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Examining recent revisions to CPI-common

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Key messages

- Unusually large revisions to CPI-common in recent months stem from increased common price movements across components of the consumer price index (CPI) amid broad inflationary pressures.
- While prices for services have tended to drive CPI-common, the weights attached to many CPI goods components have increased because inflation has become more synchronized across the CPI basket.
- With recent revisions, CPI-common now aligns more closely with the other two preferred measures of core inflation—CPI-median and CPI-trim. However, because of these revisions, caution is necessary when interpreting real-time estimates of CPI-common in the current environment.

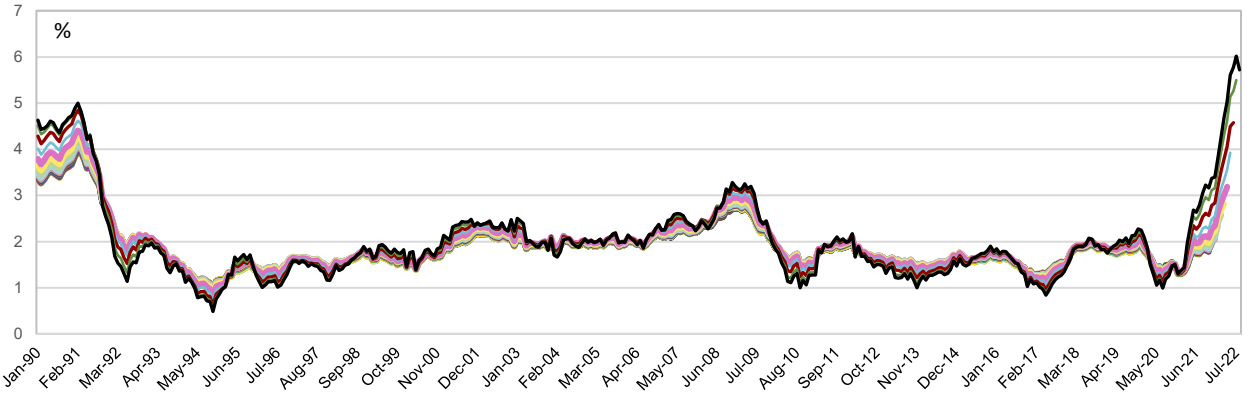
Context and motivation

CPI-common measures core inflation by tracking common price movements across the components of the CPI basket. We calculate it using a factor model, which represents the variation in disaggregated inflation rates as the sum of common and sector-specific price changes.

CPI-common can be revised because this factor model is re-estimated each month. Typically, these revisions are modest, but unusually large revisions have been recorded in recent months (**Chart 1**). With the August release of CPI data, CPI-common in July was revised up by 0.5 percentage points, from 5.5% to 6.0%. We expect similar revisions in the coming months. Given the importance of CPI-common in the Bank's communication concerning the rate of underlying inflation, these revisions warrant a more thorough explanation. We examine recent developments around CPI-common and analyze the revisions to this measure.

Chart 1: Estimates of CPI-common over the pandemic

Year-over-year percentage change



Note: This chart is generated by estimating CPI-common from January 1990 to December 2019, and then expanding the estimation window one month at a time up to August 2022. Each line depicts a separate monthly estimate.

Sources: Statistics Canada and Bank of Canada calculations

Last observation: August 2022

Construction of CPI-common

The construction of CPI-common follows three steps:

1. **Data**: The input data for CPI-common comprise the series for the 55 components of the CPI, which are adjusted to remove the effect of changes in indirect taxes. These series are expressed in year-over-year percentage changes and standardized before estimating the factor model. Since these series are never revised, this step is not a potential source of revision.

2. **Factor model**: We estimate the factor model as follows:

$$\pi_{i,t} = \Lambda_i F_t + \varepsilon_{i,t}; i = 1, \dots, 55; t = 1,2, \dots, T \qquad (1)$$

   The inflation rate of the i^{th} component is linked to the common factor F_t through its factor loading Λ_i, and $\varepsilon_{i,t}$ is an idiosyncratic term that denotes sector-specific disturbances and is not correlated with the common factor.[1]

   We extract the common factor using the contemporaneous covariance matrix of the CPI data, which ultimately determines the factor loadings (i.e., the weights attached to different CPI components). If the covariance matrix changes over time, this alters the relative weights and results in revisions to the common factor.

3. **Scaling**: We scale the common factor to the total inflation rate. This is necessary because the common factor has zero mean and unit variance, meaning it needs to be re-normalized to be expressed in inflation units. To achieve this scaling, we perform a linear regression of the year-over-year percentage change in total CPI on the common factor. We then obtain the CPI-common using the fitted values of the following regression:

$$Total\_CPI_t = \alpha + \beta(F_t), \qquad (2)$$

   where α is the mean of inflation over the estimation period and β reflects the sensitivity of inflation to the common factor. Thus, $\hat{\alpha}$ and $\hat{\beta}$ are two additional sources of potential revisions to CPI-common.

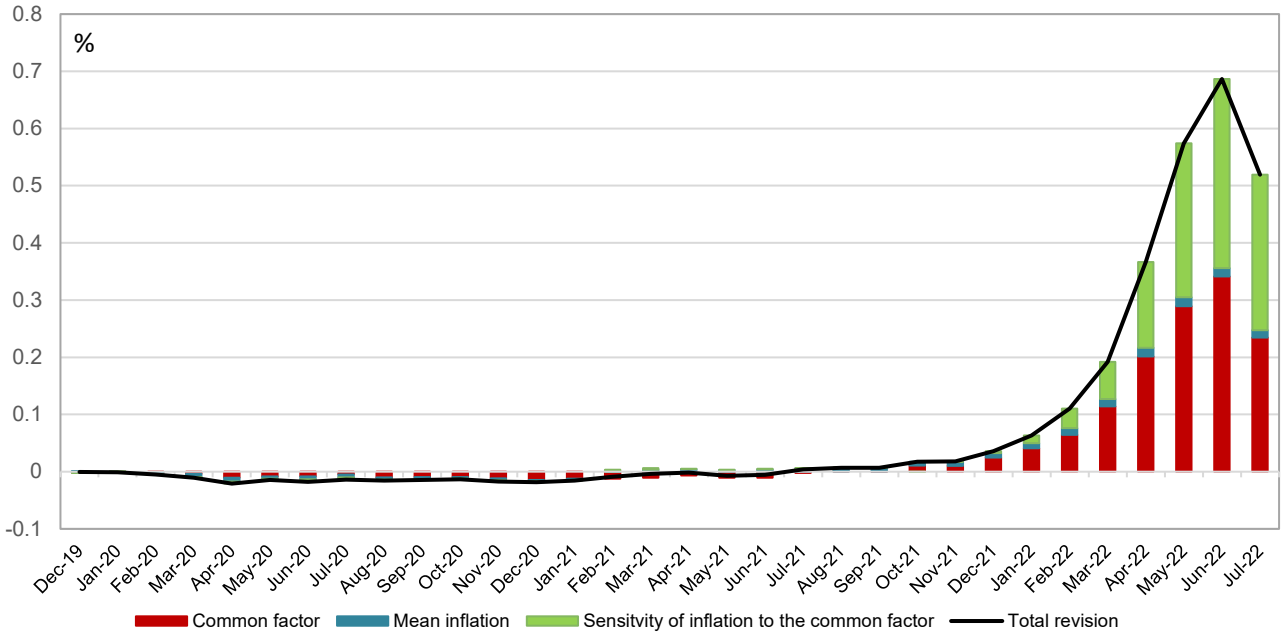
Sources of recent revisions to CPI-common

Having touched on how CPI-common is calculated, we can now quantify the three different sources of revision. To do this, we estimate the common component from January 1990 to December 2019. We then expand the estimation window one month at a time and record the changes to the previous month's reading of CPI-common. We decompose each revision into contributions from each of the three sources identified in the previous section: the common factor, the mean of inflation and the sensitivity of inflation to the common factor.

[1] See M. Khan, L. Morel and P. Sabourin, "The Common Component of CPI: An Alternative Measure of Underlying Inflation for Canada," Bank of Canada Staff Working Paper No. 2013-35 (October 2013).

Chart 2 shows that the large revisions are a recent phenomenon. We will now examine the three sources of revision in turn.

Chart 2: Decomposition of the revision to the previous month's estimate of CPI-common



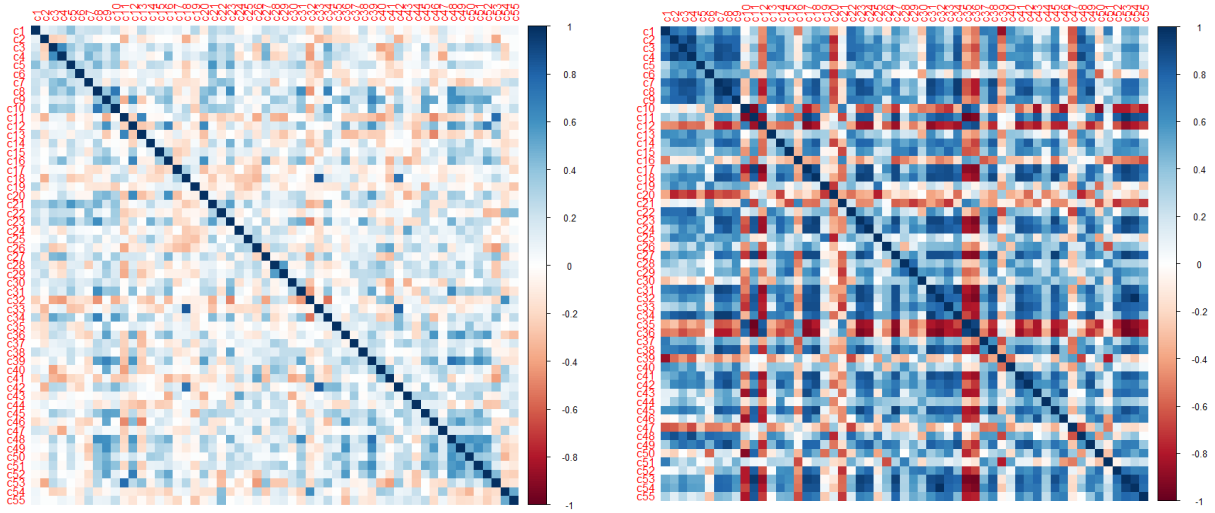
Sources: Statistics Canada and Bank of Canada calculations

Last observation: August 2022

Revisions to the common factor are the first source and explain around half of the recent revisions (**Chart 2**). Increased common price movements across the CPI basket during the pandemic caused the revisions to the common factor. **Chart 3, panel a** shows the correlation matrix across the year-over-year growth rates of the 55 components from 1990 to 2019. **Chart 3, panel b** shows the same correlation matrix over 2020–22. We can see that the extent of common price movements between the components of the CPI increased significantly during the pandemic.

Chart 3: Correlations between the year-over-year growth rates of 55 components of the CPI

a. 1990–2019 **b.** 2020–2022



Note: The numbers in the legend represent correlation coefficients. Brighter colours indicate stronger correlations; duller colours indicate weaker correlations. Blue shades represent positive correlations; red shades represent negative correlations.
Sources: Statistics Canada and Bank of Canada calculations Last observation: August 2022

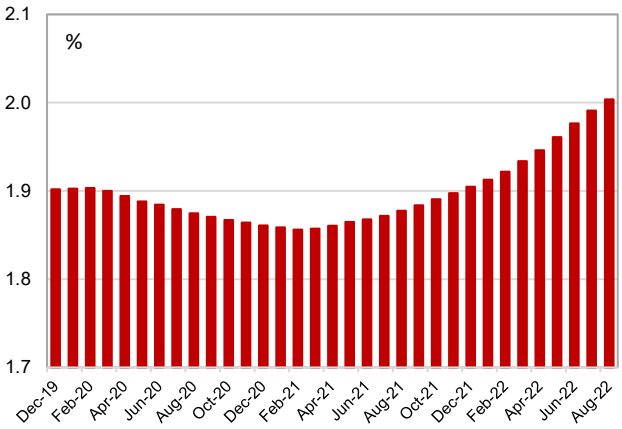
This means that the covariance matrix of the CPI data, which determines the factor loadings, has undergone important changes during the current episode of high inflation. These increased common price movements have been significant enough, even in a relatively short period, to cause large revisions to CPI-common. While it may seem unusual that two years of data could cause such significant changes, much of the sample period had been characterized by idiosyncratic price movements during low and stable inflation.

With the increased common price movements in the CPI data, the factor loadings for many components have increased over the pandemic, particularly for many goods. Examples of components that have seen the largest increases over the pandemic include furniture, gasoline, household equipment, textiles and some components of food. In addition, the share of components with negative factor loadings decreased from 20% in December 2019 to 9% in August 2022 (see the **Appendix** for more information). While CPI-common has traditionally placed more emphasis on the prices of services (and, by extension, on domestic pressures), this interpretation could be complicated by recent developments.

The second source of revision to the common component is revisions to mean inflation. However, as can be seen in **Chart 2**, these changes do not play a major role. **Chart 4** shows that mean inflation has increased approximately 0.07 percentage points over the recent period of high inflation. This modest increase lends support to the idea that changes in mean inflation are not an important factor behind the overall revisions to CPI-common.

Chart 4: Mean inflation over the pandemic

Estimates of α from equation 2; monthly

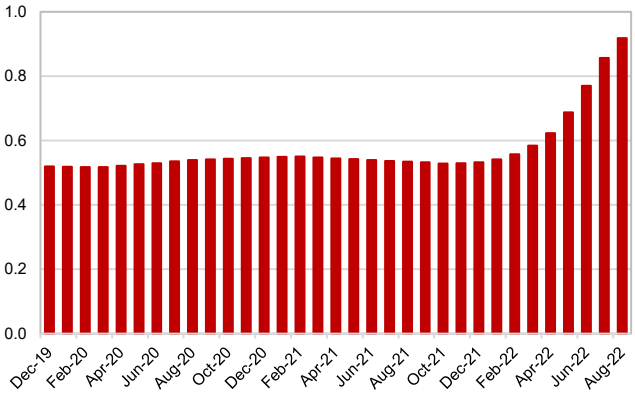


Sources: Statistics Canada and Bank of Canada calculations

Last observation: August 2022

Chart 5: Sensitivity of inflation to the common factor over the pandemic

Estimates of β from equation 2; monthly



Sources: Statistics Canada and Bank of Canada calculations

Last observation: August 2022

The third source of revision to CPI-common is changes to estimates of β, which represents the sensitivity of inflation to the common factor. As shown in **Chart 2,** changes to these estimates have played an increasingly important role in explaining the revisions to CPI-common. **Chart 5** shows that estimates of β have been relatively stable for much of the pandemic but have increased by about 0.4 percentage points in recent months. These revisions reflect the fact that common price movements explain a higher-than-usual share of total CPI inflation. Indeed, the *R*-squared of equation 2 has risen from 0.30 in December 2019 to 0.57 in August 2022.

With recent revisions, CPI-common now aligns more closely with the other two preferred measures of core inflation. However, because of these revisions, caution is necessary when interpreting real-time estimates of CPI-common in the current environment. Future work will assess whether methodological refinements can make CPI-common less prone to revision.

Appendix

Table 1: Changes in factor loadings over the pandemic period

Component	Difference in factor loading between August 2022 and December 2019 (percentage points)
Rental of passenger vehicles	0.14
Purchase of recreational vehicles and outboard motors	0.13
Furniture	0.11
Other food products and non-alcoholic beverages	0.11
Travel services	0.11
Homeowners' replacement cost	0.10
Household equipment	0.10
Gasoline	0.09
Leasing of passenger vehicles	0.09
Fuel oil and other fuels	0.09
Purchase of passenger vehicles	0.08
Operation of recreational vehicles	0.07
Household textiles	0.07
Paper, plastic and aluminum foil supplies	0.07
Home entertainment equipment, parts and services	0.07
Passenger vehicle parts, maintenance and repairs	0.06
Other owned accommodation expenses	0.06
Fish, seafood and other marine products	0.05
Meat	0.05
Inter-city transportation	0.05
Personal care supplies and equipment	0.05
Natural gas	0.05
Bakery and cereal products (excluding baby food)	0.05
Footwear	0.05
Homeowners' home and mortgage insurance	0.04
Dairy products and eggs	0.04
Homeowners' maintenance and repairs	0.04
Food purchased from restaurants	0.03
Fruit, fruit preparations and nuts	0.03
Recreational equipment and services (excluding recreational vehicles)	0.02
Clothing	0.02
Other household goods and services	0.02
Vegetables and vegetable preparations	0.02
Clothing material, notions and services	0.01
Rented accommodation	0.01

Services related to household furnishings and equipment	0.00
Household cleaning products	0.00
Clothing accessories, watches and jewellery	0.00
Other cultural and recreational services	0.00
Electricity	-0.02
Reading material (excluding textbooks)	-0.02
Alcoholic beverages purchased from stores	-0.02
Health care goods	-0.03
Communications	-0.03
Health care services	-0.03
Alcoholic beverages served in licensed establishments	-0.05
Tobacco products and smokers' supplies	-0.05
Mortgage interest cost	-0.05
Other passenger vehicle operating expenses	-0.06
Education	-0.07
Personal care services	-0.08
Property taxes and other special charges	-0.09
Water	-0.09
Child care and housekeeping services	-0.11
Local and commuter transportation	-0.14

Note: Changes in factor loadings are listed in descending order, with green colours signifying large positive changes and red colours signifying large negative changes.

Sources: Statistics Canada and Bank of Canada calculations