

# **ALTERNATIVE ESTIMATES OF PRICE CHANGE FOR PRIVATE TRANSPORTATION**

**Empirical study with theoretical discussion**

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## Abstract

A theoretical discussion in the first chapter of the paper is focused on the issue of levels at which price statisticians search for comparability between more or less incomparable sets of products. Although the approach through narrow common denominators is prevalent in practice, broad common denominators may be useful as well, especially for analytical purposes. This topic is developed in the two other chapters of the paper, with some empirical results of comparisons<sup>1</sup>. The purpose of the comparisons is analytical rather than normative. Although no concrete suggestions are made, the findings may contribute to some changes in the current CPI methodology and practices.

The author chose private transportation to test alternative approaches because of its importance in the CPI and because of the difficulties involved in its computation. The component has almost the same weight as the entire food and non-alcoholic beverages purchased in Canada from both stores and restaurants (17.1% versus 17.8% according to value of the 1996 basket, currently in use). The estimation of its price movement, however, is much more challenging than for food, especially with respect to the purchase of automotive vehicles, which account for over 6% of the basket value. Even the use of sophisticated hedonic methods for price-quality adjustments in a research mode brought more disappointment than satisfaction. All this gives way to understandable criticism about the results, yet the critics' claims vary from a large overestimation to underestimation of actual increases of car prices by the official CPI series.

Comparison of the CPI car index with the movement of average, quality-unadjusted prices implies that if the adjustments made in the CPI were correct, the quality of private cars in Canada must have been improving at the average rate of 2% per year in the last decades, or must have approximately doubled within thirty years. Since this hypothesis is not entirely convincing, the possibility that the CPI underestimates price changes of cars should not be excluded without further studies.

The author also points out that a disjointed treatment of various sub-components in the CPI series Private Transportation may be potentially detrimental to the Index. To assess the direction and magnitude of distortions, he suggest analysing the joint effect of all changes in the cost of private transportation, which are in fact only inputs to the transportation service. For this purpose, historical data on costs of owning, maintaining and using automotive vehicles could be used. The author hopes to have access to such data for their inclusion in the final version of the paper.

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<sup>1</sup> The author is very thankful to Michel Piché of Prices Division, who spent a lot of time and energy on a not-so-enviable task of digging in historical files, and offered many interesting suggestions about the study.

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## 1. Comparing the incomparables

### 1.1. The issue

The quantity, quality and mix of products<sup>2</sup> that are being produced, sold, purchased or consumed, do change through time. This fact of life is both a curse and a blessing for statisticians who try to measure price variation through time or in space. It is a malediction because these changes make direct comparisons of observed prices unsuitable for the purpose of measuring price variation *stricto sensu*. At the same time it is a blessing, because in absence of such changes there would not be much demand for methodologists of price indices. Indeed, their principal *raison d'être* is finding ways how to compare prices of more or less incomparable sets of products.

Various assumptions and various approaches have been proposed to solve, overcome or bypass this seemingly insurmountable problem. Some proposals are very sophisticated, even esoteric, some are down the earth, to the point of being simplistic. They are too many of them to quote in a single paper, in fact they constitute the bulk of a formidable price index literature. As I see the problem, however, all trials of rendering prices comparable may be associated with one of the two following conceptual directions. One of them lies in searching comparability at lower levels of product hierarchy, by breaking down their broad categories into more specific ones and making direct comparisons only at these levels. The other direction, on the contrary, consists in looking for common denominators at levels higher than the individual products or the groups of products defined by their physical characteristics. Either direction offers promising features but also creates pitfalls.

### 1.2. Narrow common denominators

Searching for low-level denominators is a prevalent practice in price index making, particularly in the Consumer Price Index (CPI). One breaks down the consumption into classes and sub-classes of goods or services, and designates within each of them some representative products, whose prices are supposed to be comparable through time or in space. Ideally, only prices of identical products should be compared, which would require extremely precise definition of specific representative products. Yet, the more detailed is the description of products, the more problems arise with their representativity and with price collection. Particular

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<sup>2</sup> The term *products* is used here to designate both goods and services.

difficulties arise from frequent discontinuities of narrowly-defined products. They force price statisticians to make replacement of observed products and to apply explicit or implicit adjustments to their prices for quality changes, which is a very delicate procedure. In addition, what was decomposed has to be later aggregated, and this leads to more theoretical and practical problems.

One can pursue the decomposition even farther, down to the level of product characteristics, which are considered more stable and comparable than the products themselves. This hedonic approach, requiring the estimation of shadow prices of characteristics, has its own strengths and weaknesses, as discussed in other papers presented at the meeting.

### 1.3. Broad common denominators

Estimating price movement based on direct comparisons above the level of individual products is another option. Comparisons of average prices or unit values of larger groups of products constitute a very simple application of this approach. Since large groups of products generally endure longer than individual products, one can avoid this way the trouble and pitfalls related to the treatment of discontinuities of finely defined representative products. This comes, though, at the cost of ignoring the effect of potential changes in the mix of groups.

The search for broad common denominators can be carried on much farther, beyond the groups of products described by their physical attributes. Utility is suggested by many theoreticians as such common denominator in the context of consumer price indices. The advantages of utility are that it ties price index making to the economic theory of consumer behaviour, and that it is an umbrella concept able to cover any imaginable kind of goods and services consumed in every combination. In practice, though, utility encounters serious problems because of its abstract nature. There is no objective way to measure it, especially at social levels. For this reason, utility-defined price indices can only be approximated, at best, and this using questionable assumptions. Although utility can be used as a general conceptual guideline in choosing between different methods and practices of the consumer index making, it is contested by many even in this capacity. Indeed, it is difficult to explain the elusive nature of utility to the public at large, and this may be considered detrimental to credibility of consumer price indices.

It is possible, however, to use another broad common denominator in the process of generating consumer price indices, namely the service rendered by

products. Service is a concept consistent with consumer perception, yet much less abstract than the notion of utility. The service rendered may be common to the entire range of products, either substitutes or complements. A letter, a fax and e-mail are the examples of the former because all of them serve transmitting messages. In that context, their prices could be compared directly to each other, although with adjustments for differences in the speed and conditions of transmitting, which might be tricky. Car, gasoline and a parking spot, are the examples of complementary products, which are purchased by people with a single final purpose of transportation. Treating the cost of private transportation as one entity in consumer price indices would offer many advantages over a disintegrated approach, albeit it would involve some additional practical difficulties.

#### 1.4. Confronting the results of different approaches

None of the approaches to solve the problem of changing quantity, quality and mix of the products is foolproof. This notwithstanding or, rather, because of this, comparisons of index numbers obtained using different approaches make sense. They can contribute to a better understanding of the latent assumptions of specific approaches and shed light on their strengths and weaknesses. The results of such comparisons can serve as benchmarks to assess what could be the index values under some extreme assumptions.

## **2.Comparisons between the CPI and other indicators of car price change**

### 2.1. Index of car prices in the Canadian CPI

Price index for cars, part of the Private Transportation component, covers only purchases of new cars, which is consistent with the net purchase approach used in the Canadian CPI. It is computed from averages of quality-adjusted retail car prices, calculated for each of their four categories by size (according to a customary North American classification: full-size, intermediate, compact and sub-compact).

The averages of quality-adjusted prices are derived from data for a sample of car models, selected judgementally to represent the four categories of vehicles produced by the major car companies present on the Canadian market. When a chosen model ceases to be considered representative of the market, it is replaced by another model from the same category and, if possible, made by the same manufacturer as the discontinued one. Similar procedure is used in the case of radical modifications to a given model, even if it remains on the market under the

same name. New models and new manufacturers are introduced to the sample when justified by their importance on the market. Table I in the Annex shows the births and deaths that took place in the Canadian CPI sample of cars from 1963 to 1998.

The process starts with gathering information from manufacturers of the cars in the sample. The manufacturers report the suggested prices for the new season, which usually starts in the fall, list the modifications introduced to each of these models, and assess their dollar value. Commodity specialists in Prices Division may accept, modify or reject these values, following a set of quality adjustment rules. The retained value of modifications is used to adjust the price suggested previously by the manufacturer for the corresponding, though not necessarily identical model. This makes it possible to estimate the quality adjustment factor for a given car model, by dividing its unadjusted price into the adjusted one. Table II in the Annex illustrates this procedure by providing average numerical results of the estimations for the compact category of cars.

The next step involves data from a retail price survey carried out by Prices Division through a network of car dealers. The price quotes, which reflect prices actually paid, including typical rebates and charges but excluding taxes, are collected at least once a quarter, or whenever a substantial price change took place. They relate to the same sample of models in the same configurations as those used in discussions with the manufacturers. On this basis, average car prices are calculated for each of the four categories by geographical strata and sales taxes are added.

If a given model has been subject to modifications since the previous price collection, its price recorded at that time (the *back price*) is adjusted for quality changes using the adjustment factors derived in the first step of operations. The correction is meant to make the current price quote comparable with the back price in terms of "pure price change".

In the final step, the current average prices for each car category in each geographical stratum are divided by the corresponding, quality-adjusted average back prices, following the principle of matched samples. The obtained month-to-month price indices are linked to each other, creating index series on the previous year time base, by car category. Indices for the four categories are then aggregated into a single price index for purchased automotive vehicles, using provincial data on the sales of new cars as weights. These indices are, in turn, set on a fixed time base.

## 2.2. Index of average, quality-unadjusted car prices

To shed some light on the effects of various explicit and implicit adjustment procedures used in the CPI, a series of quality-unadjusted average prices of cars has been generated from the original CPI input price data. This required retrieving individual records of car prices far back in time, because only long-term comparisons could lead to meaningful conclusions, if any. The intention was to go back at least to the great oil crisis of the mid-seventies, which was the starting point for many changes in the car design. After laborious searches in archives, working ledgers and computer files, series of individual retail price data have been recovered from 1971 till present, unfortunately with a gap between 1985 and 1987<sup>3</sup>. These are the price quotes ex tax obtained from individual car dealers that have been actually used in the CPI, but without taking into account any subsequent quality adjustments.

All the unadjusted price data have been annualised, separately for every car model in the CPI sample. Then, equi-weighted averages of the annualised values have been derived for each of the four categories of cars by their size, i.e. for the full sized, intermediates, compacts and sub-compacts. Table III in the Annex presents these averages for the compact category in province of Ontario from 1971 to 1998, accompanied by indicators of price dispersion in the corresponding CPI car samples.

Next, these four averages of unadjusted prices have been aggregated into one general average, using a weighted average formula with fixed quantitative proportions between the categories as weights. The proportions, applied to all years from 1971 to 1998, reflect the numbers of new cars sold in Canada in this entire period, by category. Finally, for comparability with the CPI series, a version with sales taxes has been computed. The resulting weighted averages of prices, after taxes, were used to derive an index series referred to as the *Index of Average Quality-Unadjusted Prices (IAQUP)*.

## 2.3. The CPI car index and the movement of average, quality-unadjusted car prices

Due to the use of fixed inter-category weights, the IAQUP series is not influenced by changes in the average size of passenger cars that took place in North

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<sup>3</sup> For most of the years it was also possible to find matching information provided by manufacturers about the suggested car prices and the estimated value of modifications introduced to the surveyed models. This information has not been used to derive alternative price indices, but some of it is shown in Table II in the Annex for illustration purposes.



America in the last three decades. The series is affected, however, by all other changes that occurred through time in the mix and quality of cars included in the consecutive CPI samples. Since the CPI series is supposed to reflect “pure price changes”, this is one of the reasons why the two series may move differently.

The Table 1 and the Chart A, which appear on the following pages, compare the CPI car price index series with the IAQUP series from 1971 onwards. Both series exhibit price increases, but the IAQUP series rises much faster. In the light of undeniable improvements in the quality of North-American cars during the covered period, this result is consistent with the statement in the previous paragraph.

While the sign of differences between the two series was anticipated, their magnitude may surprise. It amounts to 77% during the period of 27 years, hence to more than 2% a year. The question arises whether such a discrepancy could be explained solely by the improvements in car quality. A positive answer would be equivalent with the assumption that the quality of cars doubled in 33 years, which seems to be a questionable hypothesis. Thirty-three years ago cars have already had pretty decent basic features: they were able to transport four or more passengers at long distances at a good speed, providing acceptable levels of security and comfort. Did the other properties of cars improve so dramatically that the all-inclusive quality of cars, counted with their basic attributes, doubled since 1966? There is no immediate, objective answer to this question, however serious doubts exist.

If the answer were negative, then the CPI component “Purchase of Automotive Vehicles”, must have underestimated to some degree the price increases of cars that took place in the past. This conclusion, although possibly startling to some, should not be rejected *a priori*. The underestimation may result from some shortcomings of different procedures used in the CPI to eliminate the impact of changes in the mix and in the quality of surveyed cars.

As described in section 2.2, the principle of “matched samples” is used to avoid changes in the mix of the CPI samples. Since new models of cars have to be, nevertheless, introduced once a while to the sample and some other models dropped from it, price indices associated with different samples are linked to each other (spliced). This practice is equivalent to the assumption that the relative prices of models brought to the sample or eliminated from it, compared to the average price of models remaining in the sample, properly represent the quality differentials between these models. The assumption is far from being always correct, which might have caused some misestimation of price change in the CPI.

TABLE 1

**Price indices for automotive vehicles (1971=100)****CPI VERSUS INDEX OF AVERAGE QUALITY-UNADJUSTED PRICES**

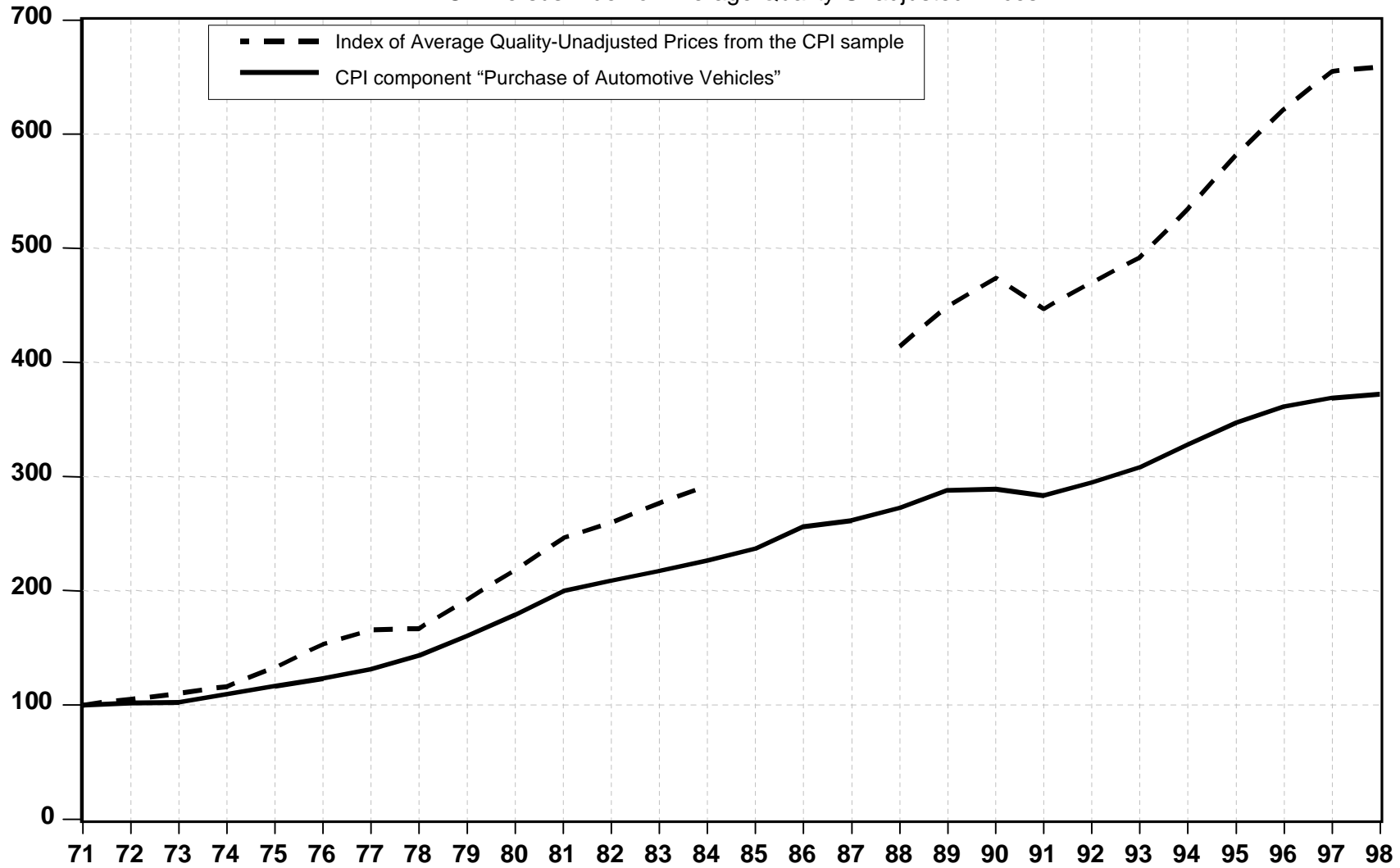
<b>Year</b>	<b>CPI component "Purchase of Automotive Vehicles"</b>	<b>Index of Average Quality-Unadjusted Prices from the CPI sample</b>	<b>Ratio of the Index of Average Quality-Unadjusted Prices to the CPI component "Purchase of Automotive Vehicles" in %</b>
<b>1971</b>	100.0	100.0	100.0
<b>1972</b>	102.1	105.4	103.2
<b>1973</b>	102.4	110.1	107.5
<b>1974</b>	109.4	116.3	106.3
<b>1975</b>	116.5	133.1	114.2
<b>1976</b>	123.3	153.3	124.3
<b>1977</b>	131.6	165.6	125.8
<b>1978</b>	143.4	167.2	116.6
<b>1979</b>	160.5	192.4	119.9
<b>1980</b>	179.1	217.7	121.6
<b>1981</b>	199.7	246.1	123.2
<b>1982</b>	209.1	259.5	124.1
<b>1983</b>	217.4	277.0	127.4
<b>1984</b>	226.5	292.3	129.1
<b>1985</b>	236.9	..	..
<b>1986</b>	256.3	..	..
<b>1987</b>	261.7	..	..
<b>1988</b>	272.9	414.3	151.8
<b>1989</b>	288.2	448.9	155.8
<b>1990</b>	289.1	474.2	164.0
<b>1991</b>	283.5	447.0	157.7
<b>1992</b>	295.0	470.2	159.4
<b>1993</b>	308.0	492.0	159.7
<b>1994</b>	328.0	534.5	163.0
<b>1995</b>	347.2	581.4	167.5
<b>1996</b>	361.4	621.4	171.9
<b>1997</b>	369.0	654.9	177.5
<b>1998</b>	372.0	658.9	177.1

.. Figures not available

CHART A

**Price indices for automotive vehicles (1971=100)**

CPI versus Index of Average Quality-Unadjusted Prices



Also, as described in Section 2.2, previous prices (back prices) of the models of cars that remain in the sample but with modifications, are adjusted to remove the effect of modifications. Car manufacturers suggest the value of these modifications, but the final choice of quality adjustment factors is made by commodity specialists in Prices Division, who are supposed to follow a set of rules established for this purpose by the Division. In general, the rules distinguish between modifications that affect performance, durability and safety of the car and those considered cosmetic. In most cases, the acceptance of changes affecting comfort and convenience was contingent on the percent of their market penetration.

The practice of quality adjustments to car prices, however, leaves many things to desire. The rules about adjustments, although recently straightened, provide guidelines rather than strict prescriptions, hence they are subject to various interpretations. The suggestions made by manufacturers about the value of improvements in the car design, construction or equipment, have to be taken with a grain of salt, especially that the deteriorations are rarely notified. There is no full-proof way how the commodity officers could objectively assess the actual value to consumers of a given modification, which may affect, or not, the durability, reliability, safety and comfort of a car. The problem of consistency is further aggravated by the fact that the divisional rules have been altered a few times since the sixties. Incorrect quality adjustments might have been another potential cause of some misestimation of price change in the CPI.

In an attempt to pinpoint the problem, if any, the CPI car price movement and the movement of average quality unadjusted prices were compared on a year-over-year basis. The results, shown in the following Table 2, indicate that the largest discrepancies between the CPI and IAQUP happened in the years 1975-76. As it can be seen in the Annex Table II, 1975 was the year when exceptionally high quality adjustment have been applied in the CPI to the compact car category (data about adjustments applied in 1976 could not have been retrieved). The same happened with respect to the other three categories. In other words, it was a generous assessment of quality improvements that opened the gap between CPI and IAQUP in 1975. In contrast, there is no evidence that the gaps in 1975 or 1976 are due to the use (abuse) of the splicing procedure. Indeed, it can be seen in the Annex Table I that neither 1975 nor 1976 seem to be the years with particularly heavy turnover of car models in the CPI sample.

TABLE 2

**Year-over-year price movement of automotive vehicles****CPI versus Index of Average Quality-Unadjusted Prices**

<b>Year</b>	<b>CPI component “Purchase of Automotive Vehicles”</b>	<b>Index of Average Quality-Unadjusted Prices from the CPI sample</b>	<b>Ratio of the Index of Average Quality- Unadjusted Prices to the CPI component “Purchase of Automotive Vehicles”</b>
<b>1972</b>	102.1	105.4	103.2
<b>1973</b>	100.3	104.5	104.2
<b>1974</b>	106.9	105.6	98.8
<b>1975</b>	106.5	114.4	107.5
<b>1976</b>	105.8	115.2	108.9
<b>1977</b>	106.7	108.0	101.2
<b>1978</b>	109.0	100.9	92.6
<b>1979</b>	111.9	115.1	102.8
<b>1980</b>	111.6	113.2	101.4
<b>1981</b>	111.5	113.0	101.4
<b>1982</b>	104.7	105.5	100.7
<b>1983</b>	103.9	106.7	102.7
<b>1984</b>	104.2	105.5	101.3
<b>1985</b>	104.6	..	..
<b>1986</b>	108.2	..	..
<b>1987</b>	102.1	..	..
<b>1988</b>	104.3	..	..
<b>1989</b>	105.6	108.4	102.6
<b>1990</b>	100.3	105.6	105.3
<b>1991</b>	98.1	94.3	96.1
<b>1992</b>	104.1	105.2	101.1
<b>1993</b>	104.4	104.6	100.2
<b>1994</b>	106.5	108.6	102.0
<b>1995</b>	105.8	108.8	102.8
<b>1996</b>	104.1	106.9	102.7
<b>1997</b>	102.1	105.4	103.2
<b>1998</b>	100.8	100.6	99.8

.. *Figures not available*

#### 2.4. Comparison with other car price index series

The CPI component “Purchase of Automotive Vehicles” and the IAQUP will be now compared with two other price index series for cars. One of them is the series “Passenger Automobiles”, part of the Industry Product Price Index (IPPI), which is also generated by Prices Division. The series reflects the movement of producer prices in Canada, hence excludes imported cars. From the point of view of quality adjustments, though, the procedures are similar to those used in the CPI for the same car models.

The second series is derived from annual data on registration of passenger cars, compiled by the Transportation Division of Statistics Canada. They were used to calculate unit values of the registered cars, by dividing their quantities into values. The resulting Index of Unit Values (IUV) is affected by changes in the average size of cars, unlike the quality-unadjusted index series with fixed inter-category proportions.

The four series are compared to each other in the Table 3 and in the Chart B, shown on the following pages. The CPI and IPPI series move very similarly, but this does not necessarily confirm adequacy of procedures applied in the CPI. Rather, this is the effect of an incestuous relationship between the two series, both using the same approach to price-quality adjustments. In addition, the similarity of price movement seems to indicate that imported cars have had no specific impact on the CPI over the last 27 years.

The remaining series, IUV and IAQUP, move very differently from the former, but similarly to each other, which is certainly caused by the fact that both use quality-unadjusted prices as inputs. Since the IUV series are derived from exhaustive data, the similarity also appears to prove that judgmental selection of the CPI samples of cars did not have much long-term detrimental effect on the Index.

Interestingly, the IUV series was rising a little faster than IAQUP from mid-seventies to mid-eighties, but somewhat slower in the last fifteen years. This means that in the former sub-period Canadians were buying relatively more larger cars than in the average mix from 1971-98, used as fixed inter-category weights in IAQUP, but relatively less in the latter sub-period. In other words, Canadians responded with some delay to the oil crisis. By showing it, unit values confirmed their additional usefulness as measures of changes in the mix.

TABLE 3

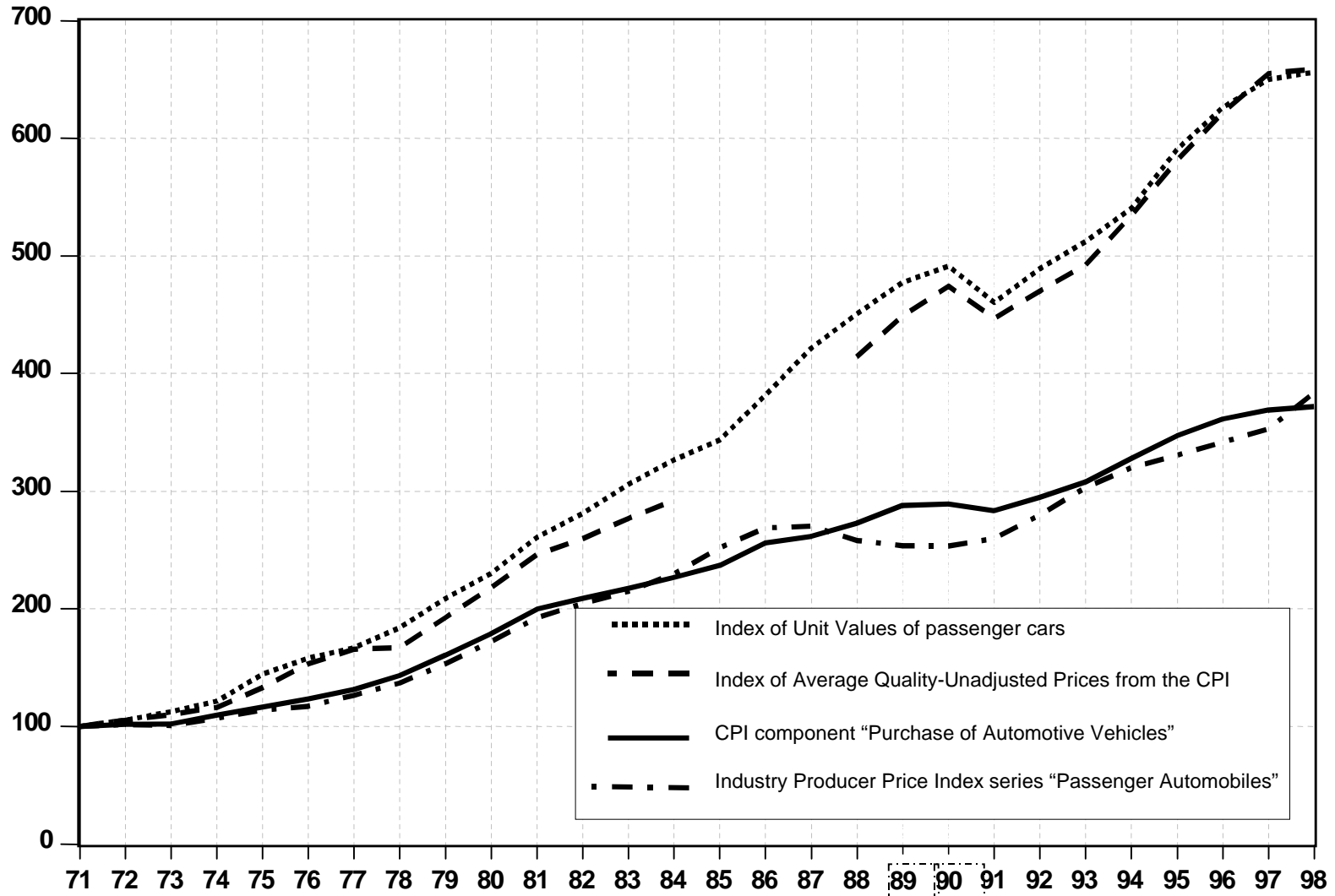
**Price indices for automotive vehicles (1971=100)**  
**CPI versus IPPI, Index of Average Quality-Unadjusted Average Prices,**  
**and Index of Unit Values**

<b>Year</b>	<b>CPI component "Purchase of Automotive Vehicles"</b>	<b>Industry Producer Price Index series "Passenger Automobiles"</b>	<b>Index of unadjusted average prices from the CPI sample *</b>	<b>Index of unit values of passenger cars, calculated using data from the Transportation Division</b>
<b>1971</b>	100.0	100.0	100.0	100.0
<b>1972</b>	102.1	101.6	105.4	105.2
<b>1973</b>	102.4	100.7	110.1	112.6
<b>1974</b>	109.4	106.7	116.3	121.5
<b>1975</b>	116.5	113.9	133.1	144.6
<b>1976</b>	123.3	117.2	153.3	157.9
<b>1977</b>	131.6	126.3	165.6	166.6
<b>1978</b>	143.4	136.6	167.2	184.0
<b>1979</b>	160.5	153.1	192.4	208.7
<b>1980</b>	179.1	172.1	217.7	229.9
<b>1981</b>	199.7	192.5	246.1	260.8
<b>1982</b>	209.1	204.3	259.5	281.2
<b>1983</b>	217.4	214.6	277.0	305.6
<b>1984</b>	226.5	229.7	292.3	326.9
<b>1985</b>	236.9	251.8	..	343.6
<b>1986</b>	256.3	268.6	..	381.8
<b>1987</b>	261.7	270.2	..	421.5
<b>1988</b>	272.9	257.9	414.3	450.9
<b>1989</b>	288.2	253.9	448.9	477.2
<b>1990</b>	289.1	253.4	474.2	491.3
<b>1991</b>	283.5	259.5	447.0	460.4
<b>1992</b>	295.0	280.0	470.2	489.1
<b>1993</b>	308.0	303.1	492.0	512.2
<b>1994</b>	328.0	319.8	534.5	540.0
<b>1995</b>	347.2	330.5	581.4	590.5
<b>1996</b>	361.4	341.7	621.4	626.0
<b>1997</b>	369.0	352.8	654.9	649.9
<b>1998</b>	372.0	383.7	658.9	656.2

.. Figures not available

CHART B

***Price indices for automotive vehicles (1971=100)***  
CPI versus IPPI, Index of Average Quality-Unadjusted Prices and Index of Unit Values





### **3. Alternative indicators of price change for private transportation**

#### **3.1. Private Transportation component in the Canadian CPI**

According to current methodology, the Price Index for Private Transportation (PIPT) is calculated as a weighted average of price indices for the following basic commodity classes<sup>4</sup>, shown below with their weight in percent of the total 1996 basket value:

- purchase and leasing of automotive vehicles (7.1%),
- rental of automotive vehicles (0.1%),
- gasoline and other fuels (3.9%),
- parts and supplies (0.8%),
- maintenance and repair services (1.5%),
- insurance premiums (3.2%),
- registration fees (0.2),
- driver's licences (0.1%),
- parking fees (0.2%),
- other automotive vehicle operating expenses (0.1%).

The quantitative proportions between these sub-components, as those between most basic classes in the Canadian CPI, are derived from data on households' expenditures in the basket reference year, and are kept constant during the lifetime of the basket. Indices for the sub-components are based on price data gathered for this purpose by commodity specialists and interviewers of Statistics Canada. As other price indices generated by Prices Division, they are deemed to measure "pure price movement", i.e. the movement that is not attributable to changes in the quantity, quality or mix of goods and services. It is difficult, though, to comply with this assumption, as it has been discussed in the preceding chapter with respect to the purchase of automotive vehicles.

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<sup>4</sup> Some sub-components are further divided to form more homogeneous micro-aggregates.

### 3.2. Potentially detrimental effects of a disjointed treatment of sub-components

PIPT shares the above-mentioned difficulties with virtually all price index series. In author's opinion, though, the treatment of its sub-components constitutes another major source of potential shortcomings of PIPT. Most of the sub-components are closely interrelated, at least in the sense that they serve one purpose, namely providing the transportation service. Yet, they are treated in the CPI in isolation from each other, which creates insurmountable conceptual and practical problems. Suppose, for example, that a new model of cars costs more than the previous one, but offers a lesser use of gasoline. It would be second to impossible to assess properly the effect of this feature through quality adjustments to car prices. On the other hand, nothing else in the PIPT can show the savings that consumers would achieve with the new car model. The use of gasoline would remain constant, at least until the life-end of the CPI basket. Many other examples could be quoted.

### 3.3. Treating the cost of transportation as one entity in the index

A comprehensive treatment of all aspects of the cost of transportation would provide a radical departure from the current practice. The practicality of such endeavour seems to be a major obstacle. It is not necessary, however, to search for the Holy Grail of utility as a common yardstick to bring together all elements. A much simpler solution would be to compare through time the estimates of the cost of owning, maintaining and using automotive vehicles that belonged to successive generations of cars.

Such estimates already exist. Car manufacturers most certainly study various aspects of transportation costs, but there are also other, more independent sources of information. For example, Automobile Associations occasionally publish data on costs of owning, maintaining and using specific models of cars. The published data, however, are too sporadic and too incomplete to be used in a serious comparative study. Moreover, this is a second-hand information. The original information is produced by private companies that specialise in estimating various business costs. The data are broken down by categories of cost, and by uses of cars.

Prices Division is in contact with one of these companies, asking it to provide historical series of cost estimates for as large number of car models as possible, including those used in the CPI samples. Ideally, the estimates would reflect typical Canadian conditions of car utilisation and maintenance. Unfortunately, the negotiations are taking much more time than expected, so that it was impossible to include empirical results into the presentation during the Reykjavik meeting. There is hope, though, that the final version of the study will contain numerical comparisons between the CPI component "Private Transportation" and the integrated cost series.

**ANNEX**

to

**Alternative estimates of price change  
for private transportation**

**by Bohdan Schultz**

TABLE I

**Births and deaths in the CPI sample of automotive vehicles\*****Full-size category**

Model of the car	Manufacturer	Years in the sample
Custom 500, Galaxie,	Ford	63-74
Fury, Fury 1	Chrysler	66-77
Meteor, Meteor	Ford	68-73
Polara	Chrysler	68-73
Parisienne	GM	70-77
Impala	GM	70-84
Monaco	Chrysler	73-77
LTD	Ford	75-84
New Yorker, Fifth	Chrysler	88-93
Caprice	GM	88-96
Crown Victoria	Ford	95-98
Oldsmobile 88	GM	96-98

**Intermediate category**

Model of the car	Manufacturer	Years in the sample
Mercury Montego	Ford	68-72
Satellite, Sebring	Chrysler	68-77
Chevelle Malibu	GM	68-83
Gran Torino	Ford	70-77
Cordoba	Chrysler	78-83
Caravelle	Chrysler	78-84
Thunderbird	Ford	78-92
Le Baron	Chrysler	84-89
Celebrity (89)/Lumina	GM	84-98
Accord	Honda	84-98
Taurus	Ford	88-98
Acclaim	Chrysler	90-95
Corsica	GM	90-96
Ciera	GM	90-96
Camry	Toyota	92-98
Intrepid	Chrysler	94-98
Cirrus	Chrysler	95-96

**Compact Category**

Model of the car	Manufacturer	Years in the sample
Nova	GM	63-78
Dart	Chrysler	68-75
Maverick	Ford	70-77
Corolla	Toyota	72-98
Volare	Chrysler	76-78
Fairmont	Ford	78-83
Citation	GM	78-84
Reliant	Chrysler	78-90
Mustang	Ford	83-84
Cavalier	GM	83-98
Tempo	Ford	84-95
Jetta	Volkswagen	88-98
Sundance	Chrysler	91-95
Contour	Ford	95-98
Neon	Chrysler	95-98

**Sub-compact Category**

Model of the car	Manufacturer	Years in the sample
Beetle	Volkswagen	63-76
Vauxhall Victor, Viva	GM	70-71
Sentra, 510	Nissan	71-96
Pinto	Ford	72-78
Vega	GM	73-77
Golf, Rabbit	Volkswagen	74-88
Chevette	GM	78-84
Civic	Honda	78-98
Escort	Ford	78-98
Tercel	Toyota	78-98
Horizon	Chrysler	81-91
Excel	Hyundai	88-94
Sprint (89)/Géo (92)	GM	88-96
Protegé	Mazda	94-96

*Working files for 1985-87 could not have been recovered*

TABLE II  
**Adjustments to prices of compact automotive vehicles in the CPI sample**  
 Values in \$

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
<b>1</b>	2959	2942	..	..	4388	..	3429	3616	..	..	..	8089	8097	8314
<b>2</b>	2835	2893	..	..	3744	..	3413	3616	..	..	..	7571	8198	8110
<b>3</b>	..	..	..	..	..	..	..	..	..	..	..	..	..	..
<b>4</b>	4	18	..	..	364	..	16	13	..	..	..	172	63	48
<b>5</b>	..	..	..	..	..	..	..	..	..	..	..	..	..	..
<b>6</b>	2839	2911	..	..	4109	..	3429	3629	..	..	..	7743	8261	8158

**Ratios**

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
<b>7</b>	1,044	1,017	..	..	1,172	..	1,005	1,000	..	..	..	1,068	0,988	1,025
<b>8</b>	..	..	..	..	..	..	..	..	..	..	..	..	..	..
<b>9</b>	1,001	1,006	..	..	1,097	..	1,005	1,004	..	..	..	1,023	1,008	1,006
<b>10</b>	1,042	1,011	..	..	1,068	..	1,000	0,996	..	..	..	1,045	0,980	1,019
<b>11</b>	..	..	..	..	..	..	..	..	..	..	..	..	..	..

1. Average of current year prices suggested by the manufacturers

2. Average of previous year prices as suggested at that time by the manufacturers (unadjusted)

3. Average of quality adjustment to the previous year prices as suggested by the manufacturers

4. Average of quality adjustment to the previous year prices as retained in the CPI

5. Average of previous year price adjusted according to the manufacturers (2+3)

6. Average of previous year prices adjusted as in the CPI (2+4)

7. Unadjusted average annual relative price change according to the manufacturers' suggestions (1÷2)

8. Average of quality adjustment factor to the previous year prices according to the manufacturers' suggestions (5÷2)

9. Average of quality adjustment factor to the previous year prices according to the CPI (6÷2)

10. Average of "pure" annual relative price change according to the CPI (1÷6)

11. Average of relative correction made in the CPI to the quality adjustment factor suggested by the manufacturers (6÷5)

.. Figures not available

TABLE II, continuation  
**Adjustments to prices of compact automotive vehicles in the CPI sample**  
 Values in \$

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
<b>1</b>	9374	9332	11170	10987	12665	12474	13119	12877	13324	15755	16726	17514	19534	18287
<b>2</b>	9038	8935	10334	10752	11889	12063	12455	12200	13654	14152	15981	16915	18997	18181
<b>3</b>	..	..	..	349	180	170	36	411	131	-215	936	610	574	235
<b>4</b>	155	154	309	288	178	187	-11	304	109	-94	653	426	-37	335
<b>5</b>	..	..	..	11100	12069	12233	12491	12611	13784	13937	16917	17525	19571	18415
<b>6</b>	9193	9089	10643	11039	12067	12250	12444	12504	13763	14058	16637	17341	18960	18516

**Ratios**

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
<b>7</b>	1,037	1,044	1,081	1,022	1,065	1,034	1,053	1,056	0,976	1,113	1,047	1,035	1,028	1,006
<b>8</b>	..	..	..	1,032	1,015	1,014	1,003	1,004	1,010	0,989	1,015	1,036	1,030	1,013
<b>9</b>	1,017	1,017	1,030	1,027	1,015	1,016	0,999	1,025	1,008	0,993	1,020	1,025	0,998	1,018
<b>10</b>	1,020	1,027	1,049	0,995	1,050	1,018	1,054	1,030	0,968	1,121	1,006	1,010	1,030	0,988
<b>11</b>	..	..	..	0,995	1,000	1,001	0,996	0,992	0,998	1,009	0,983	0,990	0,969	1,005

1. Average of current year prices suggested by the manufacturers

2. Average of previous year prices as suggested at that time by the manufacturers (unadjusted)

3. Average of quality adjustment to the previous year prices as suggested by the manufacturers

4. Average of quality adjustment to the previous year prices as retained in the CPI

5. Average of previous year price adjusted according to the manufacturers (2+3)

6. Average of previous year prices adjusted as in the CPI (2+4)

7. Unadjusted average annual relative price change according to the manufacturers' suggestions (1÷2)

8. Average of quality adjustment factor to the previous year prices according to the manufacturers' suggestions (5÷2)

9. Average of quality adjustment factor to the previous year prices according to the CPI (6÷2)

10. Average of "pure" annual relative price change according to the CPI (1÷6)

11. Average of relative correction made in the CPI to the quality adjustment factor suggested by the manufacturers (6÷5)

.. Figures not available

TABLE III

**Average of unadjusted retail prices and price dispersion in the CPI sample of compact cars**

## Ontario

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
<b>1</b>	2865	2967	3086	3501	4221	4654	4963	5262	5765	7070	8359	8694	9204	9326
<b>2</b>	3197	3826	3478	3823	4500	5046	5341	5897	6466	8252	8979	9382	10348	10123
<b>3</b>	2458	2195	2612	2961	3758	4199	4383	4365	2802	5947	7452	7838	7948	8734
<b>4</b>	244	289	207	178	194	201	302	241	496	461	259	311	461	333
<b>5</b>	8.53	9.74	6.71	5.08	4.60	4.32	6.09	4.59	8.60	6.52	3.10	3.58	5.01	3.57

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
<b>1</b>	..	..	..	11544	12653	12904	11722	12444	12977	15178	17478	18793	18641	18742
<b>2</b>	..	..	..	13496	14760	14381	14955	15576	18160	19796	21247	22647	21624	21124
<b>3</b>	..	..	..	9954	10377	11038	9235	8420	10895	11960	12790	15044	15269	14950
<b>4</b>	..	..	..	941	1085	844	1127	1737	1601	2295	2652	2118	1658	1787
<b>5</b>	..	..	..	8.15	8.57	6.54	9.62	13.96	12.33	15.12	15.17	11.27	8.90	9.53

1. Average of unadjusted retail prices from the CPI sample (ex tax)

2. Maximum value accepted

3. Minimum value accepted

4. Standard deviation

5. Coefficient of variation in %

.. Figures not available