



Inflation in France during the lockdowns

Measured at a monthly frequency by INSEE, France's national statistical office, inflation reflects the change in the prices of French households' average consumption basket. Each product is assigned an importance in the price index equal to its weight in total consumption. This weight is assessed as an annual average. However, the two 2020 lockdowns due to Covid-19 distorted the structure of household consumption temporarily. For a few months in 2020, this caused a gap to open up between the published inflation rate and an alternative inflation index capturing these distortions in real time. As the overall structure of consumption soon got back to normal after the lockdowns, the gap between the two inflation indices was contained over 2020 as a whole. The annual update of the weights used in the 2021 index provided an opportunity to factor in Covid-19's impact on the structure of consumption.

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1.1 percentage point

maximum gap between published inflation and alternative inflation

0.5 percentage point

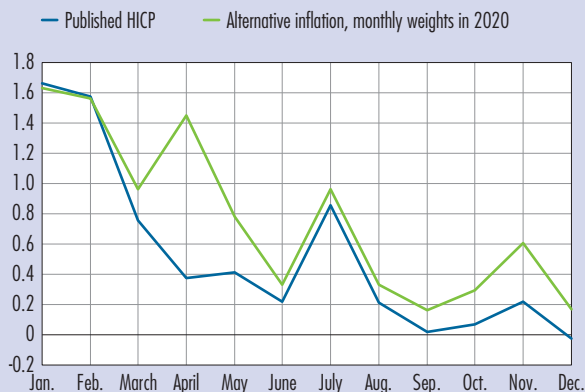
contribution of food excluding tobacco to the maximum gap

33%

estimated weight of food excluding tobacco in consumption in April 2020, around twice the share of food in consumption in 2019

Inflation in France: harmonised index of consumer prices (HICP) year-on-year change and alternative inflation in 2020

(%)



Sources: INSEE, bank card (CB) payment data; authors' calculations.
Key: Inflation stood at 0.4% year-on-year in April 2020 according to INSEE's HICP index, compared with 1.5% according to the alternative measure of inflation using current monthly weights.



1 Measure inflation while taking account of changes to the structure of consumption

Covid-19 affected the measurement of inflation

Inflation is measured by statistical offices as the average of price changes over the year for products of a benchmark consumption basket. In European Union (EU) countries, this inflation measure is harmonised through the use of shared methodological rules (Eurostat, 2018). As a result, the same definition is used for the benchmark consumption basket across all EU countries: it covers all household consumption and includes goods, such as food, clothing, energy and furnishings, as well as services, such as rent, recreation and cultural services, restaurants and hotels. The change in the price of each good or service contributes to total inflation in an amount reflecting that good or service's share of total consumption. For example, food excluding tobacco¹ gets a weight of approximately 18% in the price index for France, reflecting the share of these products in the overall household consumption in France. The structure of consumption used to construct the price index is reviewed at the start of each year to ensure that the index continues to be representative of consumption in France. The shares of each of the products consumed in the price index are updated using the average consumption of each product during the previous year.² Use of the average share for the previous year and not the current year is due to the difficulty in obtaining accurate and detailed real-time information on monthly consumption.³ Using information on the previous year's consumption is a way to have reliable information on the structure of consumption at the most granular product level. This is not generally a problem when it comes to measuring inflation, as the structure of the consumption basket does not change much from one year to the next, reflecting gradual shifts in household consumption habits.

However, using the previous year's consumption structure as the benchmark becomes much more problematic when the consumption basket is subject to abrupt and large changes during the course of a single year, as was the case in 2020 with the initial lockdown in March and its subsequent gradual exit, followed by the second lockdown in November (Diewert and Fox, 2020). By construction, the inflation measure cannot capture this structural change, which may make it harder to interpret published inflation figures (Tenreyro, 2020), since the weights used are no longer sufficiently representative of the actual consumption basket.⁴

Constructing an alternative inflation measure

Lockdown-related changes prompted some institutions and researchers to harness available sources of consumption information, including bank card transaction data and scanner data, in an effort to develop alternative price indices capturing the shift in consumption structure. But these alternative indices are not as reliable as the price indices regularly published by statistical offices, because the sources of consumer and price data are less detailed. There are numerous examples of this in Europe and the United States, including Alvarez and Lein, 2020; Cavallo, 2020; Kouvavas *et al.*, 2020; and Reinsdorf, 2020. In France, INSEE is one of the few statistical offices in the world to have produced an alternative inflation measure using current consumer data every month since April 2020 (INSEE, 2020a, 2020b, 2020c).⁵ Appendix 3 compares the results of this study with the most recent results published by INSEE as part of the release of the final harmonised index of consumer prices (HICP) for December 2020.

Bank card (CB) payment data are an especially useful source of information that allows us to track a large swathe of household consumption, by retailer type, in real

1 Food excluding tobacco includes beverages (including alcoholic beverages).

2 In practice, the consumption structure of year N-1 is estimated using the national accounts for year N-2 and all available information on consumption over year N-1 (see Eurostat, 2018).

3 Linking monthly indices whose weights potentially vary considerably from one month to the next is another significant technical difficulty.

4 Another source of difficulty during the lockdown is the lack of information on prices for some products, either because the consumption segment itself vanished or because it was impossible to collect prices on the ground.

5 The UK Office for National Statistics has also published a weekly indicator of food prices since the start of the Covid-19 crisis.



time. These data may be used to estimate changes in the consumption basket in real time, week by week (Castelletti *et al.*, 2020), and then construct alternative price indices. In this article, we use bank card transaction data for the period from January 2019 to December 2020 to construct a consumption structure in real time (at level 2 of the product classification, i.e. 42 items – see Appendix 2 for a detailed description). This enables us to calculate aggregate inflation that captures changes in the consumption basket in real time. In practice, we calculate the year-on-year change in prices weighted by the current monthly structure of consumption observed based on CB data, which we compare against the year-on-year change in the HICP published by INSEE, distinguishing standard seasonal effects from the effects arising specifically from the distortion to consumption caused by the Covid-19 epidemic (see Appendix 1). Using this alternative inflation indicator, we can monitor in real time the gap between published inflation and the average change in prices reflecting actual household consumption during the lockdowns.

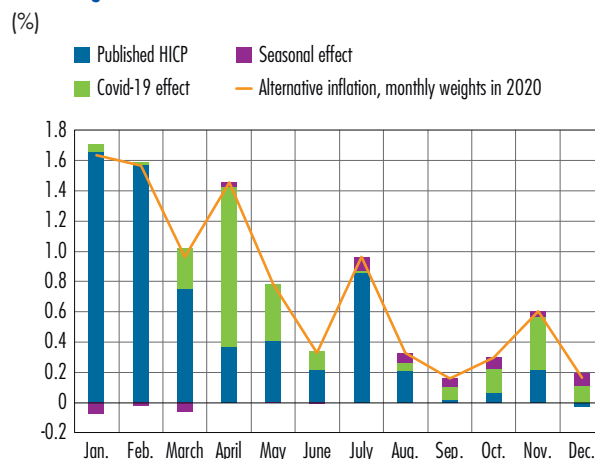
2 Inflation capturing Covid-19's impact on consumption was temporarily higher than HICP inflation

Published inflation fell steeply over 2020, declining from 1.7% in January to 0.0% in December. However, Covid-19 had a significant effect on the inflation measure

The gap between alternative and published inflation stood at 1.1 percentage point (pp) in April and 0.4 pp in November, but averaged just 0.2 pp over 2020 as a whole

If we use the weighting structure observed over the course of 2020, inflation patterns sometimes diverge significantly, if temporarily, from those measured by the HICP (see Chart 1). In April 2020, in the middle of the first lockdown, HICP inflation was 0.4% year-on-year, while the alternative inflation measure was 1.5%, i.e. a gap of 1.1 pp. As lockdown measures were eased, the gap narrowed to 0.4 pp in May 2020, and then to

CI HICP inflation and alternative inflation in 2020, year-on-year change



Sources: INSEE, bank card (CB) payment data; authors' calculations. Key: Inflation stood at 0.4% year-on-year in April 2020 according to INSEE's HICP index, compared with 1.5% according to the alternative measure of inflation using current monthly weights.

0.1 pp in June and July.⁶ From September, measures taken in response to the second wave of the pandemic again affected the structure of consumption and hence the inflation measure, although less dramatically. The gap opened up to 0.4 pp in November 2020, at the height of the second lockdown, before shrinking again to 0.2 pp in December after the restrictions were lifted. Accordingly, outside the lockdown months, the gaps were small (0.1 pp on average), and over 2020 as a whole, the gap between the alternative measure and published inflation was contained at 0.2 pp on average.

The gaps between published HICP and the alternative measure based on monthly weights observed in 2020 partly reflect the fact that HICP inflation uses average weights for 2019 that do not factor in the seasonality of certain types of consumption. Using bank card (CB) data, we can construct the value that would have been recorded for HICP inflation had the calculation taken into account seasonality as observed in 2019 instead of using the average weights for the year. However, the gaps are small and less than 0.1 pp.⁷

⁶ These gaps are extremely close to the gaps relative to the consumer price index (CPI) estimated by INSEE – see chart in Appendix 3.

⁷ See Sillard and Wilner (2015) for a more detailed analysis of the seasonal effects of certain types of consumption on the inflation measure.



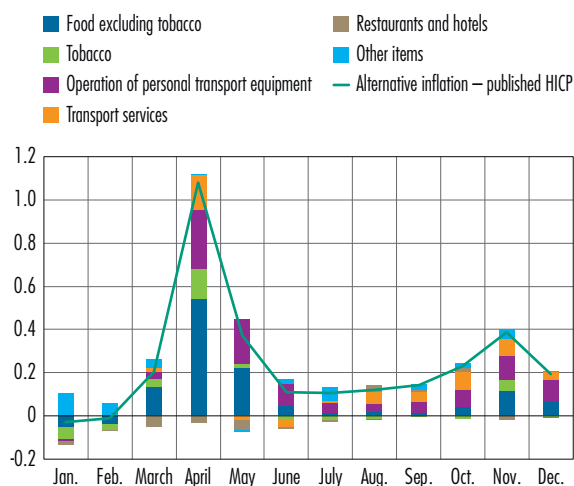
Having said that, in July 2020, seasonal effects accounted for the entire gap between the published HICP and alternative inflation, while the Covid-19 effect was zero.

Food and transportation account for the bulk of the gap

Four main consumption items account for virtually all of the gap between HICP inflation and inflation measured using monthly weights observed in 2020 (see Chart 2). In April 2020, food excluding tobacco was responsible for about half of the total observed gap, while operation of personal transport equipment, including fuels but also repair services and parts and accessories for personal transport equipment, contributed one-quarter. These two items alone accounted for 0.8 pp of the total gap in April 2020. Two other products, tobacco and transport services, also made positive contributions of around 0.15 pp each. For the rest of 2020, food, fuels and transport services continued to account for the bulk of the gap between published and alternative inflation.

C2 Gap between the year-on-year changes in the alternative index and the HICP, with contributions from consumption items

(in percentage points)



Sources: INSEE, bank card (CB) payment data; authors' calculations.
Key: In April 2020, the gap between the year-on-year change in the alternative inflation measure and the year-on-year change in the published HICP was 1.1 percentage point, of which 0.5 pp was due to food excluding tobacco.

3 The gap between the two inflation indices stems from a temporary distortion of the consumption structure and increased dispersion in price variations

How do we account for the gap between HICP inflation and the alternative inflation measure based on the consumption structure observed in 2020? Consumption items whose relative weights increased by most (tobacco, food excluding tobacco) were also those whose prices saw the sharpest acceleration, while items whose weights declined by most (fuel, transport) were those whose prices slowed most significantly or even declined.

A sharp but short-lived distortion of the consumption structure

The lockdown linked to the Covid-19 pandemic severely impacted consumption as a whole (reduction of approximately 30% in April), but also its structure, affecting consumption of different goods and services in very different ways. Chart 3 below compares the weekly change in 2019 and in 2020 in the weight in total consumption of the items that were most affected by Covid-19. For example, food spending's weight rose from around 15% pre-lockdown to close to 35% of consumption at the height of the lockdown, before reverting to a level that was similar to although higher than that observed in 2019.

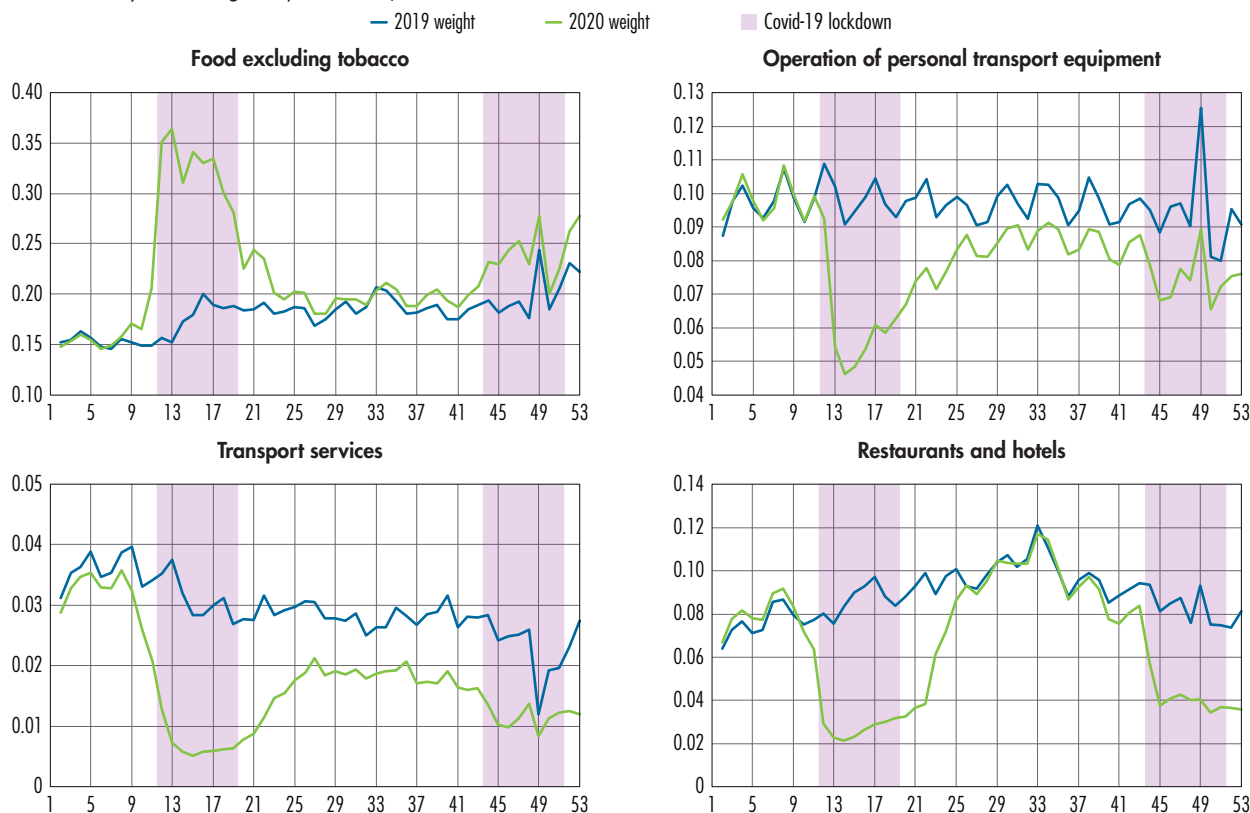
Conversely, the share of vehicle operating expenses (notably fuel), which is usually around 10%, fell by half during the first lockdown. Steep declines were also observed in the relative shares of spending related to transport services and hotels. During the first exit from lockdown, these shares gradually headed back up towards their 2019 levels. However, the consumption shares of transport services and vehicle operating expenses remained below 2019 levels, notably reflecting persistent constraints in the transport sector. The second lockdown led to changes in the structure of consumption that were similar but on a smaller scale.⁸

⁸ Significant variations in weekly weights are observed at the end of 2019 and at the end of 2020. These reflect the disjointed trajectory of aggregate spending linked to Black Friday promotional campaigns and purchases ahead of the year-end holidays. In 2020, these factors were compounded by the gradual exit from lockdown and the week-long delay for Black Friday, which potentially affected aggregate spending as well as the structure of spending. However, these variations did not have a material impact on the monthly averages used to calculate the alternative price index.



C3 Distortion of the consumption structure, by major consumption item (2019-2020)

(x-axis: weeks; y-axis: weight in price index)



Sources: Bank card (CB) payment data; authors' calculations.

Key: The share of food excluding tobacco was around 15% during the first few weeks of 2019 and 2020.

Increased dispersion in price variations by product

A change in consumption structure does not necessarily impact the aggregate inflation measure. If all consumption items experience inflation that is identical and equal to aggregate inflation, a structural change would have no effect on the inflation measure. The gap between published HICP inflation and the alternative measure appears because, in addition to the structural change, price variations are highly dispersed across consumption items.

Chart 4 below shows the annual price variations over time for consumption items at the granular level (250 items approximately). While aggregate inflation was below 2% on average between 2019 and 2020, there was dispersion between items: in January 2020, the 10% of items experiencing the most dynamic price movements saw their prices climb by more than 7.6%. This dispersion in inflation levels increased during the

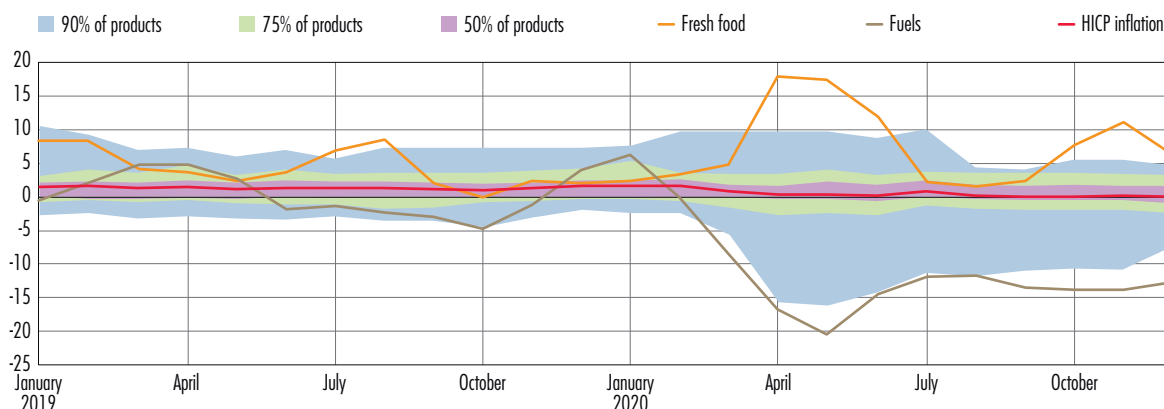
first lockdown: food prices, for example, surged to record levels, especially for fresh food products (17% year-on-year increase), while prices for transport-related goods and services collapsed, with fuel prices falling by 20% year-on-year in April 2020. Following the first exit from lockdown, the increased dispersion was only partially reabsorbed: while food prices experienced a relatively swift downward correction, energy prices did not totally recover, exerting downward pressure on the year-on-year price change for a prolonged period.

Overall, products whose relative consumption weights increased were those such as food that were experiencing sustained price growth when the lockdowns were imposed, which contributed to the gap between published and alternative inflation. Conversely, goods and services whose share of consumption shrank, such as petroleum products and transport services, were those that saw price declines, which also played a part in fuelling the gap.



C4 Inflation by product between January 2019 and December 2020, year-on-year change

(%)



Sources: INSEE; authors' calculations, based on the year-on-year changes of 254 HICP items at level 5 of the classification of individual consumption by purpose (COICOP). Update of Eco Notepad No. 171 (Gautier, Ulgazi and Vertier, 2020), Banque de France.
Key: In April 2020, year-on-year index changes ranged from -15.7% (5th percentile value) to +9.7% (95th percentile value) for 90% of the 254 items in the HICP.

In this setting, households saw the cost of their consumption basket go up temporarily

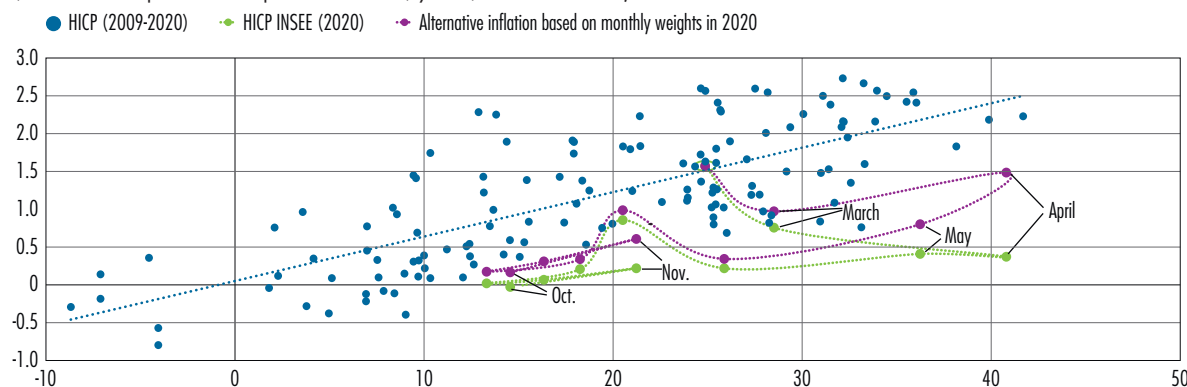
Whereas household inflation expectations usually align with published inflation on average, in April 2020 far more households expected a sharp price increase, even though published inflation was low (Gautier *et al.*, 2020). The gap was consistent with the household consumption experience: inflation expectations were better correlated with the alternative inflation measure reflecting the structural change in consumption (see Chart 5, purple line) than with published inflation (green line). However, the gap between expectations and published inflation narrowed sharply during the first exit from lockdown, before widening

again in October and November. That said, this second gap was less pronounced than during the first lockdown and also narrowed after the lockdown was eased.

As it does every year, INSEE updated the annual weights used in its price index in early 2021. At this time, it took into account recent movements in the consumption structure and particularly the Covid-19 effects observed in 2020 (following precise recommendations from Eurostat for all EU countries – Eurostat, 2020). Overall, while 2021 may continue to be affected by sub-annual movements in the consumption structure linked to the end or continuation of the pandemic, the effects of these potential distortions on inflation in 2021 should remain weak.

C5 Households' inflation expectations and inflation measured as a year-on-year change

(x-axis, balance of opinion on expected inflation; y-axis, inflation as a %)



Sources: INSEE, Eurostat, European Commission, authors' calculations.
Key: In April 2020, published HICP inflation was 0.4%, the alternative inflation measure using monthly weights was 1.5% year-on-year, and the balance of opinion on expected inflation was around 40.



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Appendix 1

Constructing an alternative inflation index

Harmonised index of consumer prices (HICP)

A consumer price index (CPI) measures the average change in prices within a fixed consumption basket corresponding to the average structure of household consumption in the previous year. CPIs may differ across countries in terms of their methodology and coverage. To ensure the comparability of price indices within Europe, the European Central Bank (ECB) tracks the harmonised index of consumer prices (HICP) published by Eurostat.⁹

The HICP published monthly for France is based on a Laspeyres index: the aggregate index uses consumption weights measured as averages for the previous year. All the monthly price indices in 2020 therefore use the consumption weights observed in 2019.

Inflation in France is then calculated as the annual change in this index and can therefore be written as a weighted average of the annual price changes measured at the level of each product:

$$\Delta p_t = \sum_i \alpha_i^{2019} \Delta p_{it}$$

where Δp_t is aggregate inflation in month t of 2020, Δp_{it} is inflation for each consumption sector i (measured here using the price index published by INSEE for each COICOP level 2), and $\alpha_{i,2019}$ is the weight of product i measured as an average in 2019 (weights published by INSEE).

Alternative inflation measure

Bank card (CB) data are used to estimate the weights of each product in each month t of 2020 ($\alpha_{i,t}$) and construct an alternative inflation measure such that it is equal to:

$$\Delta p_t^{alt} = \sum_i \alpha_{i,t}^{2020} \Delta p_{it}$$

These weights, which are estimated in real time, are used to construct an alternative inflation measure capturing changes in consumption caused by lockdown effects. The gap between alternative inflation and published inflation can then be written:

$$\Delta p_t^{alt} - \Delta p_t = \sum_i (\alpha_{i,t}^{2020} - \alpha_i^{2019}) \Delta p_{it}$$

Note that the contribution of each product to the difference between the two inflation measures depends on the weighting gap (for example, during the lockdown, some products are consumed less than usual) as well as on the inflation value for that product.

⁹ In France, the HICP differs from the CPI in the way that health spending is counted. The CPI counts gross spending, while the HICP takes the value net of health insurance refunds.



Distinguishing the Covid-19 effect from standard seasonal effects

This new weighting structure introduces two changes with respect to published inflation Δp_t : i) weights are monthly and no longer yearly averages; ii) weights are those that are observed over the course of the year.

In sum, the gaps between alternative and published inflation can be attributed to:

- Standard seasonal variations, that is, the gap between a weight in a given month in 2019 and an average weight measured over 2019 ($\alpha_{i,2019} - \alpha_{i,t2019}$). Some goods are consumed more heavily in a given month no matter what the year, and this seasonality may affect the inflation measure from one month to the next (Sillard and Wilner, 2015). This contribution makes it possible to distinguish standard seasonal effects from the lockdown-related monthly effects;
- The monthly structural gap between 2020 and 2019 ($\alpha_{i,t} - \alpha_{i,t2019}$), which measures the impact of Covid-19 on the inflation measure (i.e. excluding the standard seasonal effects).

$$\Delta p_t^{alt} - \Delta p_t = \sum_i (\alpha_{i,t}^{2020} - \alpha_{i,t}^{2019}) \Delta p_{it} - (\alpha_i^{2019} - \alpha_{i,t}^{2019}) \Delta p_{it}$$



Appendix 2

Processing bank card (CB) data

To measure the sector shocks affecting the HICP consumption basket, we use data produced by the CB Bank Card Consortium. These data show, for every day since 6 January 2020, the value of cleared transactions (excluding withdrawals) in around 250 business categories identified by their merchant category codes (MCCs), thus also providing a baseline for an equivalent day in 2019.

In order to be able to use these data to estimate a price index, we transpose them to fit the classification of individual consumption by purpose (COICOP), which forms the basis for the HICP. To do this, we perform two steps:

- First, we transpose bank transaction data from the MCC system to level 5 of the French classification of business activities (NAF 5), using an equivalence table provided by the Bank Card Consortium. Where several NAF categories exist within a single MCC, transaction amounts are shared between them according to an equal division rule. In the case of retailers selling a variety of goods, such as supermarkets, we apply an ex ante distribution across different NAFs using a detailed structure per product sales by non-specialised shops based on INSEE's trade accounts for 2018 (INSEE, 2019). This methodology is described by Castelletti *et al.*, 2020.
- Next, we transpose the data from the NAF classification to the COICOP classification, using the equivalence table provided by Eurostat-RAMON. This allows us to obtain COICOP level 2 weights, i.e. for 42 aggregate products of the COICOP classification.

At each stage, if we were unable to classify goods or services based on existing classifications, we applied a number of equivalences based on expert judgement. For example, some reserved merchant codes have no detailed equivalence with the NAF system. In this case, we used the available equivalence at a higher level of aggregation.

The final step involves estimating a consistent weighting structure based on COICOP 2 transaction values. An important aspect of our estimate is that bank card transactions do not necessarily cover all consumption items uniformly: some items, such as food, are overrepresented, while others, such as vehicle purchases, rents and social welfare services, are underrepresented. We therefore adjust the weights obtained to bring them in line with published HICP weights, on average and over a typical year. To do this, we perform two steps:

- First, we estimate an initial "gross" monthly weighting structure: the weight of each COICOP 2 item over the course of a given month corresponds to the total value of transactions for that item, divided by the total value of transactions recorded for all items over the course of the month.
- Next, we adjust these gross weights to bring them in line with published HICP weights. We take different approaches for 2019 and 2020:
 - For 2019, we multiply each gross weight for a given aggregate by the ratio of the annual HICP weight for 2019 and the average of the gross weights for that aggregate in 2019: accordingly, the adjusted monthly weights for an aggregate in 2019 are equal, on average, to the published weight for this aggregate in 2019.



- For 2020, we have to take into account the fact that unusual shocks to bank card data are observed: to ensure that the adjustment factor does not include these shocks, we multiply each gross weight for a given aggregate in 2020 by the ratio of the annual published HICP weight for 2020 and the average of the gross weights for this aggregate in 2019. The adjustment factor is thus such that if bank card transactions in 2020 had been similar to those of 2019, the average of the adjusted weights in 2020 would equal the published HICP weight for 2020.
- Finally, since this step is performed for each item independently of the others, the sum of the adjusted weights obtained does not spontaneously equal 1 for each month. We therefore standardise these adjusted monthly weights by dividing them by the sum of the adjusted monthly weights in order to obtain a weighting structure that sums to 1.



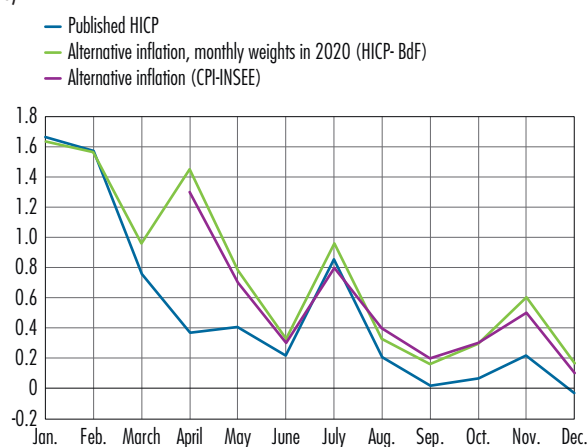
Appendix 3

Comparison with the alternative index published by INSEE

This appendix compares our inflation estimate from bank card data with the alternative estimate published

Published HICP inflation, alternative inflation (HICP-BdF) and alternative inflation (CPI-INSEE)

(%)



Sources: INSEE, Eurostat, authors' calculations.

by INSEE. Since April, alongside the final estimate of the CPI and HICP, INSEE has published a set of indices based on the consumption structure for each month in 2020. In the chart opposite, we compare the year-on-year change in our alternative index to the year-on-year changes published by INSEE for a fixed basket index for the current month, according to statistics published at the time of the final HICP estimate for December 2020.

Our proposed index, which covers the scope of the HICP, thus appears to be close, in terms of its methodology and results, to the fixed basket index for the current month published by INSEE, which covers the scope of the CPI. The gaps that we observe may stem from various factors, including the data sources used to calculate monthly weights, the granularity of the classification system used to calculate weightings, and differences between the CPI and the HICP, which differ slightly in the scope of their data and how data are processed.

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