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INFLATION MONITOR – JUNE 2022

OFFICE OF THE PARLIAMENTARY BUDGET OFFICER
BUREAU DU DIRECTEUR PARLEMENTAIRE DU BUDGET

The Parliamentary Budget Officer (PBO) supports Parliament by providing economic and financial analysis for the purposes of raising the quality of parliamentary debate and promoting greater budget transparency and accountability.

This report provides current analysis of recent consumer price inflation data.

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Yves Giroux
Parliamentary Budget Officer

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Table of Contents

Summary

This report provides current analysis of recent consumer price inflation data.

Recent developments

Total Consumer Price Index (CPI) inflation has exceeded the 3 per cent upper bound of The Bank of Canada's control range since April 2021. With a rate of 6.8 per cent recorded in April 2022, CPI inflation now sits at its highest level since the introduction of inflation targeting in 1991.

Since the beginning of 2021, increases in the CPI have outpaced monthly inflation consistent with the 2 per cent target. Indeed, annualized month-over-month increases in the CPI have averaged 6.1 per cent, with outsized increases in early 2022: 9.4 per cent in February and 13.0 per cent in March.

Inflation and the pandemic

The ultimate impetus for the resurgence of high inflation can traced back to the COVID-19 pandemic. More recently, the Russian invasion of Ukraine has compounded inflationary pressures.

- Strong consumer demand for goods running into constrained supply—along with surging energy and food prices—have contributed to boosting goods CPI inflation from -2.8 per cent in April 2020 to 9.1 per cent in April 2022.
- As public health measures eased and vaccination coverage expanded, pent-up demand boosted services consumption, putting upward pressure on services price inflation.
- Along with the pandemic-related move to remote working, low interest rates and high incomes have boosted the demand for housing. With supply constrained in the housing sector, house prices have rapidly increased across Canadian cities.

Inflation and purchasing power

Based on the most recent monthly data, CPI inflation in April was more than double the increase in average hourly wages and almost 2 percentage points higher than the increase in the maximum monthly Old Age Security (OAS) payment.

- However, relative to pre-pandemic (February 2020) levels, the increase in the CPI in April (of 9.0 per cent) is only slightly higher than the increase in average wages (8.6 per cent) over the same period.
- The increase in CPI since the start of the pandemic has outpaced the increase in the maximum OAS payment (of 5.7 per cent), due to the time lag in the indexation of monthly payments.

Inflation expectations

Both consumers and businesses have revised their short-term inflation expectations upward. However, consumers' longer-term inflation expectations remain relatively stable and have trended lower during the pandemic period.

Financial market participants largely do not see the current high-inflation environment as permanent, with CPI inflation returning to the 2 per cent target over the medium to long term.

To date, wage settlements data also show little indication of higher observed and expected inflation feeding into wage negotiations in the unionized sector.

Broad-based versus concentrated inflation

The inflation rate represents the average price change of a basket of goods and services. We measure the dispersion of price changes within the basket of goods and services using the standard deviation. For this analysis we use personal consumption expenditure (PCE) data.

If prices of items in the consumption basket are changing by similar amounts, the standard deviation is low, suggesting that inflation is broad based. However, if price changes are limited to a few items that account for a significant share of inflation, the standard deviation is high, suggesting that inflation is concentrated.

- During the pandemic, inflation initially fell well below its historical average as crude oil prices collapsed and the standard deviation of price changes spiked in the second quarter of 2020.
- As inflation started to recover and rise above average levels in 2021, the standard deviation of price changes spiked again and has remained elevated near historical highs, suggesting that inflationary pressures have been concentrated across consumer expenditure items.

This finding is consistent with the view that supply or sector-specific issues are a key driver of high inflation. A finding of broader-based inflationary pressures would be more consistent with stronger aggregate demand as the primary driver of high inflation.

- Our finding is also consistent with the Bank of Canada's CPI-common measure of core inflation that "minimizes the impact of sector-specific disturbances in extracting the signal in total CPI inflation".
- CPI-common inflation remained subdued over most of the pandemic period and has only recently risen above the upper bound of the Bank of Canada's inflation-control range.
- The wide gap between CPI-common and the Bank of Canada's other preferred measures of core inflation suggests that supply disruptions

and sector-specific factors are helping to push total CPI inflation to historically high levels.

That said, CPI-common inflation has picked up noticeably since January and at 3.2 per cent in April 2022, exceeds the upper bound of the Bank of Canada's inflation-control range, suggesting that strong aggregate demand is also putting upward pressure on inflation.

1. Current Analysis

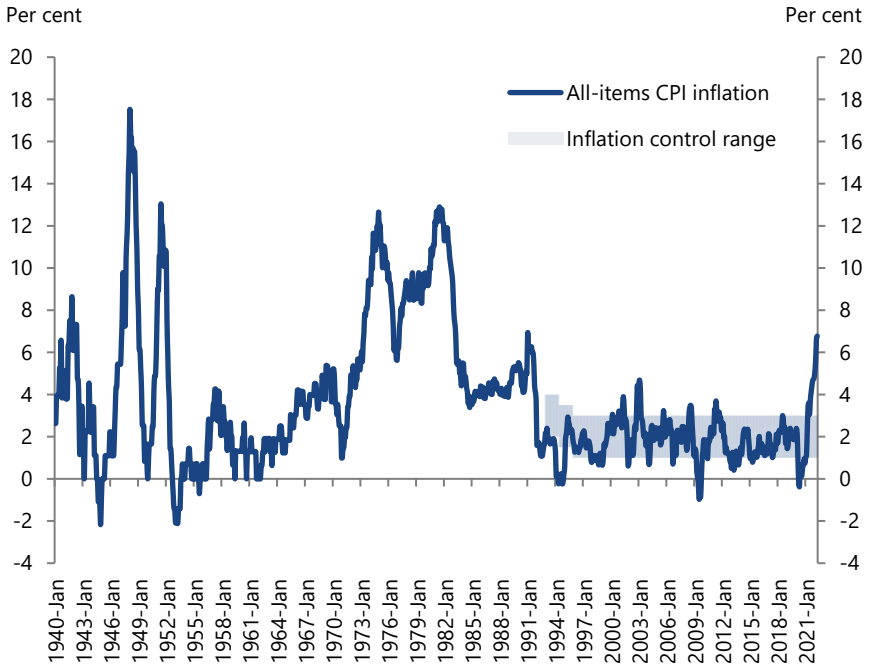
Inflation is typically defined as a persistent increase in the average level of prices over time.[1] For households, inflation is primarily measured as the change in the Consumer Price Index (CPI), which compares the cost of a fixed basket of goods and services purchased by consumers over time.[2]

The objective of the Bank of Canada's monetary policy is "to preserve the value of money by keeping inflation low, stable and predictable".[3] In December 2021, the Government and the Bank of Canada renewed the inflation target, defined in terms of the 12-month rate of change in the CPI, at the 2 per cent midpoint of the 1 to 3 per cent inflation-control range.[4]

Recent developments

Total CPI inflation has exceeded the upper bound of The Bank of Canada's control range since April 2021. With a rate of 6.8 per cent recorded in April 2022, CPI inflation now sits at its highest level since the introduction of inflation targeting in 1991 (Figure 1-1).

Figure 1-1 CPI inflation at its highest level in 30 years



Sources: Statistics Canada and Office of the Parliamentary Budget Officer.

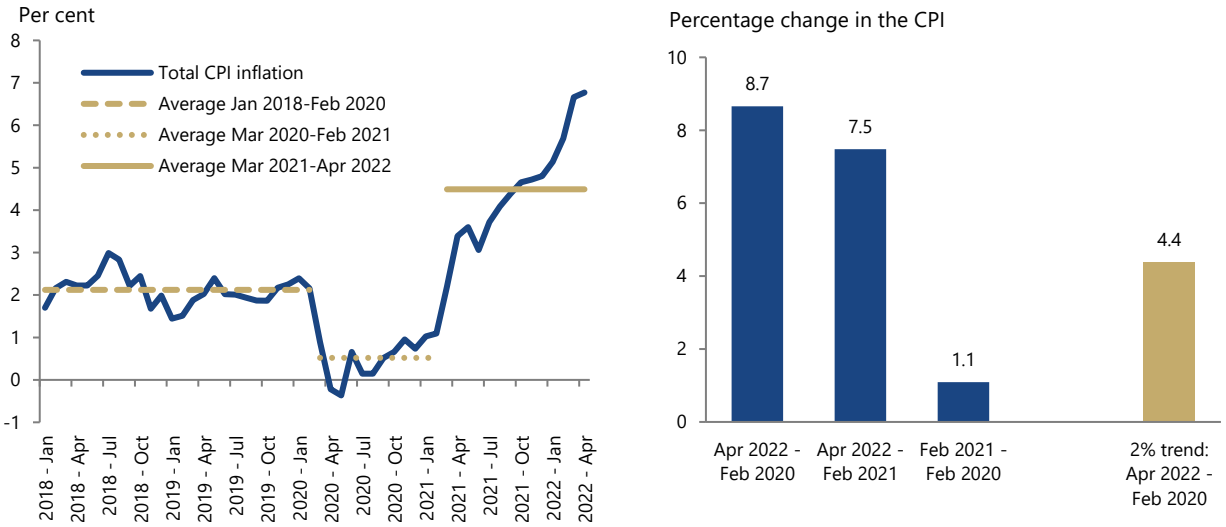
Note: The last data point is April 2022.

In the two years prior to the pandemic, monthly CPI inflation averaged 2.1 per cent—only marginally above the 2 per cent target rate. With the onset of the pandemic in March 2020, CPI inflation decreased sharply, falling to -0.4 per cent in May 2020, and remained below the 2 per cent target rate through February 2021 (Figure 1-2, left panel). Inflation then rebounded rapidly, rising to 5.7 per cent in February 2022.

However, the rapid rebound in CPI inflation over March 2021 to February 2022 reflected, in part, "base-year effects".[5] That is, given the year-over-year nature of the calculation, the weakness in inflation in 2020 following the onset of the pandemic exaggerated the strength in inflation in 2021 and early 2022.

Given the volatility in inflation over the pandemic period, it is informative to compare the current (April 2022) level of the CPI to its pre-pandemic level in February 2020. Figure 1-2 (right panel) shows that the CPI in April 2022 is 8.7 per cent above its pre-pandemic level, with most of this increase occurring over the past year. If CPI inflation remained at 2.0 per cent (annualized, month-over-month basis) over this period, the CPI would be 4.4 per cent above its pre-pandemic (February 2020) level, suggesting that approximately half of the inflation experienced to date has been "excess".

Figure 1-2 Inflation since the beginning of the pandemic



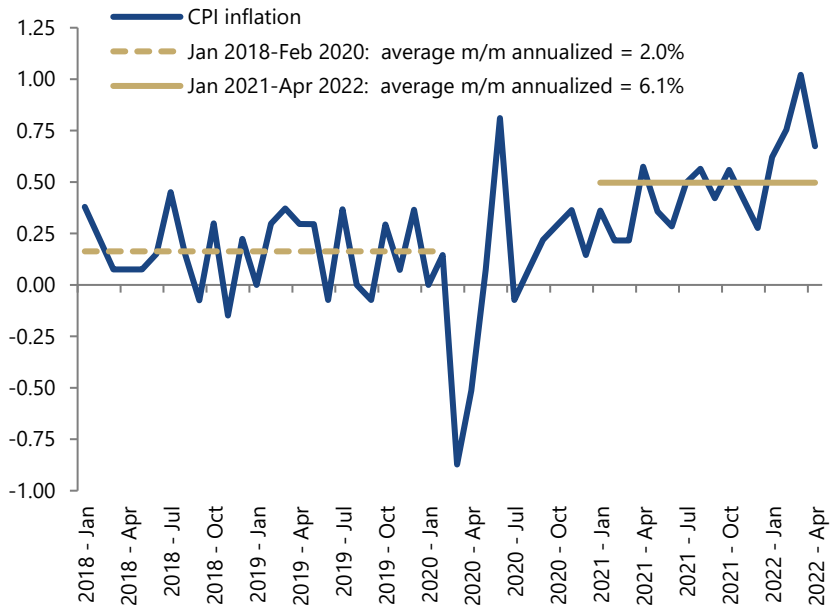
Sources: Statistics Canada and Office of the Parliamentary Budget Officer.

Note: The percentage changes shown in the right panel are calculated using seasonally adjusted CPI data.

Since the beginning of 2021, increases in the CPI have outpaced monthly inflation consistent with the 2 per cent target (Figure 1-3). Indeed, annualized month-over-month increases in the CPI have averaged 6.1 per cent, with outsized increases in early 2022: 9.4 per cent in February and 13.0 per cent in March.

Figure 1-3 **Month-over-month increases in the CPI**

Per cent, seasonally adjusted

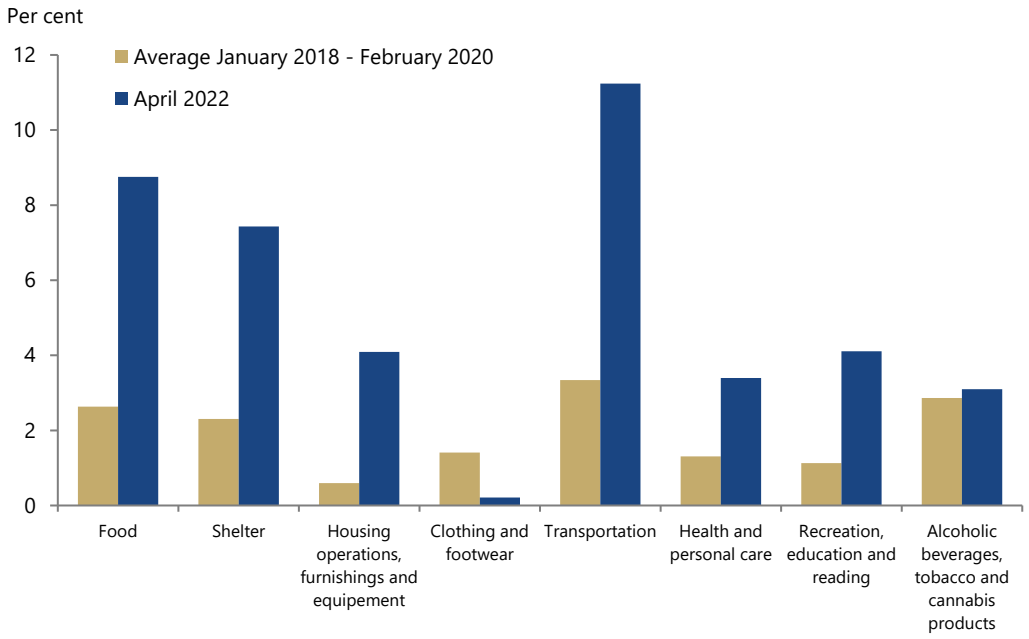


Sources: Statistics Canada and Office of the Parliamentary Budget Officer.

As previously noted, the CPI represents a basket of good and services. These goods and services are divided into 8 major groups. Consumer price indices are also constructed for various geographical areas, including individual provinces and territories.

Figure 1-4 indicates that, except for clothing and footwear, inflation in April 2022 exceeded the average rate of inflation observed in the pre-pandemic period. In particular, the rate of inflation in the transportation category exceeded its pre-pandemic average inflation rate by almost 8 percentage points (3.3 per cent versus 11.2 per cent).

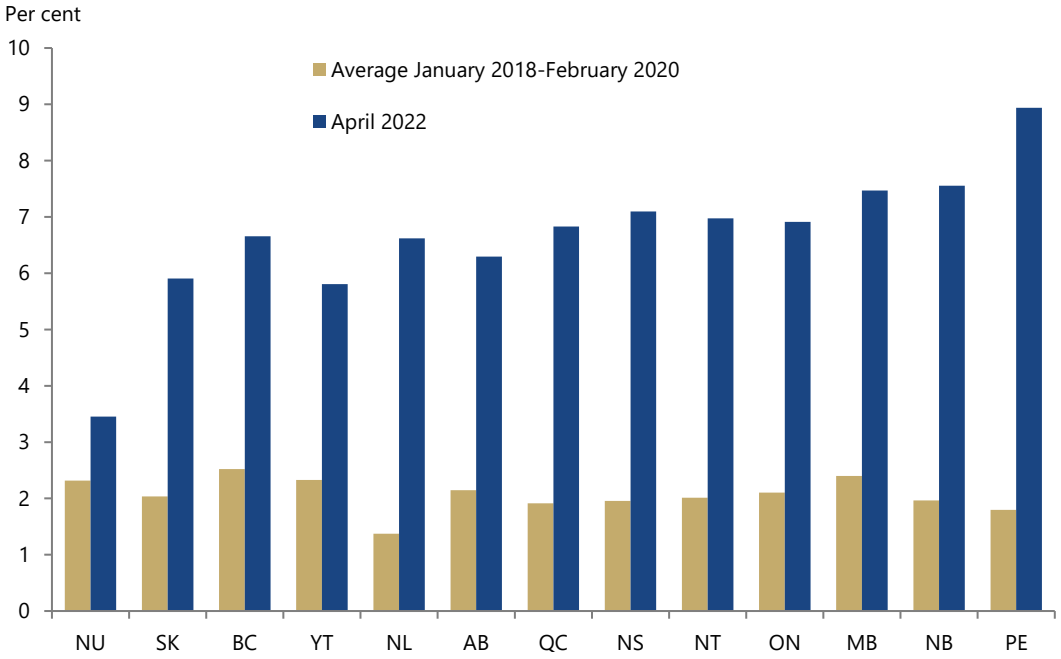
Figure 1-4 Total CPI inflation: major components



Sources: Statistics Canada and Office of the Parliamentary Budget Officer.

Similar to the breadth of higher inflation across categories of goods and services, consumers in all provinces and territories have experienced a significant increase in CPI inflation compared to the pre-pandemic period (Figure 1-5).

Figure 1-5 CPI inflation in provinces and territories



Sources: Statistics Canada and Office of the Parliamentary Budget Officer.

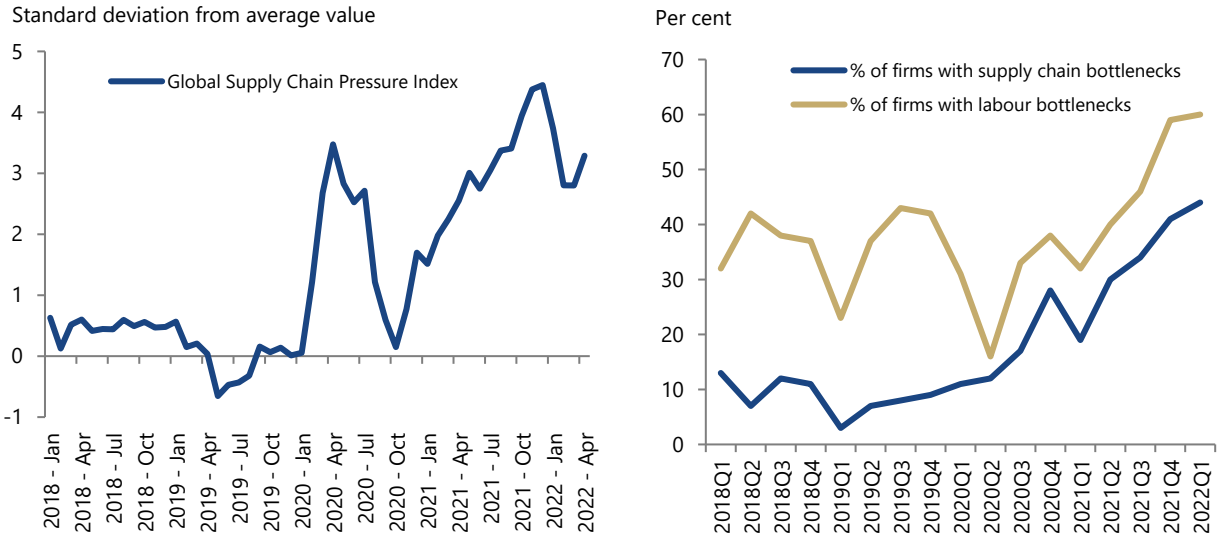
Drivers of CPI inflation

The ultimate impetus for the resurgence of high inflation can traced back to the COVID-19 pandemic. More recently, the Russian invasion of Ukraine has compounded inflationary pressures.

Following the COVID-19 pandemic declaration by the World Health Organization in March 2020, several countries, including Canada, implemented lockdowns, disrupting production and temporarily reducing supply. At the same time, many governments provided emergency income support for individuals and businesses. With restrictions on in-person contact, such as stay-at-home orders, consumer demand shifted away from contact-intensive services toward goods.[6] In Canada, demand also shifted toward housing.

As economies started to reopen, renewed lockdowns and other public health measures, combined with shortages of intermediate inputs, labour and other disruptions, constrained supply while demand, particularly for goods, grew rapidly.[7] Based on an index of global supply chain pressure developed at the Federal Reserve Bank of New York, supply chain disruptions reached record levels at the end of 2021 (Figure 1-6, left panel).[8] In Canada, the proportion of businesses reporting labour and supply chain bottlenecks has increased significantly since the second half of 2021 (Figure 1-6, right panel).

Figure 1-6 Supply chain disruptions and constraints



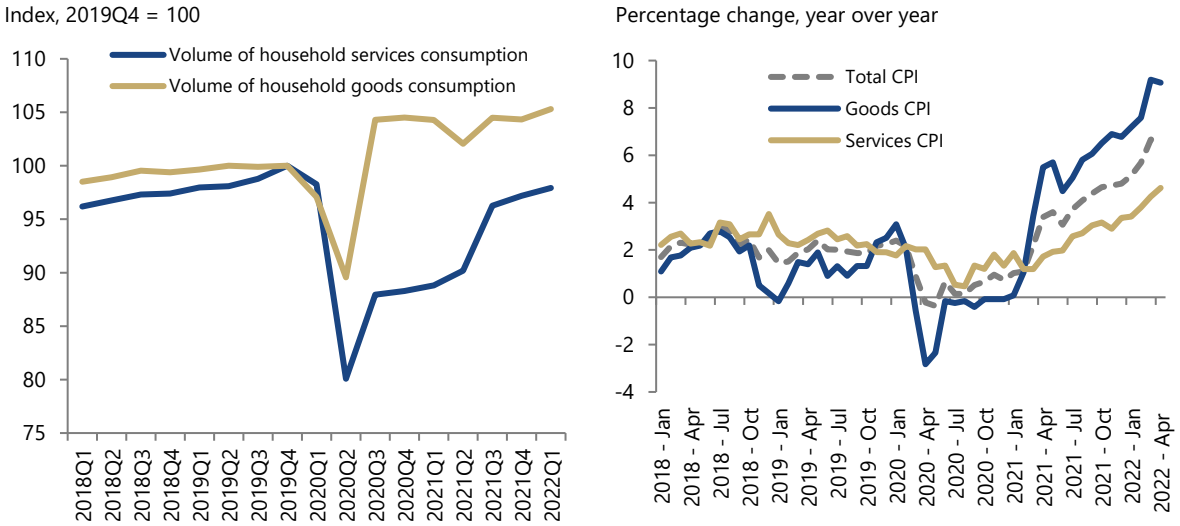
Sources: Bank of Canada, Federal Reserve Bank of New York and Office of the Parliamentary Budget Officer.

Note: Last data point in the left panel is April 2022 and 2022Q1 in the right panel.

Figure 1-7 (left panel) shows the sharp rebound and strength in goods consumption in Canada following the contraction in the second quarter of 2020. In the first quarter of 2022, goods consumption increased to 5.3 per cent above its pre-pandemic level. Despite a strong pickup in services consumption in the second half of 2021, spending on services remains 2.1 per cent below its pre-pandemic level.

Strong consumer demand for goods running into constrained supply—along with surging energy and food prices—have contributed to boosting goods CPI inflation from -2.8 per cent in April 2020 to 9.1 per cent in April 2022, registering one of the largest and most rapid swings on record (Figure 1-7, right panel). As public health measures eased and vaccination coverage expanded, pent-up demand boosted services consumption, putting upward pressure on services price inflation.

Figure 1-7 Pandemic-related shifts in consumer spending and inflation



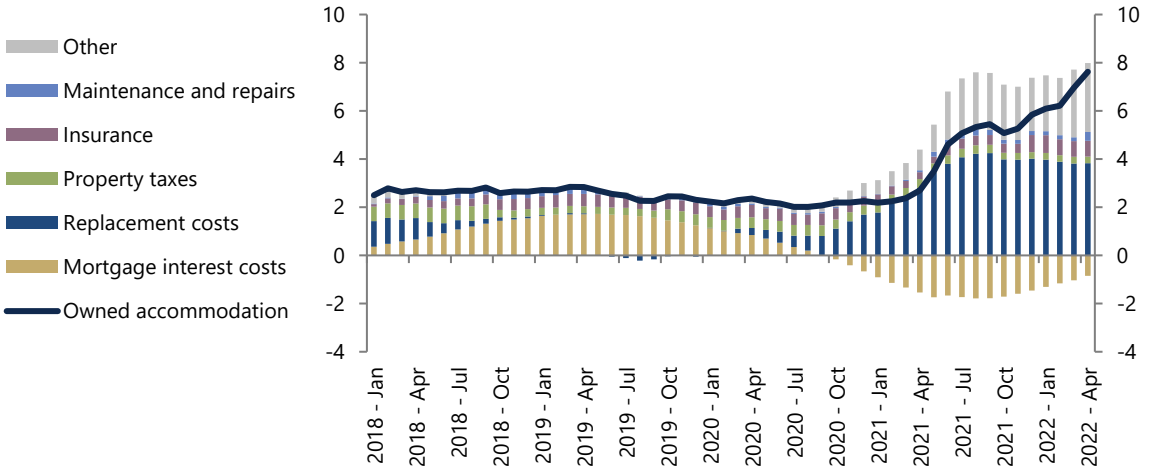
Sources: Statistics Canada and Office of the Parliamentary Budget Officer.

Along with the pandemic-related move to remote working, low interest rates and high incomes have boosted the demand for housing.[9] With supply constrained in the housing sector, house prices have rapidly increased across Canadian cities.

House prices influence the owned accommodation subcategory of shelter in the CPI, in particular the replacement cost component, which is an imputed depreciation expense. As house prices rise, replacement cost typically increases.[10] Prior to the pandemic, replacement cost contributed 0.2 percentage points, on average, to owned accommodation inflation (Figure 1-8).

Figure 1-8 Owned accommodation inflation and its components

Percentage points, contributions to owned accommodation inflation



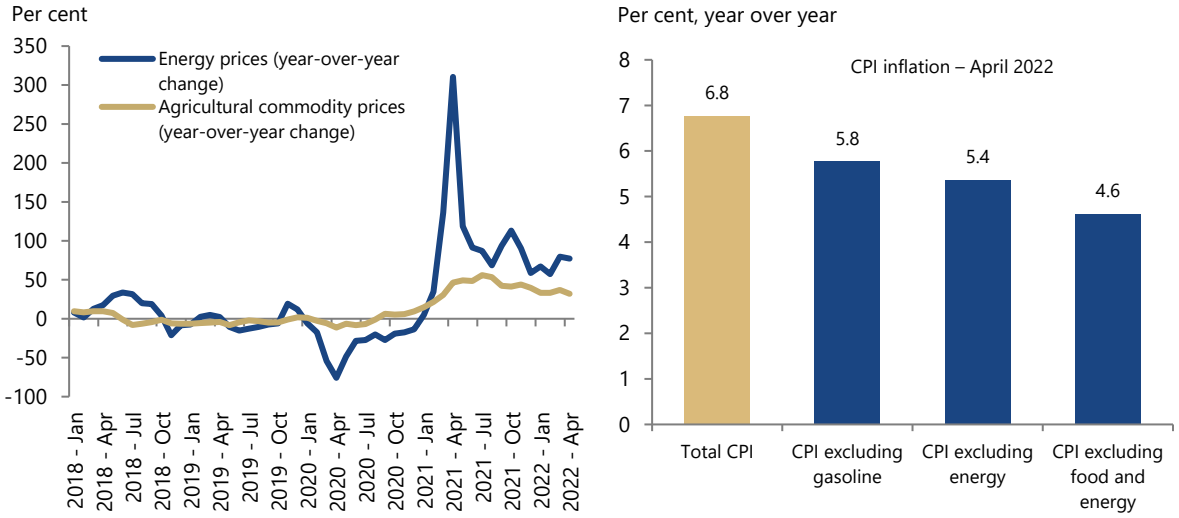
Sources: Statistics Canada and Office of the Parliamentary Budget Officer.

The contribution of replacement cost to owned accommodation inflation rose sharply to over 4 percentage points in July 2021 as new home prices (house only, excluding land) increased by over 14 per cent on a year-over-year basis. In April, replacement cost contributed 0.7 percentage points to total CPI inflation of 6.8 per cent, which is down slightly from its high of 0.8 percentage points in September 2021.

With the strengthening in global economic activity over the course of 2021, commodity prices increased sharply (Figure 1-9, left panel). Supply issues and weather disruptions also contributed to boosting commodity prices over this period. Energy prices—specifically crude oil and natural gas—have remained high and volatile, particularly following the Russian invasion of Ukraine in February. Agricultural commodity prices also surged through 2021 and spiked in February and March during the war in Ukraine.

Rising crude oil prices have pushed gasoline prices higher. In April 2022, higher gasoline prices contributed 1.3 percentage points to the 6.8 per cent year-over-year increase in the total CPI. Excluding energy and food reduces total CPI inflation in April by over two percentage points to 4.6 per cent (Figure 1-9, right panel).

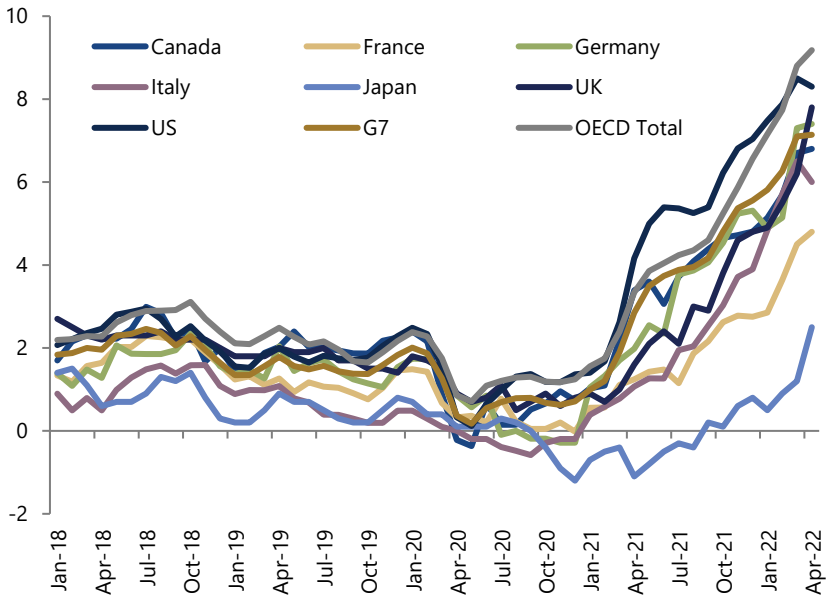
Figure 1-9 Commodity prices and CPI inflation



Sources: Bank of Canada, Statistics Canada and Office of the Parliamentary Budget Officer.

Recent analysis by the Organisation for Economic Co-operation and Development (OECD) indicates that rising energy and food prices are a global phenomenon pushing up inflation in most countries (Figure 1-10).[11] The OECD notes "[s]upply-chain disruptions and pent-up consumer demand due to COVID-19 have contributed to high inflation in most countries".

Figure 1-10 Inflation has surged in most advanced economies



Sources: OECD and Office of the Parliamentary Budget Officer.

Note: The last data point is April 2022.

CPI inflation and purchasing power

Over time, inflation erodes the purchasing power of money. To determine the implications of inflation on consumers' purchasing power, it is informative to compare changes in the CPI to changes in components of household income such as wages and pensions.

Figure 1-11 provides a comparison of CPI inflation and increases in wages and maximum Old Age Security (OAS) monthly payments, which are indexed to CPI.[12] Based on the most recent monthly data, CPI inflation in April was more than double the increase in average hourly wages and almost 2 percentage points higher than the increase in the maximum monthly OAS payment.[13]

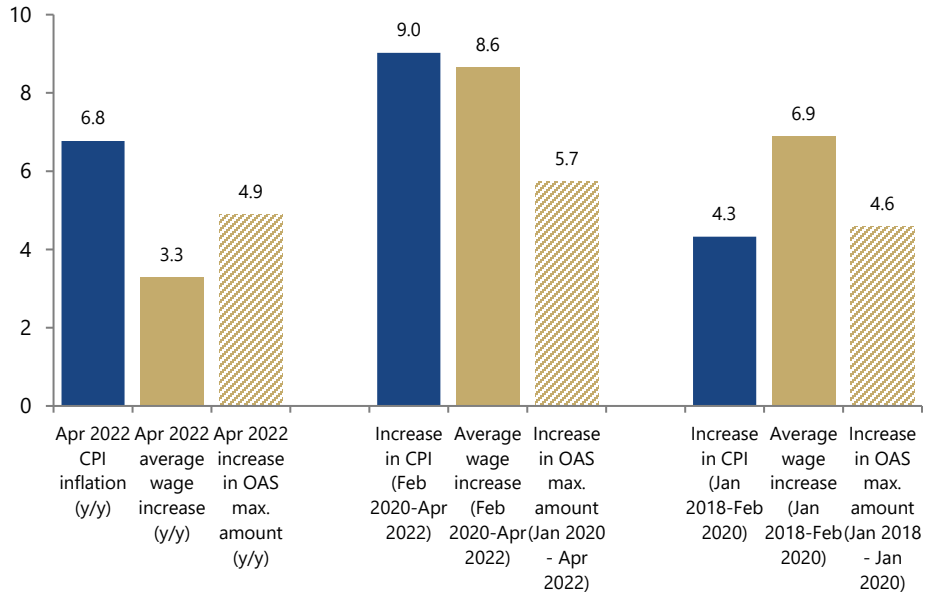
However, given the volatility of CPI inflation during the pandemic period, it is helpful to compare current levels of the CPI and incomes to their pre-pandemic levels (February 2020).

Relative to February 2020, the increase in the CPI in April (of 9.0 per cent) is only slightly higher than the increase in average wages (8.6 per cent) over the same period. That said, the increase in CPI since the start of the pandemic has outpaced the increase in the maximum OAS payment (of 5.7 per cent), due to the time lag in the indexation of monthly payments.

With the increase in inflation during the pandemic, the gains in purchasing power experienced in the two years prior to the pandemic have been eroded.

Figure 1-11 CPI inflation and income growth

Per cent



Sources: Statistics Canada and Office of the Parliamentary Budget Officer.

Inflation expectations

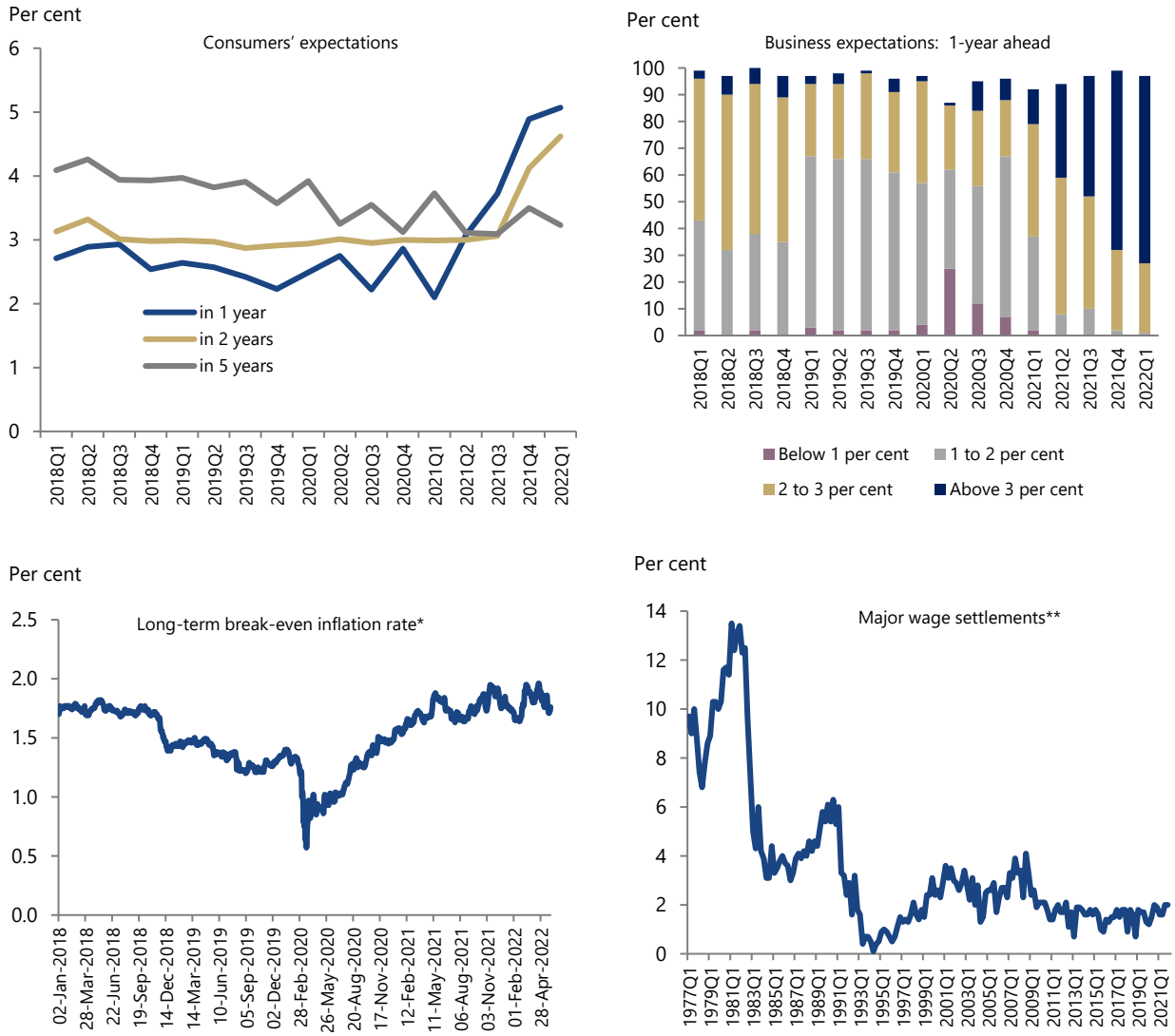
In its April Monetary Policy Report, the Bank of Canada noted concerns that "high and persistent inflation can affect long-term inflation expectations" which are "an important factor behind future inflation".[14]

Both consumers and businesses have revised their short-term inflation expectations upward (Figure 1-12, top panels). Consumers have increased their 1-year ahead inflation expectation from 2.1 per cent in the first quarter of 2021 to 5.1 per cent as of the first quarter in 2022. Similarly, 70 per cent of businesses anticipate that inflation will be above 3 per cent for the next year. However, consumers' longer-term inflation expectations remain relatively stable and have trended lower during the pandemic period.[15]

Financial market participants largely do not see the current high-inflation environment as permanent, with CPI inflation returning to the 2 per cent target over the medium to long term. The Bank of Canada notes that the 5-year break-even inflation rate (that is, the difference between 5-year nominal and inflation-linked bonds) has increased to close to 3 per cent, which is "consistent with a rise in inflation over the near term followed by a decline toward the 2% target".[16] The long-term (greater than 10 years) breakeven inflation rate also supports this view (Figure 1-12, lower left panel).

To date, wage settlements data also show little indication of higher observed and expected inflation feeding into wage negotiations in the unionized sector (Figure 1-12, lower right panel).

Figure 1-12 Inflation expectations



Sources: Bank of Canada, Statistics Canada and Office of the Parliamentary Budget Officer.

Note: * Calculated as the nominal long-term Government of Canada benchmark bond minus the long-term real return bond rate. Last data point is May 31.
** All industries, average annual percentage adjustment. Last data point is 2022Q1.

2. Broad-based vs. concentrated inflation

In its April 2022 Monetary Policy Report, the Bank of Canada noted that "price pressures are broadening, with about two-thirds of CPI components growing above 3%", which is approximately double the share that existed prior to the pandemic.

In this section we highlight a statistical measure of dispersion of price changes that captures the extent to which inflation is broad based or concentrated across consumer expenditure items.

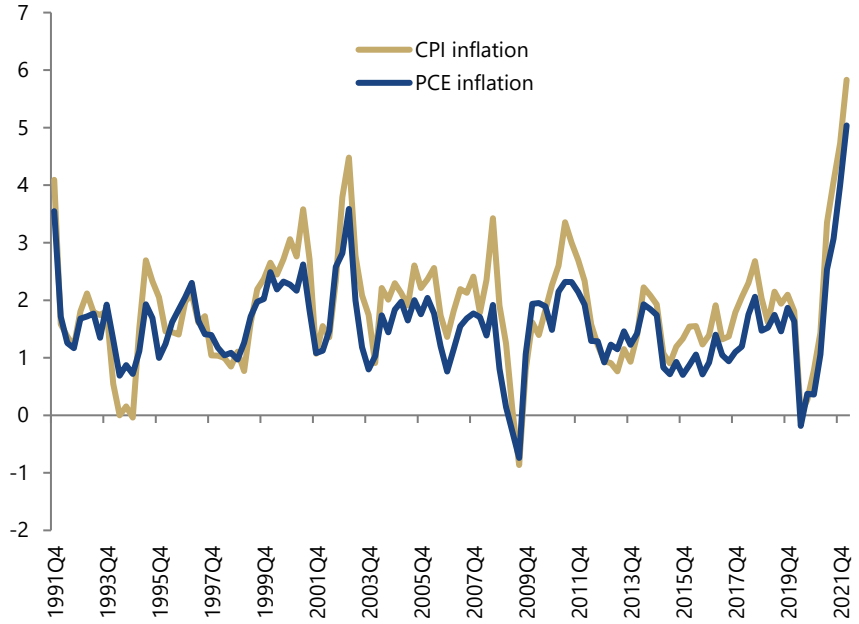
Personal Consumption Expenditure inflation

Households may alter their consumption patterns when prices of goods and services change, or when new goods become available, which can distort the inflationary signal from a price index like the CPI.[17] To control for some of the impacts of these types of shifts in consumption patterns, we use detailed personal consumption expenditure (PCE) data to construct our measure of inflation and the dispersion of price changes across expenditure items.[18]

That said, the PCE measure of inflation is highly correlated with CPI inflation (Figure 2-1).[19] There is, however, a discernable difference in the level of inflation rates over time: quarterly PCE inflation is 0.3 percentage points lower, on average, over 1991Q1-2022Q1. Despite this level discrepancy, our measure of dispersion still serves as a meaningful metric since it is based on the deviation from an average inflation rate.

Figure 2-1 PCE and CPI inflation

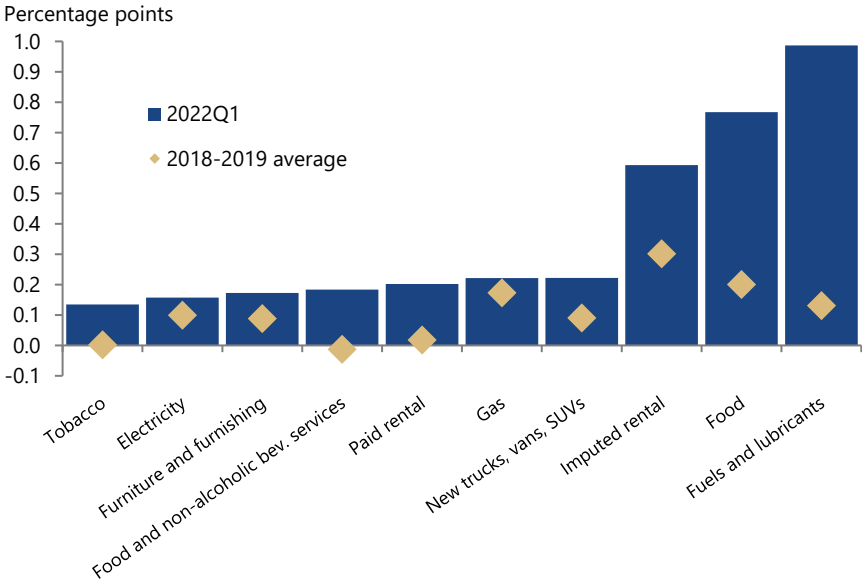
Per cent



Sources: Statistics Canada and Office of the Parliamentary Budget Officer. The last data point shown is 2022Q1.

In the first quarter of 2022, the top-ten contributors to PCE inflation accounted for 72 per cent of the inflation rate in that quarter and were above their pre-pandemic contribution levels (Figure 2-2). However, the difference between contributions over the two periods is not substantial, except for a few categories such as fuels and lubricants, food, and imputed rent. While looking at contributions to inflation provides an indication of the relative importance of specific consumer items, the standard deviation of price changes provides a more intuitive summary measure of the breadth of inflationary pressures.

Figure 2-2 Top-10 contributors to PCE inflation in 2022Q1



Sources: Statistics Canada and Office of the Parliamentary Budget Officer.

Note: The pre-pandemic period 2018Q1 to 2019Q4 is used as a reference point.

Dispersion of price changes

As noted above, the inflation rate represents the average price change of a basket of goods and services. The standard deviation of the price changes across expenditure items provides a natural measure of their dispersion (see Appendix A for additional detail).[20]

If prices of items in the consumption basket are changing by similar amounts, the standard deviation is low, suggesting that inflation is broad based. However, if price changes are limited to a few items that account for a significant share of inflation, the standard deviation is high, suggesting that inflation is concentrated.[21]

We use the average of the time series of the standard deviation to represent the "normal" degree of price change dispersion.[22] That is, above-average values suggest that inflationary pressures are more concentrated; below average values suggest that inflationary pressures are broader based.

Pre-pandemic experience suggests that both above- and below-average PCE inflation rates generally coincide with periods of higher concentration of price changes (Figure 2-3). This suggests that when inflation deviates from its average, price changes concentrated among relatively few items are a determining factor.[23] Of course, there are exceptions to this result, such as the 1996Q2-1997Q2 period.

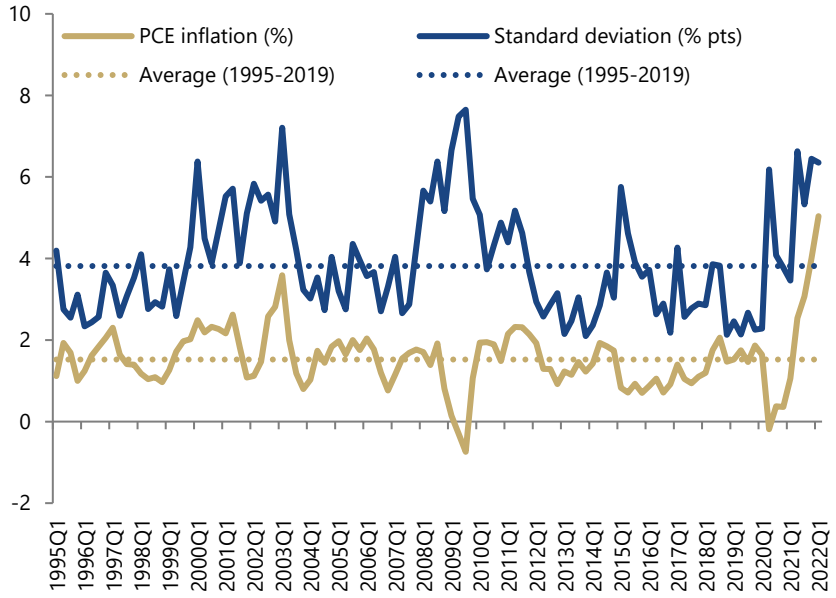
During the pandemic, inflation initially fell well below its historical average as crude oil prices collapsed and the standard deviation of prices changes spiked in 2020Q2. Then, as inflation started to recover and rise above

average levels, the standard deviation of price changes spiked again and has remained elevated near historical highs. This suggests that inflationary pressures have been more concentrated across consumer expenditure items.

Moreover, this finding would be consistent with the view that supply or sector-specific issues are a key driver of high inflation. Broader-based inflationary pressures would be more consistent with stronger aggregate demand as the primary driver of high inflation.[24]

Figure 2-3 Inflation and the dispersion of price increases

Per cent, percentage points



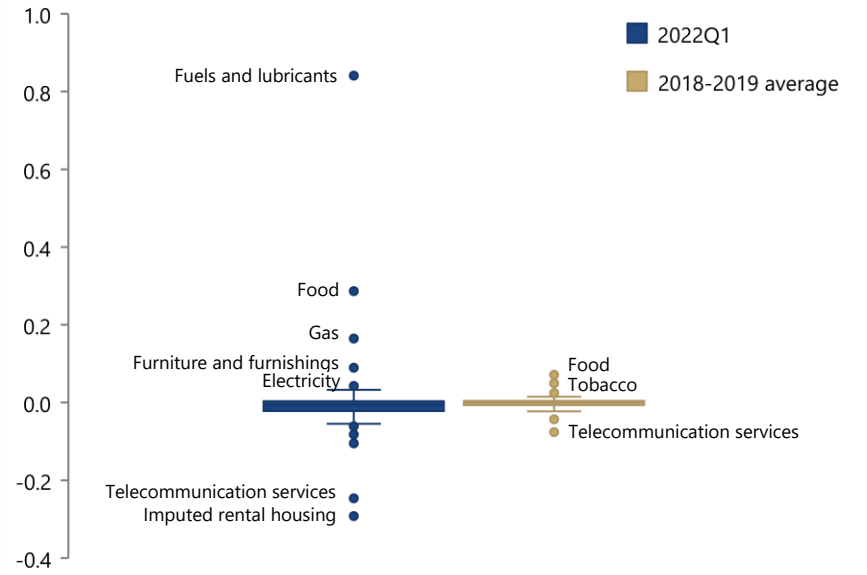
Sources: Statistics Canada and Office of the Parliamentary Budget Officer.

A box plot is another tool that can be used to visualize the concentration of price pressures across expenditure items and to help identify outliers, that is, items where the magnitude of the price change is significantly different from that at the aggregate level. The dots, or circles, shown in the plot are calculated as the difference between inflation for a given item and the aggregate inflation rate, weighted by the share of that item in total consumer expenditure (that is, its "excess" contribution).

Figure 2-4 indicates that the contribution of fuels and lubricants, and food in the first quarter of 2022 was markedly different from the pre-pandemic period.

Figure 2-4 Contributors to inflationary pressures

Weighted deviation from PCE inflation, percentage points



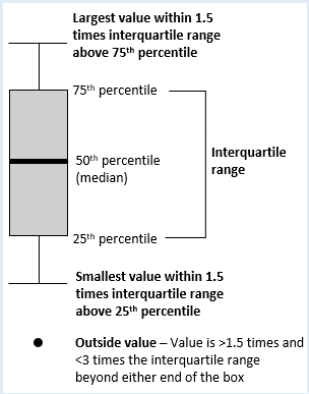
Sources: Statistics Canada and Office of the Parliamentary Budget Officer.

Note: The pre-pandemic period 2018Q1 to 2019Q4 is used as a reference point.

Box plot

A box plot shows the median, the 25% and 75% quantiles (called "quartiles") and the "outliers", defined as data points that are a fixed fraction away from the quartiles.*

The figure below explains how to read a box plot.



Source: https://waterdata.usgs.gov/blog/boxplots/

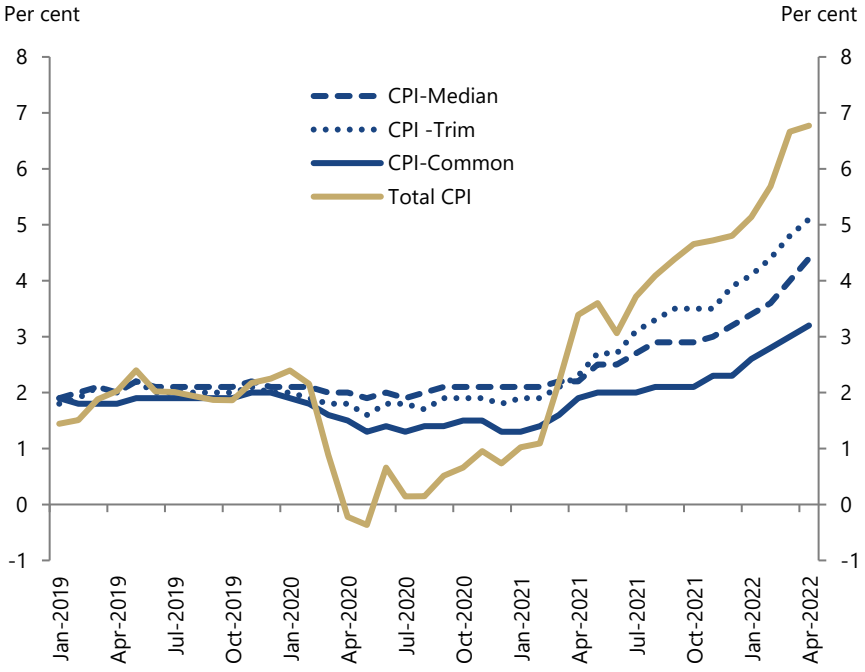
* Le Boudec, J.-Y. (2021). Performance Evaluation of Computer and Communication Systems. EPFL. Retrieved from https://leboudec.github.io/perfeval/.

Filtering out supply disruptions and sector-specific shocks

Our finding that inflationary pressures have been more concentrated and less broad based is also consistent with the Bank of Canada's "common component" (CPI-common) measure of core inflation. CPI-common uses a factor model to exploit "co-movements between individual prices comprising the Canadian CPI and minimizes the impact of sector-specific disturbances in extracting the signal in total CPI inflation".[25] As such, this measure of inflation should be less susceptible to supply disruptions.[26]

Moreover, the wide gap between CPI-common and the Bank of Canada's other preferred measures of core inflation suggests that supply disruptions and sector-specific factors are helping to push total CPI inflation to historically high levels (Figure 2-5).[27] That said, CPI-common inflation has picked up noticeably since January and at 3.2 per cent in April 2022, exceeds the upper bound of the Bank of Canada's inflation-control range, suggesting that strong aggregate demand is also putting upward pressure on inflation.

Figure 2-5 Total CPI inflation and measures of core inflation



Sources: Bank of Canada, Statistics Canada and Office of the Parliamentary Budget Officer.

Appendix A: PCE inflation and dispersion of price changes

Personal consumption expenditure (PCE) data

Nominal and real (inflation-adjusted) personal consumption expenditure data from the National Accounts were collected for individual categories from 1990Q1 to 2022Q1 (Statistics Canada Table 36-10-0124). The consumption basket of goods and services we use covers 97 categories. We excluded the net expenditure abroad category to more closely align with the structure of the CPI basket of goods and services.

Implicit prices

We derived implicit price indices *P* for each expenditure category series *i* (in nominal and real terms) and each quarter *t* using the following equation:

$$P_{i,t} = \frac{nominal\ expenditure_{i,t}}{real\ expenditure_{i,t}}$$

The inflation rate π for each category is then calculated as the year-over-year percentage change in the implicit price index.

$$\pi_{i,t} = 100 \times \left(\frac{P_{i,t}}{P_{i,t-4}} - 1\right)$$

Basket weights

Basket weights *w* were calculated as the share of each category in total nominal expenditures.

$$w_{i,t} = \frac{nominal\ expenditure_{i,t}}{\sum_{i=1}^{97} nominal\ expenditure_{i,t}}$$

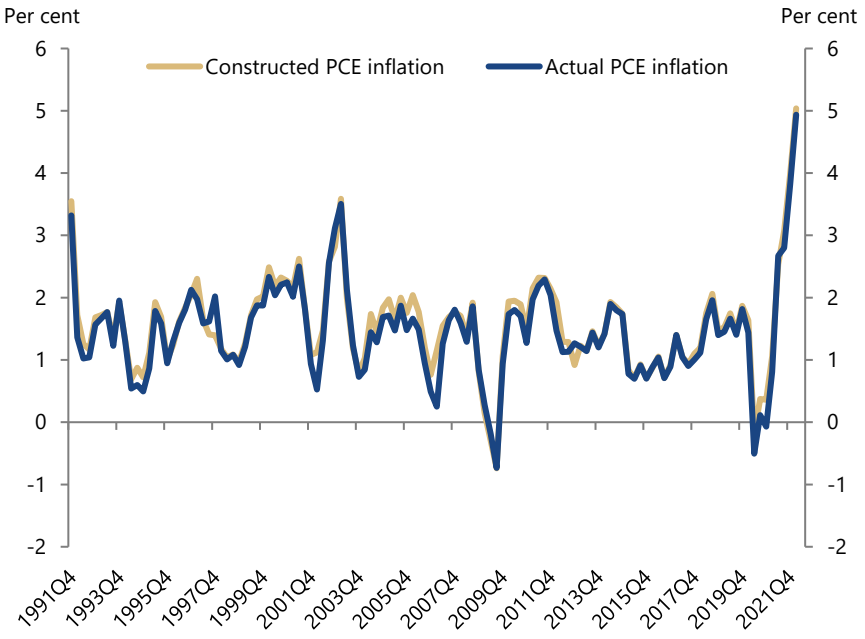
PCE inflation rate

To construct total PCE inflation, we aggregate the inflation rates by category weighted by their nominal expenditure shares.

$$\pi_t^{PCE} = \sum_{i=1}^{97} w_{i,t-4} \times \pi_{i,t}$$

As a check on our data construction, we compare our measure of PCE inflation with that derived using the total expenditure series (the "actual" PCE inflation rate).[28] That is, the above implicit price index using total nominal expenditure and total real expenditure (excluding net expenditure abroad). Figure A-1 shows that the two series are almost identical.

Figure A-1 PCE inflation: actual versus constructed



Sources: Statistics Canada and Office of the Parliamentary Budget Officer.

Dispersion of price changes

We use the standard deviation of price changes across expenditure categories σ as a measure of their dispersion. We follow the definition of the higher order moments of inflation in Kearns (1998)[29] to calculate the standard deviation in each quarter.

$$\sigma_t = \sqrt{\sum_{i=1}^{97} w_{i,t-4} \times \left(\pi_{i,t} - \pi_t^{PCE}\right)^2}$$

Notes

1. For example, see the Bank of Canada "Understanding Inflation" Explainer, available at: https://www.bankofcanada.ca/2020/08/understanding-inflation/.

   Unless otherwise noted, inflation rates in this report are calculated as the year-over-year percentage change in a price index.

2. See Statistics Canada's Consumer Price Index Portal for additional detail at: https://www.statcan.gc.ca/en/subjects-start/prices_and_price_indexes/consumer_price_indexes.

3. For additional detail, please consult: https://www.bankofcanada.ca/core-functions/monetary-policy/.

4. The joint statement on the renewal of the monetary policy framework is available at: https://www.bankofcanada.ca/2021/12/joint-statement-of-the-government-of-canada-and-the-bank-of-canada-on-the-renewal-of-the-monetary-policy-framework/.

5. For additional detail, please consult: https://www.bankofcanada.ca/2021/05/understanding-consumer-price-index/#Baseyear-effects.

6. The February 2022 IMF Working Paper, "Supply Bottlenecks: Where, Why, How Much and What Next?" outlines key stylized facts of the repercussions of the pandemic, and also provides a conceptual framework for analyzing supply constraints. Available at: https://www.imf.org/en/Publications/WP/Issues/2022/02/15/Supply-Bottlenecks-Where-Why-How-Much-and-What-Next-513188.

7. See the Bank of Canada's October 2021 and January 2022 Monetary Policy Reports for a discussion of the inflationary impacts of pandemic-related goods consumption and supply constraints in Canada. Available at: https://www.bankofcanada.ca/2021/10/mpr-2021-10-27/; and https://www.bankofcanada.ca/2022/01/mpr-2022-01-26/.

8. The Federal Reserve Bank of New York Global Supply Chain Pressure Index integrates a number of indicators, such as transportation costs and manufacturing data from purchasing manager surveys, "to provide a more comprehensive summary of potential disruptions affecting global supply chains". For additional detail, see the article "A New Barometer of Global Supply Chain Pressures" available at: https://libertystreeteconomics.newyorkfed.org/2022/01/a-new-barometer-of-global-supply-chain-pressures/.

9. Bank of Canada analysis points to "[s]trong demand fundamentals, shifting preferences for more space, and limited supply of single-family homes" that together have contributed to the acceleration in house prices across Canadian cities. See Bank of Canada Staff Analytical Note 2021-9, Detecting exuberance in house prices across Canadian cities.

Available at: https://www.bankofcanada.ca/2021/05/staff-analytical-note-2021-9/.

10. Statistics Canada derives replacement cost from data extracted from its annual Survey of Household Spending and applies a depreciation rate of 1.5 per cent. For monthly changes in replacement cost, Statistics Canada uses its New Housing Price Index (house only). For additional detail, see Statistics Canada's "Shelter in the Canadian CPI: An overview" available at: https://www150.statcan.gc.ca/n1/pub/62f0014m/62f0014m2017001-eng.htm.

11. Available at: https://www.oecd.org/sdd/prices-ppp/statistical-insights-why-is-inflation-so-high-now-in-the-largest-oecd-economies-a-statistical-analysis.htm.

12. For additional detail, see: https://www.canada.ca/en/services/benefits/publicpensions/cpp/old-age-security/payments.html.

13. There is a time lag in the indexation of OAS payments. For example, the monthly payment in April 2022 reflects the increase in the average level of total CPI in November 2021 to January 2022 relative to the average level in August 2021 to October 2021.

    In addition, OAS payments are not reduced if there is a decline in the CPI; payments are maintained at prior levels.

14. See: https://www.bankofcanada.ca/2022/04/mpr-2022-04-13/.

15. In the pre-pandemic period, consumers' perceptions and expectations of inflation as measured by the Bank of Canada's Canadian Survey of Consumer Expectations, were consistently higher than actual inflation as measured by the CPI. Analysis by Statistics Canada and Bank of Canada researchers examine factors that contribute to this gap. See: https://www150.statcan.gc.ca/n1/pub/62f0014m/62f0014m2021017-eng.htm.

16. See: https://www.bankofcanada.ca/2022/04/mpr-2022-04-13/.

17. These distortions are referred to as commodity-substitution and new-goods bias. For a discussion this and other biases in the CPI, see the Summer 2021 Bank of Canada Review article, Measurement Bias in the Canadian Consumer Price Index: An Update. Available at: https://www.bankofcanada.ca/wp-content/uploads/2012/08/boc-review-summer12-sabourin.pdf. To reduce the impact of some of the measurement biases, Statistics Canada has revised CPI weights more frequently (every two years instead of every four years).

18. Specifically, we use Statistics Canada's detailed household final consumption expenditure data from Table 36-10-0124. The data are quarterly and implicit prices are calculated from nominal values using 2012 constant dollar volumes.

    For a discussion of the differences between the CPI and PCE measures of inflation, see the September 2007 paper, Accounting for the Difference between the CPI and Personal Expenditure Price Index in Canada by Harchaoui, T. M., J. Hume and J. Withington. Available at:

https://www.ottawagroup.org/Ottawa/ottawagroup.nsf/home/Papers+-+Article+title.

The detailed PCE volume data are constructed using constant, as opposed to chained, dollar volumes. Chained dollar volumes are limited to 39 commodity categories (excluding net expenditure abroad) and to maximize the number of commodity categories, we used the detailed constant dollar data, which include 97 commodity categories.

As a check on our results, we constructed aggregate PCE inflation and standard deviations of PCE price changes using the chained volume series (Statistics Canada Table 36-10-0107) to derive implicit prices. The difference between aggregate constant dollar and chained dollar PCE inflation was, on average, 0.01 percentage points over 1995Q1 to 2022Q1, with a correlation of 0.99. The correlation of the constant dollar and chained dollar standard deviation series over 1995Q1 to 2022Q1 was 0.93.

19. Over 1991Q1 to 2022Q1, the correlation coefficient of the PCE and CPI inflation series is 0.93.

20. For a discussion of the statistical moments of inflation, see the Reserve Bank of Australia Research Discussion Paper 9810, The Distribution and Measurement of Inflation. Available at: https://www.rba.gov.au/publications/rdp/1998/pdf/rdp9810.pdf.

21. Recent analysis in The Economist used the standard deviation of price changes in the U.S. personal consumption expenditures index to gauge the concentration of inflationary pressures. See the 6 November 2021 article, A handful of items are driving inflation in America. We thank the authors for providing additional detail regarding their analysis and have adopted their "broad-based" and "concentrated" inflation terminology.

22. This approach differs from that used in The Economist (see note 21), which developed a time series regression model to estimate the "excess" concentration of inflation. That is, the standard deviation of price changes relative to what one would expect based on overall inflation.

23. This is not an entirely surprising result given that large fluctuations in energy and food prices, typically drive swings in headline inflation rates such as the total CPI.

24. In constructing their measure of the common component of CPI inflation, Khan et al. note that "common movements in prices are more likely to reflect underlying inflationary pressures related to aggregate demand than sector-specific disturbances". Bank of Canada Working Paper 2013-35, The Common Component of CPI: An Alternative Measure of Underlying Inflation for Canada: https://www.bankofcanada.ca/2013/10/working-paper-2013-35/.

25. See Bank of Canada Working Paper 2013-35, The Common Component of CPI: An Alternative Measure of Underlying Inflation for Canada. Available at: https://www.bankofcanada.ca/2013/10/working-paper-2013-35/.

26. Indeed, in recent remarks, the Governor of the Bank of Canada noted that "CPI-common, which is more related to inflation in services and less influenced by global supply disruptions, was only 2.3% in January." Available at: https://www.bankofcanada.ca/2022/03/economic-progress-report-controlling-inflation/.

27. In his March 3 remarks, the Governor of the Bank of Canada highlighted the gap between the preferred measures of core inflation, noting that "unusual forces" were at play.

28. We also constructed the aggregate inflation rate using current quarter (contemporaneous) weights and achieved similar results. Our constructed PCE inflation series based on lagged weights was marginally more highly correlated with the actual series. The standard deviation calculated using current quarter weights was virtually identical to our measure calculated with lagged weights.

29. See note 20.