Technical Guide for the Couriers and Messengers Services Price Index (CMSPI)

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Release date: February 27, 2023
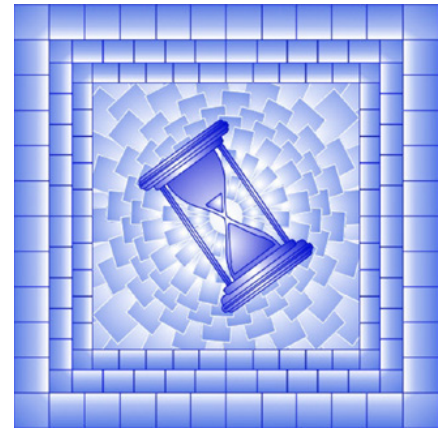
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by **Maryam Mustafa**

1 Introduction

The Couriers and Messengers Services Price Index (CMSPI) measures the monthly change in the price of shipping services provided to households and businesses by delivery companies in Canada. The CMSPI is an indicator of economic activity within the courier and messenger services industry, serving as a tool for performance evaluation, cost monitoring, contract assessment and benchmark comparisons. It is also used by the Canadian System of Macroeconomic Accounts to calculate the real value added for the industry and to measure changes in productivity.

For the CMSPI, services are classified into one of two industry groups:

NAICS 4921: Couriers

NAICS 4922: Local messengers and local delivery[1]

The CMSPI is an aggregation of these two service industries. NAICS 4921 measures price movements for inter-city, intra-city, and some international delivery services provided by courier companies. NAICS 4922 covers regular messengers and food delivery establishments and hence, tracks price change for intra-city delivery of small parcels, restaurant meals and groceries.

2 Data

The price data used to produce the index is obtained through companies' websites for couriers, telephone interviews for regular messengers and financial reports for food delivery establishments.

Data collection for the CMSPI occurs on the 15th of the reference month for couriers and some of regular messengers. The price data for remaining regular messengers is obtained the following month. However, for food delivery establishments, monthly data is collected when financial statements are released after the reference quarter. For example, data for Q3 – July, August, September is obtained in November.

Indexes are published at the national level for each industry group and for the overall aggregated CMSPI.

2.1 Sampling Process

The target population for the CMSPI consists of all establishments on the Statistics Canada's Business Register (BR) that are classified to NAICS 492—Couriers and messengers under the North American Industry Classification System (NAICS). Judgement sampling is used to create the sampling frame for couriers [NAICS 4921]. The sample only covers a few of the largest companies that account for approximately 80% of the courier industry revenue.

The sampling frame for the local messengers [NAICS 4922] is determined by excluding all establishments that contribute to the bottom 10% of the total revenue in each province. All remaining messengers establishments, including food delivery establishments, above the threshold are included in the sample for possible selection based on the Sequential Poisson Probability Proportional to Size methodology. The probability of an establishment being selected into the sample is proportional to its revenue. The largest establishments are selected into the sample with a probability of 100%, forming the take-all (TA) stratum. The remaining establishments are selected for the take-some (TS) stratum.

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1. NAICS 4922 – Local messengers and local delivery covers regular messengers and food delivery establishments. Regular messengers are engaged in delivery of parcels and letters, groceries, and liquor within a city whereas, food delivery establishments provide delivery services for take-out restaurant meals.

2.2 Prices

The service price is defined as the amount charged by a carrier for delivering a parcel or letter using express or non-express shipping service between selected origin and destination pairs.

Table 1
Example of Service Price for Couriers and Regular Messengers

NAICS	Route	Delivery	Service type	Origin postal code	Destination postal code
4921 (Couriers)	Domestic	Parcel	Air (Express service)	ABC 123	XYZ 345

For each courier company, monthly base tariff rates and fuel surcharges are collected for 112 services for selected origin and destination postal codes across domestic, US and international routes. Each regular messenger establishment, however, only reports price information for 4 domestic services. These collected prices are used to compute a final price for each service where final price is the dollar amount invoiced to a client for a particular shipping service and includes adjustments for fuel surcharges but excludes all taxes and other charges.

For each food delivery establishment, 1 final price is calculated for each month based on their quarterly financial statements. For this purpose, data on revenues and total orders is extracted from these reports to compute a service price for the quarter.

Price quotes for reference months within the quarter are imputed using the quarterly final price. The final price is defined as the price received by food delivery companies on each order and includes commissions earned from restaurants and delivery fee paid by consumers.

Table 2
Example of Service Price for Food Delivery Establishments

Period	Orders (millions)	Order Revenues ($ million)	Final price (revenue per order $)
Q1	20.0	100.0	5.0
January	…	…	5.0
February	…	…	5.0
March	…	…	5.0

...not applicable.
This symbol is used when an entry for the table cell is not logically possible.

In any given period, price data for regular messengers may not be available for collection. In such cases, missing prices are imputed using the average price movement of remaining services within the establishment. If all services within an establishment have missing prices, then imputation is done using the average price movement of remaining units within the same province.

2.3 Revisions

With each data release, data for the previous six months may have been revised. These revisions occur when late data is collected for a previously non-responding regular messenger establishment and to account for monthly price variations for food delivery establishments since their data is available with a lag of 1 month after the reference quarter. The indexes are not seasonally adjusted.

2.4 Weights

The CMSPI is calculated as a weighted average of the price change of delivery services in Canada. The weights are designed to capture the relative importance of the establishments as measured by their revenue shares. The overall impact of a price change of an establishment on the total index is determined by its weight value.

Two sets of weights are associated with each sampled unit: economic weights and design weights. Economic weights refer to the establishment revenue at the time of initial selection of the sample and are derived from the revenue data reported in the Statistics Canada's BR. The economic weights of establishments are accumulated to derive their respective industry group weights. The share of total revenue of each industry group in the sample is assumed to be representative of the true share of the industry in the population. For couriers, delivery route

economic weights are based on revenues reported by companies in their financial statements at the time of sample selection.

The design weight can be interpreted as the revenue in the target population that each sampled unit represents and is equivalent to the reciprocal value of the establishment's probability of being included in the sample.

For the CMSPI, sampling weight is the product of 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 Aggregation Structure

Figure 1 presents the aggregation structure from the elementary aggregates at the delivery route level for couriers and establishment level for local messengers, up to the total CMSPI. Elementary aggregates are defined as the lowest level of aggregation and are formed by taking an unweighted average of price relatives of services. All index levels above elementary aggregates use sampling weights for aggregation.

Figure 1
CMSPI Aggregation Structure
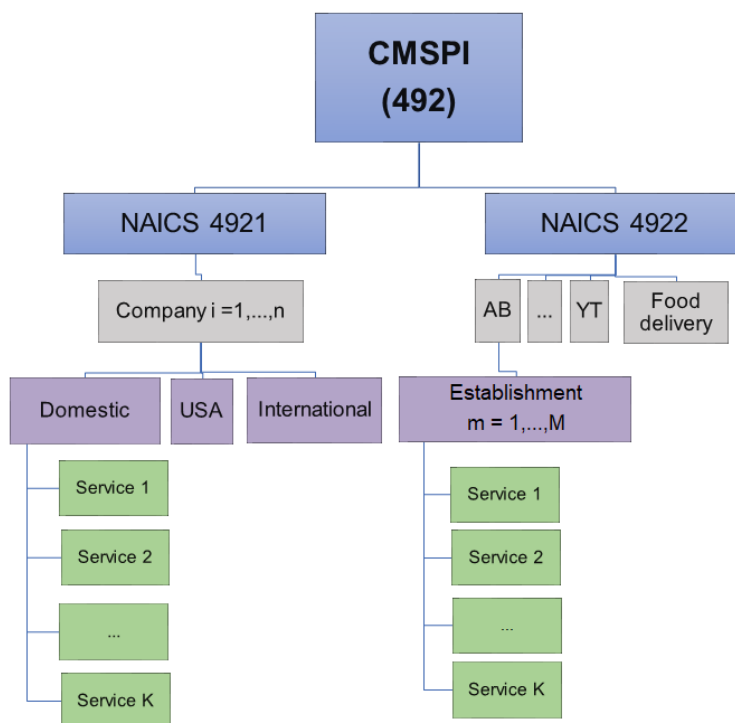
4 Index Estimation and Aggregation

4.1 Introduction

The CMSPI is based on a fixed sample, where monthly price changes for a fixed basket of services are measured over time. The index is calculated for the current month and compared to the previous month to track monthly price movements.

Index estimates are produced by calculating a weighted average of price relatives by industry group [NAICS 4921 and NAICS 4922], which are then chained together to form an index series for NAICS 492. The CMSPI is a fixed base Laspeyres index, available at the national level only.

All levels of indexes along with the top level CMSPI are estimated using a transparent and efficient R-based process. The package, PIAR – Price Index Aggregation,[2] is used for index estimation where month-over-month elemental indexes are first calculated for elementary aggregates each month, and then aggregated according to the aggregation structure.

4.2 Calculation of elementary aggregates

At the first stage of aggregation, the price relatives are aggregated using an unweighted geometric average of delivery services for each delivery route for each courier company. These lowest level aggregations or elementary aggregates are at the delivery route level for couriers.

The monthly index for delivery route j in company i is given by:

$$EA_{ij}^{t} = \prod_{k=1}^{K}\left(\frac{p_{ijk}^{t}}{p_{ijk}^{t-1}}\right)^{1/K} \; for \; t \geq 1$$

EA_{ij}^{t} : The elementary aggregate of route j for company i at time t.

p_{ijk}^{t} : The price of delivery service k for route j for company i at time t.

4.3 Compilation of upper-level aggregated indexes

The elementary price indexes are aggregated across three routes within each courier company using a weighted arithmetic Laspeyres index where delivery route weights reflect the relative importance of each route within a courier company.

The monthly index for company i is given by:

$$I_{i}^{t} = I_{i}^{(t-1)}\sum_{j}[(EA_{ij}^{t})w_{ij}^{t}] \; for \; t \geq 1$$

I_{i}^{t} : The index for company i at time t.

w_{ij}^{t} : The price-updated weight[3] of delivery route j for company i in period t.

The above price index is then aggregated across all companies to derive the index for couriers [NAICS 4921] using company weights.

The elementary price indexes and upper-level aggregates for messengers can be calculated using the same methodology by replacing delivery route service prices with messenger establishment-level prices and aggregating them to derive the province-level or food delivery index.

The two industry group indexes, $I_{s=1,2}$, are then combined using industry weights to estimate the total CMSPI:

$$I_{T}^{t} = I_{T}^{(t-1)}\sum_{s}[(I_{s}^{t})w_{s}^{t}]$$

I_{T}^{t} : The overall price index for couriers and messengers at time t.

w_{s}^{t} : The price-updated weight of industry group s in period t.

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2. Refer to https://CRAN.R-project.org/package=piar for further information on PIAR.
3. Price updated weights, w_{ij}^{t}, can be obtained by multiplying the initial revenue weights by price relatives i.e., $w_{ij}^{t} = \frac{EA_{ij}^{(t-1)}w_{ij}^{(t-1)}}{\sum(EA_{ij}^{(t-1)}w_{ij}^{(t-1)})}$ .This allows the index to be chained i.e. be calculated between month t and t-1 without referring to the base period t^0.

4.4 Basket Updates

Revenue weights of the sampling units are updated on a regular basis to better represent current economic activity. For the CMSPI, this typically occurs every 5 years. Basket updates consist of revising revenue weights and the sample of companies by adding or removing units to ensure the sample is representative of the population.

With the introduction of a new basket, historical estimates are linked to the new basket by maintaining the same historical monthly changes. 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. This chain-linking process ensures that period-over-period changes in the index only reflect price movements.

Appendix

Table A
Concepts and definitions used for constructing the CMSPI

Concept	Definition
Base Period	The period for which the index equals 100. The base period for the CMSPI is 2019.
Company	The lowest level organizational unit for which financial statements are maintained.
Establishment	The unit at which all accounting data required to measure production are available.
Industry	Mutually exclusive grouping of shipping companies based on their work in either couriers or messenger services.
Price	The dollar amount invoiced to a client for a particular shipping service inclusive of fuel surcharges but excluding taxes and other charges.
Target Population	All establishments in the couriers and messengers services industry classified under the following NAICS: 4921 and 4922, with all messengers establishments that contributed to the bottom 10% of the total revenue in each province excluded from the sampling frame.