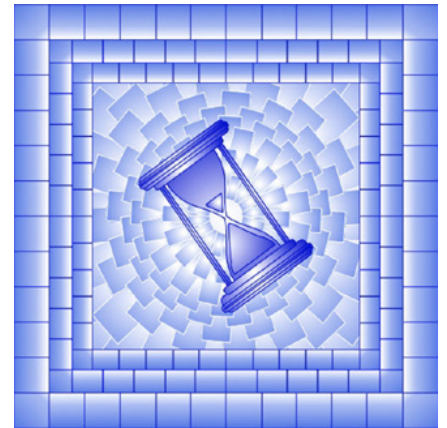


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Development of a Consumer Price Index for Seniors

by Catherine Michaud

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Development of a Consumer Price Index for Seniors

by Catherine Michaud

Executive summary

At the request of Employment and Social Development Canada (ESDC), Statistics Canada has compiled a Consumer Price Index for Seniors (CPI-S) from January 2013 to August 2018.

During the studied period, the Consumer Price Index (CPI) and the CPI-S showed very little differences in trends, which may imply that the sub-population of seniors and the Canadian population overall are facing the same general inflation. In fact, the CPI-S increased by 11.0% from January 2013 to August 2018, compared to 10.6% for the CPI. Over the period studied, the CPI-S showed an average annual increase of 1.7% and the CPI, 1.6%.

Among the eight major components, Shelter contributes the most, on average, to the observed differences between the CPI and the CPI-S. As well, seniors tend to spend relatively more on Health and personal care and less on Transportation and on Recreation, education and reading as compared to the whole population.

Although the CPI-S was built using a robust methodology, there are a number of limitations given that its compilation relies exclusively on the data collected for the calculation of the CPI:

1. The existing price information is representative of the target population for which it has been collected, namely the average Canadian. Therefore, it is not specific to the spending habits of the senior population.
2. The use of two years of combined expenditures from the Survey of Household Spending (SHS) may increase the substitution bias and hinder the comparability of the CPI-S with the CPI – this was, however, a necessary measure in order to achieve a fit-for-use quality of the weight estimates and allow the compilation of the CPI-S.

Background information

To support the work of ESDC to ensure that Old Age Security (OAS) pension and Guaranteed Income Supplement (GIS) payments are indexed in a manner that reflects the price level faced by seniors, Statistics Canada developed a CPI-S for the period of January 2013 to August 2018.¹ The purpose of this paper is to present an overview of this work. The paper begins by defining the concept of a senior household and outlining the methodology used to develop the CPI-S. This is followed by an examination of the CPI-S components, as well as a comparison of their movements to the CPI.

Senior population in Canada

The first part of this report presents an overview of the senior population in Canada and determines if a sub-sample of the SHS could be used to calculate the weights for the defined population. Seniors' spending patterns are then examined and compared to that of the Canadian population.

Population

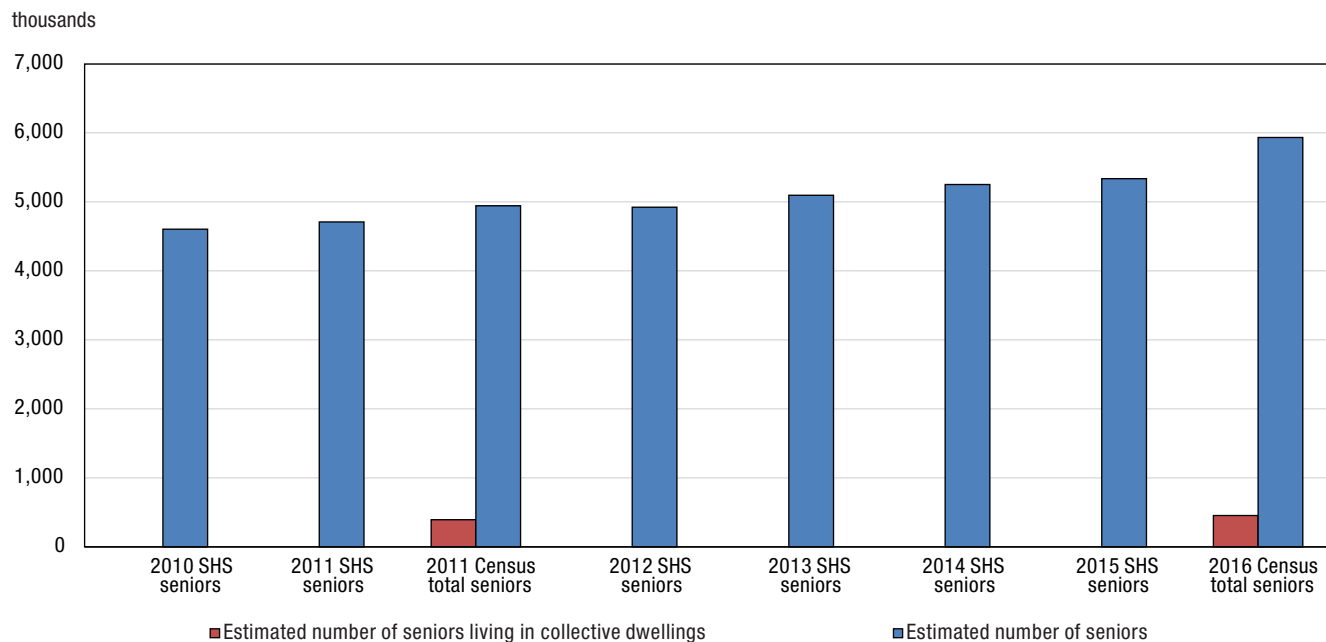
A key element in the construction of the CPI-S is the determination of the definition of a senior household. The SHS measures household expenditures, while the CPI-S measures the inflation faced by seniors. Therefore, it is necessary to choose a definition that aligns as closely as possible to the senior population. It was decided that a senior household, for the purpose of the CPI-S, would be any household where the main revenue earner is at least 65 years old.

1. The CPI-S was calculated beginning in January 2013 for two main reasons: 1) the SHS underwent a redesign in 2010, and it would not have been possible to reconcile the data with previous years' surveys; and 2) the estimation system used to calculate the index series was redesigned, consequently the aggregation structure needed to calculate the CPI-S was not available prior to January 2011.

Chart 1 shows the evolution of the senior population in Canada, based on the Census, as well as the calculated estimates from the SHS sub-sample. As expected, the population of seniors is increasing gradually over time. Also, the SHS estimation of the Canadian senior population is very close to the Census one, which suggests that the SHS senior sub-sample used in building the CPI-S is representative.

It should be noted that while collective dwellings are included in the chosen definition of a senior household, the SHS contains almost exclusively seniors living in private dwellings. The proportion of seniors in collective dwellings is estimated at 7.7% of the population aged 65 and over (or 455,690 seniors), according to the 2016 Census.

Chart 1
Evolution of the senior population in Canada



Source: Statistics Canada.

Spending behaviour

Why do spending patterns matter?

There are two elements involved in the compilation of a consumer price index. The first is the prices for a multitude of goods and services gathered month after month to measure the price changes faced by the target population. The second is the expenditure share allocated to each category, which gives the relative importance of a group of goods or services compared to the others, and is measured using the information gathered from the SHS. The observed changes in prices are then weighted by their expenditure share. Therefore, for a fixed price movement, a larger proportional weight will result in a bigger impact on the overall change in the index. In other words, price changes in goods and services which make up a significant proportion of seniors' expenditures will have a larger impact than price changes in goods and services for which the seniors' budget share is smaller.

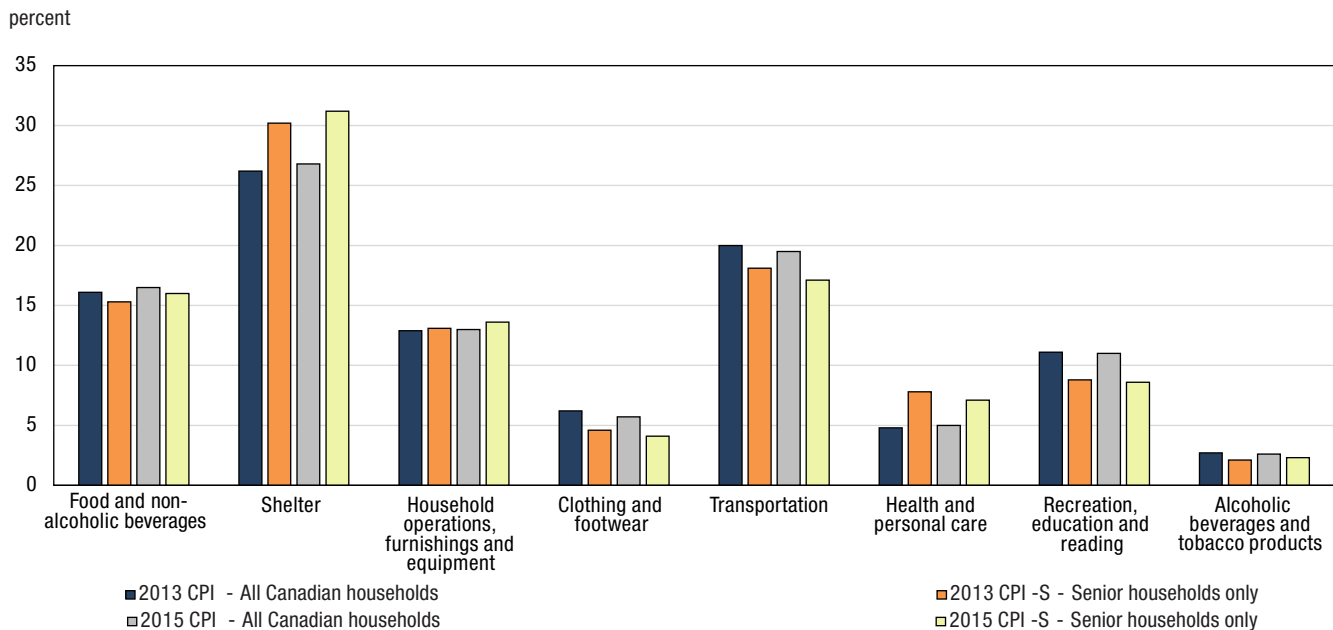
In designing a specific consumer price index for seniors, it is important to recognize that this sub-population's consumption patterns may differ from those of the overall Canadian population. Furthermore, these general trends can vary between provinces, highlighting the importance of accurately measuring weights to correctly take into account the impact of price movements of each product category on the CPI-S.

The following two sub-sections examine the similarities and differences in spending behaviour between the average senior household and the average Canadian household for the reference years 2013 and 2015.² The spending shares in each of the eight major components of the indexes are compared for the average senior household and the average Canadian household. These eight major components are: Food and non-alcoholic beverages; Shelter; Household operations, furnishings and equipment; Clothing and footwear; Transportation; Health and personal care; Recreation, education and reading; and Alcoholic beverages and tobacco products.

Canada-level comparison

Compared to the population as a whole, seniors spend relatively more on Shelter and Health and personal care, and less on Transportation, Recreation, education and reading and on Clothing and footwear. At the national level, seniors' expenditures on Food and non-alcoholic beverages, Household operations, furnishings and equipment and Alcoholic beverages and tobacco are similar in proportion to those of the total population. Chart 2 illustrates the average proportion of budget spent by seniors and by all Canadians on each of the eight major components.

Chart 2
Basket weight distribution by major component



Note: Figures may not add up as a result of rounding.
Source: Statistics Canada.

Even though seniors' larger spending share in Shelter is widespread throughout this major component, the biggest differences are in the Water, fuel and electricity class. However, for both populations, most of the shelter expenses are allocated to commodities belonging to the Owned accommodation class – 18.1% of the seniors' budget compared with 16.1% for the average Canadian household. Mortgage interest costs represent a significantly lower share of seniors' budgets (0.9% for the average senior household compared to 3.8% for the average Canadian household), however this is largely mitigated by higher spending in Homeowners' replacement cost (6.6% for the average senior household vs 4.7% for the average Canadian household), Property taxes (4.8% for the average senior household vs 3.4% for the average Canadian household), and Homeowners' maintenance and repairs cost (2.2% for the average senior household vs 1.3% for the average Canadian household).

2. Unless otherwise stated, all shares are an average of the 2013 and the 2015 expenditures.

Health and personal care is another category where seniors (7.4%) spend a higher proportion of their budget than the average Canadian household (4.9%). Most of this difference is attributable to Health care goods (3.4% for the average senior household and 1.7% for the average Canadian household) and Health care services (1.9% for the average senior household vs 1.1% for the average Canadian household).

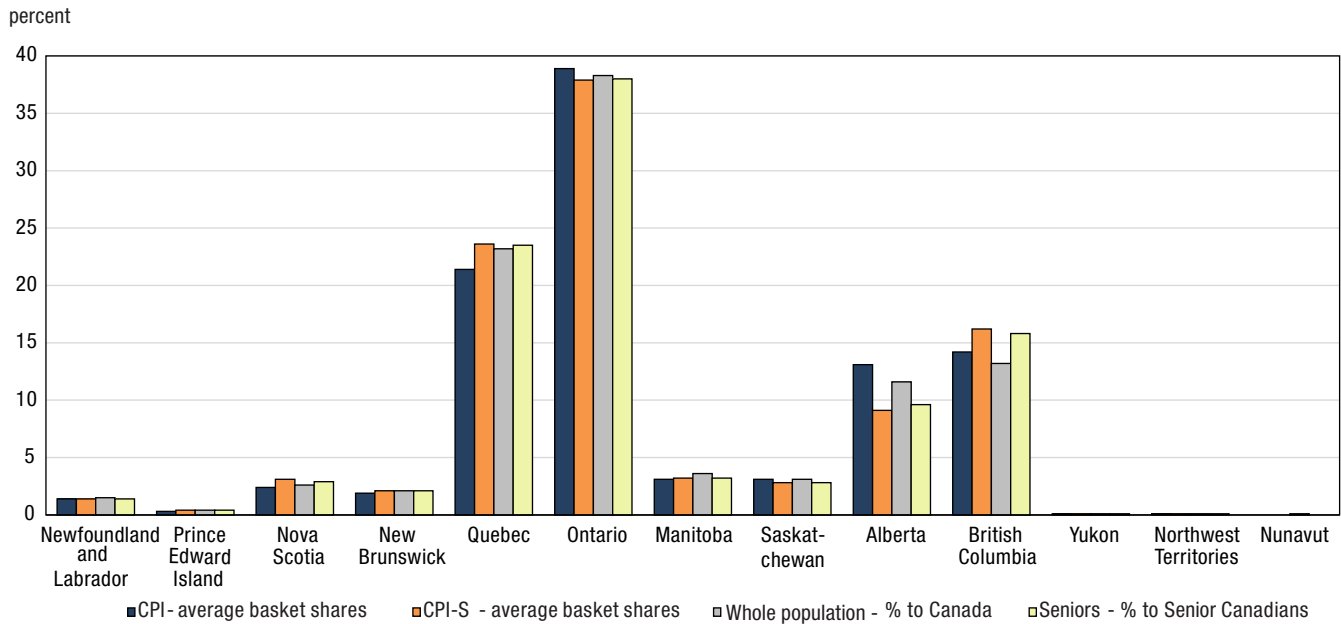
Canadian seniors tend to spend a smaller share of their budget on Transportation, Clothing and footwear and Recreation, education and reading. More specifically, seniors spend considerably less on Education (0.6% compared with 2.7% for the average Canadian household), Purchase of passenger vehicles (6.1% for the average senior household and 6.9% for the average Canadian household) and Public transportation (1.6% for the average senior household vs 2.1% for the average Canadian household).

In summary, seniors are more sensitive than the Canadian population to price changes in Health care goods and Homeowner’s replacement cost, while changes in Mortgage interest cost and in the price of Education affect them to a lesser degree.

Provincial disparities

Seniors’ expenditures are proportionally higher in Nova Scotia, Quebec and British Columbia relative to the corresponding expenditures for all Canadian households, and lower in Ontario and Alberta, as shown in Chart 3.³ This suggests that either seniors in Ontario and Alberta spend proportionally less than seniors elsewhere in Canada when compared with the whole population, or that there are smaller proportions of seniors in these two provinces, or both.

Chart 3
Expenditure share and relative population, seniors and entire population, provinces and territories



Note: Figures may not add up as a result of rounding.
Source: Statistics Canada.

3. The expenditure shares are derived from the Survey of Household Spending for 2013 and 2015. The relative percentage of the population of seniors and the entire population are derived from the 2016 Census of Population.

Seniors in Newfoundland and Labrador tend to spend a higher proportion of their budget on Food and non-alcoholic beverages compared with the average provincial household. In Newfoundland and Labrador, seniors spend 18.2% of their household budget on Food and non-alcoholic beverages while the average household spends 15.7%. Conversely, seniors in British Columbia spend 1.2% less on Food and non-alcoholic beverages when compared to the average British Columbia household (mostly attributable to Food purchased from restaurants). Seniors in Newfoundland and Labrador also spend 4.3% less on Recreation, education and reading, the main contributors being lower spending on the Purchase and operation of recreational vehicles as well as on Education.

When comparing the provincial average with the Canadian average for senior households, very similar trends are observed with respect to their spending on Shelter, Clothing and footwear, Transportation, and Health and personal care.

Both seniors (17.8%) and the general population (18.7%) in Quebec spend a larger share of their budget on Food and non-alcoholic beverages than the national average (15.7% for seniors and 16.3% for the general population). Also, seniors in Ontario (14.5%) spend relatively less on Food and non-alcoholic beverages compared with the overall population of Ontario (15.4%).

Methodology and construction

Calculating a price index

The CPI-S is calculated in two steps, using the same methodology as the CPI. The first step involves calculating price relatives, using a matched-model approach, and then averaging them together to obtain the movement for the elementary price indexes. This is done by averaging the price relatives by commodity and geography using, in most cases, an equally weighted geometric average known as the Jevons formula. This produces the first level of aggregation.

The second level of aggregation uses expenditure weights of the different elementary aggregates and calculates a weighted arithmetic average using a fixed-basket Lowe formula.

The Lowe formula is denoted by:

$$P_{Lo} = \sum_{i=1}^n s_i^{0b} \left(\frac{p_i^t}{p_i^0} \right)$$

where s_i^{0b} represents the share of the expenditure on commodity i at time 0 , the time of reference of the prices. The expenditure weights are price-updated to reflect changes in prices between the reference period of the basket (b) and the price reference period (0). s_i^{0b} can be expressed as:

$$s_i^{0b} = \frac{p_i^0 q_i^b}{\sum p_i^0 q_i^b}$$

The basket weights, or shares of expenditures, determine the relative importance of the different product classes and geographical regions in the All-items index.⁴

4. The SHS only started including the Territories in 2015. Therefore, for the earlier years a retropolation was made for compiling the weight distribution in the Territories.

Construction

Given that the senior population represents approximately 25% of the surveyed population, there was a need to assess the quality of a senior-only household sub-sample and to select an appropriate index construction method.

Pooling of expenditure for weights

Due to small sub-sample sizes, four years of SHS senior-specific expenditures would have been needed to attain the same level of quality in basket weights as the CPI. However, this would reduce the timeliness of the basket weights and could result in a larger substitution bias.⁵ Therefore, the following factors were assessed to find an optimal solution: 1) the statistical quality of the weights; 2) comparability with the CPI weights; 3) the magnitude of the resulting substitution bias in the index; and 4) operational feasibility.

While pooling multiple years of data increases the accuracy of the weight estimates, the introduction of older weights reduces the timeliness, which in turn brings the possibility of increasing the substitution bias. The operationally feasible option that strikes the best balance between statistical quality and substitution bias is to combine two years of expenditure data;⁶ it leads to expenditure weights with acceptable sampling variability and reduces the potential substitution bias increase caused by using four years of data. By pooling two years together, it is assumed that the target populations of the survey cycles are the same and spending patterns are not significantly different between the years.

Use of the same sample of products and outlets as the CPI

The CPI-S is based on the same sample of products and outlets as the official CPI, which assumes that the senior population has the same spending preferences as the general population. This approach excludes various senior-specific products and may include goods and services that are not as representative for the average senior household. It also assumes that Canadian seniors have the same outlet preferences as the average Canadian.

Quality evaluation

In order to evaluate the quality of the CPI-S, an International Monetary Fund (IMF) Data Quality Assessment Framework (DQAF) for the Consumer Price Index was used. The current approach in constructing a CPI-S series uses known statistical techniques. The series can be analyzed and quality can be monitored.

The CPI-S is built using a robust methodology. However, according to the DQAF, the current approach does not meet certain quality criteria, notably:

- the expenditure weights are of lesser statistical quality.⁷
- the product and outlet sample includes more than what may be specific to the target population of senior households.

Further research would lead to improvements in the weights and in the product and outlet samples, resulting in an improved index quality. An option for improving the quality according to one of the criteria without affecting the other is to increase the sample size of the SHS to a point that would allow the use of a single year for the CPI-S weight estimates. In addition, to best measure price changes experienced by seniors, both the prices and the CPI-S weights would need to reflect the reality of this segment of the population. The CPI-S measures inflation experienced by senior households based only on different spending patterns. A complete representation of price change as experienced by seniors can only be attained by calculating a price index using both seniors' expenditures as well as a basket of goods and services representative of seniors' consumption for which the prices have been collected in outlets typically visited by seniors.

5. Substitution bias is generally understood to be the bias resulting from a fixed-basket which mitigates the fact that consumers tend to adjust their spending habits in response to changes in prices, i.e. consumers substitute towards relatively cheaper goods when prices increase more than what they are willing to pay. For more information on substitution bias, refer to Chapter 9 of [The Canadian Price Index Reference Paper](#).

6. For the calculation of the CPI-S over the period from January 2013 to August 2018, three different expenditure baskets were used to compile the weights: the SHS data from the reference years 2010 et 2011 were used to compile the weights for the indexes calculated between February 2013 and December 2014; the SHS data from the reference years 2012 et 2013 were used to compile the weights for the indexes calculated between January 2015 and December 2016; the SHS data from the reference years 2014 et 2015 were used to compile the weights for the indexes calculated between January 2017 and August 2018.

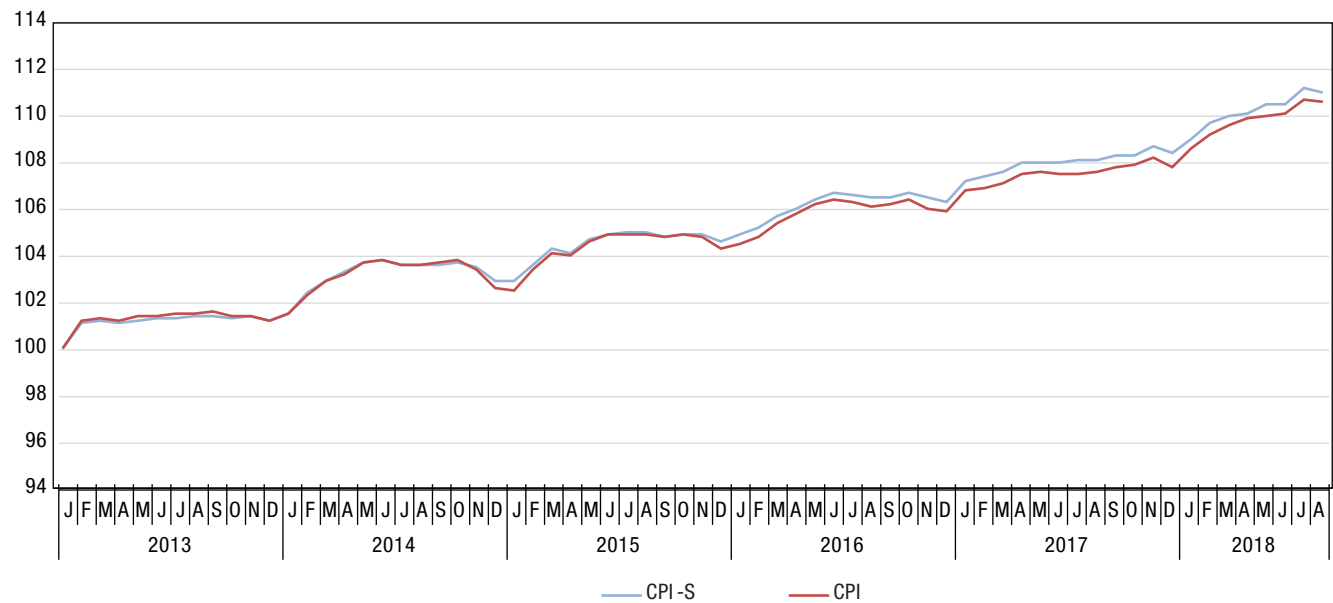
7. While the statistical techniques are appropriate, the current CPI-S uses pooled expenditure weights due to an annual sub-sample size below the optimal level.

Consumer Price Index for Seniors

The CPI-S spans from January 2013 to August 2018, and largely follows the same trend as the CPI. As illustrated in Chart 4, the divergent trend appearing in early 2016 continues through 2018. Still, given the relatively short time period studied, small differences such as those observed between the two indexes are not enough to conclude that the CPI-S is at a higher level than the CPI. In addition, for the duration of the latest basket (from January 2017 onward), the trends in the indexes show almost no difference, suggesting that the observed difference between the indexes appeared during previous baskets.

Chart 4
All-items, Consumer Price Index for Seniors and Consumer Price Index

201301 = 100

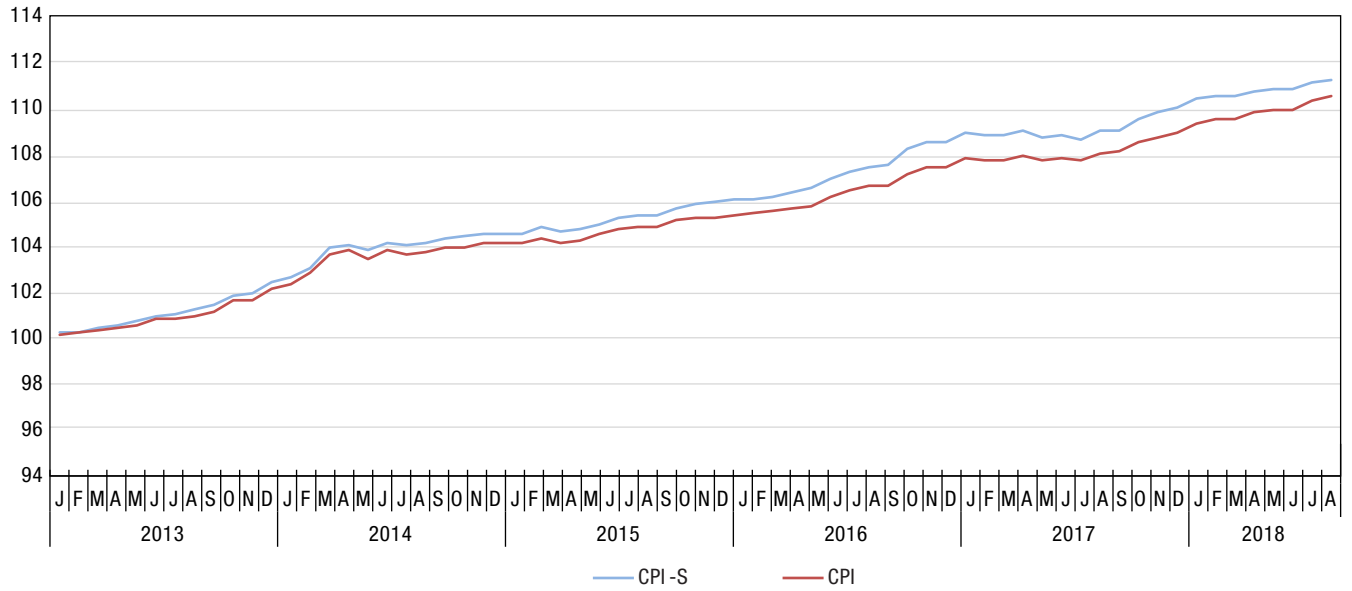


Source: Statistics Canada.

Among the major components, Shelter contributes the most, on average, to the observed difference between the CPI and the CPI-S. However, despite overall higher spending, the senior population is not facing significantly different inflation for the Shelter component, as demonstrated in Chart 5. Both the CPI and the CPI-S show a steady increase through time. Furthermore, the gap between the two indexes appearing in early 2014 is diminishing after reaching a peak in late 2016 through late 2017.

Chart 5
Shelter, Consumer Price Index for Seniors and Consumer Price Index

201301 = 100

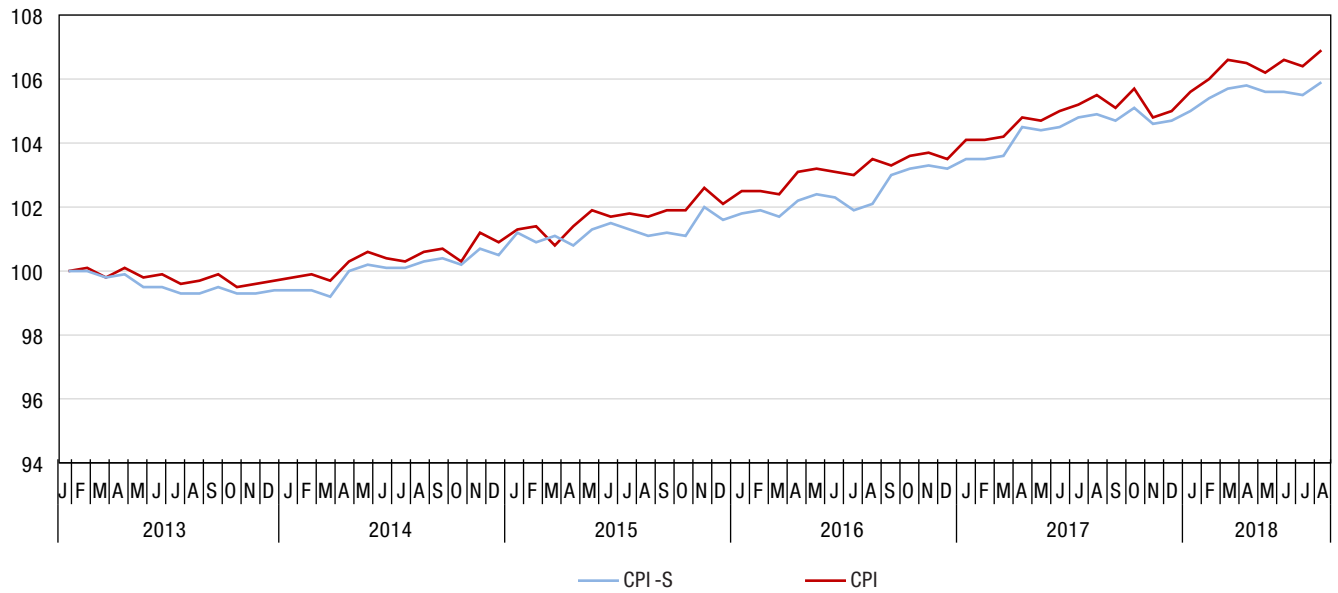


Source: Statistics Canada.

In addition, even though seniors tend to spend proportionally more on goods and services in Health and personal care, they are facing very similar inflation in that component relative to the Canadian population as a whole, as can be seen in Chart 6. The two indexes have diverged by one percentage point over the 5 year period studied.

Chart 6
Health and personal care, Consumer Price Index for Seniors and Consumer Price Index

201301 = 100



Source: Statistics Canada.

Conclusion

From January 2013 to August 2018, the two indexes showed very little difference in trends, which may imply that the sub-population of seniors and the overall Canadian population are facing the same general inflation. In fact, the CPI-S increased by 11.0% compared to 10.6% for the CPI.

Table A.1
CPI and CPI-S, All-items and major components, Monthly

Reference month	All-items		Food and non-alcoholic beverages		Shelter		Household operations, furnishings and equipment		Clothing and footwear		Transportation		Health and personal care		Recreation, education and reading		Alcoholic beverages and tobacco products		
	CPI	CPI-S	CPI	CPI-S	CPI	CPI-S	CPI	CPI-S	CPI	CPI-S	CPI	CPI-S	CPI	CPI-S	CPI	CPI-S	CPI	CPI-S	
	201301 = 100																		
2017																			
January	106.8	107.2	107.5	107.4	107.8	108.9	107.0	107.4	103.6	103.8	105.0	105.5	104.1	103.5	107.3	107.6	114.3	112.4	
February	106.9	107.4	107.7	107.5	107.7	108.8	107.2	107.7	105.7	106.0	104.1	104.6	104.1	103.5	109.2	110.8	114.6	112.7	
March	107.1	107.6	107.8	107.5	107.7	108.8	107.0	107.5	108.2	108.5	103.5	104.0	104.2	103.6	110.8	113.6	115.0	113.0	
April	107.5	108.0	108.1	107.8	107.9	109.0	107.7	107.9	107.1	107.3	105.1	105.8	104.8	104.5	109.8	111.7	115.3	113.3	
May	107.6	108.0	108.7	108.6	107.7	108.7	107.8	108.0	107.6	107.6	104.4	105.1	104.7	104.4	110.4	112.7	115.7	113.7	
June	107.5	108.0	109.1	109.0	107.8	108.8	108.1	108.3	105.2	105.1	104.0	104.6	105.0	104.5	110.8	113.1	116.1	114.0	
July	107.5	108.1	109.5	109.4	107.7	108.6	107.7	108.1	105.2	105.0	103.6	104.3	105.2	104.8	111.7	114.4	116.4	114.4	
August	107.6	108.1	109.1	108.9	108.0	109.0	107.4	108.0	106.0	105.8	104.0	104.7	105.5	104.9	111.2	114.0	116.6	114.6	
September	107.8	108.3	108.2	107.8	108.1	109.0	107.0	107.9	107.6	107.6	105.1	105.9	105.1	104.7	112.1	114.5	117.0	115.0	
October	107.9	108.3	107.7	107.2	108.5	109.5	107.8	108.3	109.2	109.2	105.4	106.0	105.7	105.1	110.0	111.3	116.9	114.9	
November	108.2	108.7	108.6	108.1	108.7	109.8	108.1	108.6	108.4	108.7	107.1	107.8	104.8	104.6	109.0	110.0	117.0	114.9	
December	107.8	108.4	109.0	108.7	108.9	110.0	106.5	107.8	105.1	105.7	107.1	107.7	105.0	104.7	107.2	107.5	116.8	114.7	
2018																			
January	108.6	109.0	110.0	109.6	109.3	110.4	107.8	108.5	104.3	104.7	108.3	109.0	105.6	105.0	107.8	108.4	117.5	115.4	
February	109.2	109.7	110.0	109.6	109.5	110.5	108.7	109.7	106.1	106.7	108.7	109.3	106.0	105.4	110.0	111.9	118.1	116.0	
March	109.6	110.0	109.6	109.0	109.5	110.5	108.3	109.4	108.1	108.6	108.9	109.6	106.6	105.7	112.2	115.5	119.5	117.3	
April	109.9	110.1	110.0	109.5	109.8	110.7	109.2	110.0	109.4	109.8	110.1	110.8	106.5	105.8	109.6	110.8	120.9	118.6	
May	110.0	110.5	109.9	109.3	109.9	110.8	108.2	109.5	108.5	108.8	110.3	111.2	106.2	105.6	112.3	115.0	121.0	118.7	
June	110.1	110.5	110.6	110.1	109.9	110.8	108.0	109.5	107.2	107.5	110.9	111.7	106.6	105.6	111.5	113.2	121.6	119.2	
July	110.7	111.2	111.0	110.5	110.3	111.1	108.5	109.7	105.8	106.0	112.1	112.9	106.4	105.5	113.7	117.2	121.7	119.3	
August	110.6	111.0	110.9	110.3	110.5	111.2	108.3	109.8	106.6	107.1	111.5	112.0	106.9	105.9	113.3	116.5	122.0	119.6	

Source: Statistics Canada.