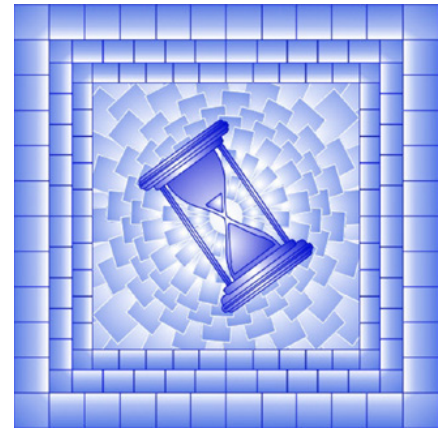


Catalogue no. 62F0014M
ISSN 1706-7723
ISBN 978-0-660-35295-4

Consumer expenditures during COVID-19: An exploratory analysis of the effects of changing consumption patterns on consumer price indexes

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Release date: July 13, 2020



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This analytical work is experimental and should not be used instead of the official measure of consumer price inflation. Updating the official Consumer Price Index (CPI) basket of goods and services to account for consumption changes in the absence of a reliable and robust source of expenditure data would compromise the accuracy of the index values.

1. Background

The COVID-19 outbreak, declared a pandemic on March 11, 2020, has led to economic disruptions that continue to affect financial and labour markets across the globe. While crude oil prices fluctuated and international travel restrictions put pressure on the tourism sector, domestically, the Canadian federal, provincial/territorial and municipal governments took measures to limit the spread and impact of the virus. By April, all provinces had declared a state of public health emergency and measures were enacted across the country to restrict the movement of people and order the temporary closure of businesses. A sustained period of physical distancing followed, with [Canadians adapting to staying home, travelling less and buying more of certain items, like cleaning products and non-perishable foods](#).¹

Shifts in household purchasing patterns have implications for the basket weights used in the calculation of the Consumer Price Index (CPI). Typically, expenditure patterns evolve slowly and in a sustained manner over time in response to shifts in relative prices, changes in the level or distribution of household incomes, changing demographics, evolving habits and the availability of new technology. A fixed-basket price index, such as the Canadian CPI, can only reflect these changes when the CPI basket weights are updated. Under normal economic circumstances, any over or underestimation of the importance of a given product or service in the CPI is minimized by scheduling basket updates at regular intervals.²

The COVID-19 pandemic created an unprecedented situation where the behaviours of Canadians were significantly altered over a very short period of time, undoubtedly affecting consumption patterns which, by design, are not accounted for in the official CPI fixed basket weights. In order to assess the impact of COVID-19 on Canadian household expenditures, Statistics Canada, in partnership with the Bank of Canada, explored current, punctual sources of expenditure data to estimate basket weights that reflect shifting consumption patterns during the pandemic. These data were supplemented with transaction and survey data as well as subject matter expertise to derive an alternate set of expenditure weights, which were used to calculate an analytical price index series for the months of March, April and May 2020.

2. Methodology

2.1 Data

In partnership with the Bank of Canada, Statistics Canada obtained temporary access to aggregated current expenditure data representing nearly all CPI product categories. These data were used to estimate expenditure weights for March, April and May 2020 and reflect the new consumption patterns that evolved during the COVID-19 pandemic. Where necessary, expenditure data from the Bank of Canada were supplemented with information from additional sources, including Statistics Canada's Monthly [Retail Trade Survey](#), transaction data from Canadian grocery retailers and subject matter expertise.

1. Retail scanner data used to produce the CPI reveal that sales of cleaning products and non-perishable foods increased substantially in the days following the onset of the COVID-19 pandemic. Compared with the 2019 average volume of sales, sales of household cleaners rose 164% in the week ending March 14th, while non-perishables such as rice, pasta and canned soup rose 239%, 205% and 158% respectively. Sales of hand sanitizers rose 639% from the 2019 average. Source: [Canadian Consumers Prepare for COVID-19](#) (2020) Statistics Canada.
2. The Canadian CPI maintains the fixed basket concept in accordance with best practices established by international price experts and other national statistical agencies, in part because there are no current statistical survey data to inform the magnitude of any change in consumption at the level required for CPI calculation. The CPI basket weights are based primarily on expenditure data reported by Canadians in the annual [Survey of Household Spending](#) (SHS), and are normally updated every two years. The most recent basket update took place in January 2019, using 2017 SHS data, the most current expenditure data available.

2.2 Basket weights

2.2.1 CPI basket weights

The Consumer Price Index basket weights are sourced primarily from aggregated household expenditures reported in the [Survey of Household Spending](#) (SHS), which are mapped at a low level of product and geographical classifications of the CPI.³ Additional, alternative data sources, including other Statistics Canada surveys, administrative data, and scanner data from retailers, are used to break down aggregate expenditures further for product classes for which the SHS does not provide sufficient detail.

2.2.2 Derivation of weights for the Analytical price index series

The data used in this analysis consist of consumer expenditures for several product groups, which were mapped to higher aggregation levels of the CPI product classification structure. The major component shelter, and the sub-component purchase and leasing of passenger vehicles, are not covered by the available expenditure data.

To calculate the new adjusted expenditure share for the mapped CPI product categories, the year-over-year growth rate of consumer expenditures for each product category in a given month was calculated and then multiplied by its corresponding CPI basket expenditure from 12 months prior. For example, the expenditures for a given CPI mapped product category in February 2020, equal its CPI basket expenditure in February 2019, multiplied by the year-over-year growth in consumer expenditures for that product category between February 2019 and February 2020.

Adjusted expenditures for CPI lower-level product categories were further refined by distributing the adjusted expenditure of each mapped product category between its lower-level components using their proportional basket shares from February 2020. Wherever possible, adjustments were made to reflect changes in sales arising from changes in quantities.

For components not covered by the expenditure data,⁴ adjusted expenditures were created by estimating 12-month change in quantity at lower CPI product category levels for February, March and April, using reliable data sources. In the absence of data sources on expenditures, sales or quantity data, changes in quantity between February 2019 and February 2020 were assumed to be equal to the annual growth rate in expenditures of all categories covered by the current expenditure data.

2.3 Index calculations

The official CPI is calculated using the Laspeyres-type formula, which is consistent with the fixed basket concept. The Laspeyres formula expresses the change in the cost between period 0 and period t of buying a fixed basket of period 0, by aggregating the prices of the products in the basket using quantities consumed from the price reference period 0 as weights, which are then used to estimate quantities of goods and services consumed for upper-level index aggregation:⁵

$$I_{L,A}^{0:t} = \frac{\sum_{i=1}^n p_i^t q_i^0}{\sum_{i=1}^n p_i^0 q_i^0}$$

where:

$I_{(L,A)}^{(0:t)}$ is the Laspeyres price index of aggregate class A between period 0 and t ;

n is the number of elementary aggregates i in the aggregate class A ;

3. Additional information on the 2017 basket is available in the publication [An Analysis of the 2019 Consumer Price Index Basket Update, Based on 2017 Expenditures](#) (2019) Statistics Canada. Information about the basket methodology is available in the publication [Canadian Consumer Price Index Reference Paper](#) (2019) Statistics Canada.
4. The major component shelter, and the sub-component purchase and leasing of passenger vehicles are not covered by the expenditure data obtained from the Bank of Canada.
5. Source: [Canadian Consumer Price Index Reference Paper](#) (2019) Statistics Canada. Section 6.24.

p_i^t is the price of elementary aggregate i in time t ;

p_i^0 is the price of elementary aggregate i in time 0; and

q_i^0 is the quantity weight of elementary aggregate i in the price reference period 0.

The Analytical price index series was produced using the same geographic and product aggregation structure as the official CPI. As with the official CPI, a chained, Laspeyres-type index was calculated, providing adjusted relatives for the March, April and May Analytical price index which were chained together starting in February 2020, using experimental weights that were current and that reflected COVID-19 consumption patterns.

2.4 Limitations

Timely and reliable access to detailed consumer expenditure information is needed in order to consider a change to the current method of updating CPI basket weights. The SHS, which is normally used as the basis for CPI basket weights is not finalized until several months after the end of the expenditure reference period. Other estimates of consumer expenditures, such as the Monthly Retail Trade Survey, are more timely, but the concepts they measure do not easily align with the CPI product categories.⁶ Currently, there are no statistically robust data to inform updates to the basket weights for all CPI product categories or at geographies below the national level on a monthly basis.

Additionally, the CPI is currently built on an annual set of basket weights that are price updated⁷ each month. If the CPI were instead built on monthly expenditures, spending patterns for goods and services which are highly seasonal, such as summer clothing or ski equipment, would result in a CPI with significant seasonal variation in weights.

3. Results

Using the methods outlined above, basket weights were derived for the months defined by the COVID-19 pandemic (Table 1) and an Analytical price index was calculated (Table 2).

Table 1
Derived Analytical price index basket weights for the months of February, March, and April 2020

CPI Component	Official CPI basket weights	Derived basket weights		
	December 2018 (basket link month)	February 2020	March 2020	April 2020
		percent		
Food	16.48	16.54	20.68	20.84
Shelter	27.36	27.70	31.23	37.12
Household operations, furnishings and equipment	12.80	12.66	13.04	13.99
Clothing and footwear	5.17	5.00	3.30	2.22
Transportation	19.95	19.04	15.01	12.14
Health and personal care	4.79	4.85	5.61	4.96
Recreation, education and reading	10.24	11.62	7.97	5.18
Alcoholic beverages, tobacco products and recreational cannabis	3.21	2.60	3.15	3.55

Source: Consumer Prices program.

6. The Monthly Retail Trade Survey produces estimates for industries according to the North American Industrial Classification System, not consumer product categories, and does not include estimates for significant basket components such as rent or mortgage interest cost.
7. Price updated weights are the cost of the expenditure reference period quantities if they have to be purchased at current month's prices. For more information see [Canadian Consumer Price Index Reference Paper](#) (2019) Statistics Canada.

Table 2
Analytical price index, Canada

CPI Component	February 2020		March 2020		April 2020		May 2020	
	Official CPI	Analytical price index	Official CPI	Analytical price index	Official CPI	Analytical price index	Official CPI	Analytical price index
All-items	137.4	...	136.6	136.7	135.7	136.0	136.1	136.4
Food	152.9	...	152.8	152.8	154.0	154.0	154.3	154.4
Shelter	146.7	...	146.5	146.5	146.0	146.0	145.6	145.5
Household operations, furnishings and equipment	123.3	...	123.7	123.7	124.2	124.3	123.6	123.9
Clothing and footwear	97.4	...	99.0	99.0	93.2	93.2	91.5	91.7
Transportation	144.0	...	138.9	138.7	136.7	135.7	139.7	140.2
Health and personal care	128.8	...	128.6	128.6	128.7	128.7	128.4	128.2
Recreation, education and reading	116.0	...	116.0	116.5	115.0	115.7	115.5	116.5
Alcoholic beverages, tobacco products and recreational cannabis	171.4	...	171.5	171.4	172.1	172.0	172.1	172.0

Source: Consumer Prices program.

4. Analysis

4.1 Derived basket weights

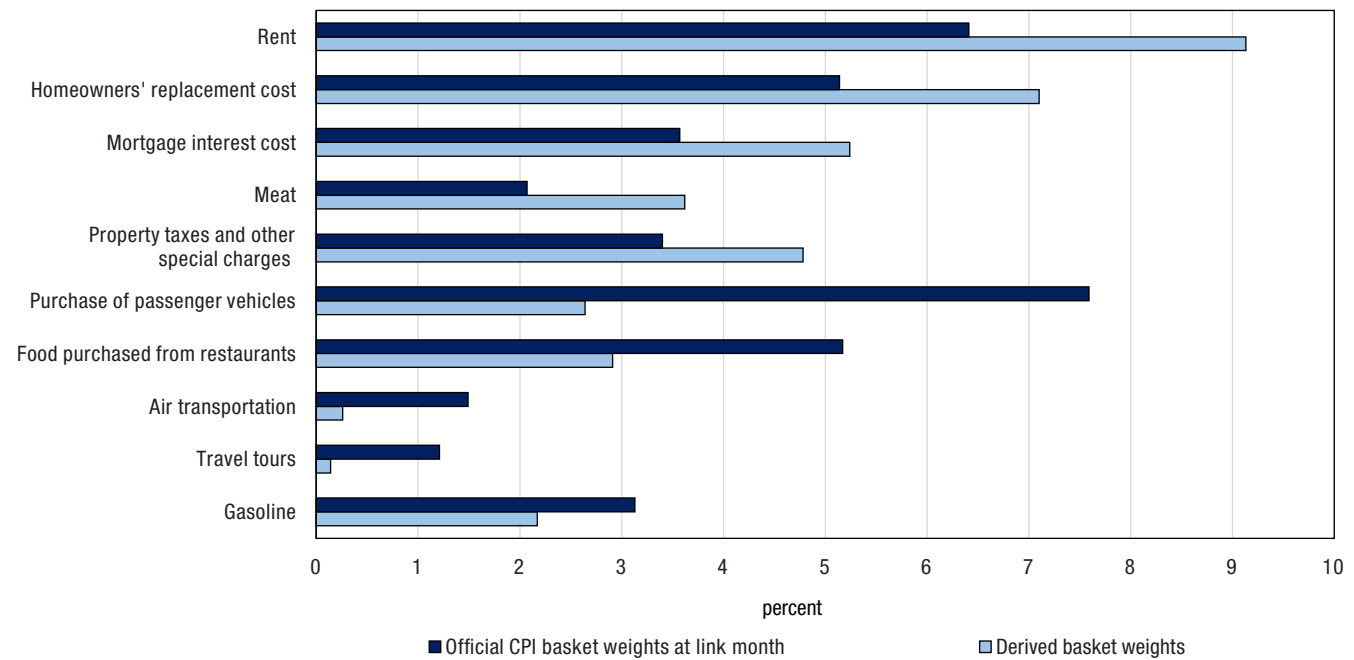
While updated basket weights were calculated between February and April 2020, the following analysis will focus on April weights, the first full calendar month characterized by the COVID-19 pandemic⁸ and the month where the largest differences between the official basket weights and derived basket weights were observed.

In April, the derived weights reflected the changes experienced by Canadians during the pandemic and the concurrent period of physical distancing (Chart 1). The basket weights for food and shelter, expenses that tend to be fairly fixed in the short term, increased the most as Canadians directed fewer dollars to other CPI components where expenditures tend to be more discretionary in nature. These shifts in consumer spending patterns reflect changing dynamics in the Canadian labour market, which was characterized by unprecedented job losses during the month of April.⁹

8. COVID-19 was declared a Public Health Emergency of International Concern by the World Health Organization on January 30, and a global pandemic on March 11. Between March 16 and April 1, nonessential businesses closed across the country, remaining closed through the entirety of April 2020.

9. Data from the Labour Force Survey reveals that the Canadian economy lost over 3 million jobs between February and April 2020. The unemployment rate increased to 13.0% in April, following a 5.6% unemployment rate reported in February. Source: Statistics Canada. Table [14-10-0287-01](#) Labour Force Characteristics.

Chart 1
Largest differences between official Consumer Price Index (CPI) weights and derived basket weights for April 2020



Source: Consumer Prices program.

The derived basket weight for the transportation component declined the most compared with its published value, led by lower expenditures on passenger vehicles,¹⁰ air transportation and gasoline. The basket weights for recreation, education and reading and clothing and footwear also fell, as many products and services in these categories became difficult or unavailable for consumption. Clothing stores, deemed nonessential retail, were largely closed to in-person shopping in April, while travel tours abroad were inaccessible due to international travel advisories. Other services under the recreational, education and reading component, including spectator entertainment (excluding video and audio subscription services) and use of recreational facilities and services, were also unavailable. At the same time, consumers spent more on household products, healthcare products and alcohol in April, which is reflected in the higher derived basket weights for those components.¹¹

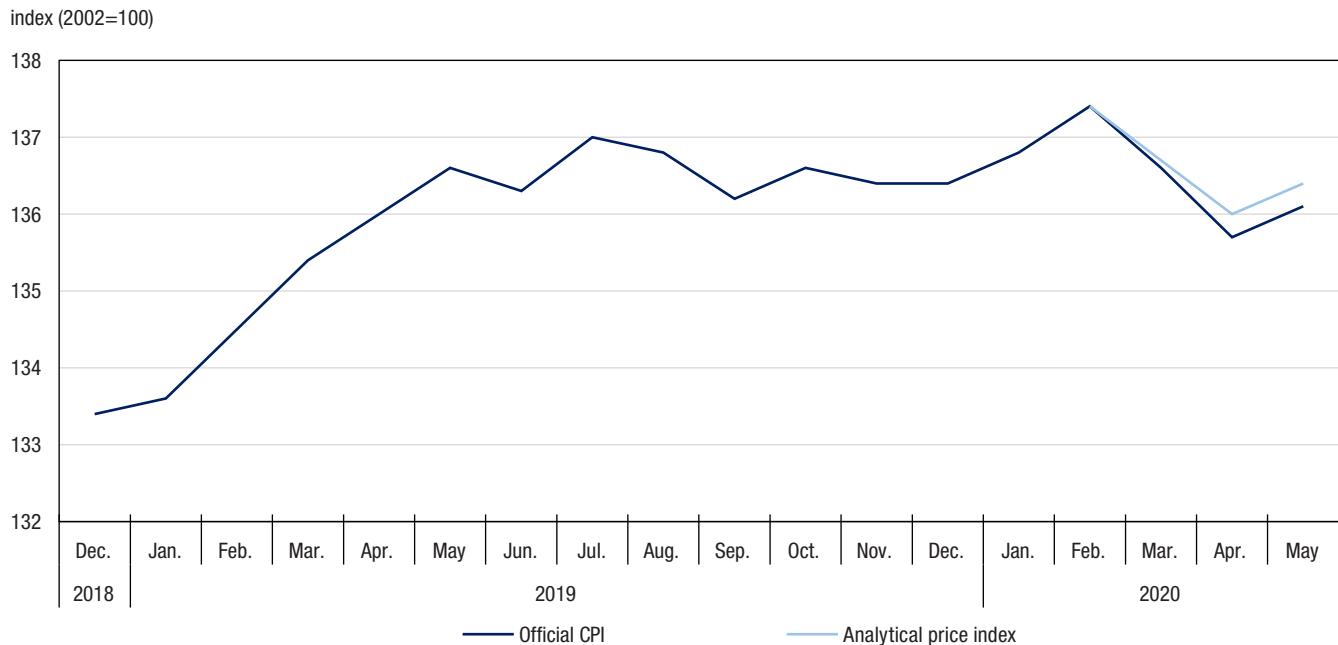
4.2 Analytical price index

The derived basket weights enabled the calculation of an Analytical price index, which provides an estimate of consumer price inflation as if the basket were updated on a monthly basis (Chart 2).

10. Data from the New Motor Vehicle Sales Survey reveal that sales of motor vehicles fell 62.6% between February and April 2020 in Canada. Source: Statistics Canada. No date. Table 20-10-0001-01 New Motor Vehicle Sales.

11. Source: [Canadian Consumers Prepare for COVID-19](#) (2020) Statistics Canada.

Chart 2
Consumer Price Index (CPI) and Analytical price index, Canada, December 2018 to May 2020



Note: The Analytical price index is calculated using a chain Laspeyres index, with monthly basket updates beginning in February 2020.
Source: Consumer Prices program.

The Analytical price index resulted in smaller month-over-month declines at the all-items level in March and April, relative to the official CPI (Table 3).

Table 3
1-month and 12-month change in the official CPI and the Analytical price index

	1-month change		12-month change	
	Official CPI	Analytical price index	Official CPI	Analytical price index
	percent			
March 2020	-0.6	-0.5	0.9	1.0
April 2020	-0.7	-0.5	-0.2	0.0
May 2020	0.3	0.3	-0.4	-0.1

Source: Consumer Prices program.

The difference between the two index lines in Chart 2 can be attributed to two main factors:

- The Analytical price index captured consumer shifts away from certain products and services, such as clothing and traveller accommodation, which arose from restrictions on consumption or reduced demand. Consequently, the impact of downward price movements of these components on the all-items Analytical price index was reduced.
- At the same time, consumers shifted toward products deemed essential during the pandemic, such as household paper supplies or non-perishable foods. Prices for these products rose as a result of higher demand, and when the importance of these products grew in the basket, there was additional upward pressure on the all-items Analytical price index.

For the April Analytical price index (based on March 2020 weights), the largest difference in 1-month price change compared to the official CPI was clothing price change (Table 4). Prices for clothing and footwear fell at record pace between March and April, contributing significantly to the month-over-month decline in the official all-items CPI. At the same time, however, nonessential retail outlets were closed throughout the country. While there were resulting price effects as retailers discounted seasonal stock online to move inventory, there was a large,

concurrent drop in clothing sales.¹² When using derived basket weights, the impact of these price declines was minimized.

While consumers were buying some products in lower-than-usual quantities, they also substituted toward other products. The other food preparations index, which includes soup, infant food, frozen food and snack products, took on more importance in the analytical price index as consumers substituted toward nonperishable and preserved foods. The increase in this index created additional upward pressure on the analytical price index.

Table 4
Top contributors to the difference between official CPI and Analytical price index, Canada, April 2020

CPI Component	Contribution to 1-month change in official CPI	Contribution to 1-month change in Analytical price index	Difference in percent contribution
Men's clothing	-0.114	-0.069	0.045
Women's clothing	-0.106	-0.064	0.042
Traveller accommodation	-0.062	-0.042	0.020
Other food preparations	0.017	0.036	0.019
Footwear	-0.045	-0.027	0.018
Rent	-0.041	-0.047	-0.006
Purchase of passenger vehicles	0.015	0.009	-0.006
Gasoline	-0.403	-0.420	-0.017
Electricity	-0.098	-0.115	-0.017
Meat	-0.005	-0.027	-0.022

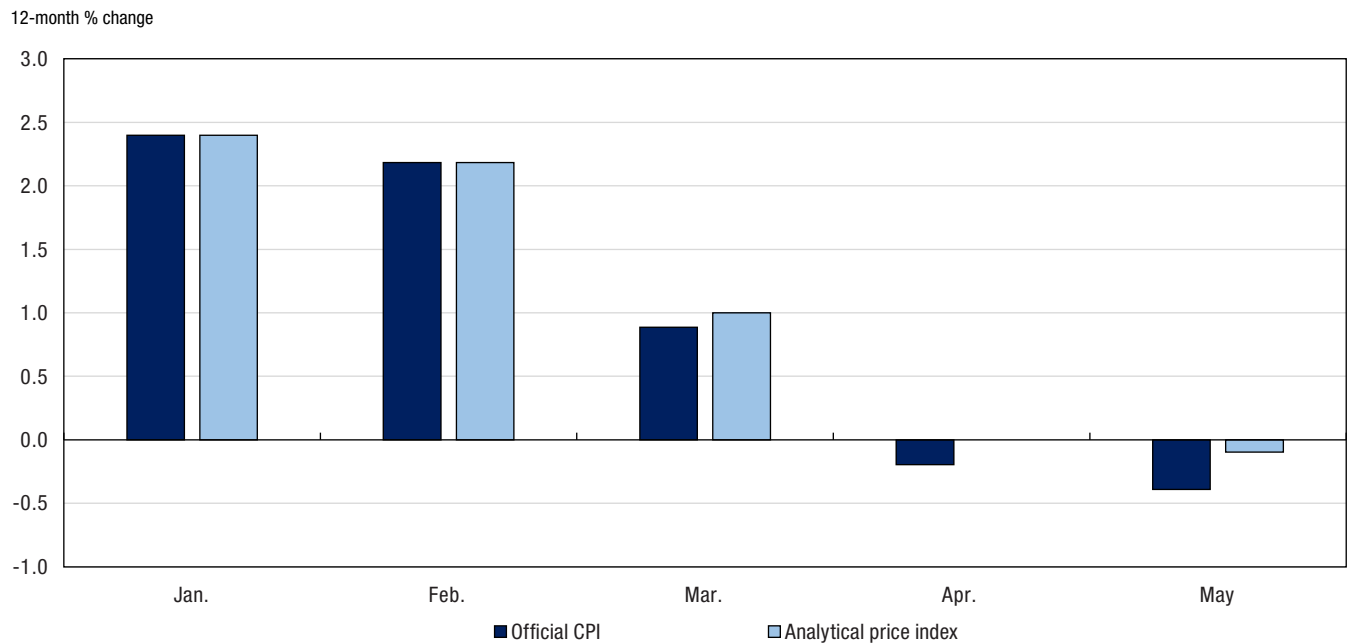
Source: Consumer Prices program.

Calculated using derived basket weights, the headline Analytical price index was 0.2 percentage points higher in April 2020 and 0.3 percentage points higher in May 2020 (Chart 3) compared with the official CPI. The annual average CPI,¹³ which is used by most programs employing the CPI for indexation purposes, measures the average increase in the CPI in a given 12-month period. For the 12-month period ending in May 2020, the annual average is 1.6% when calculated using both official CPI values and Analytical price index values. This supports the theory that while a specific consumption pattern may prevail at some point during the life of the CPI basket, the resulting difference in headline consumer inflation would have to be sustained in order to have a subsequent impact on the annual average CPI. Continued observation of the availability of goods and services in the CPI basket, variations in consumption patterns and evolving business models will provide additional insight into the long-term impact of COVID-19 on the CPI.

12. Data from the Monthly Retail Trade Survey reveal that there was a 69.5% decline in sales at stores selling clothing or clothing accessories between March and April 2020. Source: Statistics Canada. Table [20-10-0008-02](#) Retail Sales by Industry (x1000).

13. Annual average indexes are obtained by calculating the average of 12 monthly index values during a one-year period. Annual average percent change should not be confused with the 12-month percent change that is published each month with the release of the CPI. Unlike annual average change, 12-month change compares the monthly index level with the level from the same month a year earlier.

Chart 3
Headline Consumer Price Index (CPI) and Analytical price index, Canada, January 2020 to May 2020



Source: Consumer Prices program.

5. Conclusion

The Analytical price index provides insight into how consumer price indexes can be affected by sudden, extreme shifts in purchasing patterns and on the specific impact of COVID-19 on the CPI. Producing the CPI with updated basket weights would enable the most punctual measure possible of the price change consumers face in a given month. During the COVID-19 pandemic, the available evidence suggests that the Analytical price index was slightly higher than the headline CPI in April and May. However, annual average CPI calculations indicate that COVID-19-related variations in expenditure patterns would need to be sustained over a longer period to impact the long-term consumer inflation cycle.

While the partnership with the Bank of Canada allows for temporary access to the necessary expenditure data, ongoing access to reliable and timely expenditure information at the appropriate level of detail and quality will enable Statistics Canada to monitor shifts in consumer spending and pursue the development of other sought-after indicators, such as measures of inflation for different groups, household types and geography. Statistics Canada continues to work with price experts, national statistical organizations and other partners to ensure the data and methods used in the calculation of the official CPI are aligned with international standards, as well as to explore new potential sources of expenditure information for future basket updates and to keep Canadians informed with relevant statistics.