

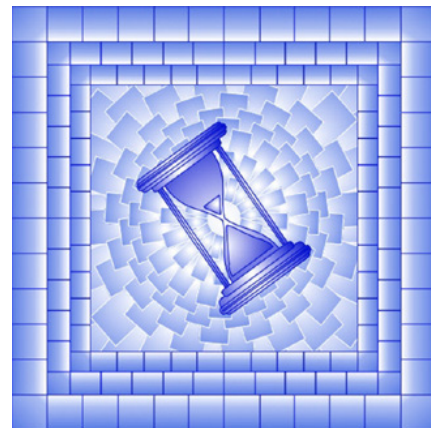
Catalogue no. 62F0014M
ISSN 1706-7723
ISBN 978-0-660-49449-4

Prices Analytical Series

Technical guide for the Commercial and Industrial Machinery and Equipment Rental and Leasing Services Price Index (CIMERLSPI)

by Benoit Germain

Release date: October 13, 2023



 Statistics Canada Statistique Canada

Canada 

How to obtain more information

For information about this product or the wide range of services and data available from Statistics Canada, visit our website, www.statcan.gc.ca.

You can also contact us by

Email at infostats@statcan.gc.ca

Telephone, from Monday to Friday, 8:30 a.m. to 4:30 p.m., at the following numbers:

- Statistical Information Service 1-800-263-1136
- National telecommunications device for the hearing impaired 1-800-363-7629
- Fax line 1-514-283-9350

Standards of service to the public

Statistics Canada is committed to serving its clients in a prompt, reliable and courteous manner. To this end, Statistics Canada has developed standards of service that its employees observe. To obtain a copy of these service standards, please contact Statistics Canada toll-free at 1-800-263-1136. The service standards are also published on www.statcan.gc.ca under "Contact us" > "[Standards of service to the public](#)."

Note of appreciation

Canada owes the success of its statistical system to a long-standing partnership between Statistics Canada, the citizens of Canada, its businesses, governments and other institutions. Accurate and timely statistical information could not be produced without their continued co-operation and goodwill.

Published by authority of the Minister responsible for Statistics Canada

© His Majesty the King in Right of Canada, as represented by the Minister of Industry, 2023

All rights reserved. Use of this publication is governed by the Statistics Canada [Open Licence Agreement](#).

An [HTML version](#) is also available.

Cette publication est aussi disponible en français.

Table of contents

1 Introduction	4
1.1 Target population.....	4
1.2 Sampling	4
2 Data	5
2.1 Price	5
2.2 Lease and rental agreements	5
2.3 Weights.....	5
3 Price index aggregation structure	6
4 Index estimation	6
4.1 Calculation of elementary aggregates.....	7
4.2 Calculation of higher-level indexes.....	7
5 Outliers and imputation method	8
6 Revisions and basket updates	8
7 Appendix	8

Technical guide for the Commercial and Industrial Machinery and Equipment Rental and Leasing Services Price Index (CIMERLSPI)

by **Benoit Germain**

1 Introduction

This guide provides an overview of the measurement framework for the Commercial and Industrial Machinery and Equipment Rental and Leasing Services Price Index (CIMERLSPI).

The CIMERLSPI measures changes in the prices for the commercial and industrial machinery and equipment rental and leasing (CIME) industry in Canada. It is a monthly index with fixed weights, released quarterly at the national level.

The index is used by businesses to monitor trends in this sector and to assess their performance. At Statistics Canada, the CIMERLSPI is used by the Canadian System of Macroeconomic Accounts to derive the real production value of the CIME industry. The index is also used by academics for statistical and research purposes.

1.1 Target population

The target population consists of all establishments primarily engaged in the CIME industry in Canada in 2020. This corresponds to industry group 5324 in the North American Industry Classification System (NAICS).¹

Establishments in this industry group are generally engaged in supplying equipment of a capital or investment nature. They typically serve businesses and do not generally operate a retail-like or storefront facility. For instance, companies operating in the CIME industry offer several types of equipment, such as construction machinery, manufacturing tools and specialized instruments, which are rented or leased to businesses for their operational needs.

Establishments sampled for this survey are part of one of the following industries:

- 53241—construction, transportation, mining, and forestry machinery and equipment rental and leasing
- 53242—office machinery and equipment rental and leasing
- 53249—other commercial and industrial machinery and equipment rental and leasing.

Among the three industries, construction, transportation, mining, and forestry machinery and equipment rental and leasing (NAICS 53241) is the largest in terms of revenue and represents about 75% of the overall NAICS 5324 revenue.

1.2 Sampling

The sample for this survey has a longitudinal design. The survey frame is the portion of Statistics Canada’s Business Register classified under NAICS 5324. The sampling unit is the [establishment](#), the most homogeneous unit of production for which the business maintains accounting records.

The population is stratified by five-digit NAICS code and by revenue size. It includes all establishments that realized a gross annual revenue of at least \$100,000 in the year the sample has been drawn. The largest establishments are selected with a probability of 100% (“take-all”), and they represent about 20% of the sampled units. The remaining establishments are selected according to the “take-some” sequential Poisson sampling method,² where the probability of selection is proportional to the revenue of the establishment for the reference year. The sample size is approximately 500 establishments.

1. NAICS Canada 2022 Version 1.0. (Refer to the Appendix for additional information.)

2. Sequential Poisson sampling is a method for drawing probability-proportional-to-size samples and is commonly used for price-index surveys. The probability of selection for unit i is given by,

$$\pi_i = \frac{nx_i}{\sum_{i=1}^N x_i}$$

where the sampling frame consists of N units, n is the desired sample size and x_i is the revenue of unit i .

2 Data

Most of the data are collected from respondents via an electronic questionnaire. In some cases, data are also collected through special arrangements with respondents. Collection takes place once the reference quarter is over; for example, data for the first quarter (January, February and March) are collected throughout April and May, for about six weeks.

2.1 Price

The price is defined as the transaction price of the products being rented or leased in each month, exclusive of any sales tax or additional fees.

Respondents are asked to report monthly prices for a maximum of three products that they consider representative of their rental and leasing activity. They are asked to report prices for the same products over time to produce a constant-quality price index. If businesses did not rent or lease any products during the reporting period, respondents will be asked to provide price estimates.

However, product substitutions occur periodically when products become discontinued or when new products become available. The price of replacement products that cannot be directly compared with previously available products is imputed.³ To minimize the number of breaks in the series, price movements resulting from product changes are researched and validated so that products deemed comparable are accepted into the index calculation. A product is considered comparable if it serves the same function, has similar characteristics and serves the same market.

Additional information is collected about the rental or leasing agreement, such as the number of days the product was leased or rented, the type of client (i.e., business, government or other), the industry of the client (e.g., oil and gas extraction, construction, or transportation and warehousing) and the type of price charged to the client (i.e., leasing price or rental price).

2.2 Lease and rental agreements

A lease agreement is a contract involving a lessor and a lessee. The contract grants the lessee the right to use a particular asset for a specified period (usually a long-term commitment). The lessee is responsible for the maintenance of the asset, and, when the term is over, they have the option to purchase the asset.

Leasing is the preferred option for businesses that want to try equipment with the intention of buying it in the future. Leasing can also be cheaper than renting because of the long-term nature of the engagement.

A rental agreement is an arrangement between an owner and a renter, which allows the renter to use a particular asset for a specified period (usually a short-term commitment) at a flat rate or based on a preferred frequency: hourly, daily, weekly or monthly. As opposed to a lease agreement, the responsibility for maintenance of the asset lies with the owner.

This option is more flexible and is preferred by businesses that want to use certain equipment without the intention of buying it. Small and medium-sized businesses prefer to rent equipment as it brings the flexibility of having access to up-to-date equipment without making a large capital expenditure.

2.3 Weights

The CIMERLSPI is calculated as a weighted average of the price change of rental and leasing services in Canada. The weights are designed to capture the relative importance of the sampled establishments as measured by their revenue shares.

Two sets of weights are associated with each unit: economic weights and design weights. Economic weights refer to the establishment revenues at the time of the sample selection. Design weights can be interpreted as the number of units that each sampled unit represents in the population. The sampling weight is the product of the economic weight and design weight for each establishment and represents its relative importance in the population. Sampling weights are used for aggregating upper-level indexes.

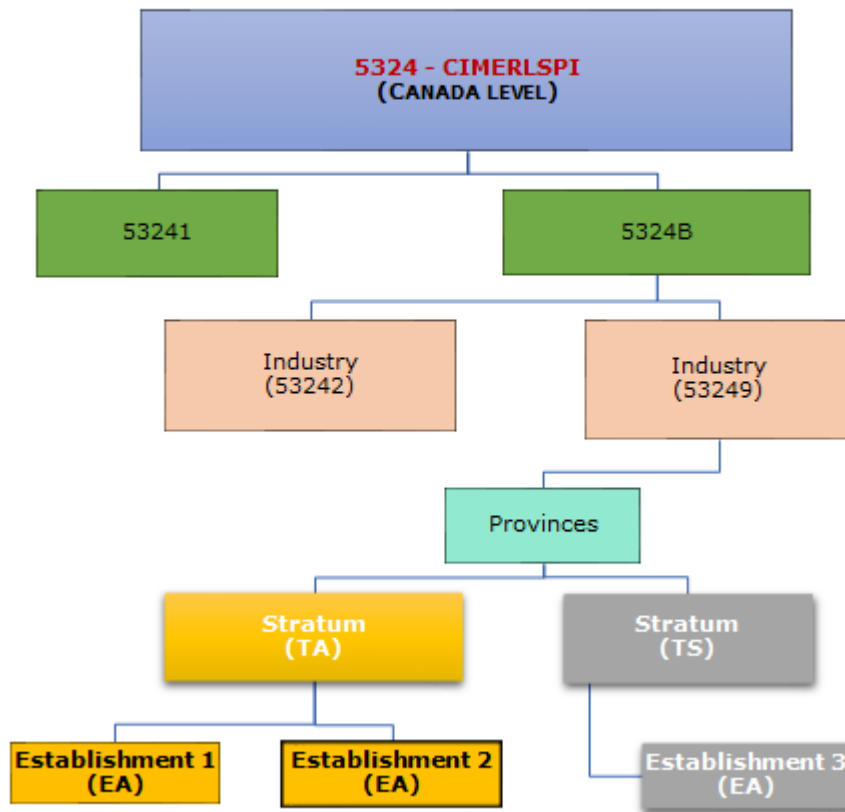
3. Section 5 provides more information on the imputation method.

3 Price index aggregation structure

The following diagram presents the aggregation structure of the CIMERLSPI. The structure consists of various levels of aggregation from the lowest-level index (elementary or elemental aggregates) to the top-level index (CIMERLSPI).

Elementary aggregates are defined as the lowest level of aggregation and are formed by taking an unweighted geometric average of price relatives of services. All index levels above elementary aggregates use sampling weights for aggregation.

Figure 1
CIMERLSPI aggregation structure



Source: Statistics Canada.

4 Index estimation

The CIMERLSPI uses a standard two-step methodology with fixed weights to produce chained indexes at each level of aggregation. A geometric index (Jevons price index) is used to calculate the elementary aggregates, and an arithmetic index (Lowe price index) is used to calculate higher levels of aggregation. Six levels of aggregation are calculated, but only the top two levels are published.⁴

4. NAICS 53242 and 53249 are aggregated and published together because the weight of NAICS 53242 is very small.

4.1 Calculation of elementary aggregates

In the first step of aggregation, price relatives (ratio of prices for product k in establishment i at time t and time t-1) within an establishment are aggregated using an unweighted geometric average to form a price index (Jevons price index). These indexes are referred to as elementary or elemental aggregates (EAs).

The formula to calculate a Jevons price index is as follows:

$$EA_{Ji}^{t/t-1} = \prod_{k=1}^n \left(\frac{P_{ik}^t}{P_{ik}^{t-1}} \right)^{1/n} ; t \geq 1$$

$$EA_{Ji}^0 = 1$$

$EA_{Ji}^{t/t-1}$: The Jevons index for establishment i between periods t-1 and t.

P_{ik}^t : The price of product k in establishment i at time t.

$EA_{Ji}^0 = 1$: The Jevons index for establishment i at time 0.

4.2 Calculation of higher-level indexes

In the second step of aggregation, elementary price indexes are aggregated across establishments using a weighted arithmetic Lowe index, where the weights reflect the relative importance of each establishment.

The indexes are chained together to form a time series that gives the evolution of prices with respect to a fixed base period (currently the year 2020).

The formula to calculate the Lowe price index has this general form:

$$I_i^t = I_i^{t-1} \sum_{i=1}^n (EA_{Ji}^t) w_i^t ; t \geq 1$$

$$\text{Where: } w_i^t = \frac{EA_{Ji}^{t-1} w_i^{t-1}}{\sum_{i=1}^n EA_{Ji}^{t-1} w_i^{t-1}}$$

I_i^t : Lowe index at time t, chained.

I_i^{t-1} : Lowe index at time t-1.

w_i^t : Price-updated⁵ weight of establishment i in period t (price-updated weights multiply the initial establishment [revenue] weights by price relatives and allow the index to be chained, i.e., be calculated between month t and t-1 without referring to the base period).

w_i^0 : The base weight of establishment i.

5. Price updating is a procedure where the quantities of an earlier period are revalued at the prices of a later period. The result is hybrid revenue weights. This procedure is necessary to hold quantities constant when revenues (not quantities) are the only source of data available for deriving basket weights.

5 Outliers and imputation method

For each month, price relatives lower than 0.4 or greater than 2.5 are considered outliers. These outliers are reviewed before being excluded or included in the index calculation. For example, outliers are included in the index calculation in instances where there is an important shift in the price level of a series caused by an event that would have a legitimate impact on prices in the industry (e.g., shortage of materials and oil embargo).

To handle missing data (e.g., because of respondent refusals), parental imputation is used for products that are unavailable or products that are not comparable. This method uses the price change of the parent aggregate in the index aggregation structure (one level higher in Figure 1).

6 Revisions and basket updates

With each release, data for the previous quarter may be revised. These revisions usually occur when data arrive late for a previously non-responding establishment or when a respondent makes a correction to the data.

Basket updates consist of updating the weights of the sampling units and the sample of establishments to ensure the population's representativeness. They are performed every five years. With the introduction of a new basket, historical estimates are linked to the new basket.

This is achieved by multiplying each element of the old index series by a link factor, which is calculated as the ratio of the new index value to the old index value in the overlap period.

7 Appendix

Table 1

Commercial and industrial machinery and equipment rental and leasing industry, North American Industry Classification System Canada 2022, Version 1.0

North American Industry Classification System title	Definition	Examples
53241—Construction, transportation, mining, and forestry machinery and equipment rental and leasing	This industry comprises establishments primarily engaged in renting or leasing heavy machinery without operator.	Aircraft rental and leasing (R&L) without operator Bulldozer R&L (without operator) Construction equipment, heavy, R&L Financial leasing of construction, mining and forestry machinery Logging equipment R&L Mining machinery and equipment, rental Oil field equipment R&L Railroad car rental (except financial) Rental of pallets and containers Rental of scaffolding and platforms Shipping containers, leasing Tanker leasing (except financial) without operator
53242—Office machinery and equipment rental and leasing	This industry comprises establishments primarily engaged in renting or leasing office machinery and equipment.	Computer hardware R&L (except finance leasing or by the manufacturer) Computer peripheral equipment R&L Computer R&L services (except finance) Office furniture rental Rental of business machines
53249—Other commercial and industrial machinery and equipment rental and leasing	This industry comprises establishments, not classified to any other industry, primarily engaged in renting or leasing commercial and industrial machinery and equipment.	Agricultural machinery and equipment rental Communications equipment R&L Construction signs rental Diesel generators, rental Farm equipment R&L Garbage dumpster, R&L Industrial machinery and equipment, R&L Lottery terminal equipment, leasing and maintenance Medical equipment R&L, commercial and industrial Motion picture equipment rental Plumbing equipment rental Restaurant equipment, R&L Temporary road signs, rental Vending machines, rental only Woodworking machinery and equipment rental

Source: Statistics Canada.