, it enables to illustrate what inflation should have been with a consumption basket purchased during April 2020.

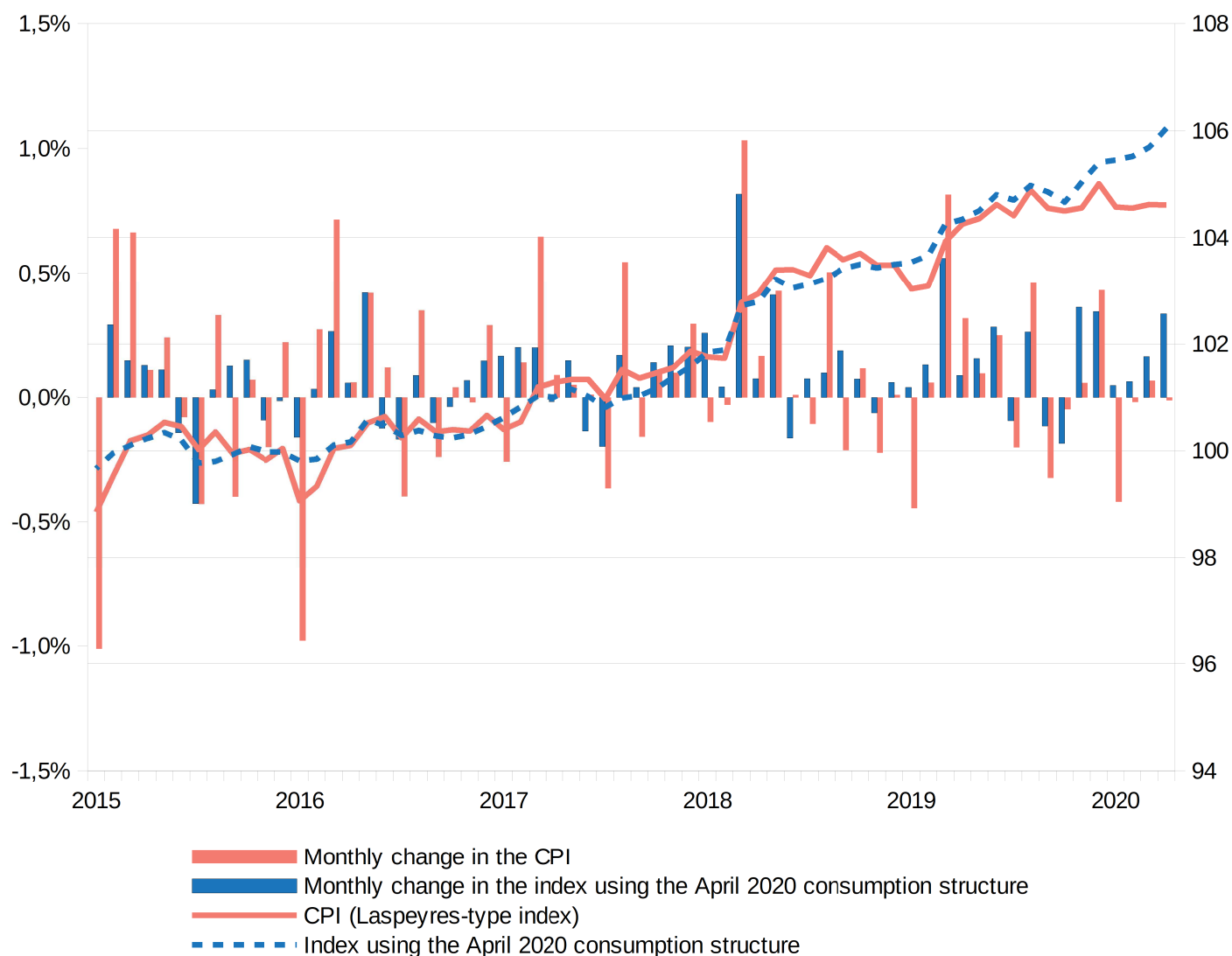
According to this nowcasting exercise, fuel consumption (expressed in current euro) dropped sharply (-72%) as well as transport services (-80%) and accommodation and catering services (-87%) ; food consumption is contrariwise one of the few products whose consumption is maintained in current euro (+3%). Therefore, the consumption structure in April 2020 has a higher weight for food and a smaller weight for fuel, transport and accommodation services whose volatile prices have often a high contribution to the monthly change in prices.

Although the consumption structures are quite different, the gap between the price changes measured with these two different indices is limited. With a Laspeyres-type index, prices were stable in April: the drop in fuel prices was offset by the rise in food prices; with a Paasche-type index, the prices increased in average by 0.3% month on month – the gap is explained by the more important weight of food and the lesser weight of fuel in the Paasche-type index (*figure 1*). The gap between the two indexes is however also the consequence of seasonality effects: both indices are not seasonally adjusted and their seasonality is different because of the different weight of highly seasonal products as airfare or tourism.

The year-on-year change in prices enables to take into account seasonality effects: the CPI (the Laspeyres-type index) increased by 0.3% in April year on year whereas the index built from the April consumption structure increased by 1.6% year on year. However this gap was important even before the health crisis when the true consumption structure was nearer from that used for the Laspeyres-type index (*figure 1*).

To conduct a consistent analysis and to take into account seasonality effect, we should compare the change in the yearly price evolution for each index: with a Laspeyres-type index, the year-on-year change in prices decreased by 0.4 point in April 2020 (from +0.7% in March to +0.3% in April 2020) whereas it would have accelerated by 0.2 point (from +1.4% in March to +1.6% in April) if the consumption structure had been identical to that observed in April 2020 (Paasche-type index).

Figure 1 : The Consumer Price Index and an alternative index using the consumption structure observed in April 2020



Lecture: If the consumption structure, from 2015 on, was that observed in April 2020, the price index would be 106 in April 2020 (compared to 105 for the official CPI) ; in April 2020, the month-on-month change in prices, using the consumption structure observed during the current month, would have been +0.3% compared to +0.0% measured with the CPI (i.e. the 2019 consumption structure for 2020 indices, the year Y-1 structure for the year Y index).

2 – How to measure inflation when the price collection in the field is adjourned?

2.1 – To mitigate the adjournment of price collection on the field in April, INSEE carried out new kinds of price collection.

Usually, about 160 000 prices are collected each month by INSEE's price collectors in physical outlets. INSEE uses other data sources but this on-the-field collection represents more than four tenth of the CPI basket. They are particularly important for fresh food produces, food sold in other outlets than super and hypermarkets, clothing and footwear, furniture, sustainable goods, other manufactured products (except cleaning and maintenance products and articles for personal hygiene and beauty products), other services (hotel and restaurant, services provided by craftsmen, cleaning services, hairdressing, mechanic...).

This price collection on the field has been adjourned since the 16th March. As it was also done in other European countries and in compliance with the European guidelines, INSEE tried to compensate the consequence of the missing manual price collection for the month of April by developing new types of collection.

- When outlets usually visited by price collectors have a website and are still opened or at least offer an online trade, price are collected online. Products concerned are mainly fresh food produces, meat, cheese, bread sold in super and hypermarkets, food products sold in minimarkets, hard-discounters... as well as clothes, sustainable goods and some other manufactured products.
- Some scanner data were usually unused (for clothes or sustainable goods sold in super and hypermarkets or for some small shops); they are used in order to register the prices of products that belong usually to the CPI basket.
- From May 2020 on, a prise collection by phone was gradually performed for services and in some small shop.

These changes in the data collection or in data sources make the price measure less precise because:

- Usually, CPI is computed from the prices of a fixed basket of products so that inflation do not take into account any change in the quality of the products or of the related sale service. Therefore, prices are collected every month for the same product and in the same outlet. In April, however, the forms of sales were changed (prices collected online and not on the field, often in drive) and products were replaced more often than usual (due to a different supply of products online and also due to shortage in products). The assumption, in this case, is that on the whole sample of products, the averaged quality of the products is unchanged in comparison with what was followed before but this assumption is not guaranteed as usual by the strict fixity of the CPI basket.
- The number of prices used in order to compute the CPI is really below the usual standards and consequently, all the estimation are very less precise.

Moreover, the price changes recorded in the April CPI are less representative of the different types of outlets than usually : it was indeed impossible to collect prices for all the different types of outlets usually

visited by the price collectors. For food, small shops, open-door market and generally all the shops whose prices are not available online are not included in April. Service prices that are usually collected by price collectors and were still opened during the lockdown are also not covered (for instance, rest home, funerary services).

2.2– The CPI is usually built from various data sources, most of which were not impacted by the health crisis.

In order to compute the French CPI, INSEE uses different data sources. Prices collected on the field by price collectors are impacted by the health crisis but it is not the case for the other data sources that remain available.

- The use of scanner data is not impacted by the health crisis. Scanner data are used in order to follow manufactured food, cleaning and maintenance products and articles for personal hygiene and beauty products sold in super and hypermarkets (one tenth of the index in term of consumption share) as well as medicine sold in pharmacy.
- Prices are also collected online; this online price collection was carried out even during the lockdown. Online price collection is used mainly for transport services, tourism, communication services, gas, electricity, insurances, financial services, some manufactured goods and cultural services.

For transport and tourism, prices are usually collected in advance and are registered in the index, the month when the service is provided; the prices of these services when they have been cancelled because of the health crisis were withdrawn from the price sample for April.

- Some prices are collected thanks to dedicated surveys like rents (the rents and charges survey, the social housing landlord survey); the prices of the rents and charges survey obtained from households were collected by phone.
- Some prices come from administrative data, mandatory declarations or are official tariffs; in this case, data collection was not impacted by the health crisis; it is the case for fuel prices, health service prices, tobacco prices...

2.3– Finally, more than four tenth of the CPI basket were imputed

Finally, the share of imputation due to the Covid-19 is about 44% in the April all-item index; these imputations include both missing data due to the adjournment of the price collection and the disappearance of some consumption segments.

These imputation rates are particularly high for manufactured products and food (*figure 2*) whereas some aggregates remain well-followed: tobacco, energy, rents, communication services, health services. A table in the complementary data attached to the CPI dissemination for April provides information for each index about the imputation rate due to the health crisis.

A commonly used method to perform these imputations is the imputation by the observed price change for the same products (about 14% of the CPI basket is imputed with this method) ; the imputation by the nearest aggregate estimation or a close consumption segment represents about 12% of the CPI basket. When no price was observed for a close product (it is the case for a lot of services, furnitures, cars), the estimation is based on the all-item index (about 14% of the CPI basket). Last, in few cases (about 3% of the basket), the

carry-forward method was used (mainly for products purchased on a yearly basis). Because in April the change in the all-item index is zero, the choice between the all-item imputation or the carry-forward imputation leads to similar results (*figure 3*).

Figure 2 : imputation rate, in terms of consumption, according to the type of products

	Imputation rate
All-item	43.5
Food	43.2
Fresh food	57.3
Other food	40.8
Tobacco	1.3
Manufactured products	56.9
Clothing and footwear	71.1
Health products	24.8
Other manufactured products	61.5
Energy	6.7
Petroleum products	9.4
Services	44.7
Actual rentals and services for dwellings	2.8
Health services	1.8
Transports	46.3
Communications	0
Other services	66.8

Note : Here are only registered the imputations linked to missing data due to (i) a non-observation of prices because of the adjournment of the price collection in the physical outlets, because of the lockdown, (ii) the lack of transaction for some consumption segments in the context of the Covid-19 crisis (extraordinary closure of some outlets, for instance) .

Figure 3 : imputation rate, in terms of consumption, according to the imputation method

Imputation method	Share in terms of consumption
Estimation based on available prices for the same product	13.9%
Nearest aggregate estimation	12.1%
Estimation based on the all-item index	14.1%
Carry-forward	3.4%
Total	43.5%