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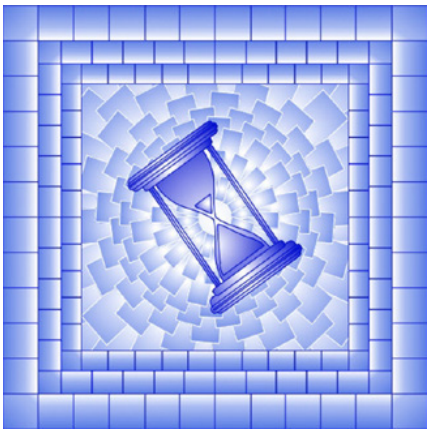
Enhancements to the passenger vehicle and homeowners' home insurance price indexes



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Enhancements to the passenger vehicle and homeowners' home insurance price indexes

by **Arman Attaran, Faouzi Tarkhani** and **Zachary Weselake-George**

Executive summary

Statistics Canada's access to a broker service's data warehouse provides the agency with comprehensive monthly information on home and vehicle insurance quotes for a variety of consumer profiles. The data includes insurance premium quotes, information on policy characteristics, the insured household or person, the building structure or vehicle characteristics and their location. It does not include transaction prices or premiums paid for pre-existing, active binding contracts.

With the release of the April 2025 Consumer Price Index (CPI), price indexes for insurance are calculated using time-dummy hedonic regressions. These regressions facilitate the "unbundling" of the overall price and estimate marginal values for each individual characteristic. The model employs a hedonic regression to explain the logarithm of the premium quote as a function of individual insurance contract characteristics and time dummy variables. Price changes are estimated using the coefficient of the time dummy variable after applying a log transformation. To account for geographical fixed effects, distinct price functions are also specified for home and vehicle insurance across different geographic regions. For homeowners' home insurance, a hedonic time dummy model was selected using one insurance quote per consumer profile within a 12-month window from a cut-off sample of market influencing companies at the detailed geographical level. For passenger vehicle insurance, a hedonic time dummy model using all insurance quotes was selected within a 12-month window from a sample of companies associated with the top 50 insured vehicle models at the detailed geographical level. As a result, both generated indexes provide significant advantages in terms of reduced volatility and computational complexity, ensuring that short-term fluctuations and seasonal effects do not distort the relationship between insurance premiums and key individual characteristics.

Introduction

Statistics Canada periodically reviews methods and investigates data sources used to measure price changes for the CPI's various components. This review helps to maintain the CPI's quality and better reflect market and consumer behaviour trends. This paper presents the enhanced method introduced with the release of the April 2025 CPI for the estimation of price indexes for passenger vehicle insurance and homeowners' home insurance. Homeowners' home and passenger vehicle insurance accounted for 3.59% of the 2023 CPI basket. This weight reflects home and vehicle gross insurance premium expenditures, while monthly price changes for the CPI's homeowners' home and passenger vehicle insurance components reflect gross premium price changes.

Improving Statistics Canada's estimation method for price changes in homeowners' home and passenger vehicle insurance premiums is important for a high-quality CPI, especially as Canadians experience the impacts of the rise of extreme weather and natural disasters. Events such as wildfires, floods, rainstorms, ice and hailstorms, cause damage to and in some cases, the destruction of Canadian households' homes and vehicles. The Insurance Bureau of Canada (Severe Weather Centre) reported that the eight most costly disasters in Canadian history occurred since 2013 (Insurance Bureau of Canada, January 5, 2023). In addition, supply chain disruptions and skilled labour shortages due to COVID-19 disruptions[1] have resulted in higher repair and replacement costs, and, in turn, higher home insurance premiums. For example, the cost of lumber and wood products, fabricated metal products and other construction materials have increased since before the pandemic.[2]

Measurement of insurance in the Canadian CPI

The scope of insurance in the Canadian CPI is affected by conceptual and practical constraints, such as data availability and other limitations. The Canadian CPI includes homeowners' home insurance, tenants' home

1. Why Home Insurance Premiums Are Rising and What You Can Do, Travelers Canada.
2. Statistics Canada. Table 18-10-0265-01 - Industrial product price index, by major product group, monthly.

insurance,[3] and passenger vehicle insurance categories. Term life insurance, disability insurance, and health insurance are excluded. Life insurance is excluded because it is not practically feasible to separate service charges related to the insurance and investment elements within a single premium. It is important to note that disability insurance is included in home and vehicle insurance, as both cover disability risk. Health insurance is also excluded from the CPI calculation, as Canada has a government-funded, universal health care system.

The treatment in the Canadian CPI is consistent with the risk-assuming view of insurance. The risk-assuming view regards policyholders as purchasing a service, or "replacement guarantee", to protect their assets or income against loss. Changes in the price of insurance reflect any change in the price of providing the replacement guarantee within the terms and conditions of the insurance policy. Thus, the current treatment in the Canadian CPI holds the level of security constant, and changes in the purchasing power of the consumer to buy a fixed level of security are best measured by changes in gross premiums. The other view of insurance is the risk-pooling view, which regards insurance as a form of risk-pooling and involves administrative services provided on behalf of a population. In the risk-pooling view, changes in premiums due to changes in expected levels of claims are not considered as price change but rather a change in the size of the pool of funds needed to pay claims.

The Canadian CPI's passenger vehicle and homeowners' home insurance price indexes measure price change of insurance premiums under constant price-determining conditions.[4] In other words, price change is based on the change in gross value of the insurance premium for a policy whose price-influencing characteristics (product quality) do not change. Any change[5] in a policyholders' coverage specifications or characteristics is considered a quality change. Tax levies on insurance premiums are considered part of the price of insurance, so any tax change is considered part of the pure price change of insurance.

The passenger vehicle insurance price index measures changes through time in the cost of insuring a vehicle against a specified combination of perils. The measurement is based on gross insurance premiums of representative vehicle insurance profiles. Passenger vehicle insurance representative products are based on profile characteristics held constant across time. These include:

- Insurance contract characteristics (collision and comprehensive coverage, deductible amounts, liability maximums, and other policy provisions)
- Driver characteristics (age, gender, and usage of vehicle and driving records)
- Classes of vehicles (vehicles' makes, models and years)

The homeowners' home insurance[6] price index measures changes through time in the cost of insuring a representative sample of dwellings against a specified combination of perils. This cost varies not only with changes in insurance rates for home values, but also with changes in their values covered arising from changes in replacement costs. The homeowners' home insurance price index is estimated as the product of two component index series that measure changes in:

- The value of the replacement cost of dwellings
- Insurance rates of identical insurance policies for dwellings of given value, using gross premium rate information from insurance companies

The price change in homeowners' home insurance rates is estimated using gross insurance premiums of representative homeowners' home insurance profiles where characteristics of these representative home insurance policies are held fixed, including:

- Insurance policy details (deductible levels, liability maximums, protection type, and other policy provisions)
- Insured household or person (age, smoking habits, insurance history, and financial solvency)
- Dwelling structure and location site (value, size, age, type, plumbing and electrical condition, neighbourhood characteristics, and distance from fire services)

3. The tenants' insurance expenditure weights are based on tenant insurance premiums, whereas its price is currently imputed from household furnishings and equipment as price data of sufficient quality for inclusion in the CPI are not available.
4. The tenants' insurance measures also track price changes of insurance premiums under constant price-determining conditions. However, due to data limitations, this index is not calculated directly and is instead currently imputed from household furnishings and equipment.
5. There are no adjustments related to changes in the probabilities of claims or for changes in the prices and repair costs of insured goods and altered health service prices.
6. The Canadian Consumer Price Index Reference Paper, Treatment of Owned Accommodation in the Consumer Price Index, section 10.27, 2023.

Data sources

Statistics Canada uses a broker service warehouse of vehicle and homeowner's home insurance quote profiles as its data source for insurance prices. The data warehouse provides timely and detailed information on insurance quotes from 85% of Canadian brokers and the majority of insurance companies operating in Canada. The price-determining characteristics of each potential insurance policy are factors considered by insurers to estimate a premium per consumer profile. Almost all current Canadian consumer profiles are covered, so insurance price indexes based on these data reflect the change in the prices of premiums experienced by Canadian consumers using broker services and current Canadian insurance market conditions. Also included in this database is a measure of home replacement cost for homeowners' home insurance. This allows for improved timeliness and coherence in measuring this aspect of price change due to its integration in the data source.

The database includes multiple homeowners' home insurance quotes for a unique set of the same client's specifications and characteristics. This leads to multiple values of the dependent variable in a hedonic regression equation for a single value of a group of independent variables. This can be related to heteroscedasticity or potentially, to a model specification, depending on the nature of data. There is a risk of model specification weakness, since multiple dependent variable values for a single group of independent variables are treated as separate observations. To mitigate this issue, the median for homeowners' home insurance quotes is selected, ensuring a stable and representative estimate while reducing the effects of heteroscedasticity and potential model specification errors.

The time dummy hedonic regression approach was selected to best account for quality change of heterogeneous price quotes. Given there is not a monthly insurance premium time series, the insurance price indexes derived are compiled from frequent observations of heterogeneous insurance premiums. A quality adjustment approach such as a time dummy hedonic regression is required to control for changes in the characteristics of insurance policies.

Estimation approach: time-dummy hedonic regression

Estimating insurance premium price change using time-dummy hedonic regressions can help hold fixed the quality-mix of quoted premiums used in the price index calculation. The hedonic approach identifies an insurance premium as being tied to a group or "bundle" of characteristics. Since there is no market price for each characteristic, except for the building value (construction cost) in the case of homeowners' home insurance, a hedonic regression of insurance premiums on a household and home (or vehicle) characteristics facilitates the "unbundling" of the overall price and estimate marginal values for each individual characteristic.

Heteroscedasticity was addressed by transforming the data and applying a log transformation. The log-linear specification is outlined below.

$$LnP_{i,t} = \beta_0 + \sum_{k=1}^{K} \beta_k Z_{k,i} + \sum_{l=1}^{T=12} \delta_l D_{i,l}(t) + \sum_{m=1}^{M} \varphi_m D_{i,m}(FSA) + \sum_{n=1}^{N} \omega_n D_{i,n}(City) + \varepsilon_{i,t}$$

Where:

$P_{i,t}$ represents a home or vehicle insurance premium quote or the building value as reported by a third-party data source used by brokers.

$Z_{k,i}$ represents the contract specific characteristics for home insurance, building value, or vehicle insurance, the independent variables.

$D_{i,l}(t)$ has a value of 1 if $t = 1$ and a value of 0 if t differs from 1 for observation i.

$D_{i,m}(FSA)$ has a value of 1 for FSA where insured home or vehicle is located, otherwise it has a value of 0 for observation i.

$D_{i,n}(City)$ has a value of 1 for $City$ where insured home or vehicle is located, otherwise it has a value of 0 for observation i.

To control for geographical fixed effects, specific price functions were adopted for home and vehicle insurance for each geographic area. The Forward Sortation Area (FSA), the first three characters of a home's postal code, along with the city where the home is located, were used to define geographical regions. This enabled localized estimates of the hedonic price curve to be generated based on the characteristics of the insured person and their home within each city and FSA. In the model, $D_{i,l}(t)$ represents time dummy variables.

The model coefficients were estimated using the ordinary least squares method over rolling windows of 12 months. The estimate of the time-dummy coefficient δ_t is $\hat{\delta}_t$ and the monthly price relative in month t is defined as:

$$P_{t,t-1} = \exp(\hat{\delta}_t - \hat{\delta}_{t-1})$$

Separate equations for homeowners' home insurance premiums, building values, and passenger vehicle insurance premiums were estimated. Each equation uses different contract-specific characteristics ($Z_{k,i}$ independent variables). The contract-specific characteristics include the following:

- Homeowners' home insurance premiums:
  - the insurance policy (deductible levels, liability maximums, protection type and other policy provisions)
  - the insured household or person: age, smoking habits, insurance history, and financial solvency in terms of number of mortgages and credit score)
  - the building structure and its location site (value, size, age, type of building, type and age of plumbing and electrical conditions, neighborhood characteristics and the distance of the site from fire services)
- Building value (replacement cost):
  - the building structure (house size, age, and type of building, type and age of plumbing and electrical conditions)
- Passenger vehicle insurance premiums:
  - the contract (coverage and deductible amounts, liability maximums, and other policy provisions)
  - the driver (age, gender, driving record, criminal record)
  - the vehicles (vehicle models, list price, date of purchase)
  - the geography (FSA, distances travelled, and the type of parking typically used each night)

Estimates from these models were made at the CPI geographical stratum[7] level, operating under the assumption that insured consumers residing within the same stratum are subject to similar insurance pricing rules in consideration of the characteristics included in the models.

Hedonic time dummy models were developed for both homeowners' home insurance and passenger vehicle insurance. The homeowners' home insurance price index was estimated with a hedonic time dummy model using a 12-month window and a single representative quote, the median, for each consumer profile in a cut-off sample of market influencing companies at the stratum level. Using the median quote for home insurance significantly reduces the risk of heteroscedasticity or potential model specification issues. The passenger vehicle insurance price index was estimated with a hedonic time dummy model that includes all insurance quotes from flagged companies associated with the top 50 insured vehicle models at the stratum level. This method excludes very expensive premiums,[8] ensuring that the analysis focuses on a representative and practical dataset. Policies on commercial vehicles were also excluded. Incorporating all quotes, this approach captures a comprehensive range of consumer profiles, accounting for variations in variables such as driver's sex, age, discounts, and generic driving record and class. This inclusivity enhances the model's ability to reflect real-world pricing trends and provides valuable insights for vehicle insurance policy and market analyses.

7. CPI geographical stratum is the lowest geographical level in which expenditure weights are used in the construction of the CPI. The geographical strata also serve as sampling areas within which product offers are collected for the CPI.
8. Since insurance companies are obligated to give clients a quote, some very high quotes proposed for risky clients are excluded because they are not based on accurate risk assessments by insurers. They are considered extreme outliers.

Conclusion

With the release of the April 2025 CPI, an enhanced approach for measuring price change in home and vehicle insurance has been implemented allowing for a high-quality adjustment methodology by applying hedonic regression and improved geographical estimation based on local model specification and increased market coverage of premium quotes, accompanied by important characteristics.

Statistics Canada continues to work with price experts, national statistical organizations, and other partners to ensure data and methods used in the calculation of the CPI are aligned with international standards and best practices. The agency is continuing to monitor prices and market dynamics to ensure the ongoing accuracy and relevance of the CPI.

For additional information or to provide comments on the proposed enhancement, users may contact the Consumer Prices Division at statcan.cpddisseminationunit-dpcunitedediffusion.statcan@statcan.gc.ca.

References

Beelen, G. (2004). *The Treatment of Property-Casualty Insurance in the Canadian Consumer Price Index*. Paper prepared for the Ottawa Group meeting, August 2004. Helsinki.

Bourassa, S. C., Dröes, M. & Hoesli, M. (2021). *Hedonic Models and Market Segmentation*. Swiss Finance Institute Research Paper No. 21-62.

Bureau d'assurance du Canada (2017). *Les assureurs de dommages : présents partout, pour tous : Un compte rendu des assureurs habitation, automobile et entreprise du Québec*. Bureau d'assurance du Canada.

Chaffe, A., Ezzaouali, W. & Lequain, M. (2007). *An Alternative Collection Method and Its Impact on Accuracy, Reliability and Efficiency of the CPI Program: The case of automobile insurance in Canada*. Technical paper presented at the tenth meeting of the Ottawa Group, December 2007. Ottawa.

Diewert, E. (1999). *Research in Price Measurement for the Next Twenty Years*. Department of Economics and NBER, University of British Columbia. Written version of presentation given at the NBER Summer Institute Productivity Program, July 1999. Cambridge, MA.

Diewert, E. (2004). *Index Number Theory: Past Progress and Future Challenges*. Paper presented at the SSHRC Conference on Price Index Concepts and Measurement, June 30-July 3, 2004. Vancouver.

Eurostat (2018). *Harmonised Index of Consumer Prices (HICP): Methodological Manual*.

Heath, A. (2007). *CPI Measurement issues with a specific focus on owner-occupied housing*. Bank for International Settlements.

Hume, J. (2007). *A Revision of the Methodology of the Home Insurance Component of the Consumer Price Index beginning with the February 2008 CPI*. Statistics Canada.

International Labour Office (2004). *Consumer Price Index Manual: Theory and Practice*. Geneva.

International Monetary Fund (2003). *Producer Price Index Manual*. Chapter 5: Sampling Issues in Price Collection.

Kelly, M. & Nielson N.L. (2005). *Does Age Matter? Age Distinctions in Insurance Law*. Commission of Canada. Research project LCC04-019A.

Kelly, M. & Neilson, N.L. (2006). *Age as a Variable in Insurance Pricing and Risk Classification*. Geneva Papers, 31: 212-232.

Miller, M. J. & Smith, R. A. (2003). *The Relationship of Credit-Based Insurance Scores to Private Passenger automobile Insurance Loss Propensity*. Epic Actuaries, LLC. Bloomington, IL.

Laurin, A. & Omran, F. (2018). *Piling On – How Provincial Taxation of Insurance Premiums Costs Consumers*. C.D. Howe Institute. Commentary No. 522.

PricewaterhouseCoopers (2017). *Insurance Industry*.