

Accounting for the Difference between the CPI and Personal Expenditure Price Index in Canada^{*}

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Abstract: The purpose of this paper is to account for the difference between the Consumer Price Index (CPI) and the Personal Expenditure Price Index (PEPI), the personal consumption deflator for quarterly GDP. The CPI is the most widely recognized indicator of consumer price change in Canada and is used primarily as a current indicator of inflation, and for the indexation of wages, pensions and other payments. The PEPI, an alternative measure of consumer price change, is used to deflate current dollar estimates of personal expenditure of quarterly GDP. This paper uses a step-by-step process to decompose the difference between the two indexes and attribute it to various sources. We find that over the 1997-2005 period, approximately 45% of the difference between the indexes can be attributed to formula and coverage differences, while the remaining 55% can be attributed to differences in price and weight data. We also find that the prices and weights that contribute most significantly to the difference are for commodities with significantly different measurement methodologies in each index.

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1. Introduction

Statistics Canada produces two measures of the change in the price of consumer goods and services over time. The first and more widely recognized is the All-items Consumer Price Index (CPI), produced by the Prices Division. The second, produced by the Income and Expenditures Accounts Division, is the Personal Expenditures Price Index (PEPI).

The All-items CPI is a monthly measure of price change while the PEPI is the price-deflator series for estimates of personal expenditure in quarterly Gross Domestic Product (GDP). While both indexes are designed to measure changes in prices for a basket of consumer goods, they often differ in their results. Since 1986, average annual consumer price change as measured by the CPI has been 2.7%, while the PEPI has shown a 2.5% change.

More significantly, between 1997 and 2005, the CPI indicated a change in consumer prices of 2.1%, while the PEPI showed 1.7%. One would expect these indexes to be reasonably consistent measures of price change and as such, this is a more significant difference. Given the importance of measuring consumer inflation in Canada, the purpose of this paper will be to trace and quantify the sources of the difference between these two measures of consumer price change. This objective originated from continuing quality assurance measures undertaken in the Prices Division.

Constructing representative measures of price change is a complex task, conceptually and practically. As such, establishing a basis for comparison between two indexes is tricky, even when they are constructed for the same purpose, with similar components. With this in mind, our paper accounts for differences between the two indexes one step at a time, explaining both the reason for a conceptual difference and an estimate of its impact on the overall difference. The first step accounts for the impact of formula differences, the second for differences in population coverage and the commodity basket. Finally, the third step accounts for differences in weight and price data.

This approach shows that over the 1997 to 2002 period, approximately 51% of the difference between the CPI and PEPI can be attributed to formula, 1% to differences in population and commodity coverage and 48% to differences in price and weight data. Over the 2002-2005 basket period, approximately 15% of the difference was due to formula, 29% to differences in coverage and 56% to differences in prices and weights.

The following will outline the structure of this paper. Section 2 describes the conceptual basis for the CPI and PEPI and the construction of each index. Section 3 estimates the impact of differences between the indexes in the step-by-step procedure described above. Section 4 provides some insight into the results while section 5 concludes.

2. Comparing the CPI and PEPI

Constructing indexes of price change, even for the same purpose, is a complex process for which alternate methods are both available and reasonable. This section will describe the major components of the CPI and PEPI from which we expect differences to arise. This will provide the basis for Section 3, which will provide estimates of the impact of these components on the difference between the CPI and PEPI.

2.1 Purpose

The first step in comparing the CPI and PEPI is to determine the intended purpose of the indexes being compared. Even when comparing measures of the same variable, the purpose of use for which the index is intended may contribute to differences in population and commodity coverage, index formula and price and weight data used to construct the index. Reconciling differences in purpose will assist in focusing the rest of the analysis.

The primary purpose of the CPI is to provide a monthly indicator of the price change experienced by Canadian individuals and households, in their role as consumers. It is used to analyze changes in real incomes and the purchasing power of the consumer dollar, as well as to adjust wages and pensions to reflect these changes.¹ The PEPI is a price index obtained through the process of constructing constant dollar estimates of personal expenditure in GDP; that is, estimates of current personal expenditure at the prices of some reference period.² Having outlined the purpose of either index, it is important for this analysis to assess how these alternate purposes might impact on differences between the resulting indexes.

Given the purpose described above, the CPI is designed to function as a ‘stand-alone’ measure of consumer price change. Specifically, the CPI measures price movements in a way that is most directly applicable to accurately estimating the current rate of inflation. While the impact of methodology on other uses of the CPI is assessed, these impacts are not an over-riding consideration in CPI construction.

This is not the case for the PEPI, as it is constructed for deflating personal expenditure in GDP. GDP is constructed within the framework of the Canadian System of National Accounts (CSNA), which is the integrated sequence of accounts that provide the framework for measuring all components of GDP.³ As such, the PEPI must also be

¹ These are the primary purposes for which the CPI is constructed, although it is often put to many other uses.

² Current dollar estimates are the actual amount of expenditure on a commodity in a given period. Constant dollar estimates are the amount of money that would have been spent on that commodity in the same period, provided the commodity price was the same as that of the reference period.

³ The CSNA is the framework used by Statistics Canada for the purpose of constructing estimates of income and expenditure in the Canadian economy. It is derived from the methods outlined in the 1993 SNA.

constructed within this framework and for the clearly defined purpose of deflating current personal expenditure. While many CPI price series are suitable for this purpose, there are a number of personal expenditure components in GDP for which different measures of price change are required. In addition, there are segments of the population, as well as commodities, that are included in GDP but not in the CPI reference population or basket. As such, the PEPI must include additional data for these commodities. These considerations are described in more detail below, although it should already be apparent why there can be differences between the two indexes.

2.2 Coverage

The coverage of an index refers to the reference population for which price movements are relevant and the group of commodities purchased by that population that are also relevant. The reference population and commodity coverage of an index follow directly from the purpose for which the index has been constructed.

The reference population for the CPI follows from its purpose of measuring inflation for Canadian consumers. It consists of all private households and individuals living in urban and rural areas. Individuals living in collective communities such as prisons, chronic care facilities and nursing homes, as well as people living on First Nations reserves, are excluded.

The PEPI reference population is determined by the CSNA and includes all individuals and households in Canada (in addition to those excluded by the CPI), as well the expenditure of Non-Profit Institutions Serving Households (NPISHs), which are included due to the data sources used to compile GDP current expenditure data. It is worth noting that even excluding NPISHs, the PEPI reference population coverage is a more inclusive group of consumers than that of the CPI.⁴

The group of commodities included in each index is determined by the expenditures of each reference population on consumption goods and services.⁵ In both the CPI and PEPI, the universe of commodities purchased by each reference population is represented by a list of ‘elementary’ commodities. Each elementary commodity is comprised of individual goods or services homogenous enough to represent overall price change for that class of commodity.⁶ The list of commodities included in the CPI and PEPI can be found in appendix A.1 and A.2, respectively. The domain of commodities in either index is nearly identical, save for a number of ‘commodities’ in the PEPI meant to represent the expenditures of NPISHs. Given the similarity between the reference population, it is

⁴ The household sector includes all consumers involved in expenditure for non-business activity. Unincorporated business (Non profit institutions serving households – NPISHs) are defined as legal entities, with the purpose of producing goods and services, whose status does not permit them to be a source of income, profit or other financial gain to units that establish, control or finance them. They are not separated from the household sector in the CSNA.

⁵ A ‘commodity’ in the CPI is defined as either a good or service.

⁶ For example, different cuts of beef are part of an elementary commodity called “Fresh or Frozen Beef from Stores.”

intuitively sensible that both indexes would include a similar list of commodities purchased by these populations, in their role as consumers.

2.3 Formula

Constructing a single measure of price change for a large group of individual commodities requires a method of averaging the price movements of each. Given that there are an infinite number of possible averages to use, the question must be: What is the most robust and representative way to average the individual price movements of the commodities in an index? In determining a formula for aggregating the commodities in an index, numerous factors must be considered, such as the availability and periodicity of price and weight data, the mathematical quality of the results when price movements are very volatile (or not volatile) etc.

There is a large and well developed literature on the selection of optimal formulas for measuring price change. Without going into any great detail, there is a general consensus as to the type of formula that should be used for indexes of consumer price change.⁷ Nevertheless, due (primarily) to a lack of monthly weight data for the CPI, it and the PEPI use different formulas for constructing an aggregate estimate of price change.

The CPI uses a formula based on the fixed-basket Laspeyres concept, in which the commodity price movements in the index are weighted according to consumer expenditures in a fixed reference year. The reference year is updated every four or five years to reflect changes in consumption patterns. The PEPI uses a chained Fisher formula, which is a geometric average of a fixed base Laspeyres-type formula, as used by the CPI, and a Paasche-type formula. The Paasche-type formula averages commodity price movements based on current period expenditures, as opposed to expenditures in some fixed reference period, as in the Laspeyres formula.

It is generally agreed that the Laspeyres formula overstates price change, while the Paasche formula understates price change.⁸ As such, the Fisher formula, an average of the two, is considered a more appropriate formula for measuring price change from one period to the next. Given that the CPI and PEPI use different formulas for constructing a measure of total price change, it is important to account for this impact in the following analysis. This is due to the fact that even if the indexes had the same population and commodity coverage, as well as identical price data, the different formulas used would likely result in different measures of total price change.

⁷ For the purpose of CPIs, a consensus has emerged that a class of ‘superlative indexes,’ and in particular a geometric mean of a Paasche and Laspeyres index, provides the best formulas for constructing consumer price indexes. See chapters 15-19 of the ILO Consumer price index manual: Theory and practice (2004) for a discussion.

⁸ Due to substitution between commodities over the comparison period.

2.4 Weights

Expenditure weights are used in price indexes to weight the price movements of individual commodities by the relative size of their share of consumer expenditure. This provides a measure of the importance of particular commodities in a consumption basket. Differences in weights between two indexes can actually result from a variety of factors, besides having different sources of expenditure data. Primarily, the expenditure data could be different due to the indexes having different reference populations or commodity coverage. Additionally, differences in formula could also result in weights from different time periods being included in the index formula. In the case of the CPI and PEPI, the weights are from different data sources, time periods and cover different population and commodity groups.

The expenditure weights for the CPI are derived from the Survey of Household Spending (SHS). This is a recall survey, mailed to households, of consumer expenditures over the previous year and is intended to obtain expenditure data on all commodities purchased by urban and rural households (the reference population of the CPI). The expenditure weights for the PEPI are derived from the current dollar personal expenditure GDP estimates. This data is not obtained directly from consumers, but from the retail surveys. The primary source of this information is the Quarterly Retail Commodity Survey (QRCS), supplemented by additional internal and external data sources.⁹

The relative quality of the CPI and PEPI weights is beyond the scope of this paper but suffice to say, there are significant differences in the expenditure estimates. This results in differences in the expenditure weights of each index, even for immediately comparable commodities.

In addition, even if expenditure data were derived from the same source, index formulas that require weights from different time periods will end up with different sets of weights, trivially. This occurs in the case of the CPI and PEPI (although the data sources are different), in which the CPI Laspeyres-type formula requires weight data from a fixed reference period while the PEPI Fisher formula requires current period weight data, as well as weight data from a previous reference period. Even if the reference periods for the two indexes happened to coincide, the current period weights in the Fisher formula would serve to confound a simple assessment of the impact of weights on differences between the indexes.

As described in the previous section, the CPI and PEPI have different reference populations. This can result in different estimates of consumer expenditure on similar commodities. Additionally, different reference populations can result in the inclusion of extra commodities in one index that are not found in the other. Both of these factors result in weights that may be different, even for comparable commodities.

⁹ National Income and Expenditure Accounts, <http://www.statcan.ca/cgi-bin/imdb/p2SV.pl?Function=getSurvey&SDDS=1901&lang=en&db=IMDB&dbg=f&adm=8&dis=2>

It is for the reasons above that a step-by-step procedure is used to determine the impact of weight data on the difference between the CPI and PEPI, controlling in turn for the differences above.

2.5 Prices

The inflation concept used for the CPI and PEPI is that of a ‘pure price change’. This is the change in price that occurs after accounting for changes in the quantity and quality of the commodity purchased. Numerous issues have to be resolved in achieving this in a practical setting. First and foremost is defining the good or service for which a price is associated. For the majority of goods this is a straightforward process. For example, a car is a good purchased for a given price. Ideally, that purchase price (including applicable price modifiers such as taxes and discount) is then adjusted for quality and quantity to obtain a measure of pure price change. Many services and durable goods, however, present conceptual problems in constructing a measure of pure price change. For these difficult to measure commodities, the purpose-of-use for the index often guides the selection of a measurement methodology; different methodologies can produce significantly different results, even for the same commodity.

Nevertheless, the majority of the price data used in the CPI and PEPI is measured at market prices, that is, the actual price a consumer would pay to purchase the commodity – a relatively straightforward concept. Given this similarity, CPI commodity price data is used for many of the same commodities in the PEPI.¹⁰ Of the 130 commodities included in the PEPI, all but 22 use CPI data. Of the 22 non-CPI price series, 17 are for PEPI commodities included due to differences in population coverage.

The remaining 5 are due to commodities that require purpose-specific concepts for the PEPI. These conceptual differences arise mainly because the PEPI is constructed within the CSNA framework. Generally, the CSNA measures GDP by summing expenditures on personal consumption, investment, government expenditure and net exports. In determining ‘personal expenditures,’ the PEPI must account for components of these expenditures that could also conceivably belong to other types of expenditure (investment, for example).

Clearly, different price data will impact on the difference between the indexes. As an additional complication, the absolute impact of differences in price data will also be determined by the importance of the associated commodities (via their expenditure weight) in each index. This must also be accounted for in the step-by-step procedure used in this paper, described in the following section.

¹⁰ Minor adjustments are often made to the CPI price data for PEPI purposes.

3. Comparison Methodology

This section describes a step-by-step process for estimating the impact of differences in formula, population, commodity coverage and price and weight data on the CPI and PEPI. This methodology is similar to that of Fixler and Jaditz (2002), which was used to analyse the difference between the US CPI and personal expenditure deflator. By controlling for differences in the indexes one by one, an estimate of the impact can be derived for the dimension being controlled for, as well as to make the indexes more comparable for further comparison. The paper proceeds by first estimating (and adjusting for) the impact of formula differences, then for population and commodity coverage and finally for the remaining price and weight data.

Estimating the impact of formula differences requires re-aggregating the PEPI, using the CPI formula and basket years and then comparing to the CPI for an equivalent period. The second step is to adjust the coverage of the PEPI to that of the CPI by removing population and commodity expenditure considered to be outside the scope of the CPI. The third step requires decomposing the difference in the contribution of equivalent commodities in each index to the total difference between the CPI and PEPI. This difference will be further decomposed so that a contribution from prices and a contribution from weights can be independently established. Section 4 will follow with an analysis of these estimates.

3.1 Accounting for Differences in Formula

As described previously, the CPI uses a Laspeyres-type formula actually known as the Lowe or Young index, shown in equation (6.1). The PEPI, on the other hand, is constructed using a chained Fisher formula, shown in equation (6.2). As shown in the equations below, the CPI index is constructed using expenditure weights from a fixed reference year. The PEPI is a function of expenditure weights for the current and previous period.

$$P_{Lo}(p^0, p^t, q) \equiv \frac{\sum_{i=1}^n p_i^t q_i}{\sum_{i=1}^n p_i^0 q_i} = \sum_{i=1}^n s_i \left(\frac{p_i^t}{p_i^0} \right); \text{ where } s_i \equiv \frac{p_i^0 q_i}{\sum_{j=1}^n p_j^0 q_j} \quad (6.1)$$

$$P_F(p^0, p^1, q^0, q^1) \equiv \left(\sum_{i=1}^n s_i^0 \left(\frac{p_i^1}{p_i^0} \right) * \sum_{i=1}^n s_i^1 \left(\frac{p_i^1}{p_i^0} \right) \right)^{1/2} \quad (6.2)$$

The literature on price indexes suggests that the Fisher formula will consistently show a lower rate of price change than a Laspeyres-type formula, all other aspects of the index

remaining the same.¹¹ In the case of the CPI and PEPI, differences in coverage, price and weight data mean that this will not necessarily be the case. However, the first step in comparing the indexes is to determine how the difference between the two indexes would be affected if the PEPI were re-constructed using the exact CPI formula. This will result in an estimate of the difference in the indexes that can be attributed to formula, while the remaining difference must still be accounted for by all other aspects of index construction.

Reducing the PEPI Fisher index to the CPI formula required selecting fixed reference years for the expenditure weights of the re-constructed index. The CPI basket years were updated with new consumer expenditure data in 1996 and 2001.¹² To be consistent with this pattern, the PEPI was reconstructed using the CPI formula, with the above reference weight periods, over the entire comparison period.

An estimate of the impact of formula on the difference between the indexes was made by comparing the difference between the CPI and PEPI Fisher index and the CPI and re-constructed PEPI Index. We'll refer to this estimate as the 'difference reduction' from formula. *Table 1* shows the difference reduction from formula first for the price change between 1997 and 2002 and then for price change between 2002 and 2005.

Differences in Indexes:	Difference (Index Points)	Percentage of Total Difference
% Change 1997 to 2002		
CPI – PEPI	1.34	100.00%
CPI – (PEPI with CPI Formula)	0.66	48.91%
Difference Reduction from Formula	(-)0.69	51.09%
% Change 2002 to 2005		
CPI – PEPI	1.68	100.00%
CPI – PEPI with CPI Formula	1.44	85.32%
Difference Reduction from Formula	(-)0.25	14.68%

Table 1

For the 1997 to 2002 period, formula differences can be said to account for approximately 51% of the difference between CPI and PEPI, with 49% left to be explained by differences in coverage and weight and price data. For the 2002 to 2005 period, formula differences account for approximately 15% of the difference between the indexes, while 85% is left to be explained by differences in coverage, weights and prices.

¹¹ See footnote 8 and 9.

¹² A change in the Survey of Household Spending resulted in an error in the Mortgage Interest Cost Index weight calculation for the 2001 basket. The error was corrected in June 2004 but did not affect CPI numbers over its duration. For the purposes of this analysis, the corrected weight is used. See <http://www.statcan.ca/english/freepub/62-001-XIB/01106/data.htm#6>

Interestingly, the percentage point difference reduction from formula, shown in the second column in *Table 1*, also provides a rough estimate of the upper-level substitution bias that would exist in the PEPI if it were published as a fixed-base index (i.e. an approximately 0.1 percentage point bias year-to-year). This is consistent with what has been estimated for other consumer price indexes and is also roughly expected from theory.¹³

3.2 Coverage

The above step results in a PEPI with a formula equivalent to that of the CPI. The remaining divergence between the two indexes can be attributed to differences in the reference population, commodity coverage and weight and price data. The next step in decomposing the remaining divergence will be to estimate the impact from different reference populations and commodity coverage. This is achieved by removing components of the PEPI that are not within the scope of the CPI.

Estimating the impact of coverage differences requires that the reference population and commodity coverage of the PEPI be reduced to that of the CPI. Since both the commodity coverage and reference population of the PEPI are larger than the CPI, it is the PEPI that must be scaled down. To achieve this, any commodities in the PEPI relating to expenditures by NPISHs or individuals living in collective communities such as prisons, chronic care facilities, nursing homes or First Nations reserves are excluded. Any remaining commodities not included in the CPI were also removed. Removing these components should account for most of the coverage differences in each index.

The components removed from the PEPI account for approximately 22% of the PEPI commodities and 35% of total expenditure in the PEPI. Figure 3.2 shows the PEPI components removed to ensure comparability between the indexes. It should be noted that while most of the commodities removed from the PEPI clearly lie outside the ideal coverage of the CPI, some are potentially relevant and could be included in a reasonable CPI.

J012	Used Motor Vehicles (net value)
J167	Special Care Facilities
J169	Hospital Care and The Like
J185	Games of Chance
J199	Stock and Bond Commissions
J200	Financial Intermediaries - Implicit Loan Charges
J201	Credit Unions, Implicit Deposit Charges
J204	Financial Intermediaries - Implicit Deposit Charges
J206	Trusted Pension Funds
J207	Credit Unions, Implicit Loan Charges
J208	Mutual Funds
J212	Welfare and Charitable Organizations

¹³ See chapter 11 of the Consumer price index manual: Theory and practice (2004).

J213	Religious Organizations
J214	Trade Unions
J215	Travel Payments Abroad
J216	Spending of Military Personnel Abroad
J218	Travel Receipts from Non-Residents
J220	Political Parties
J226	Indian Bands and Inuit
J171	Accident and Sickness Insurance
J168	Other Health Care
J202	Life Insurance
J157	Lodging in Universities
J186	Pari-mutuel

The impact of making CPI and PEPI coverage comparable can be calculated in the same way as the formula reduction in section 3.1. In this step, the difference between the coverage *and* formula-adjusted PEPI and the CPI is compared alongside the results in *Table 1*. This gives an estimate of the difference from coverage that exists after differences from formula have been accounted for. The following figure shows the difference reduction from coverage in price change between 1997 and 2002 and 2002 and 2005 respectively.

Differences in Indexes:	Difference (Index Points)	Percentage of Total Difference
% Change 1997 to 2002		
CPI - PEPI	1.34	100.00%
Difference Remaining after Formula Change (see table 1)	0.66	51.09%
CPI - PEPI with CPI Formula and Coverage Adjustment (remaining difference)	0.65	48.14%
Difference Reduction from Coverage	(-)0.01	0.77%
Differences in Indexes:		
% Change 2002 to 2005		
CPI - PEPI	1.68	100.00%
Difference Remaining after Formula Change (see figure 3.1)	1.43	14.68%
CPI - PEPI with CPI Formula and Coverage Adjustment (remaining difference)	0.95	56.17%
Difference Reduction from Coverage	(-)0.49	29.14%

Table 2

Over the 1997 to 2002 period, differences in coverage account for approximately 0.8% of the difference between the indexes, in addition to the original difference resulting from the two indexes having different formulas. This leaves 48% of the difference between the indexes to be explained by differences in price and weight data. Over the 2002-2005 period, differences in coverage account for approximately 29% of the difference between the indexes, over and above the difference from formula. In total, this leaves 56% of the difference between the indexes to be explained from differences in price and weight data.

The decomposition results in *Table 2* and *Table 3* show clearly that even before accounting for different price and weight data, index purpose, coverage and formula can have a significant impact on aggregate price change. The next step accounts for the impact of price and weight data on the remaining divergence between the CPI and adjusted PEPI.

3.3 Weights and Prices

The adjusted PEPI and CPI can now be considered comparable in formula and coverage. The remaining difference can be attributed to weights and prices. Accounting for the impact of different price and weight data is not entirely straightforward, however.

Clearly, the CPI and adjusted PEPI formula is a function of a current and reference period price vector and a reference period weight vector. Obviously, weights and prices act in conjunction with each other to produce the final price movement of the index. For example, if a commodity has a very large price movement between two periods but a small weight in the index, the commodity will have little impact on total index change. Alternatively, small price movements for a commodity that has a large weight can result in a large impact on the price movement of the overall index. A comparison of the own-index contribution of two components therefore yields little in terms their contribution to total difference between the indexes (although it does serve to indicate areas of very significant difference).

In identifying large disparities between components of either index and attributing these to differences in weights and prices, a decomposition of the difference between the CPI and PEPI must be used. This purpose of this decomposition is to establish, in two steps, the commodities that contribute significantly to the difference between the indexes and secondly, to estimate the contribution of the different weight and price data in either index.

A practical consideration in constructing estimates of price and weight contributions is deciding upon the level of aggregation at which commodities are to be compared. There are 169 basic classes in the CPI and 110 in the coverage-adjusted PEPI. Given that the population and commodity coverage of these two indexes are now comparable, there are obviously differences in the way the indexes have been aggregated from an elementary level. This makes it difficult to compare the commodity structures of the CPI and PEPI directly, without introducing a great deal of uncertainty as to whether the weight and price information being compared represents the same set of sub-commodities. To resolve this problem, both indexes were re-aggregated into an equal number of comparable indexes, which should eliminate most of the uncertainty. The new aggregation structure can be found in appendix A.3.¹⁴ Considering the additive nature of

¹⁴ The CPI and adjusted PEPI have a different number of component indexes, making comparison and decomposition difficult. Additionally, the expenditure weights associated with a component in a class of commodities (such as the children's and infants component in the clothing class) in one index may not include exactly the same expenditure sources as those of a similar sounding component in the other index.

the CPI and the adjusted-PEPI, re-aggregating the sub-commodities of either index does not change the total price change shown, nor the total difference between them.

The final consideration in carrying out the price and weight decomposition was that the weights and prices must be on the same base year. Given that the PEPI is a quarterly index and the CPI is a monthly one, the indexes were re-based and the weights price updated to the year after the relevant basket update year. The decomposition was carried out using annual data (averaged from sub-periods) for all years of the 1996 and 2001 basket; i.e. the 1996 basket was used for the period 1998-2002, so the decomposition used 1996 reference weights for this period of data.

The following describes the decomposition formula. Equations 6.5 and 6.6 show the formulas for CPI and PEPI percentage change (from base year 0 and reference period b) as a summation of the contribution of individual commodities i to overall change.

$$\% \Delta^{cpi} = P^{t/cpi}(p^0, p^t, q^b) - 100 = \sum_{i=1}^n \left\{ \frac{(P_i^{t/cpi} - 100) * S_i^{cpi}}{\sum_{i=1}^n S_i^{cpi}} \right\} = \sum_{i=1}^n (P_i^{t/cpi} - 100) * S_i^{cpi} \quad (6.5)$$

$$\% \Delta^{pepi} = P^{t/pepi}(p^0, p^t, q^b) - 100 = \sum_{i=1}^m \left\{ \frac{(P_i^{t/pepi} - 100) * S_i^{pepi}}{\sum_{i=1}^m S_i^{pepi}} \right\} = \sum_{i=1}^m (P_i^{t/pepi} - 100) * S_i^{pepi} \quad (6.6)$$

The first step in estimating the contribution of price and weight data to the difference between the aggregate indexes is to subtract (6.6) from (6.5). The result (6.7) provides the contribution of each comparable commodity to the total difference between the two indexes. As can be seen from the formula, the summation of the commodity differences is equal to the total difference between the two indexes.

$$\% \Delta^{cpi} - \% \Delta^{pepi} = \left\{ \sum_{i=1}^n (P_i^{t/cpi} - 100) * S_i^{cpi} \right\} - \left\{ \sum_{i=1}^m (P_i^{t/pepi} - 100) * S_i^{pepi} \right\} \quad (6.7)$$

The second step in estimating the impact of prices and weights is to estimate, by commodity, the independent contribution of prices and weights to the total difference between the CPI and adjusted PEPI. While any number of decompositions might potentially be used to estimate the independent contribution of prices and weights, the Bennet (1920) decomposition is both relatively simple and fits nicely with the above formulas, given their additive nature.¹⁵

Aggregating the components of each index into easily comparable classes avoids this problem, by grouping all expenditure that could be associated with any component in a particular class of goods.

¹⁵ See *Chapter 2: Early Approaches to Index Number Theory* (Diewert ()) for a discussion

Additionally, and analogous to the argument for using some average of a Laspeyres and Paasche-type index for measuring price change between two periods, the Bennet decomposition is an arithmetic average of two decompositions; each of which uses a perfectly reasonable reference series to construct estimates. These decompositions are as follows:

$$\% \Delta^{cpi} - \% \Delta^{pepi} =$$

$$\left[\sum_{i=1}^n (P_i^{t/cpi} - 100) (S_i^{cpi} - S_i^{pepi}) \right] + \left[\sum_{i=1}^n \{ (P_i^{t/cpi} - 100) - (P_i^{t/pepi} - 100) \} S_i^{pepi} \right] \quad (6.8)$$

or;

$$\left[\sum_{i=1}^n (P_i^{t/pepi} - 100) (S_i^{cpi} - S_i^{pepi}) \right] + \left[\sum_{i=1}^n \{ (P_i^{t/cpi} - 100) - (P_i^{t/pepi} - 100) \} S_i^{cpi} \right] \quad (6.9)$$

The left side of 6.8 is the contribution to total difference between the indexes from weights, given the use of CPI prices as the reference series (similar to using period 0 or t quantities in the temporal context). The right side of 6.8 is the contribution from prices, with PEPI weights as the reference series. Equation 6.9 is essentially the same as 6.8 except that the price and weight reference series have been reversed. Similar to the Paasche and Laspeyres indexes in the temporal context, both 6.8 and 6.9 are reasonable decompositions of the difference between the indexes. The Bennet decomposition (6.12) seems a reasonable compromise between the two as it treats both the PEPI and CPI price and weight data symmetrically, in that an arithmetic average is used. The Bennet decomposition is derived below:

$$\pm \sum_{i=1}^m (P_i^{t/cpi} - 100) * S_i^{pepi} \pm \sum_{i=1}^m (P_i^{t/pepi} - 100) * S_i^{cpi} \quad (6.10)$$

Adding 6.10 to 6.7 and rearranging gives 6.11,

$$\begin{aligned} &= \left(\frac{1}{2} \right) * \left\{ \sum_{i=1}^n (P_i^{t/cpi} - 100) * S_i^{cpi} - \sum_{i=1}^n (P_i^{t/pepi} - 100) * S_i^{cpi} + \sum_{i=1}^n (P_i^{t/cpi} - 100) * S_i^{pepi} - \sum_{i=1}^n (P_i^{t/pepi} - 100) * S_i^{pepi} \right\} + \\ &\left\{ \sum_{i=1}^n (P_i^{t/cpi} - 100) * S_i^{cpi} - \sum_{i=1}^n (P_i^{t/cpi} - 100) * S_i^{pepi} + \sum_{i=1}^n (P_i^{t/pepi} - 100) * S_i^{cpi} - \sum_{i=1}^n (P_i^{t/pepi} - 100) * S_i^{pepi} \right\} \end{aligned} \quad (6.11)$$

Factoring equation (6.11) results in the Bennet decomposition formula shown in 6.12. The first line is the estimate of the contribution of prices to the total difference between

the CPI and PEPI for commodity i . The second line is the estimate of the contribution of weights to the total difference between the indexes, for commodity i .

$$= \left(\frac{1}{2}\right) * (S^{cpi} + S^{pepi}) * \left\{ \sum_{i=1}^n (P_i^{t/cpi} - 100) - \sum_{i=1}^n (P_i^{t/pepi} - 100) \right\} + \tag{6.12}$$

$$\left(\frac{1}{2}\right) * \left\{ \sum_{i=1}^n (P_i^{t/cpi} - 100) + \sum_{i=1}^n (P_i^{t/pepi} - 100) \right\} * (S^{cpi} - S^{pepi})$$

As described previously, a two stage process is used to determine the source and impact of different price and weight data in the CPI and PEPI. The first uses (6.7) to identify commodities where there are large differences in contribution to percentage difference. The second part is used to attribute large disparities to differences in weights and prices, by commodity. The results follow in section 4.

4. Results

The results that follow show that the difference remaining between the CPI and PEPI, after controlling for formula and coverage, can be attributed largely to the following commodities: Transportation, the structural component of shelter, recreation equipment and services and alcohol and tobacco. It is worth noting that these are commodities where significant conceptual differences exist in the measurement of the commodity prices and determination of weights.

Figure 4.1 shows the contribution of the re-aggregated commodities to the difference between the CPI and PEPI over the 1997-2002 period. The difference between the CPI and PEPI is the leftmost bar, while the remaining bars show the contribution to the difference of the various commodities. Clearly, shelter-structure, transportation and alcohol and tobacco are the dominant contributors, although their effects cancel each other out, to some extent. Recreation equipment and services is also a significant contributor, due mostly to differences in the price movement of computers in the CPI and PEPI.

The CPI and PEPI use different measurement methodologies for the shelter-structure commodity, the price movement of which is the primary contributor to the difference between each index. The weight for shelter-structure in the CPI and PEPI is fairly similar. In measuring shelter-structure prices, the CPI uses a user-cost approach to the measurement of owned accommodation, while the PEPI uses a rental equivalence method. A comparison of the merits and accuracy of each is beyond the scope of this paper.

Transportation and alcohol and tobacco are large contributors to the difference between the indexes due to significant differences between the weights of each in the index. The

measurement of automobile insurance in the PEPI is based on a net premium approach, while the CPI uses a gross premium approach. This results in a CPI weight that is close to 4 times larger than the equivalent PEPI weight. Significant differences in prices for auto insurance also contributed to the difference over this period. The difference in methodology is due primarily to the different purpose-of-use of either index.

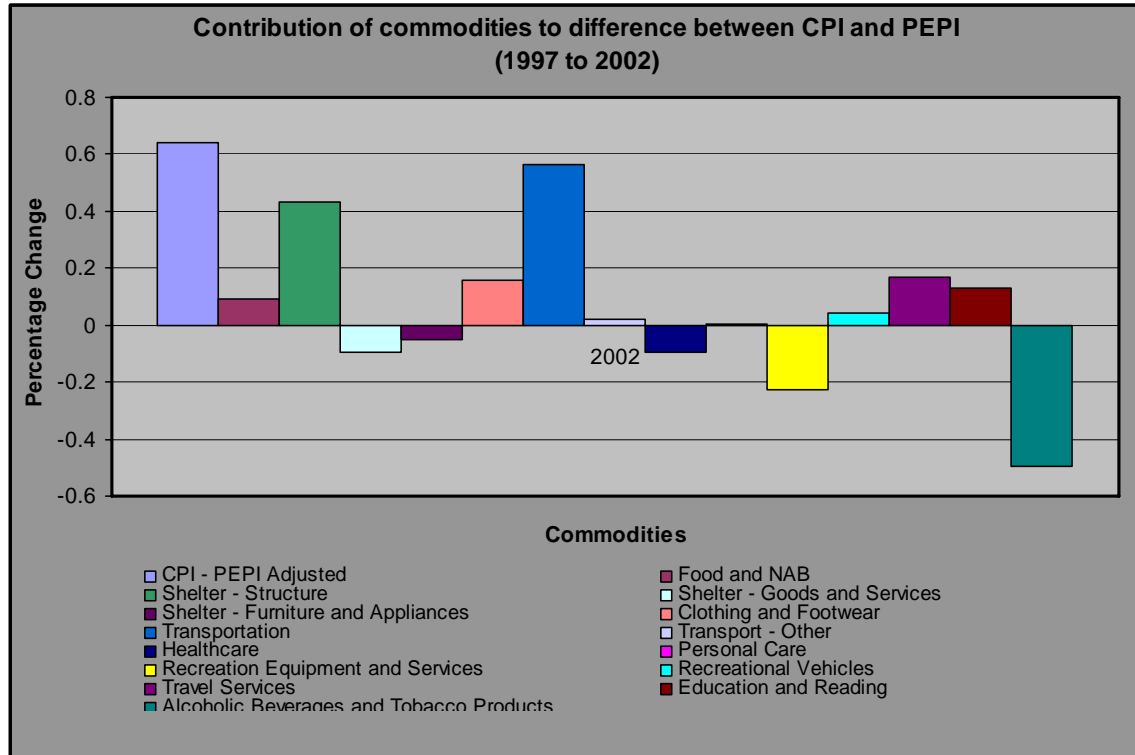


Figure 4.1

Figure 4.2 shows the same decomposition, except for the 2002-2005 period. Given that this period is two years shorter than the 1997-2002 period, the difference between the indexes (again, the leftmost bar) is more significant. Very clearly, the shelter-structure component was the primary contributor to the difference between the indexes, while travel services and alcohol and tobacco were also somewhat significant. The shelter-structure contribution is the almost entirely the result of a difference in the movement of the two price series. The CPI price series increased at a rate approximately 3.5 times that of the PEPI series.

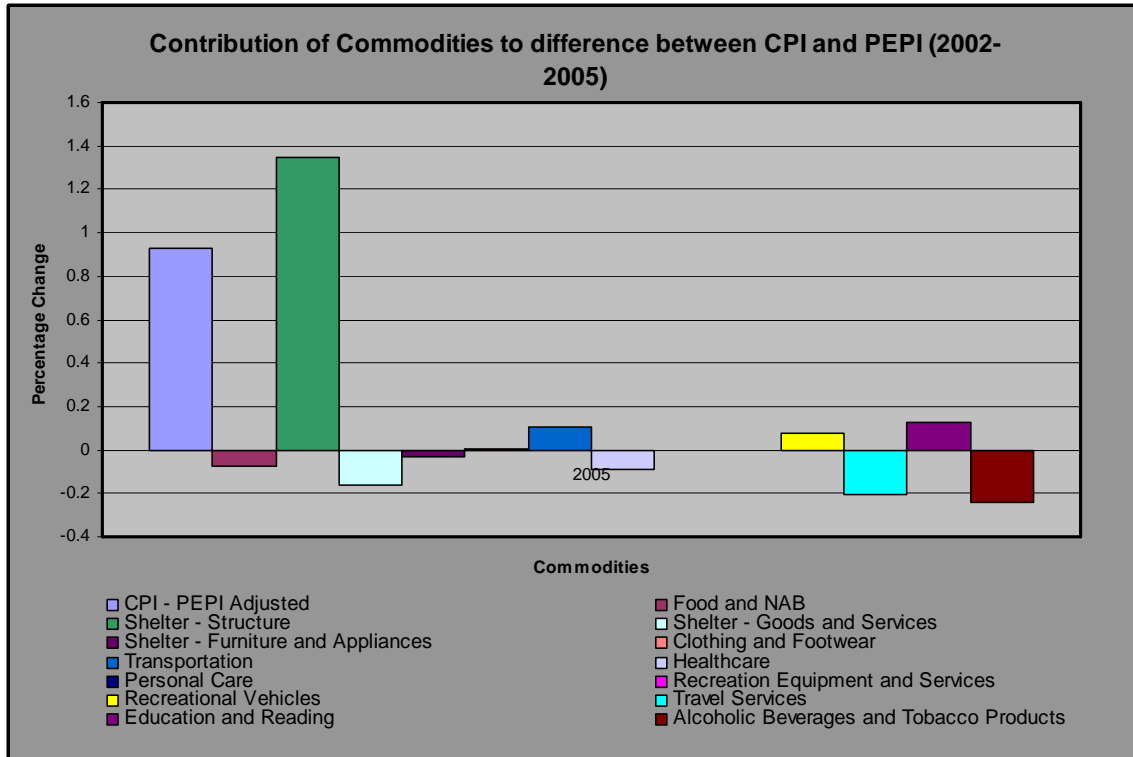


Figure 4.2

Figures 4.3 and 4.4 show the price and weight decomposition for the commodities of interest outlined above. The italicized commodities are the sub-components of the major commodities. These tables show the contribution of price and weight differences, for each commodity, to the total difference between the two indexes. For example, for the 2002-2005 period in Figure 4.4, the shelter-structure component contributed 1.35% to the percentage difference between the indexes. The Bennet decomposition shows that differences in prices contributed 1.32% to the difference, while differences in weights only contributed 0.03% to the difference.

In interpreting these tables, notice that the ‘total contribution’ of each sub-component sums to the ‘total contribution’ of their respective major commodity. However, the weight and price contributions do not sum vertically to the weight and price contribution of their major commodity.

Contribution to Difference (1997-2002) for Commodity:	Weights	Prices	Total Contribution
Shelter - Structure	-0.05	0.48	0.43
Transportation	0.49	0.07	0.56
<i>Purchases, Leasing, Renting</i>	0.04	-0.08	-0.04
<i>Operating Expenses</i>	0.11	0.01	0.11
<i>Insurance</i>	0.20	0.29	0.49
Recreation Equipment and Services	-0.01	-0.22	-0.23
<i>Computers</i>	-0.20	-0.11	-0.31
<i>Other</i>	-0.06	0.15	0.09
Alcoholic Beverages and Tobacco Products	-0.83	0.34	-0.49
<i>Alcohol from Stores</i>	-0.10	-0.00	-0.10
<i>Alcohol from Establishments</i>	-0.12	-0.00	-0.12
<i>Tobacco Products</i>	-0.41	0.14	-0.27

Figure 4.3

Contribution to Difference (2002-2005) for Commodity:	Weights	Prices	Total Contribution
Shelter - Structure	0.03	1.32	1.35
Travel Services	-0.02	-0.19	-0.20
Alcoholic Beverages and Tobacco Products	-0.40	0.15	-0.24
<i>Alcohol from Stores</i>	-0.07	0.00	-0.07
<i>Alcohol from Establishments</i>	-0.07	-0.00	-0.07
<i>Tobacco Products</i>	-0.11	0.01	-0.10

Figure 4.4

5. Conclusion

The primary purpose of this paper has been to provide an analysis of the difference between the Consumer Price Index (CPI) and the Personal Expenditure Price Index (PEPI), both produced by Statistics Canada as measures of the change in consumer prices over time. This paper should provide users with a better understanding of the construction of these two price indexes and why, in general, seemingly similar price indexes can diverge over the same period of time. The results for the CPI and PEPI show that formula and coverage differences account for approximately 0.2 percentage points of the average difference over the period 1997-2005, while the rest of the divergence can be attributed to differences in prices and weights. The majority of these differences can be attributed to commodities for which there are significant differences in measurement methodologies. These include the structural components of shelter, automobile insurance, computer equipment and alcohol and tobacco.

A.1 Commodity Structure in the CPI

The following is the commodity aggregation structure for the Consumer Price Index. The lowest level of aggregation shown is the basic class level.

CPI COMMODITY CLASSIFICATION 2001 BASKET

FOOD & NON-ALCOHOLIC BEVERAGES

FOOD & NON-ALCOHOLIC BEVERAGES PURCHASED IN STORE

MEAT

FRESH OR FROZEN MEAT (EXCL. POULTRY)

FRESH OR FROZEN BEEF

FRESH OR FROZEN PORK

OTHER FRESH OR FROZEN MEAT (EXCL. POULTRY)

FRESH OR FROZEN POULTRY MEAT

FRESH OR FROZEN CHICKEN

OTHER FRESH OR FROZEN POULTRY MEAT

PROCESSED MEAT

HAM & BACON

OTHER PROCESSED MEAT

FISH & OTHER SEAFOOD

FISH

FRESH OR FROZEN FISH (INCL. PORTIONS & FISH STICKS)

CANNED & OTHER PRESERVED FISH

OTHER SEAFOOD

DAIRY PRODUCTS & EGGS

DAIRY PRODUCTS

FRESH MILK

BUTTER

CHEESE

ICE CREAM & RELATED PRODUCTS

OTHER DAIRY PRODUCTS

EGGS

BAKERY & OTHER CEREAL PRODUCTS

BAKERY PRODUCTS

BREAD, UNSWEETENED ROLLS & BUNS

BISCUITS

OTHER BAKERY PRODUCTS

OTHER CEREAL GRAINS & CEREAL PRODUCTS

RICE (INCL. MIXES)

BREAKFAST CEREAL & OTHER CEREAL GRAINS (EXCL. INFANT)

PASTA PRODUCTS

FLOUR & FLOUR BASED MIXES

FRUIT, FRUIT PREPARATIONS & NUTS

FRESH FRUIT

APPLES

ORANGES

BANANAS & PLANTAINS

OTHER FRESH FRUIT

PRESERVED FRUIT & FRUIT PREPARATIONS

FRUIT JUICES

OTHER PRESERVED FRUIT & FRUIT PREPARATION

NUTS

VEGETABLES & VEGETABLE PREPARATIONS

FRESH VEGETABLES

POTATOES

TOMATOES

LETTUCE

OTHER FRESH VEGETABLES

PRESERVED VEGETABLES & VEGETABLE PRODUCTS

FROZEN & DRIED VEGETABLES

CANNED VEGETABLES & OTHER VEGETABLE PREPARATION

OTHER FOOD PRODUCTS & NON-ALCOHOLIC BEVERAGES

SUGAR & CONFECTIONERY

SUGAR & SYRUP

CONFECTIONERY

- FATS & OILS
 - MARGARINE
 - OTHER EDIBLE FATS & OILS
- COFFEE & TEA
 - COFFEE
 - TEA
- CONDIMENTS, SPICES & VINEGARS
- OTHER FOOD PREPARATIONS
 - SOUP (EXCEPT INFANT SOUP)
 - INFANT & JUNIOR FOODS
 - PRE-COOKED FROZEN FOOD PREPARATIONS
 - OTHER FOOD PRODUCTS
- NON-ALCOHOLIC BEVERAGES
- FOOD & NON-ALCOHOLIC BEVERAGES PURCHASED FROM RESTAURANTS
 - FOOD & NON-ALCOHOLIC BEVERAGES -TABLE SERVICE RESTAURANT
 - FOOD & NON-ALC. BVGS. PURCH. FAST FOOD & TAKE-OUT RESTAURANTS
 - FOOD & NON ALCOHOLIC BVGS PURCHASED - CAFETERIA. &OTHER RESTAURANTS
- SHELTER
 - RENTED ACCOMMODATION
 - RENT
 - TENANTS' INSURANCE PREMIUMS
 - TENANTS' MAINTENANCE, REPAIRS & OTHER EXPENSES
 - OWNED ACCOMMODATION
 - MORTGAGE INTEREST COST
 - REPLACEMENT COST
 - PROPERTY TAXES (INCL. SPECIAL CHARGES)
 - HOMEOWNERS' INSURANCE PREMIUMS & MORTGAGE INSURANCE
 - HOMEOWNERS' MAINTENANCE & REPAIRS
 - OTHER OWNED ACCOMMODATION EXPENSES
 - WATER, FUEL & ELECTRICITY FOR OWNED ACCOMMODATION
 - ELECTRICITY
 - WATER
 - PIPED GAS
 - FUEL OIL & OTHER FUEL
- HOUSEHOLD OPERATION, FURNISHINGS & EQUIPMENT
 - HOUSEHOLD OPERATION
 - COMMUNICATIONS
 - TELEPHONE SERVICES
 - POSTAL & OTHER COMMUNICATIONS SERVICES
 - INTERNET SERVICE PROVISION
 - CHILD CARE & OTHER CUSTODIAL SERVICES
 - CHILD CARE
 - DOMESTIC & OTHER CUSTODIAL SERVICES
 - CLEANING & OTHER HOUSEHOLD CHEMICAL PRODUCTS
 - DETERGENT & SOAP (OTHER THAN FOR PERSONAL CARE)
 - OTHER HOUSEHOLD CHEMICAL PRODUCTS
 - PAPER, PLASTIC & FOIL SUPPLIES
 - PAPER SUPPLIES
 - PLASTIC & FOIL SUPPLIES
 - OTHER HOUSEHOLD GOODS & SERVICES
 - PET & HORTICULTURAL GOODS
 - PET FOOD & SUPPLIES
 - SEEDS, PLANTS & CUT FLOWERS
 - OTHER HORTICULTURAL GOODS
 - OTHER HOUSEHOLD SUPPLIES & SERVICES
 - OTHER HOUSEHOLD SUPPLIES
 - OTHER HOUSEHOLD SERVICES
 - FINANCIAL SERVICES
 - HOUSEHOLD FURNISHINGS
 - FURNITURE & HOUSEHOLD TEXTILES
 - FURNITURE
 - UPHOLSTERED FURNITURE
 - WOODEN FURNITURE
 - OTHER FURNITURE
 - HOUSEHOLD TEXTILES
 - WINDOW COVERINGS
 - BEDDING & OTHER HOUSEHOLD TEXTILES
 - ROOM-SIZE & AREA RUGS & MATS
 - HOUSEHOLD EQUIPMENT
 - HOUSEHOLD APPLIANCES

- COOKING APPLIANCES
- REFRIGERATION & AIR CONDITIONING APPLIANCES
- LAUNDRY & DISHWASHING APPLIANCES
- OTHER HOUSEHOLD APPLIANCES
- KITCHEN UTENSILS, TABLEWARE & FLATWARE
 - KITCHEN UTENSILS
 - TABLEWARE & FLATWARE
- TOOLS & OTHER HOUSEHOLD EQUIPMENT
 - HOUSEHOLD TOOLS (INCL. LAWN, GARDEN & SNOW - REMOVAL EQUIPMENT)
 - OTHER HOUSEHOLD EQUIPMENT
- SERVICES RELATED TO HOUSEHOLD FURNISHINGS & EQUIPMENT
- CLOTHING & FOOTWEAR
 - CLOTHING
 - WOMEN'S CLOTHING
 - MEN'S CLOTHING
 - CHILDREN'S CLOTHING (INCLUDING INFANTS')
 - CLOTHING, NES
 - FOOTWEAR
 - WOMEN'S FOOTWEAR (EXCL. ATHLETIC)
 - MEN'S FOOTWEAR (EXC. ATHLETIC)
 - CHILDREN'S FOOTWEAR (EXCL. ATHLETIC)
 - ATHLETIC FOOTWEAR
 - CLOTHING ACCESSORIES & JEWELLERY
 - ACCESSORIES
 - LEATHER ACCESSORIES
 - OTHER ACCESSORIES
 - WATCHES
 - JEWELLERY (OTHER THAN WATCHES)
 - CLOTHING MATERIALS, NOTIONS & SERVICES
 - CLOTHING MATERIALS & NOTIONS
 - LAUNDRY SERVICES (INCL. SELF-SERVICE DRY CLEANING)
 - DRY CLEANING SERVICES (EXCL. SELF-SERVICE)
 - OTHER CLOTHING SERVICES
- TRANSPORTATION
 - PRIVATE TRANSPORTATION
 - PURCHASE, LEASING & RENTAL AUTOMOTIVE VEHICLES
 - PURCHASE & LEASING AUTOMOTIVE VEHICLES
 - PURCHASE OF AUTOMOTIVE VEHICLES
 - LEASING OF AUTOMOTIVE VEHICLES
 - RENTAL
 - OPERATION OF AUTOMOTIVE VEHICLES
 - GASOLINE & OTHER FUELS
 - AUTOMOTIVE VEHICLE PARTS, MAINTENANCE & REPAIRS
 - AUTOMOTIVE VEHICLE PARTS, ACCESSORIES & SUPPLIES
 - AUTOMOTIVE VEHICLE MAINTENANCE & REPAIR SERVICES
 - OTHER AUTOMOTIVE VEHICLE OPERATING EXPENSES
 - PRIVATE & PUBLIC INSURANCE PREMIUMS
 - AUTOMOTIVE VEHICLE REGISTRATION FEES
 - DRIVER'S LICENCES
 - PUBLIC PARKING
 - ALL OTHER AUTOMOTIVE VEHICLE OPERATING EXPENSES
 - PUBLIC TRANSPORTATION
 - LOCAL & COMMUTER TRANSPORTATION
 - CITY BUS & SUBWAY TRANSPORTATION
 - OTHER LOCAL & COMMUTER TRANSPORTATION (INCL. TAXI)
 - INTER-CITY TRANSPORTATION
 - AIR TRANSPORTATION
 - RAIL, HIGHWAY BUS & OTHER INTER-CITY TRANSPORTATION
- HEALTH & PERSONAL CARE
 - HEALTH CARE
 - HEALTH CARE GOODS
 - MEDICINAL & PHARMACEUTICAL PRODUCTS
 - PRESCRIBED MEDICINE
 - NON-PRESCRIBED MEDICINE
 - OTHER HEALTH CARE GOODS
 - HEALTH CARE SERVICES
 - EYE-CARE
 - DENTAL CARE
 - OTHER HEALTH CARE SERVICES

- PERSONAL CARE
 - PERSONAL-CARE SUPPLIES & EQUIPMENT
 - PERSONAL SOAP
 - TOILET PREPARATIONS & COSMETICS
 - ORAL-HYGIENE PRODUCTS
 - OTHER PERSONAL CARE SUPPLIES & EQUIPMENT
 - PERSONAL CARE SERVICES
- RECREATION, READING & EDUCATION
 - RECREATION
 - RECREATION EQUIPMENT & SERVICES (EXCL. VEHICLES)
 - SPORTING & ATHLETIC EQUIPMENT
 - TOYS, GAMES & HOBBY SUPPLIES
 - COMPUTER EQUIPMENT & SUPPLIES
 - PHOTOGRAPHIC EQUIPMENT
 - PHOTOGRAPHIC SUPPLIES & SERVICES
 - OTHER RECREATION EQUIPMENT & SERVICES
 - PURCHASE & OPERATION OF RECREATIONAL VEHICLES
 - PURCHASE OF RECREATIONAL VEHICLES & OUTBOARD MOTORS
 - OPERATION OF RECREATIONAL VEHICLES
 - FUEL, PARTS & ACCESSORIES FOR RECREATIONAL VEHICLES
 - INSURANCE, LICENCE & OTHER SERVICES FOR RECREATIONAL - VEHICLES
 - HOME ENTERTAINMENT EQUIPMENT & SERVICES
 - AUDIO EQUIPMENT
 - AUDIO TAPES & DISCS
 - VIDEO EQUIPMENT
 - RENTAL OF VIDEOTAPES & VIDEODISCS
 - PURCHASE OF VIDEOTAPES & VIDEODISCS
 - OTHER HOME ENTERTAINMENT EQUIPMENT, PARTS & SERVICES
 - TRAVEL SERVICES
 - TRAVELLER ACCOMMODATION
 - TRAVEL TOURS
 - OTHER CULTURAL & RECREATIONAL SERVICES
 - SPECTATOR - ENTERTAINMENT PERFORMANCES (EXCL. CABLEVISION & - SATELLITE)
 - CABLEVISION (INCL. PAY TV) & SATELLIT E SERVICES
 - USE OF RECREATIONAL, SPORT & HEALTH FACILIT IES & SERVICES
 - EDUCATION & READING
 - EDUCATION
 - TUITION FEES
 - SCHOOL TEXTBOOKS & SUPPLIES
 - OTHER LESSONS, COURSES & EDUCATION SERVICES
 - READING MATERIAL & OTHER PRINTED MATTER (EXCL. TEXTBOOKS)
 - NEWSPAPERS
 - MAGAZINES & PERIODICALS
 - BOOKS & OTHER PRINTED MATTER (EXCL. TEXTBOOKS)
 - ALCOHOLIC BEVERAGES & TOBACCO PRODUCTS
 - ALCOHOLIC BEVERAGES
 - SERVED ALCOHOLIC BEVERAGES
 - SERVED BEER
 - SERVED WINE & CIDER
 - SERVED LIQUOR
 - ALCOHOLIC BEVERAGES PURCHASED FROM STORES
 - BEER PURCHASED FROM STORES
 - WINE & CIDER PURCHASED FROM STORES
 - LIQUOR PURCHASED FROM STORES
 - TOBACCO PRODUCTS & SMOKER'S SUPPLIES
 - CIGARETTES
 - OTHER TOBACCO PRODUCTS & SMOKERS' SUPPLIES

A.2 Commodity Structure in the PEPI

The PEPI is published at a more aggregated level. The following are the J-Level commodities in the PEPI.

IPI001 Furniture
 IPI002 Floor Coverings
 IPI003 Upholstery and Furniture Repairs
 IPI004 Refrigerators and Freezers
 IPI005 Washers and Dryers
 IPI006 Stoves, Ranges and Microwave Ovens
 IPI007 Other Major Appliances
 IPI008 Small Electrical Appliances
 IPI009 Household Equipment Repairs
 IPI010 Garden Tools and Equipment for Outdoor Maintenance
 IPI011 New Automobiles
 IPI012 Used Motor Vehicles (net value)
 IPI013 New Trucks and Vans
 IPI014 Road and Off-Road Recreational Vehicles
 IPI015 Motor Vehicle Maintenance and Repairs
 IPI016 Motor Vehicle Parts and Accessories
 IPI017 Radios, Sound Systems and Accessories
 IPI018 TV Sets, Video Equipment and Accessories
 IPI019 Boats, Aircrafts and Accessories
 IPI020 Photographic and Optical Equipment
 IPI021 Sporting and Camping Equipment
 IPI022 Office Machines, Computers and Equipment
 IPI023 Musical Instruments and Supplies
 IPI024 Trailers
 IPI025 Recreation Equipment Repairs
 IPI026 Recreation Equipment Rentals
 IPI027 Watches and Jewellery
 IPI028 Watches and Jewellery Repairs
 IPI051 Men's and Boys' Clothing
 IPI052 Women's, Girl's and Infant's Clothing
 IPI053 Thread, Yarn and Sewing Accessories
 IPI054 Piece Goods
 IPI056 Footwear
 IPI057 Footwear Repairs
 IPI058 Luggage, Leather Goods and Other Personal Effects
 IPI059 Toys, Games and Hobby Supplies
 IPI060 Films and Other Photographic Supplies
 IPI061 Household Textiles and Furnishings
 IPI062 China, Glassware and Kitchenware
 IPI063 Lamps, Lighting Equipment and Accessories
 IPI064 Flatware
 IPI065 Hardware
 IPI066 Newspapers, Books, Magazines and Stationery
 IPI067 Women's Clothing Repairs and Alterations
 IPI068 Pets and Supplies
 IPI069 Men's Clothing Repairs and Alterations
 IPI101 Food and Non-Alcoholic Beverages
 IPI102 Imputed Food
 IPI103 Pet Food
 IPI104 Alcoholic Beverages Bought in Stores
 IPI105 Tobacco Products
 IPI106 Electricity
 IPI107 Natural Gas
 IPI108 Other Fuels
 IPI109 Soaps and Other Cleaning Supplies
 IPI110 Other Household Supplies
 IPI111 Pharmaceutical Products and Medical Goods
 IPI112 Motor Fuels and Lubricants
 IPI113 Flowers, Plants and Other Horticultural Supplies
 IPI114 Cosmetics and Toiletries
 IPI151 Water, Sewage and Garbage Charges
 IPI153 Imputed Rent

IPI154 Paid Rent
 IPI155 Imputed Lodging
 IPI156 Paid Lodging (excluding Universities)
 IPI157 Lodging in Universities
 IPI158 Domestic Services
 IPI159 Child Care, In The Home
 IPI160 Child Care, Outside Home
 IPI161 Laundry and Dry Cleaning
 IPI162 Property Insurance
 IPI163 Pet Care
 IPI164 Furniture and Appliance Rentals
 IPI165 Janitorial Services
 IPI166 Medical Care, Dental Care and the Like
 IPI167 Special Care Facilities
 IPI168 Other Health Care
 IPI169 Hospital Care and The Like
 IPI171 Accident and Sickness Insurance
 IPI173 Commissions Paid to Tour Operators
 IPI174 Bridge and Highway Tolls
 IPI175 Auto Insurance
 IPI176 Urban Transit
 IPI177 Railway Transport
 IPI178 Interurban Bus
 IPI179 Air Transport
 IPI180 Water Transport
 IPI181 Taxis
 IPI182 Moving and Storage
 IPI183 Telecommunications
 IPI184 Postal and Courier Services
 IPI185 Games of Chance
 IPI186 Pari-mutuel
 IPI187 Other Recreational Services
 IPI188 University Fees
 IPI189 Fees for Education and Training, other than University
 IPI190 Other Educational and Cultural Services
 IPI191 Hairstyling for Men and Women
 IPI192 Other Personal Care
 IPI193 Meals outside the Home
 IPI194 Alcoholic Beverages Consumed in Licensed Establishments
 IPI195 Accommodation Services
 IPI196 Board Paid
 IPI199 Stock and Bond Commissions
 IPI200 Financial Intermediaries, Implicit Loan Charges
 IPI201 Credit Unions, Implicit Deposit Charges
 IPI202 Life Insurance
 IPI203 Financial Intermediaries, Explicit Charges
 IPI204 Financial Intermediaries, Implicit Deposit Charges
 IPI205 Credit Unions, Explicit Charges
 IPI206 Trusteed Pension Funds
 IPI207 Credit Unions, Implicit Loan Charges
 IPI208 Mutual Funds
 IPI209 Legal, Accounting and Other Services
 IPI210 Undertaking and Other Funeral Services
 IPI211 Miscellaneous Household Services
 IPI212 Welfare and Charitable Organizations
 IPI213 Religious Organizations
 IPI214 Trade Unions
 IPI215 Travel Payments Abroad
 IPI216 Spending of Military Personnel Abroad
 IPI218 Travel Receipts from Non-Residents
 IPI219 Cable Television and Pay Television
 IPI220 Political Parties

- IPI221 Parking
- IPI222 Driving Lessons and Membership in Automobile Associations
- IPI223 Motor Vehicle Renting
- IPI224 Cinemas
- IPI225 Photographic Services
- IPI226 Indian Bands and Inuit

A.3 New Aggregation Structure for PEPI and CPI

In carrying out this analysis, it is important to remember that re-aggregating the CPI and PEPI is only possible when they are constructed using formulas (such as the fixed-base Laspeyres-type formulas) that are additive. This property allows for the components of an index to be re-aggregated into any composite, without changing the result obtained from the final index number.

Food and NAB	Food and NAB
<i>Food and NAB from Stores</i>	<i>Food and NAB from Stores</i>
FRESH OR FROZEN BEEF	Food and Non-Alcoholic Beverages
FRESH OR FROZEN PORK	Imputed Food
OTHER FRESH OR FROZEN MEAT (EXCL. POULTRY)	Board Paid
FRESH OR FROZEN CHICKEN	
OTHER FRESH OR FROZEN POULTRY MEAT	
HAM & BACON	
OTHER PROCESSED MEAT	
FRESH OR FROZEN FISH (INCL. PORTIONS & FISH STICKS)	
CANNED & OTHER PRESERVED FISH	
OTHER SEAFOOD	
FRESH MILK	
BUTTER	
CHEESE	
ICE CREAM & RELATED PRODUCTS	
OTHER DAIRY PRODUCTS	
EGGS	
BREAD, UNSWEETENED ROLLS & BUNS	
BISCUITS	
OTHER BAKERY PRODUCTS	
RICE (INCL. MIXES)	
BREAKFAST CEREAL & OTHER CEREAL GRAINS (EXCL. INFANT)	
PASTA PRODUCTS	
FLOUR & FLOUR BASED MIXES	
APPLES	
ORANGES	
BANANAS & PLANTAINS	
OTHER FRESH FRUIT	
FRUIT JUICES	
OTHER PRESERVED FRUIT & FRUIT PREPARATION	
NUTS	
POTATOES	
TOMATOES	

LETTUCE	
OTHER FRESH VEGETABLES	
FROZEN & DRIED VEGETABLES	
CANNED VEGETABLES & OTHER VEGETABLE PREPARATION	
SUGAR & SYRUP	
CONFECTIONERY	
MARGARINE	
OTHER EDIBLE FATS & OILS	
COFFEE	
TEA	
CONDIMENTS, SPICES & VINEGARS	
SOUP (EXCEPT INFANT SOUP)	
INFANT & JUNIOR FOODS	
PRE-COOKED FROZEN FOOD PREPARATIONS	
OTHER FOOD PRODUCTS	
NON-ALCOHOLIC BEVERAGES	
<i>Food Purchased Outside Stores</i>	<i>Food Purchased Outside Stores</i>
FOOD & NON-ALCOHOLIC BEVERAGES -TABLE SERVICE RESTAURANT	Meals outside the Home
FOOD & NON-ALC. BVGS. PURCH. FAST FOOD & TAKE-OUT RESTAURANTS	
FOOD & NON ALCOHOLIC BVGS PURCHASED - CAFETERIA. &OTHER RESTAURANTS	
Shelter - Structure	Shelter - Structure
RENT	Paid Rent
TENANTS' INSURANCE PREMIUMS	Imputed Rent
MORTGAGE INTEREST COST	Imputed Lodging
REPLACEMENT COST	Paid Lodging (excluding Universities)
PROPERTY TAXES (INCL. SPECIAL CHARGES)	Property Insurance
HOMEOWNERS' INSURANCE PREMIUMS & MORTGAGE INSURANCE	
TENANTS' MAINTENANCE, REPAIRS & OTHER EXPENSES	
HOMEOWNERS' MAINTENANCE & REPAIRS	
OTHER OWNED ACCOMMODATION EXPENSES	
Shelter - Goods and Services	Shelter - Goods and Services
<i>Childcare</i>	<i>Childcare</i>
CHILD CARE	Child Care, In The Home
	Child Care, Outside Home
<i>Electricity</i>	<i>Electricity</i>
ELECTRICITY	Electricity
<i>Natural Gas</i>	<i>Natural Gas</i>
PIPED GAS	Natural Gas
<i>Other Fuels</i>	<i>Other Fuels</i>
FUEL OIL & OTHER FUEL	Other Fuels
<i>Communications</i>	<i>Communications</i>
TELEPHONE SERVICES	Telecommunications
POSTAL & OTHER COMMUNICATIONS SERVICES	Postal and Courier Services
INTERNET SERVICE PROVISION	

<i>Pets</i>	<i>Pets</i>
PET FOOD & SUPPLIES	Pets and Supplies
	Pet Care
	Pet Food
<i>Other</i>	<i>Other</i>
SEEDS, PLANTS & CUT FLOWERS	Garden Tools and Equipment for Outdoor Maintenance
OTHER HORTICULTURAL GOODS	Soaps and Other Cleaning Supplies
OTHER HOUSEHOLD SUPPLIES	Other Household Supplies
OTHER HOUSEHOLD SERVICES	Flowers, Plants and Other Horticultural Supplies
HOUSEHOLD TOOLS (INCL. LAWN, GARDEN & SNOW REMOVALEQUIPMENT)	Water, Sewage and Garbage Charges
WATER	Domestic Services
DOMESTIC & OTHER CUSTODIAL SERVICES	Laundry and Dry Cleaning
DETERGENT & SOAP (OTHER THAN FOR PERSONAL CARE)	Janitorial Services
OTHER HOUSEHOLD GOODS & SERVICES	Legal, Accounting and Other Services
PAPER SUPPLIES	Undertaking and Other Funeral Services
PLASTIC & FOIL SUPPLIES	Hardware
LAUNDRY SERVICES (INCL. SELF-SERVICE DRY CLEANING)	Household Supplies
DRY CLEANING SERVICES (EXCL. SELF-SERVICE)	Other Household Services
	Paper Supplies
<i>Financial Services</i>	<i>Financial Services</i>
FINANCIAL SERVICES	Financial Intermediaries, Explicit Charges
	Credit Unions, Explicit Charges
Shelter - Furniture and Appliances	Shelter - Furniture and Appliances
<i>Furniture</i>	<i>Furniture</i>
UPHOLSTERED FURNITURE	Furniture
WOODEN FURNITURE	Furniture HH TXT + Furn
OTHER FURNITURE	Furniture Lamps, Lighting
<i>Appliances</i>	<i>Appliances</i>
LAUNDRY & DISHWASHING APPLIANCES	Other Major Appliances
COOKING APPLIANCES	Washers and Dryers
REFRIGERATION & AIR CONDITIONING APPLIANCES	Stoves, Ranges and Microwave Ovens
OTHER HOUSEHOLD APPLIANCES	Refrigerators and Freezers
	Other Household Appliances
<i>Services and Other</i>	<i>Services and Other</i>
WINDOW COVERINGS	Floor Coverings
BEDDING & OTHER HOUSEHOLD TEXTILES	Upholstery and Furniture Repairs
ROOM-SIZE & AREA RUGS & MATS	China, Glassware and Kitchenware
KITCHEN UTENSILS	Furniture and Appliance Rentals
TABLEWARE & FLATWARE	Flatware
OTHER HOUSEHOLD EQUIPMENT	Household Equipment Repairs
SERVICES RELATED TO HOUSEHOLD FURNISHINGS & EQUIPMENT	Moving and Storage
	Household Textiles
	Services Related to HH Furnishings

	Other Household Equipment
<i>Clothing and Footwear</i>	<i>Clothing and Footwear</i>
<i>Clothing</i>	<i>Clothing</i>
WOMEN'S CLOTHING	Men's and Boys' Clothing
MEN'S CLOTHING	Women's, Girl's and Infant's Clothing
CHILDREN'S CLOTHING (INCLUDING INFANTS')	
CLOTHING, NES	
<i>Footwear</i>	<i>Footwear</i>
WOMEN'S FOOTWEAR (EXCL. ATHLETIC)	Footwear
MEN'S FOOTWEAR (EXC. ATHLETIC)	
CHILDREN'S FOOTWEAR (EXCL. ATHLETIC)	
ATHLETIC FOOTWEAR	
<i>Watches and Jewelry</i>	<i>Watches and Jewelry</i>
WATCHES	Watches and Jewelry
JEWELLERY (OTHER THAN WATCHES)	
<i>Accessories and Other</i>	<i>Accessories and Other</i>
LEATHER ACCESSORIES	Thread, Yarn and Sewing Accessories
OTHER ACCESSORIES	Piece Goods
CLOTHING MATERIALS & NOTIONS	Leather Accessories
OTHER TOBACCO PRODUCTS & SMOKERS' SUPPLIES	Other Tobacco Products and Smokers' Supplies
<i>Other Clothing Services</i>	<i>Other Clothing Services</i>
OTHER CLOTHING SERVICES	Women's Clothing Repairs and Alterations
	Men's Clothing Repairs and Alterations
	Watches and Jewelry Repairs
	Footwear Repairs
<i>Transportation</i>	<i>Transportation</i>
<i>Purchases, Leasing, Renting</i>	<i>Purchases, Leasing, Renting</i>
PURCHASE OF AUTOMOTIVE VEHICLES	New Automobiles
RENTAL	New Trucks and Vans
LEASING OF AUTOMOTIVE VEHICLES	Motor Vehicle Renting
<i>Operating Expenses</i>	<i>Operating Expenses</i>
GASOLINE & OTHER FUELS	Driving Lessons and Membership in Automobile Associations
AUTOMOTIVE VEHICLE PARTS, ACCESSORIES & SUPPLIES	Parking
AUTOMOTIVE VEHICLE MAINTENANCE & REPAIR SERVICES	Bridge and Highway Tolls
AUTOMOTIVE VEHICLE REGISTRATION FEES	Motor Fuels and Lubricants
DRIVER'S LICENCES	Motor Vehicle Maintenance and Repairs
PUBLIC PARKING	Motor Vehicle Parts and Accessories
ALL OTHER AUTOMOTIVE VEHICLE OPERATING EXPENSES	
<i>Insurance</i>	<i>Insurance</i>
PRIVATE & PUBLIC INSURANCE PREMIUMS	Auto Insurance

Transport - Other	Transport - Other
CITY BUS & SUBWAY TRANSPORTATION	Urban Transit
OTHER LOCAL & COMMUTER TRANSPORTATION (INCL. TAXI)	Railway Transport
AIR TRANSPORTATION	Interurban Bus
RAIL, HIGHWAY BUS & OTHER INTER-CITY TRANSPORTATION	Air Transport
	Water Transport
	Taxis
Healthcare	Healthcare
PRESCRIBED MEDICINE	Medical Care, Dental Care and the Like
NON-PRESCRIBED MEDICINE	Pharmaceutical Products and Medical Goods
OTHER HEALTH CARE GOODS	
EYE-CARE	
DENTAL CARE	
OTHER HEALTH CARE SERVICES	
Personal Care	Personal Care
PERSONAL SOAP	Cosmetics and Toiletries
TOILET PREPARATIONS & COSMETICS	Hairstyling for Men and Women
ORAL-HYGIENE PRODUCTS	Other Personal Care
OTHER PERSONAL CARE SUPPLIES & EQUIPMENT	Other Personal Care Supplies and Equipment
PERSONAL CARE SERVICES	
Recreation Equipment and Services	Recreation Equipment and Services
<i>Computers</i>	<i>Computers</i>
COMPUTER EQUIPMENT & SUPPLIES	Office Machines, Computers and Equipment
<i>Other</i>	<i>Other</i>
SPORTING & ATHLETIC EQUIPMENT	Recreation Equipment Repairs
TOYS, GAMES & HOBBY SUPPLIES	Recreation Equipment Rentals
PHOTOGRAPHIC EQUIPMENT	Sporting and Camping Equipment
PHOTOGRAPHIC SUPPLIES & SERVICES	Toys, Games and Hobby Supplies
OTHER RECREATION EQUIPMENT & SERVICES	Photographic and Optical Equipment
AUDIO EQUIPMENT	Photographic Services
AUDIO TAPES & DISCS	Films and Other Photographic Supplies
VIDEO EQUIPMENT	Musical Instruments and Supplies
RENTAL OF VIDEOTAPES & VIDEODISCS	Other Recreational Services
PURCHASE OF VIDEOTAPES & VIDEODISCS	Cable Television and Pay Television
OTHER HOME ENTERTAINMENT EQUIPMENT, PARTS & SERVICES	Cinemas
SPECTATOR - ENTERTAINMENT PERFORMANCES (EXCL. CABLEVISION & SATELLITE)	TV Sets, Video Equipment and Accessories
CABLEVISION (INCL. PAY TV) & SATELLITE SERVICES	Radios, Sound Systems and Accessories
USE OF RECREATIONAL, SPORT & HEALTH FACILITIES & SERVICES	Toys, Games and Hobby Supplies 2
Recreational Vehicles	Recreational Vehicles
PURCHASE OF RECREATIONAL VEHICLES & OUTBOARD MOTORS	Trailers
FUEL, PARTS & ACCESSORIES FOR RECREATIONAL VEHICLES	Boats, Aircrafts and Accessories
INSURANCE, LICENCE & OTHER SERVICES FOR RECREATIONAL VEHICLES	Purchase of Recreational Vehicles

<i>Travel Services</i>	<i>Travel Services</i>
TRAVELLER ACCOMMODATION	Accommodation Services
TRAVEL TOURS	Commissions Paid to Tour Operators
<i>Education and Reading</i>	<i>Education and Reading</i>
<i>Education</i>	<i>Education</i>
TUITION FEES	University Fees
SCHOOL TEXTBOOKS & SUPPLIES	School Texts and Supplies
OTHER LESSONS, COURSES & EDUCATION SERVICES	Other Educational and Cultural Services
	Fees for Education and Training, other than University
<i>Newspapers, Books, Magazines</i>	<i>Newspapers, Books, Magazines</i>
NEWSPAPERS	Newspapers
MAGAZINES & PERIODICALS	Magazines and Periodicals
BOOKS & OTHER PRINTED MATTER (EXCL. TEXTBOOKS)	Books and Other Printed Matter
<i>Alcoholic Beverages and Tobacco Products</i>	<i>Alcoholic Beverages and Tobacco Products</i>
<i>Alcohol from Stores</i>	<i>Alcohol from Stores</i>
BEER PURCHASED FROM STORES	Alcoholic Beverages Bought in Stores
WINE & CIDER PURCHASED FROM STORES	
LIQUOR PURCHASED FROM STORES	
<i>Alcohol from Establishments</i>	<i>Alcohol from Establishments</i>
SERVED BEER	Alcoholic Beverages Consumed in Licensed Establishments
SERVED WINE & CIDER	
SERVED LIQUOR	
<i>Tobacco Products</i>	<i>Tobacco Products</i>
CIGARETTES	Tobacco Products

The bolded and italicized commodity composites are the highest level of aggregation and the level at which the analysis in the paper was carried out. However, the blue level of aggregation can also be used to obtain a more detailed decomposition of impacts on the difference between the CPI and PEPI. In the appendix, the blue level components were sometimes used to investigate commodities for which large differences were found at the highest level of aggregation.

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