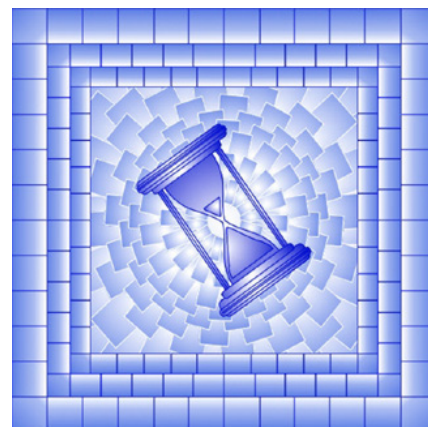


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Methodology for Lending Services Price Index (LSPI)

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Methodology for Lending Services Price Index (LSPI)

1. Overview

The Lending Services Price Index (LSPI) measures the monthly price change for existing lending services in Canada. The primary purpose of the LSPI is to provide supplemental information to help inform the deflation of the Banking industry ([NAICS 52211](#)) in the Canadian System of Macroeconomic Accounts' (CSMA). This industry is comprised of establishments primarily engaged in accepting deposits and issuing loans. The spread charged between the rates received from loans and the rates paid to depositors is called Financial Intermediation Services Indirectly Measured (FISIM). The LSPI measures changes in the lending component of this industry, and can be used as a partial deflator for the CSMA to arrive at estimates of real output.

2. Data

The data used to calculate the prices and weights for the LSPI are derived from three sources: the Bank of Canada's Report on New and Existing Lending (A4), Monthly Financial Market Statistics published by the Bank of Canada which summarize the interest rates on government debt of various terms and the CSMA Quarterly Gross Domestic Product by Income and Expenditure Accounts, which is used to deflate output in the calculation of the LSPI.

The A4 Report contains monthly lending data on all banks, foreign bank branches, trusts, and loan companies operating in Canada.¹ It requires each bank to provide data on interest rates and outstanding balances for eleven existing lending products, broken down by six interest rate term maturities (see [Appendix A](#)). The A4 data provides a snapshot of outstanding balances at the month end, which includes all new loans (funds advanced) added to and all loan repayment deducted from outstanding balances.²

3. Methodology

The primary activity of a bank is to transform the deposits of savers into loans for borrowers, a service referred to as depository credit intermediation. Banks indirectly earn significant income by collecting more in the interest charged on loans than they pay on deposits, and the output is referred to as FISIM. The LSPI aims to measure changes over time in the lending component of this industry by measuring changes in the spread between the lending rates associated with existing loans and a reference rate derived from risk-free government debt. The rates for risk-free government debt are considered to be the opportunity cost of funds, the return banks could earn on deposits while providing no lending services. By measuring changes in the actual rates received from loans and this reference rate, we can estimate the value added of the lending portion of FISIM, which can then assist with the deflation of the lending component of [NAICS 52211](#) in the CSMA.

3.1 Price Definition

Prices for the LSPI are derived as the difference between the annual percentage rates (APRs) lenders charge for each loan, and a reference rate calculated as the weighted average of yields derived from maturity matching risk-free government debt. A deflator is then applied to each price, as discussed above. Each elementary price is calculated as:

$$p_t^{bir} = (APR_t^{bir} - f_t) \times d_t$$

Where p_t^{bir} is the price for bank b , loan type i , rate type r in period t ; APR_t^{bir} is the interest rate for bank b , loan type i , rate type r in period t ; f_t represents the reference rate in period t , and d_t is the estimated level of the implicit price index in that period for Final Domestic Expenditure.

1. OFSI, [Report on New and Existing Lending](#).

2. A small portion of new loans are repaid before month end and hence are not included in existing lending data, however existing lending covers the majority of all lending activities and can be used to produce a high quality price index.

3.2 Reference rate

An appropriate reference rate represents the opportunity cost of funds for banks without any implicit service fees included.³ Therefore yields from risk-free government debt are used to create a reference rate which is then used in the calculation of each elementary price. There is no consensus either in literature or the international sphere on how this rate should be calculated. After experimenting using several individual reference rates, as well as multiple approaches to calculating mixed reference rates, a single mixed-maturity reference rate was chosen as the model. This conclusion was reached as it allows for a consistent calculation of an average opportunity cost for funds that is derived from yields on observable risk-free government debt, while also reflecting the average duration of the underlying loans.

The single-mixed reference rate (RR) is derived from six individual benchmark borrowing rates that come from the Common Output Data Repository's (CODR) Financial Market Statistics table [10-10-0122-01](#). These rates are the benchmark borrowing interest rates for loans of five different maturity groups. Since the Lending Services Price Index focuses on Existing Lending, which is comprised of loans that have been made in the past at differing points in time, a moving average is used to calculate these average borrowing rates for each of these six terms in a given period. The RR is a weighted average of these six moving average rates, with each individual weight being the specific loan term's proportionate share of funds outstanding (FO) over the previous rolling 12 months. Thus, the moving average of quoted interest rates and the moving average of funds outstanding (the amount of money lent out) are combined to calculate a single term representing the weighted average interest rate for the period. This rate is then used in each elementary price calculation (see [Appendix B](#)). The calculation of the RR is shown below:

$$RR_t = \sum R_{XmonthMArt} \times FO_{trailing12monthMArt}$$

where $R_{XmonthMArt}$ is the trailing X month moving average (MA) of the interest rate for term r , in period t , and $FO_{trailing12monthMArt}$ is the trailing 12 month MA of each interest rate term r 's proportionate share of the funds outstanding in period t .

The MA value for each loan term group reference rate is calculated as:

$$R_{XmonthMArt} = \frac{\sum R_{rt}}{X}$$

where $R_{XmonthMArt}$ is the trailing X month MA of the interest rate for term r , in period t , which is calculated as the simple average of the X month number of interest rate $APRs$ as outlined in [Appendix B](#).

3.3 Deflation

Since the value of money is eroded over time, a deflation factor is applied to the price calculation. By adjusting the LSPI prices, the index is better able to measure real changes in output through time, without any movements being attributable to changes in inflation. This ensures that the price index is comparable through time, regardless of varying inflationary pressures, and ensures that it only measures real price changes occurring in the Banking and Other Depository Credit Intermediation sector.

To adjust the LSPI, the implicit price index for Final Domestic Expenditure ([v61992662](#)) from the CSMAs' Gross Domestic Product by Income and Expenditure is used. The Gross Final Domestic Expenditure measures changes in the aggregate level of economic activity using expenditure measures, thereby removing general inflationary pressure from the output calculated by the LSPI, and ensures it only measures real changes in output. GDP calculated from Expenditures is used, ignoring adjustments made to balance with GDP calculated through income.⁴

3. This is considered to be the opportunity cost of funds because it is the rate that banks could theoretically lend their deposits at instead of offering lending services.

4. For a full breakdown of how GDP is calculated, see Chapter 5 in the article "[UserGuide: Canadian System of Macroeconomic Accounts](#)".

In order to properly create the index, it needs to account for the decline in the purchasing power of money over time on a cumulative basis. Since this implicit price index is only available quarterly, the third root of the quarterly growth rate is taken and then multiplied by the previous month's deflator to arrive at a cumulative monthly deflator, d_t .

$$d_t = d_{t-1} \times h_t$$

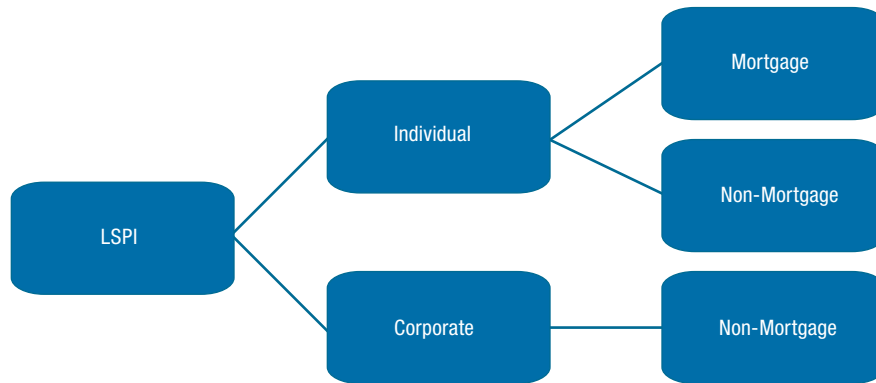
Where $d_t = 1$ in the first month. In subsequent months, d_{t-1} represents the previous month's deflator, and h_t is the monthly growth rate of GDI (Gross Domestic Income) deflator calculated as the cubic root of the quarterly growth rate.

$$h_t = \left(\frac{\text{Gross Domestic Expenditure}_q}{\text{Gross Domestic Expenditure}_{q-1}} \right)^{\frac{1}{3}}$$

Where h_t is the gross domestic expenditure monthly growth rate derived from the gross final domestic expenditure, implicit price index, from quarter $q-1$ to quarter q ([v61992662](#)).

3.4 Aggregation

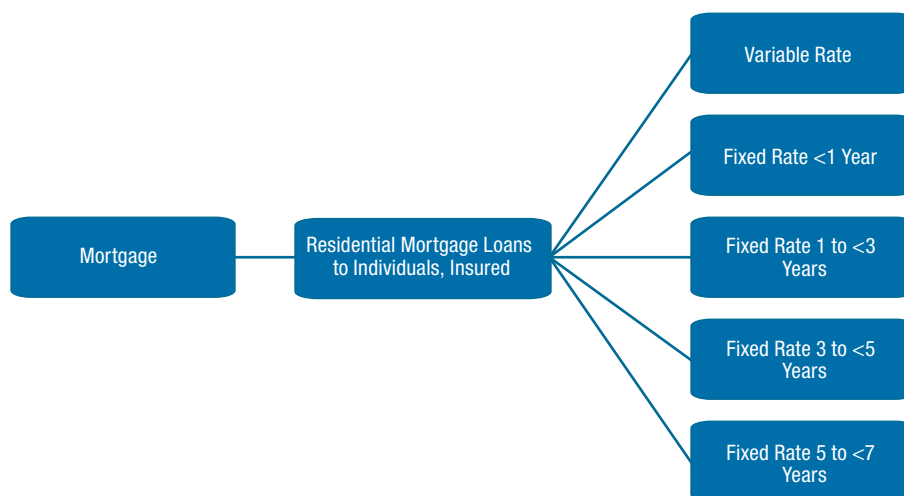
The LSPI is an aggregation of eleven products, which are further broken down by six loan maturity terms, as outlined in [Appendix A](#). The top levels of the LSPI are broken out to monitor price trends in both the individual and corporate sectors, and further broken down to identify changes between the mortgage and non-mortgage markets. To meet the needs of our data users, a Credit Card index will also be produced, and possibly others as needs evolve. At the top level, the LSPI (all Canada) will be aggregated as follows:



In order to weight the prices used at the various stages of aggregation, derived interest income (revenue) is used. Revenues are estimated by multiplying the *APRs* by the Outstanding Balances (*OB*), for each product i , at each maturity term r , for each bank b , in each monthly cycle t . The weight of each maturity term at the product level will be its proportionate share of revenue in the period, defined as:

$$w_t^{bir} = APR_t^{bir} \times OB_t^{bir}$$

For example, the aggregation for the *Residential Mortgages to Individuals, Insured* product, which falls under the Individual-Mortgage aggregation in the tree above is detailed below. The same aggregation approach is used for all eleven products, which can be found in [Appendix A1](#).



For the LSPI, a Laspeyres index is calculated using the following formula:

$$I_t^{Laspeyres} = \sum \frac{p_t^{bir}}{p_0^{bir}} \times w_0^{bir}$$

where p_t^{bir} is defined in section 3.3.

3.5 Revision and seasonal adjustment

With each release, data for the previous quarter may have been revised. Revisions can occur as the inputs used in the LSPI calculation (A4 data received from the Bank of Canada, as well as the GDI deflator value from the CSMA) are subject to quarterly revision.

The LSPI is also subject to an annual revision to be consistent with the CSMA, which is released with first quarter data following reference year.

The LSPI is not seasonally adjusted.

3.6 Basket updates

Weights are updated on an annual basis with the release of Q1 data.

Appendix A–New and Existing Lending (A4)

A1–Products included for LSPI

Section I – Interest rates (Percentages)

- To individuals:
 - ▶ Personal loan plans
 - ▶ Credit card loans
 - ▶ Personal lines of credit, secured
 - ▶ Personal lines of credit, unsecured
 - ▶ Other personal
 - ▶ Residential mortgages, insured
 - ▶ Residential mortgages, uninsured
 - ▶ Non-residential mortgages
- **Total personal loans and mortgages**
- To the corporate sector
 - ▶ Loans to regulated non-bank financial institutions
 - ▶ Lease receivables
 - ▶ Loans to individuals and others for business purposes
 - ▶ Residential mortgages
 - ▶ Non-residential mortgages
- **Total selected business loans**

Section II –Outstanding Balances (Thousands of dollars)

- To individuals:
 - ▶ Personal loan plans
 - ▶ Credit card loans
 - ▶ Personal lines of credit, secured
 - ▶ Personal lines of credit, unsecured
 - ▶ Other personal
 - ▶ Residential mortgages, insured
 - ▶ Residential mortgages, uninsured
 - ▶ Non-residential mortgages
- **Total personal loans and mortgages**
- To the corporate sector
 - ▶ Loans to regulated non-bank financial institutions
 - ▶ Lease receivables
 - ▶ Loans to individuals and others for business purposes
 - ▶ Residential mortgages
 - ▶ Non-residential mortgages
- **Total selected business loans**

A2-Maturities (Rate Type)

All

Variable rate

Fixed rate <1 year

Fixed rate 1 to <3 years

Fixed rate 3 to <5 years

Fixed rate 5 to <7 years

Fixed rate 7 years and over

Appendix B – Single-mixed reference rate calculation for the LSPI

The data for reference rates are obtained from the Common Output Data Repository (CODR) Table [10-10-0122](#).

Maturity (Loan Term)	Market Rate	Vector	Moving Average Number of Months (X)
Variable Rate	Overnight Rate	V122514 (y_1)	1
Fixed Rate <1 year	6 month Treasury Bill	V122532 (y_2)	12
Fixed Rate 1 to <3 years	1-3 year Government Bonds	V122558 (y_3)	36
Fixed Rate 3 to <5 years	3-5 year Government Bonds	V122485 (y_4)	60
Fixed Rate 5 to <7 years	5-10 year Government Bonds	V122486 (y_5)	84
Fixed Rate 7 years and over	5-10 year Government Bonds	V122486 (y_6)	120
Credit Card Loans (All)			

For example, with Fixed Rate 1 to <3 year, the average yields on 1-3 year Government Bonds for the most recent 36 months are calculated. These six averages are aggregated using the trailing 12 month outstanding balances of the matching maturities as quantity weights (credit card loans have only one term “All”, therefore not included in calculating these weights).