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Framework for a Final Demand–Intermediate Demand (FD-ID) Price Index in Canada

Session: Cross Cutting Topics

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Abstract

This paper presents a comprehensive framework developed by Statistics Canada for measuring Final Demand–Intermediate Demand (FD-ID) Price Indexes, an enhancement of traditional Producer Price Indexes (PPI) methodologies. The FD-ID system expands the analytical utility of price statistics by categorizing domestic output into final demand (goods and services sold for personal consumption, capital investment, government purchases, and exports) and intermediate demand (business-to-business transactions excluding capital investment). The framework introduces a product-based aggregation model that traces price movements based on the specific products sold and their use in final or intermediate demand. This method enhances analytical clarity by tracing price changes for individual goods and services as they flow into consumption, investment, export, or further production. The framework leverages existing price indexes and updated input-output relationships to classify products into final and intermediate demand categories. It also improves transparency in index construction by clearly delineating the role of each product in economic demand chains. This approach enables more precise monitoring of inflation pressures by product type and provides valuable insights into price transmission across sectors. This initiative supports broader efforts to modernize economic indicators in line with evolving user needs.

1 Introduction

This paper outlines the proposed framework for the development and implementation of a Final Demand-Intermediate Demand (FD-ID) Producer Price Index in Canada by **Statistics Canada**[1]. The FD-ID framework aims to enhance the measurement of producer price changes by categorizing transactions into final and intermediate demand components reflecting how goods and services flow through the Canadian economy.

Complementing the traditional industry-level indexes at **Statistics Canada**, the FD-ID framework offers a more refined and policy-relevant classification by aligning with economic demand structures. This approach supports more detailed insights into domestic inflation, cost pressures, and supply chain dynamics.

Importantly, the FD-ID framework supports **two complementary analytical approaches**:

- **Product Approach**: Tracks price changes for individual goods and services based on their final or intermediate use.

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[1]The framework presented in this paper is preliminary and subject to change. Ongoing development and new data sources may result in modifications in future versions of this work.

This approach allows for detailed product-level inflation analysis and attribution of price changes to end-use categories (e.g., final demand for exports vs. intermediate demand by manufacturers).

- **Production Flow Approach**: Analyzes price transmission through the economy by following the flow of production inputs and outputs across industries.

This approach is valuable for tracing inflationary pressures along the value chain and for examining inter-industry cost linkages.

Together, these approaches provide a comprehensive framework for analyzing price behaviour and inflation dynamics in Canada's economy.

To begin with, **Statistics Canada** initially focused its efforts on developing the product-based approach, as it was considered the more methodologically straightforward of the two available options. Consequently, this paper will primarily concentrate on the development and implementation of the product approach. As **Statistics Canada** continues to advance its work on FD-ID price indexes, future research and development activities will also encompass the more complex production flow approach, which will be explored in subsequent phases of this initiative.

2 Importance of This Work

2.1 Policy Relevance in the Canadian Context

The FD-ID price indexes will provide detailed, sector disaggregated price movements to support a range of analytical and policy applications, including:

- Informing the Bank of Canada's inflation monitoring and monetary policy decisions by offering timely insights into price changes across final and intermediate stages of production.

- Supporting governments, policymakers, businesses, and labour organizations in analyzing supply chain dynamics, identifying sources of inflationary pressure, and monitoring price movements throughout the production and distribution process.

These price indexes will serve as a valuable tool for understanding the transmission of price changes across the economy and informing evidence-based decision-making.

2.2 Analytical Precision

The FD-ID framework offers a structured means of analyzing price dynamics across the production and supply chain. Specifically, the FD-ID approach:

- Traces inflationary pressures from upstream inputs through to final consumption, enabling a clearer understanding of how price changes propagate through the economy.

- Facilitates analysis of input cost pass-through, particularly in strategically important Canadian sectors such as energy, manufacturing, and services.

- Supports sector specific assessments of production cost inflation, providing a valuable tool for economic analysis, policy development, and business planning.

This approach strengthens the capacity to monitor and interpret inflationary trends within the broader context of domestic production and supply chain structures.

2.3 Harmonization with Other Statistical Agencies

This framework is consistent with international statistical standards, including those employed by other national statistical agencies such as the **U.S. Bureau of Labor Statistics (BLS)** and the **Bank of Japan (BOJ)** in the compilation of FD-ID price indexes. This alignment promotes cross-country comparability and supports harmonized economic analysis across jurisdictions.

3 Data Sources

The aggregation of the FD-ID price indexes draws on existing Statistics Canada data holdings, including the following key sources:

- **Producer Price Indexes (PPIs)**: Industry and product level PPIs form the primary input for measuring price changes.

- **Consumer Price Index (CPI)**: Where appropriate, the CPI is used as a proxy for certain products in the FD-ID framework in cases where corresponding PPIs are not available.

- **Supply and Use Tables (SUTs)**: These tables are utilized to classify transactions into Final Demand and Intermediate Demand since they serve as the basis for weighting price indexes according to economic linkages.

- **Symmetric Input Output Table (IO)**: This table is used to measure the movement of outputs from industry to industry and industry to final demand sector. This table is used to classify industries into stages of production for the production flow approach.

4 Methodology

4.1 Conceptual Design

In the product approach, the FD-ID Price Index categorizes transactions into Final Demand and Intermediate Demand. These transactions can be further categorized as:

4.1.1 Final Demand by Type of Output

Final demand can be divided into three broad categories based on the nature of the goods and services consumed:

- **Final Demand Goods**: Purchases of tangible products (e.g., cars, appliances, food).
- **Final Demand Services**: Expenditures on intangible offerings (e.g., rental of residential real estate, passenger rail transport, financial services).
- **Final Demand Construction**: Investment in structures (e.g., residential buildings, infrastructure, commercial real estate).

4.1.2 Final Demand by Spending Sector

Alternatively, final demand can be separated based on the source of expenditure:

- **Personal Consumption Expenditures (Household Spending)**: Purchases by individuals for daily needs (e.g., groceries, clothing, housing, entertainment). This includes expenditures by Canadians abroad, and is less-of-expenditure by non-residents residing in Canada.
- **Private Capital Investment (Business Spending)**: Expenditures by businesses on machinery, equipment, and structures to enhance production.
- **Government Capital Investment**: Public spending on infrastructure, including construction and intellectual property. We do not have coverage of non-capital government expenditures.
- **Exports**: Goods and services sold to foreign buyers, contributing to domestic production.

4.1.3 Intermediate Demand by Type of Input

Intermediate demand can be categorized based on the stage of production and the nature of the inputs:

A. **Goods**

- **Processed Goods**: Materials that have already undergone some level of manufacturing (e.g., steel, flour, chemicals, components). These are used to produce other goods.
- **Unprocessed Goods**: Raw materials in their natural or minimally altered state (e.g., crude oil, logs, agricultural products). These feed into production chains.

B. **Services**

Services used as intermediate inputs support business operations and production. These can be further divided into:

- **Trades**: Wholesale and retail services that facilitate the movement of goods.
- **Traditional Services**: Business-oriented services like legal, accounting, advertising, and banking.
- **Transportation & Warehousing**: Freight, shipping, storage, and supply chain logistics that enable the distribution of goods.

C. **Construction**

Includes construction services and materials used for the repair and maintenance of business infrastructure (e.g., office buildings, factories, utilities) rather than the construction of structures for business or personal use which are considered to be capital investment.

4.1.4 Out of Scope

Nonmarket products are considered to be out of scope for the FD-ID price index. This includes products that are not offered or purchased at economically significant prices or at prices that are not determined by economic forces, such as those that are heavily government subsidized. Examples of products that are considered to be out of scope for the FD-ID index include general government services, healthcare, post-secondary tuition, and imputed rental of owner-occupied housing.

4.2 Classifications

The data inputs for deriving FD-ID price indexes adhere to distinct classification systems. Table 1 outlines the specific classifications employed by each data source.

Table 1: Classifications

Price Series	Classification
Industry PPIs	North American Industry Classification System (NAICS)
Product PPIs	North American Product Classification System (NAPCS)
CPI	Internal Product Classification
SUTs and IO	Supply Use Product Classification (SUPC) and Input-Output Industry Classification (IOIC)

4.3 Mapping

One of the key methodological challenges in producing the FD-ID price indexes arises from differences in the classification systems used across input data sources. Specifically, the price series such as PPIs and CPI components are often organized according to industry or product based classifications, while the SUTs are structured around a product based classification system consistent with national accounts frameworks.

As a result, a mapping exercise is required to align the price series with the appropriate product SUPC in the SUTs. This process involves:

- Linking each price index to its corresponding SUPC in the SUTs, taking into account differences in scope, coverage, and classification definitions.

- Ensuring that multiple price series are aggregated or apportioned appropriately to represent the price movement of a single product when necessary.

- Maintaining consistency with national accounts concepts to support accurate weighting and allocation of price changes across final and intermediate demand components.

The table below shows an example of how the SUPC products falling under the transportation and warehousing services subaggregate are mapped to various price index series.

Table 2: Concordance Mapping

Index SubAggregate	SUPC Product	Price Series
Transportation and warehousing	MPS492000-Courier, parcel, and local messenger and delivery services	Couriers and messengers services price index-Couriers and messengers

Index SubAggregate	SUPC Product	Price Series
	MPS481001-Air passenger transportation services	Consumer price index-Air transportation
	MPS482001-Rail passenger transportation services	Consumer price index-Rail, highway bus and other inter-city transportation
	MPS484001-Moving services	For hire motor carrier freight services price index-Used household and office goods moving
	MPS484004-Road transportation services for general freight	For hire motor carrier freight services price index-General freight trucking
	MPS484005-Road transportation services for specialized freight	For hire motor carrier freight services price index-Specialized freight trucking
	MPS481002-Air freight transportation services	Freight rail services price index-Freight rail services

This mapping is a critical step in the FD-ID methodology, as it ensures that price movements are correctly attributed to the products in the Supply and Use framework, enabling accurate aggregation and analysis of inflation transmission.

4.4   Index Aggregation Structure

In the by product approach, there are three aggregation structures for FD-ID price indexes. Figures 1 illustrate the aggregation for Intermediate-Demand.
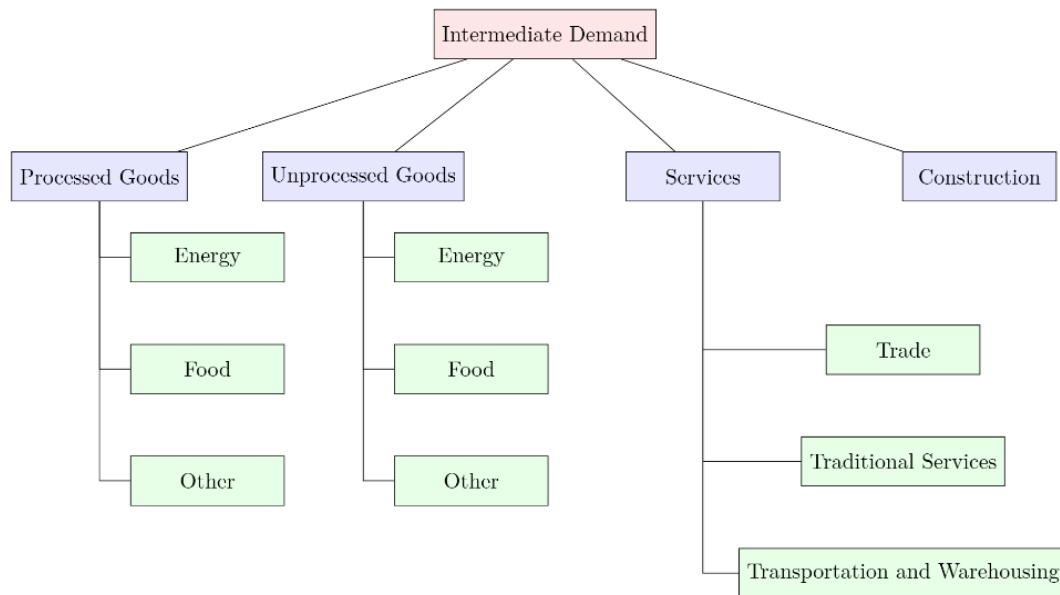

Figure 1: Intermediate-Demand Aggregation

For Final-Demand, there are two aggregation structures. The first is by type of output and the second is by spending sector.
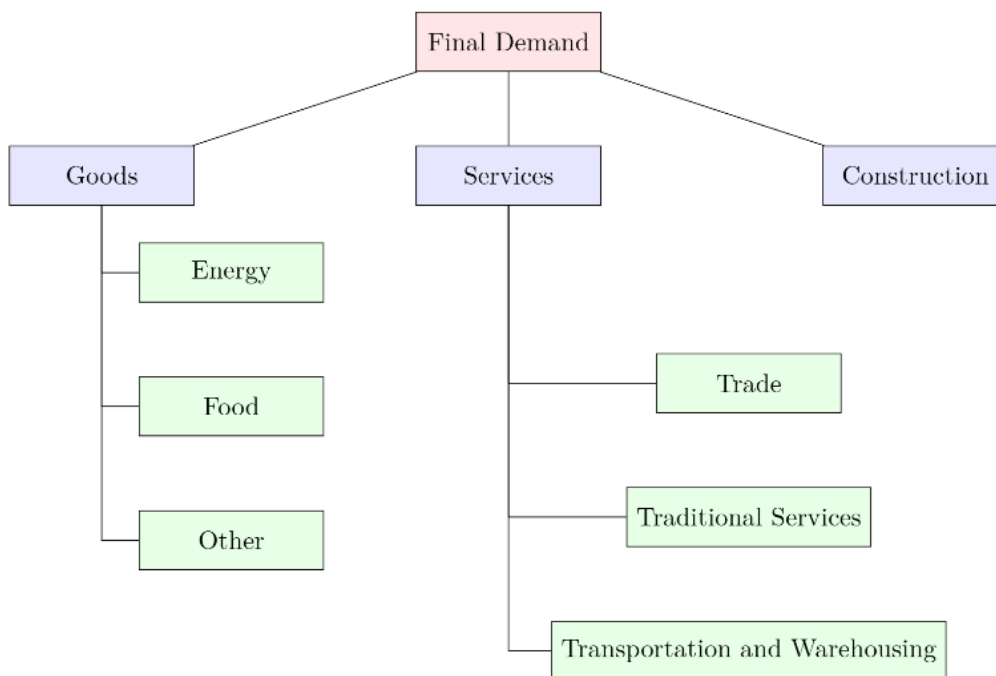

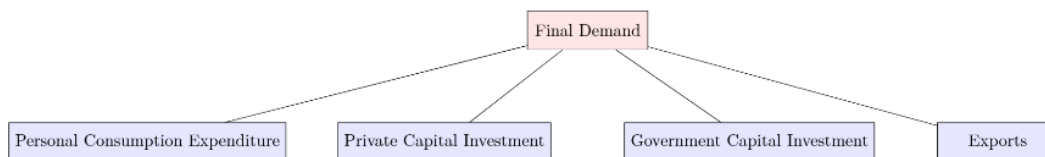Figure 2: Final-Demand Aggregation by Type of Output

Figure 3: Final-Demand Aggregation by Spending Sector

4.5 Coverage

While the FD-ID price indexes provide broad coverage across a wide range of goods and services, there are some gaps due to limitations in data availability. Certain products may lack reliable prices at this time. As a result, not all components of final and intermediate demand are fully captured within the current framework. Nonetheless, the overall coverage remains robust, and the indexes offer a representative and informative view of price movements across key areas of the economy. Ongoing efforts aim to address these data gaps and further enhance the comprehensiveness of the FD-ID system over time. Tables 3 and 4 shows the coverage percentage for both intermediate demand and final demand.

Table 3: Intermediate Demand Coverage

Classification	Coverage
Overall	71.48%
Processed Goods	100.00%
Unprocessed Goods	100.00%
Services	49.40%
Services less Trades, Transportation and Warehousing	42.17%
Services - Trades	98.15%
Services - Transportation and Warehousing	54.28%
Construction	100.00%

Table 4: Final Demand Coverage

Classification	Coverage
Overall	74.71%
Goods	98.98%
Services	53.52%
Construction	65.49%
Personal Consumption Expenditure	69.75%
Personal Capital Investment	70.31%
Government Capital Investment	54.69%
Exports	88.18%

4.6 Weights

The FD-ID price indexes are constructed based on the flow of goods and services within the production process, specifically identifying who purchases what from whom. To support this classification, SUTs and IO tables provide a comprehensive and structured representation of economic transactions across all sectors of the economy.

The Supply Table presents the total supply of each product by origin, either from domestic production or imports. The Use Table details how products are utilized, distinguishing between intermediate consumption and final consumption. Together, these tables can be used to derive the industry-industry flow of output presented in the symmetric IO table.

For the FD-ID product-based price index, product weights are taken directly from the Use table at basic prices. For the FD-ID production flow methodology, weights are taken from the symmetric IO table. These weights will be reviewed and updated annually with the release of the updated SUTs which are released with a roughly 3-year lag, ensuring alignment with the most recent structural economic data. Currently, the weight reference year for the FD-ID price indexes is 2021.

4.7 Index Calculation

4.7.1 Lower-Level Aggregation

Once the mapping of price indexes to their corresponding SUPC codes within SUTs is complete, the construction of FD-ID price indexes can proceed. In most cases, a one-to-one correspondence exists between individual price indexes and SUPC codes. However, instances arise where multiple price indexes correspond to a single SUPC code, constituting a many-to-one relationship.

In such cases, a period-to-period Jevons index is employed to derive the aggregate price relative for the SUPC. In this context, the *price* refers to the index value of the respective price index that has been mapped to the SUPC. The Jevons index between periods *t* and *t-1* is calculated using the following formula:

$$SUPC_i^{t/t-1} = \prod_{j=1}^{n} \left(\frac{p_j^t}{p_j^{t-1}} \right)^{1/n} \tag{1}$$

$SUPC_i^{t/t-1}$: The period-over-period index of SUPC i at period t.
p_j^t : The price of index j that is mapped to SUPC i at period t.

The Jevons reduces to a single price relative if there is only one index mapped to a SUPC.

4.7.2 Upper-Level Aggregation

Once the lower-level aggregates have been constructed, the upper-level aggregates of the FD-ID price indexes are calculated using a weighted arithmetic mean. This approach ensures that the contribution of each lower-level index to the upper-level aggregate reflects its relative importance.

The formula for calculating the period-over-period upper-level aggregate is as follows:

$$I_i^{t/t-1} = \sum_{j=1}^{n} SUPC_j^{t/t-1} w_j^t \tag{2}$$

$$Where:$$

$$w_j^t = \frac{SUPC_{j-1}^{t-1/t-2} w_j^{t-1}}{\sum_{j=1}^{n} SUPC_j^{t-1/t-2} w_j^{t-1}} \tag{3}$$

$$w_j^0 = w_j^1 = \frac{v_j^0}{\sum_{j=1}^{n} v_j^0} \tag{4}$$

$I_i^{t/t-1}$: The period-over-period relative for aggregate i at period t.
w_j^t : The price-updated weight of SUPC i at period t.

w_j^0 : The base period weight of SUPC i.
v_j^0 : The base period product weight of SUPC i.

4.7.3 Index Chaining

To derive the index series, the period-over-period price relatives are chained together across time.

$$I_i^t = I_i^{t-1} * I_i^{t/t-1} \tag{5}$$

I_i^t : The index at period t for aggregate i.
I_i^{t-1} : The index at period t-1 for aggregate i.

The current plan is for the FD-ID price indexes to start in 2018.

4.8 Release Policy and Revisions

The FD-ID price indexes are scheduled for quarterly publication, with data released one quarter after the reference period. A two-year revision policy will be implemented, allowing for the incorporation of updated source data. This approach ensures the accuracy and reliability of the indexes while balancing the need for timely dissemination.

5 Challenges

While the FD-ID price indexes framework provides a comprehensive view of price changes that will allow **Statistics Canada** to provide more detailed insights into domestic inflation, cost pressures, and supply chain dynamics, several challenges still exists. These include:

1. **Services Side Coverage**: Compared to the goods producing sector, coverage of services within the FD-ID price indexes remains more limited, reflecting long standing challenges in measuring prices for many service activities. Factors such as non-standard pricing models, contract-based transactions, and data availability constraints contribute to this gap. However, efforts are ongoing to expand and enhance services coverage, including the development of new price measures, improved data collection methods and the use of administrative data sources. These initiatives aim to ensure that the price indexes more accurately reflect the evolving structure of the economy, where services continue to play an increasingly prominent role.

2. **Integration of Diverse Data Sources**: The construction of FD-ID price indexes requires combining data from multiple sources. These data sources often differ in scope, definitions, periodicity, and classification systems. Harmonizing them into a coherent and internally consistent framework requires significant methodological alignment and may introduce compromises or simplifications.

3. **Operational Complexity Across Multiple Teams**: Data inputs for FD-ID price indexes are typically managed by various teams, each with their own production processes, schedules, and resource constraints. Coordinating across these teams presents logistical challenges

and can lead to inconsistencies in data delivery, processing timelines, and quality assurance standards.

4. **System Design and Usability**: Establishing a system that is methodologically sound, operationally efficient, and easy to maintain is a significant undertaking. The inherent complexity of SUTs classifications, product reallocation, and weight assignment makes it difficult to develop a production system that is both transparent and user-friendly, especially for ongoing updates and revisions.

5. **Finalization and Release Readiness**: Moving the index from late-stage compilation to release-ready status involves extensive validation, release-documentation, and quality checks. Given the volume and complexity of underlying data, the final stages of production can be resource intensive and time consuming, potentially delaying dissemination or increasing the risk of last minute changes.

These challenges highlight the need for ongoing development, refinement, and cross-team collaboration to ensure that FD-ID price indexes continue to meet user needs for accuracy, timeliness, and policy relevance.

6   Conclusion

The development of FD-ID price indexes represents a strategic modernization of Canada's producer price statistics. By leveraging **Statistics Canada's** extensive data and aligning with global standards, the FD-ID price indexes will improve the precision and policy relevance of inflation measurement in Canada.

Successful implementation will depend on sustained investment in data quality, methodological innovation, and engagement with users and stakeholders across government, industry, and academia.

7   References

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