

Producers price index: concepts, sources, and methods

Second edition



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April 2016: We updated information about the published levels of New Zealand Standard Industry Output Categories (NZSIOC). See the last paragraph on page 13 for more detail.

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1. Introduction to *Producers price index: concepts, sources, and methods*

Purpose

Producers price index: concepts, sources, and methods aims to provide customers with a greater understanding of how we compile the producers price index (PPI).

The publication describes:

- key concepts and structure of the PPI
- our methodology for compiling the PPI
- how we review the PPI to maintain its relevance.

Feedback

In 2015 we completed a review of the scope and purpose of the PPI, and sought feedback on how we could make it more useful. Customers and stakeholders confirmed the need for an updated guide to the sources and methods we use to compile the PPI, so we published *Producers price index: concepts, sources, and methods*.

If you need further information about *Producers price index: concepts, sources, and methods*, or have feedback about the document, email info@stats.govt.nz with 'PPI sources and methods' in the subject line.

[See Review of scope and purpose of the producers price index](#) for more information about the review and changes we made to the PPI.



2. About the producers price index

How the PPI is used

The primary purpose of the PPI is for use by Statistics NZ as deflators in calculating gross domestic product (GDP), which is New Zealand's official measure of economic growth. These deflators remove the effect of price change so we can measure change in the volume of goods and services produced in the economy. For this reason, the current PPI aligns closely with the System of National Accounts 2008 (SNA08).

Other uses for the PPI include short-term indicators of producer inflationary trends, and in contract indexation clauses (also known as contract escalation). Recognising this usage, we published [Contract Indexation: A Guide for Businesses](#).

The different ways that people use the PPI can result in differing requirements for the way it is compiled. We decided on the index types, weighting schemes, pricing levels, transactions, and range of expenditure based on the PPI's primary purpose as a deflator in calculating GDP.

Accessing PPI data

We release the PPI quarterly as part of an integrated Business Price Indexes release, in the third week of the second month after the end of the reference quarter. For example, *Business Price Indexes: March 2015 quarter* was released on 19 May 2015.

[See Business Price Indexes – information releases](#)

You can access longer time series for all our PPI indexes (including discontinued series) on Infoshare, which provides online access to a wide range of time series data.

[Go to Infoshare](#) and access the PPI under the 'Economic indicators' category.

About price indexes

A price index measures price changes for a fixed set of goods and services. For any set of goods and services, a representative subset (a 'basket') is selected for pricing. This subset is a sample of the whole population of prices, and is intended to represent price change in the whole set of goods and services being studied.

A price index measures the percentage change in prices between time periods, not the actual level of prices. This means that the significance of a series of index numbers lies in their relative values. A single index number, when considered alone, provides no informational value. For an index to provide information on price change, at least two index numbers from the same time series are required to derive the percentage change in price. The index numbers must relate to the same index reference period (the reference point of 1000) to give a meaningful result.

A price index is a statistical measure that summarises the price change of the goods and services represented by the items in its basket. The basket itself is a statistical estimate, representing the experience of households or businesses at a particular period. The results have certain properties such as variability, sample and non-sample error, and defined scope or boundaries. These can all result in the price change identified varying from the true or ideal measure sought by customers. The price indexes we produce are therefore estimates of the actual change in the level of prices. Over time they will fluctuate above and/or below the true price change.

The accuracy of price indexes varies depending on the particular characteristics of each index. The nature of the commodities being measured is a factor affecting accuracy as some items are easier to price on a consistent basis than others. Services are known to be particularly problematic. Both the level and quality of output are often difficult to accurately identify and price. Furthermore, the level of disaggregation may affect quality, with indexes at a lower level generally having more variability than indexes at a more aggregated level where volatility from sampling is smoothed out.

In general, an index's accuracy depends on the nature of the commodity group or industry being measured, and the level within the hierarchy from which it is drawn. In most instances, customers make a trade-off between the level of detail contained in the index, and its statistical accuracy. Customers should be aware of this trade-off when using our indexes.



3. Conceptual basis of the producers price index

This chapter describes key concepts behind the producers price index (PPI), including the two main types of indexes (outputs and inputs), pricing, weighting, and reference periods.

Topics covered in this chapter are:

- [What the PPI measures](#)
- [Output indexes](#)
- [Input indexes](#)
- [Pricing concepts](#)
- [Weighting indexes](#)
- [Reference periods](#)

What the PPI measures

The PPI measures changes in prices for the supply (outputs) and use (inputs) of goods and services by New Zealand's productive sector. It measures changes in the prices of **outputs** that generate operating income, and **inputs** that incur operating expense.

The PPI does not include prices for items related to capitalised expenditure, non-operating income, financing costs, or employee compensation. Nor does it cover depreciation, or income related to property ownership when this is not the normal source of operating income.

Output indexes

The PPI output indexes measure changes in the prices received by businesses for the goods and services they produce. The definition of output is consistent with output as defined by the international System of National Accounts 2008 (SNA08).

The prices we use to calculate the output indexes are conceptually those prices received by the producer for the good or service. The output indexes cover:

- sales of primary products
- sales of manufactured goods
- revenue from renting and leasing
- provision of services
- capital work undertaken by the producer's own employees
- margins on goods purchased for resale.

While conceptually the above items are included in the output indexes, we do not directly price capital work undertaken by the producer's own employees or margins on goods purchased for resale. These transactions are included only in the weights of the PPI.

Excluded from the output indexes are:

- interest and dividends
- royalties and patent fees
- insurance payouts
- government cash grants
- excise taxes, GST, and other indirect taxes.

Input indexes

The PPI input indexes measure price changes in the current costs of production within the economy. The definition of current costs of production is consistent with intermediate consumption as defined in the SNA08.

Intermediate consumption within the SNA08 is equivalent to the goods and services used up in the production process by a business in creating its output. However, it **excludes** expenditure on both capital and labour.

The input indexes cover:

- purchase of materials
- fuels and electricity
- transport and communication
- commission and contract services
- rent and lease of land, buildings, vehicles, and machinery
- business services
- insurance premiums less claims
- financial intermediation services.

Excluded from the input indexes are:

- wages and salaries
- capital expenditure
- ACC levies and other government charges
- local authority rates
- royalties and patent fees
- bad debts
- donations
- depreciation and amortisation.

Pricing concepts

In the PPI we use 'basic' prices collected directly from producers to compile the output indexes. The basic price is the price the goods or service producer actually receives from the purchaser of the goods or service, minus any tax payable, and plus any subsidy received on that unit as a result of its production or sale. Sometimes we use the producer's prices when the basic price is not readily available. The producer's price is the

basic price, plus any non-deductible tax on products paid by the producer, less any subsidies on products received by the producer.

Prices we use in the input indexes are a mix of output proxy prices (at basic or producer's prices) and a few directly collected input prices (at purchaser's prices). Purchaser's prices exclude deductible taxes on products (eg GST), but include any non-deductible product taxes (if they exist) and any trade margins or transportation charges. We use output proxy prices under the assumption that the trade and transport margins represent a constant proportion of the purchaser's price over time, or that they are such a small proportion of the purchaser's price that changes in the margin proportions are unlikely to have any substantial effect.

Table 1
Example: PPI pricing basis

	NZ\$	
Basic price	105	Ideal output price
+ non-deductible taxes on product	0	
- subsidies on product	(15)	
= Producer's price	90	
+ transport and trade margins paid by purchaser	10	
= Purchaser's price	100	Ideal input price

GST is excluded when measuring input prices for most industries. Our assumption is those involved in activities in these industries are businesses that provide 'taxable supply'. GST paid on intermediate consumption is recoverable under the GST credit offset system and is therefore not part of the ultimate input price.

However some industries are exceptions to this assumption. Banking and finance, life insurance, and residential property operation industries provide some 'exempt supply' activities, whereby these activities are GST exempt. The exempt supply activities include provision of life insurance, financial services, and the rental of residential properties. Therefore, for these activities, input indexes are calculated inclusive of GST.

The measurement of change in the price of inputs for the owner-occupied dwellings industry is also calculated inclusive of GST. This industry comprises households that own their own homes and notionally rent them back to themselves. It includes private dwellings such as houses, flats, and farm houses, if they are owned by the people who occupy them. This is calculated inclusive of GST because householders are not able to claim back GST (in their capacity as final consumers) on their domestic expenditure.

Weighting indexes

We have always produced the output indexes using gross weights, which means the values of all outputs within the same industrial classification category are in scope for weighting and pricing. This ensures the indexes completely cover the targeted industries.

National accounts require gross weighting to deflate gross flows of industry income and expenditure, as this is done in national accounts using NZSIOC level 4 PPI indexes. However, when using gross weighted indexes, multiple counting of price change can occur as products flow through the different production processes – this occurs where the output of an enterprise is used as the input into another enterprise within the same PPI industry. Therefore, the double counting of price movements makes the indexes less useful for inflation monitoring.

Reweighting indexes

We periodically review the PPI indexes on a rolling cycle to ensure the:

- scope and coverage of the indexes continue to meet the needs of customers
- structure of the indexes reflects the up-to-date activities of the industry concerned
- respondent load on surveyed businesses is minimised
- weights we use continue to be representative of the industry concerned.

We annually reweight the PPI industry and commodity weights, using detailed product information sourced from the supply and use reconciliation undertaken annually in the national accounts. The weights associated with the commodities, and the weights attached to each industry, are therefore annually chain-linked. This reflects changes in economy-wide income and expenditure in the mix of products and the mix of industries. The industry specific baskets and weights are provided in the industry and commodity by industry weights tables.

We undertake a rolling review of industries to refresh the NA06CC commodity weights which feed into our national accounts supply and use tables. The same reviews are used to update the prices feeding into the representative commodities, and the weights of the representative commodities feeding into the NA06CC commodities.

[See Chapter 6: Rolling review of the producers price index](#) for more information.

Reference periods

Weight reference period

The weight reference period of an index refers to the year or years from which the weighting data was derived. We introduce updated PPI weights each March quarter. For example, the March 2015 quarter introduced an updated weight reference period of the year to March 2012. The time lag is due to the time it takes our National Accounts team to complete the annual supply and use reconciliation.

Price reference period

The price reference period is the quarter that the latest quarter's prices are compared with in order to calculate indexes. As part of updating the weight reference period (see above), we update the price reference period to the December quarter of the previous year. For example, for the updated weights applied in the March 2015 quarter (which are used to weight price movements from the December 2014 quarter to the March, June, September, and December 2015 quarters), the price reference period was the December 2014 quarter.

Index reference period

The index reference period of an index is the time period (ie month or quarter) used for comparing indexes. This is where we set the index number to 1000. Changing the index reference period is a matter of convenience and does not change the meaning of the index. The percentage change between each period is unaltered by this process.

Customers may wish to re-express an index in terms of a common index reference period to allow comparison of series with differing index weighting reference periods.

We do not regularly change our index reference periods. Historically this has only happened when we have changed to a new industry classification. As from the March 2011 quarter, the index reference period of the PPI indexes was changed to the December 2010 quarter (=1000).



4. Structure of the producers price index

This chapter describes the industry and commodity classifications that we use in the producers price index (PPI), and how these are structured to compile the index.

Topics covered in this chapter are:

- [Industry classifications](#)
- [Commodity classifications](#)
- [‘Building block’ structure](#)

Industry classifications

The PPI uses the industrial classification New Zealand Standard Industrial Output Categories (NZSIOC). NZSIOC is based on Australian and New Zealand Standard Industrial Classification 2006 (ANZSIC06), and was introduced to obtain standardisation across all aggregated economic outputs. NZSIOC is hierarchal with four levels, with the most detailed level (level 4) having 118 distinct industry groupings.

The price index for each industry within the PPI is calculated at level 4. For confidentiality reasons, the most detailed level of data we publish in our information releases is level 3.

[See New Zealand Standard Industrial Output Categories \(NZSIOC\)](#)

[See Australian and New Zealand Standard Industrial Classification 2006 \(ANZSIC06\)](#)

Commodity classifications

The PPI uses two commodity classifications: National Accounts 2006 Commodity Classification (NA06CC) and Central Product Classification (CPC).

The NA06CC classification is a Statistics NZ classification developed by our National Accounts team. We use this classification for the ‘NA06CC commodity’ indexes in the PPI.

The CPC classification is an international classification that we use to classify our ‘representative commodity’ indexes. See ‘Building blocks’ below for information on how these commodity indexes are linked together.

Building block structure

The hierarchical structure we use to compile the PPI indexes is organised into levels and building blocks. Each building block consists of an index and its input prices/indexes and weights. A building block can feed into the level above.

The benefits of using a building block structure include increased industry and commodity detail, analytical capability, and the ability to undertake periodic reweighting and updating of blocks in the structure on a rolling basis.

We introduced a building block structure for the PPI indexes during a 1996–98 review. When we implemented the ANZSIC06 industrial classification we introduced an additional commodity level, the NA06CC, to the structure.

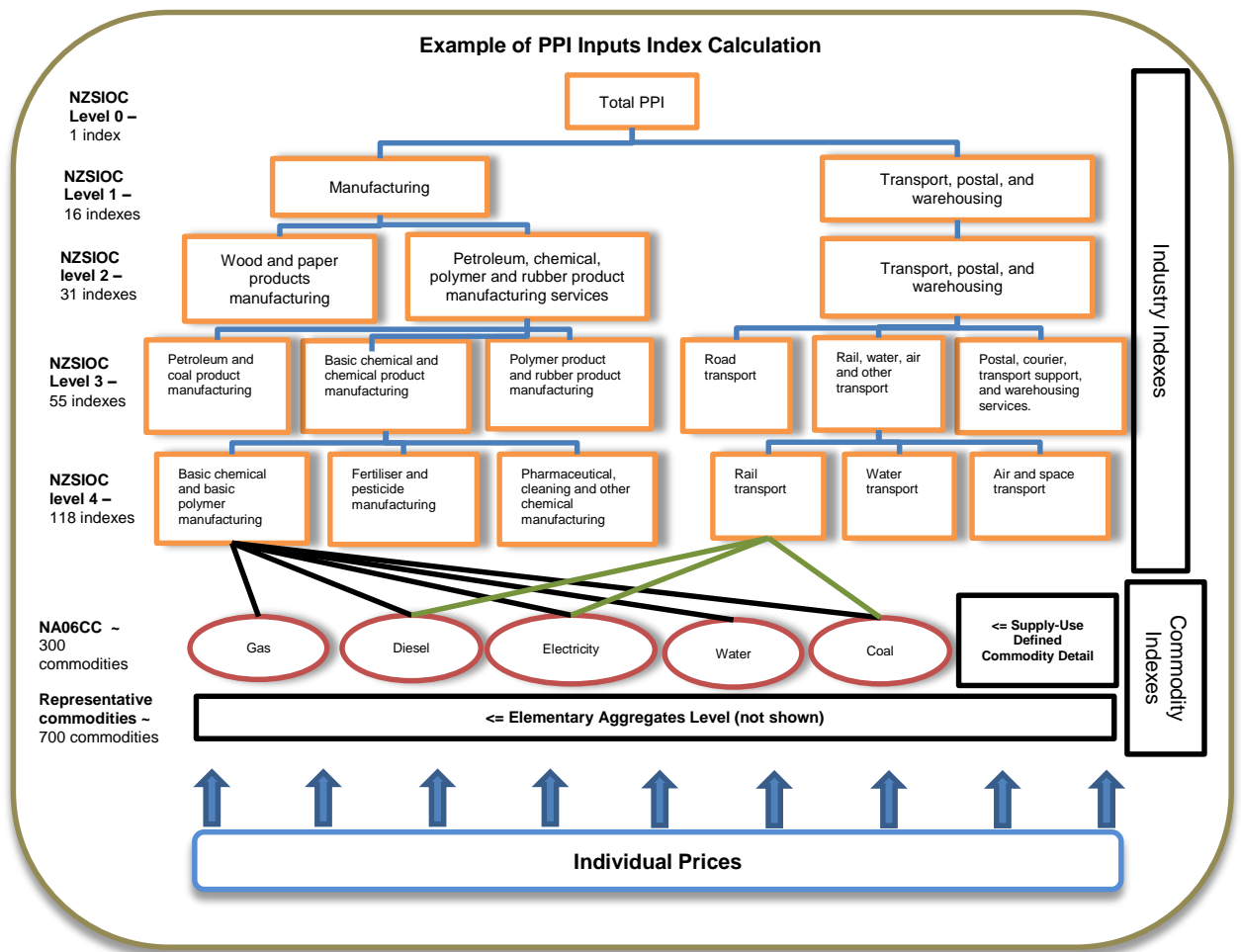
The most detailed price indexes are called representative commodities – there are over 700 of these. The price indexes for one or more representative commodities are combined into a higher-level price index at the NA06CC commodity level – there are

about 300 of these. Generally, a representative commodity contributes only to one NA06CC commodity.

Every NA06CC commodity then feeds into the lowest breakdown of industry level indexes – NZSIOC level 4. These level 4 indexes then aggregate to published industry level indexes – NZSIOC level 3, then level 2, then level 1, and finally aggregating to the all industries PPI.

See Figure 1 for an example of the building block structure for PPI inputs. This diagram is not the complete view of the PPI structure – it is an example to show how the building block structure works for both the input and output indexes. The level descriptions on the left side of the diagram include the number of indexes at each NZSIOC level, and the approximate number of commodities we compile at each level.

Figure 1
Example: PPI inputs index



We publish industry indexes at NZSIOC levels 0, 1, 2, 3, and selected level 4 industries. We also publish some commodity indexes, and mention unpublished indexes in terms of their contribution to the published indexes in the PPI information release.

5. Methodology for compiling the producers price index

This chapter describes the methods we use to compile the producers price index (PPI), including the index formula, and how we collect prices of goods and services and account for quality change over time.

Topics covered in this chapter are:

- [Price index formula](#)
- [Price collection](#)
- [Quality change](#)

Price index formula

Price indexes are the result of mathematical formulae that bring together information on individual prices, allowing them to be compared in a meaningful way. This is achieved by assigning a weight to each priced item, which reflects the relative importance of that item in the index being calculated. These weights are based on the comparative value of the item in either a business's inputs or outputs. The indexes are formulated to measure change in the level of prices.

The price index formula most commonly used in New Zealand and internationally is the Laspeyres formula. We compile the PPI indexes using a variant of this base-weighted formula. Due to the substantial amount of time required to collect weighting and pricing information from respondents, the weight reference period in which we collect the quantities is not exactly the same as the period in which we collect the reference period prices. Additionally, we 'price update' the weights in the annual reweight (ie express the quantities of the weight reference period in the prices of the price reference period) which makes our index technically a Lowe price index, rather than a pure Laspeyres price index.

Laspeyres price index

A base-weighted Laspeyres price index measures the changing cost over time of a fixed 'basket' of goods and services. A PPI outputs index measures the revenue from selling, while a PPI inputs index measures the cost of purchasing, a basket of goods. The expenditure aggregate form of the Laspeyres formula is:

$$I_t^{Lp} = \frac{\sum_{i=1}^n p_{it} q_{i0}}{\sum_{i=1}^n p_{i0} q_{i0}} \times 1000$$

Where I_{Lpt} = Laspeyres Price Index Number at time t

P_{it} = The price of good or service i in period t

P_{i0} = The price of good or service i in period 0 (the price reference period)

n = The number of goods and services in the basket

q_{i0} = The quantity of good or service i in period 0

The Laspeyres index can also be expressed in an equivalent form called the weighted price relatives form. The derivation of this form is given below:

$$I_t^{Lp} = \frac{\sum_{i=1}^n p_{it} q_{i0}}{\sum_{i=1}^n p_{i0} q_{i0}} \times 1000$$

$$P_{it} = \frac{p_{it}}{p_{i0}} \times P_{i0}$$

$$I_t^{Lp} = \frac{\sum_{i=1}^n \frac{p_{it}}{p_{i0}} p_{i0} q_{i0}}{\sum_{i=1}^n p_{i0} q_{i0}} \times 1000$$

$$= \sum_{i=1}^n \frac{p_{i0} q_{i0}}{\sum_{i=1}^n p_{i0} q_{i0}} \left(\frac{p_{it}}{p_{i0}} \right)$$

$$\text{Let } w_i = \frac{p_{i0} q_{i0}}{\sum_{i=1}^n p_{i0} q_{i0}}$$

$$I_t^{Lp} = \sum_{i=1}^n w_i \times \frac{P_{it}}{P_{i0}} \times 1000$$

In words, the relative price of item i in period t when compared with the price reference period 0 is multiplied by w_i , the weight of item i in the basket. The weight of each item i represents the total revenue or cost of q_{i0} units of good i at price reference period prices.

The numerator of the index's expenditure aggregate gives the total cost of the fixed basket of goods in the current period t while the denominator gives the total cost of the fixed basket of goods in the price reference period 0 . The ratio of these two costs (multiplied by 1000) gives the price index number.

Using the Laspeyres formula assumes, through fixed reference period weights, inelastic demand. That is, there are no quantity changes or substitution of products in response to price changes or changes in taste and fashion. Purchases and sellers do respond to relative price changes, and the impact of this can be mitigated by reweighting the index frequently.

Example of calculating a Laspeyres price index

Two items, A and B, make up index C. Assume that we will construct an output price index. In the base period, 2,500 units of A are sold for \$1 each, while 1,500 units of B are sold for \$5 each. That is:

$$q_{A0} = 2,500$$

$$p_{A0} = 1$$

$$q_{B0} = 1,500$$

$$p_{B0} = 5$$

$$w_A = \frac{1 \times 2,500}{1 \times 2,500 + 5 \times 1,500} = 0.25$$

$$w_B = \frac{5 \times 1,500}{1 \times 2,500 + 5 \times 1,500} = 0.75$$

A weight describes the relative importance of an item in the make-up of the final index. In this example, item B is more important than A, being 75 percent of the total reference period weight. Item A accounts for 25 percent.

In period 1, the price of A increases to \$2 and the price of B increases to \$6. Using these weights and prices in the weighted price relatives Laspeyres formula, we get:

$$I_t^{Lp} = \sum_{i=1}^n W_i \times \frac{P_{it}}{P_{i0}} \times 1000$$

$$I_1^{Lp} = \left(0.25 \times \frac{2}{1} + 0.75 \times \frac{6}{5} \right) \times 1000$$

$$I_1^{Lp} = 1400$$

In period 2, the price of A remains at \$2, and the price of B falls back to \$5. Using these prices, we get:

$$I_2^{Lp} = \left(0.25 \times \frac{2}{1} + 0.75 \times \frac{5}{5} \right) \times 1000$$

$$I_2^{Lp} = 1250$$

From this example we can see that movements in a Laspeyres index are the result of changes in relative prices. Once the weights for a Laspeyres index are set, movements in that index are driven by changes in the comparative prices charged by businesses.

Price collection

The PPI measures price change, over time, in broad industries of the New Zealand economy. Transactions for each of those industries may cover purchases and sales of thousands of different goods and services at a wide variety of prices. The sheer volume and complexity of these transactions means it is impossible to collect prices for every good or service or to take into account every price at which they are sold. Consequently, we need to adopt a sampling approach, pricing a sample of products from a sample of respondents.

Sample approach used

The PPI is based on 'purposive' or judgement samples, where the sample is selected on the basis of the knowledge and judgement of staff compiling the index. The alternative of using probability sampling (having some random aspect to it) would be more difficult and expensive to use. In particular:

- Factors other than sales volume are important when selecting items and businesses. These include availability of prices on an ongoing basis, degree of price dispersion, and the pricing behaviour of businesses.
- Judgement sampling is more practical in the day-to-day operations of price collection, as the selection of items and suppliers regularly needs to be updated as businesses close or items are no longer produced.

We use business directories, market reports, our Commodity Data Collection Survey, and other information to select and maintain samples of suppliers and products (specifications) for pricing.

The effectiveness of this sample approach depends on the representativeness at each hierarchical level of an index. In our approach:

- key commodities are selected to adequately represent the price movements for all the commodities that come within the scope of the particular price index
- businesses are selected to adequately represent all the suppliers/users of the selected commodities
- product specifications are determined for each surveyed business to adequately represent the product range of that business within the selected commodity description
- transaction prices that best represent the price movements of all transactions for the selected product specification are obtained.

Our use of judgement sampling has implications for the selection of replacement product specifications or businesses. Individual specifications and businesses may be representing a category of specifications or businesses, not just themselves (for example, a selected business may represent medium-sized firms or a specification may represent a broader product grouping).

Therefore the selection of replacement specifications takes into account these characteristics and, as far as possible, ensures that the category is still covered by the new specifications or businesses.

Establishing and maintaining samples

Price indexes are only as valid as the price samples they are based on. Consequently, in selecting the samples for basket items with a large weight in a published series, our aim is to cover those businesses accounting for a high proportion of sales or purchases of the products making up the index item. For less significant items, coverage may be lower.

We take care to ensure the selected businesses are representative of all the businesses trading in the less significant item.

Price indexes aim to reflect changes in market transaction prices. Therefore, the specifications identify the precise terms under which transactions are typically made. Prices collected take account of the discounts, surcharges, conditions of sale, order sizes, type of customer etc. We use list prices when most transactions in a specification occur at the list price or no alternative is available.

When selecting specifications to be priced, we consider the following factors:

- The relative importance of the item in an index – more important items (ie higher weights) are given greater representation.
- The degree of homogeneity within the index item – more homogeneous items require smaller samples.
- Influences that can cause prices of some specifications to move differently from others within the category. It is important to reflect all the significant influences in the sample.
- The extent to which the specification is expected to be continuously available for pricing. Preference is given to specifications for which transaction prices are available on a continuous basis.
- Whether the specification can be clearly described in terms of quantity and quality, so those prices can be collected over time for an item of constant quality.

Over time, the samples of businesses and specifications may become unrepresentative, or the proportions in which they are combined to calculate the index numbers may become outdated. Therefore we review the samples of businesses and specifications on a rolling basis to ensure they remain representative. When new or changed samples are incorporated in the index, we link the resulting index numbers using an overlap period. This ensures that only price movements, and not any effect of the sample change, are shown in the index.

Price collection procedures and timetable

We source most PPI prices by quarterly postal survey. The pricing date is the 15th of the middle month in the calendar quarter. This approach assumes that movements in prices between two dates that are three months apart adequately represent quarterly price movements.

The survey we use is called the Commodity Price Survey. We obtain individual price quotes for the PPI from about 2,200 different businesses and cover about 300 NA06CC commodity groups. Many prices are also used in other business price index series, such as the capital goods price index (CGPI) and the farm expenses price index (FEPI). Some prices that we principally collect for other indexes, including the consumers price index (CPI), are also used in the PPI. A small, but growing, number of prices are also collected from administrative sources such as the Internet. Our rationale for sharing prices between indexes or using other sources, where appropriate, is to minimise the administrative load placed on surveyed businesses and to optimise coherence across all our price indexes.

Some items are subject to significant price variation, such as agricultural outputs. In these cases we collect prices at more regular intervals, rather than quarterly. In a small number of cases, such as local authority rates, prices are known to be set once each year, so we collect prices annually.

Special pricing treatments

Foreign currency pricing

The Commodity Price Survey asks respondents to quote prices in New Zealand dollars. However, some prices are provided in foreign currencies (eg US\$), which we convert to New Zealand dollar prices when the questionnaires are returned.

We convert these prices using the mid-quarter exchange rate for that currency (that is, divided by the bank selling rate at the 15th day of the middle month of the quarter).

Seasonal treatment

Some commodities are produced for only part of the year (for example, strawberries). The practice we adopt in these cases is to repeat (carry forward) the last reported price until the next season's trading occurs and a new price can be collected.

This practice means that when we make a quarterly comparison, the not-in-season commodities contribute no change to the index movement. For any comparison of the latest quarter with a period a year or more earlier, all commodities will have a bearing on the index movement. While this practice has some weaknesses, we chose it in preference to having variable weights on a commodity depending on the quarter (for example, giving commodities a weight of zero when they are not in season). This approach makes our analysis of contributions to index movements more straightforward.

We trialled the two methods and saw no significant difference in the index movements using fixed and variable weights. The fixed weights approach is easier to administer, resulting in less potential for error.

Weighted average quarterly prices

Most commodities in the PPI are priced at the 15th day of the middle month in each quarter. Movements in these mid-quarter prices are then taken to represent movements in weighted average prices for the whole quarter. This assumption is acceptable for the majority of commodities. For those commodities with particularly volatile prices and/or high weights, we aim to collect or calculate average prices over the whole quarter. Examples include fuel, dairy products, and some commodities sold at auction, including fresh fruit and vegetables, livestock, and wool.

Additionally, we use weighted average quarterly prices for many exported and imported products we collect from the Overseas Trade Index (OTI). These prices are a unit value calculated as the total imports/exports of a product, divided by the total quantity of the product imported or exported.

Quality change

Our price indexes measure the extent to which the cost of an identical basket of goods and services changes over time, unaffected by changes in quality, quantity, or terms of sale. This is often referred to as 'pricing to constant quality'. This is a difficult objective for us to achieve because the characteristics of the good being sold in the market place, and its terms of sale, often change over time. Frequently the precise commodity priced in one period is no longer available in the next period. Either there has been some change in the characteristics of the commodity or something new has taken its place. Therefore, we need to use statistical techniques to identify quality differences and eliminate their effect on the calculation of price change.

The concept of quality

To identify and assess quality change in our price indexes we consider:

- how changes in commodity specifications affect the utility or usefulness of the good or service to the purchaser
- the cost of actually producing the item.

For goods where quality is closely associated with the quantitative characteristics of the product, an assessment of quality change is relatively straightforward because we can usually measure these characteristics objectively. For example, if a \$4.00 box of chocolates increases in price by \$1.00 and the quantity of chocolates also increases by 25 percent, it is easy to see that no price change has occurred from the purchaser's point of view.

It is more difficult to assess quality change when it is not purely quantitative, or involves a number of quantitative variables that may conflict in terms of their effect on quality. For example, an increase in the power of a car engine which improves performance but increases fuel consumption – it would be difficult to determine whether there is a net increase or decrease in value to the purchaser.

Identifying changes in quality

To identify changes in quality, we need to collect a considerable amount of detailed information about the goods we price. We obtain some of this information while collecting and checking price data during compilation of the price indexes. We check instances of unexplained price change with surveyed businesses to determine whether they represent a genuine price change or a change in quality.

Taking account of quality change

Whenever we determine that a change in quality has occurred in a product being priced, we aim to eliminate the effect that the quality change has on the price. This must not interfere with the measurement of any true price movement that might have occurred over the same period. The way we do this depends on the circumstances of the quality change. There are three common situations:

- Overlapping sales – where one product is replaced by another of different quality, but both have sold during an overlapping period.
- Not sold at the same time – where one product is replaced by another of different quality, but the two have not been available at the same time.
- Change in composition – where there are some changes in the composition of a particular product.

Overlapping sales

The first common situation where we aim to eliminate the effect that quality change has on the price is when the brand or model being priced ceases to be available. But there is another similar item which has been, and continues to be, available in the same market as the first item and is expected to be a substitute for the first item.

In this situation, we collect prices for both items at the one date – provided the two items have sold side by side for some time in the same market and both have sold in reasonable quantities.

Here we assume that the difference in prices at that date represents the difference in quality between the two. Our assumption is that the market has adequate knowledge of the qualities and prices of each product and that it regards the price difference as a

reasonable measure of the quality difference. We then substitute the second item for the first by linking the price series, as shown in Table 2.

Table 2
Example: Overlapping sales

	Period 1	Period 2	Period 3
Price of harvester A	\$80,000	\$85,000	
Price of harvester B		\$95,000	\$98,000
Price relative for harvester	$80,000/80,000$ = 1	$85,000/80,000$ = 1.063	$[98,000 \times (85,000/95,000)]/80,000$ = 1.096
Product total	1×1000 = 1000	1.063×1000 = 1063	1.096×1000 = 1096

The price movement reflected in the index from period 1 to period 2 is the movement in the price of harvester A. The price movement from period 2 to period 3 is based on harvester B, which we will price in subsequent periods to replace harvester A. The difference in price between harvester A and harvester B has been eliminated through the process of linking the new price series to the old price series.

We have to take care when selecting the linking period. Because in many instances, an older model may be discounted following the introduction of a new model. And if we use a discounted price in the link between the old and new models, an unrepresentative price movement may result.

In some cases, linking the price of the new specification to the existing price series is not a satisfactory way of eliminating changes in quality. This situation occurs, for example, when the price of a new model reflects not only the extent of modifications but also a degree of price change, upwards or downwards, for reasons distinct from these modifications. Linking the old and new prices would eliminate the elements of pure price change as well as the elements of quality change.

In these cases, we assess the degree of pure price change involved, and ensure this is reflected in the price series after linking. How we do this is described in 'Not sold at same time' below.

Not sold at same time

The second common situation where we aim to eliminate the effect that quality change has on the price is where one product replaces another, but the two products have not sold side by side in the market place.

In this situation, we identify any quality differences between the old and new products and estimate the value of these differences. A simple example of this sort of quality change is the replacement of a 50-litre drum of industrial solvent by a 45-litre drum. In such cases, where the proportionate change in quantity is relatively small, it is reasonable to assume that the value of the change is directly proportional to the change in quality. That is, we can make the price of the 45-litre drum comparable with the previous price of the 50-litre drum by applying a factor of 50/45. Therefore, we calculate a price relative for industrial solvent as shown in Table 3.

Table 3
Example: Not sold at same time

	Period 1	Period 2	Period 3
Price of 50 litre drum	\$40		
Price of 45 litre drum		\$40	\$42
Price relative for solvent	$40/40$ = 1	$[40 \times (50/45)]/40$ = 1.111	$[42 \times (50/45)]/40$ = 1.167
Product total		1.111×1000 = 1111	1.167×1000 = 1167

However, if the proportionate change in the unit of quantity is large, this technique is not appropriate. For example, the unit price of a kilogram of cement when purchased in a 25-kilogram bag cannot be directly compared with the unit price of a kilogram of cement purchased as part of a truckload. The two products are different in the sense that they would usually sell in different markets and to different kinds of users. In these circumstances we estimate the difference in quality using different methods, and sometimes also use expert judgement.

Change in composition

The third common situation where we aim to eliminate the effect that quality change has on the price is where there are changes in the composition of a product.

In this situation, we identify the quality differences and place a value on them. Frequently the composition of a product changes as a result of adding or removing features, or using different materials. For example, a change in the wool/synthetic mix of yarn. In these cases, we estimate the value of the quality change to the purchaser by determining the additional cost (or saving) to the manufacturer and examining the prices of broadly comparable items (for example, yarns containing various proportions of pure wool and synthetic fibres).

Sometimes the modified product differs substantially from the previously priced product – as occurs with a change in models for a particular brand of motor vehicle. To take account of this type of quality change, we collect a considerable amount of information on the products from suppliers, and in some cases use our judgement, to estimate a monetary value by which to adjust the price.

Our first step is to determine the differences between the old and new models as precisely as possible. Then we determine which of these differences represent changes in quality, and estimate the monetary value of each change. Some changes are relatively simple to quantify. For example, changing the type of tyres on a new model car when both types of tyres are sold separately on the market – the value of the quality change can be assessed as the difference in the selling prices of the tyres. Other changes require more detailed examination, for example, if a new model car has eight airbags while the old model has four airbags.

While there is some subjectivity involved in placing a dollar value on the changes in a product, quality adjustment procedures mitigate potential long-term bias in the price series. But ignoring quality changes altogether could result in significant biases in the price indexes.

Styling and packaging changes

We do not consider product changes that are purely styling changes to be changes in quality. For example, we regard the current year's range of bricks as being equivalent to last year's if the general quality of workmanship and function is similar, regardless of the actual colour, texture etc. Similarly, we do not regard styling changes in the external trim on an escalator to be quality change. We adopt this approach because it is not really possible to estimate an objective value for something as subjective as a change in styling.

Changes in packaging that do not affect the quality of the package contents have no effect on quality. However, if a different type of packaging for building materials, for example, resulted in less damage to the product while being transported, we would take this into account as a quality change.



6. Rolling review of the producers price index

This chapter describes the steps we take to develop or review a price index. We review the producers price index (PPI) on a rolling basis to ensure the index baskets remain representative of the actual purchasing and selling patterns of industries.

The main steps we take are:

- [Establish the conceptual basis and coverage of the index](#)
- [Collect income and expenditure information from businesses](#)
- [Establish the commodity groups](#)
- [Select the items to be priced](#)
- [Determine the index weights](#)
- [Document the weighting and pricing methodology.](#)

Establish the conceptual basis and coverage of the index

The conceptual basis for a price index provides the foundation on which we build the index structure. It establishes the scope and coverage of an index, and outlines the key terms and methods. For example, the conceptual basis establishes the range of businesses from which we collect prices, definitions of the inputs and outputs we price, and key practices such as the treatment of taxes.

Using a well-defined conceptual basis ensures that the prices we collect over time are consistent, and our indexes have a clear interpretation. Without this consistency, the results will lack meaning and may be used inappropriately. For example, customers of the PPI inputs indexes might index costs in a supply contract using these indexes without realising they exclude labour and capital items.

[See Chapter 3: Conceptual basis of the producers price index](#) for more information.

Collect income and expenditure information from businesses

We carry out considerable research to derive income and expenditure values in sufficient detail for index weights to be accurately calculated, and appropriate items to be selected for pricing.

The main data sources we use are:

- Commodity Data Collection Survey
- other Statistics NZ surveys
- import and export statistics
- parliamentary reports and company reports
- information from government departments, and professional and business organisations
- ad hoc surveys and discussions with businesses.

The Commodity Data Collection Survey is a dual-purpose survey that collects income and expenditure information by commodity from a representative sample of businesses in each industry of the economy. In addition to being the main source of PPI weights, this survey provides the information we need to update income and expenditure commodity proportions, as used in the balancing of the current price annual national accounts.

Establish the commodity groups

Under the index structure, there are two levels of commodity groups – NA06CC commodities, and representative commodities.

To determine the weights of the NA06CC commodity level, we use the supply and use reconciliation carried out annually as part of the national accounts. By having this level, we can use the supply and use reconciliation to update the weights of the NA06CC commodities and industry levels annually. We have been using this method since 2011 to ensure our indexes remain relevant and up-to-date.

Representative commodities are designed to contain a selection of prices for similar types of goods and services. The commodities are loosely based on the international standard commodity classification, Central Product Classification.

However, the relative importance of each classification code determines the way that we split the income and expenditure of the industry into representative commodities. Categories with large incomes or expenditures may be split into two or more categories, while categories with small incomes or expenditures may be aggregated. Insignificant categories may be excluded altogether.

In addition, industry outputs may be sold both domestically and exported, while industry inputs may be sourced from domestic production and imports. Therefore, three separate representative commodities are possible:

- commodity domestic sales
- commodity export sales, and
- commodity import purchases.

[See Chapter 4: Structure of the producers price index](#) for more information about the commodity groups.

Select the items to be priced

The number and description of items we select to price in any commodity group depends on the importance of that commodity group in relation to total expenditure or income. Typically, priced items are representative of a broad category or group of items where small weights have been added together.

We select items by using statistical techniques or subjective methods such as purposive sampling, which relies on a wider range of information and judgement from the development team. When we use purposive sampling it is to ensure the respondent load on surveyed businesses is kept to a minimum.

Determine the index weights

The weighting process is an arithmetic procedure that enables us to express the dollar value of expenditure on, or income from, particular items or groups of items as index weights. These weights sum to a common total in every index. We calculate the weights at each level of the index according to the relative importance of commodities and businesses within an industry or industry group.

Often we derive an expenditure weight for a commodity or item that is too low in value to be worth obtaining an explicit price. This weight is added to the expenditure of a similar commodity item. This has the practical effect of imputing a price movement based on the movement of the similar commodity/item.

Document the weighting and pricing methodology

We create and maintain comprehensive documentation as part of the review. Its primary purpose is to inform customers and future developers about the nature of the measures produced.

Typically, a price index summarises a considerable amount of information and presents it as a single numeric series. In order to understand the meaning of this abstract set of numbers, customers need accessible documentation that explains both the index methodology and practices. This documentation is particularly important for analysts interested in time series analysis. Such documentation is the key to understanding an index's coverage and quality many years after it has been produced. This documentation generally includes:

- an explanation of the conceptual basis of the indexes
- analysis of data sources used for both weights and prices, including a discussion of quality and coverage
- details of pricing methodologies, including strengths and weaknesses
- details of baskets produced, including a comparison with previous information to explain the impact of structural change in the industry.

7. Historical background to the producers price index

This chapter outlines the main changes we have made to the producers price index (PPI) since it was first published.

In 1920 the Department of Statistics first published a forerunner to the PPI, the wholesale price index. It was not until 1978 that coverage of the index was expanded and a PPI was published as the general price index. We changed the name to producers price index in 1981, and many reviews have since been completed.

The following table outlines the major historical milestones for the PPI.

Date	Development step
Jan 1975	The Inter-departmental Committee on Statistical Needs and Priorities recommended redeveloping the existing wholesale price index.
Jul 1978	We first published the PPI under the name of general price index, with indexes for the index reference quarter of December 1977 and the March 1978 quarter. Some indexes, for example, construction outputs and finance, insurance, property, and business services outputs, were not completed at this time. Initially, we carried out all calculations manually.
Aug 1981	We changed the index name from general price index to producers price index.
1982–88	We carried out the first review for all industry indexes in the PPI.
1996–98	We carried out a second rolling review for all industry indexes in the PPI. The PPI also changed from the New Zealand Standard Industrial Classification (NZSIC) to the Australian and New Zealand Standard Industrial Classification 1996 (ANZSIC96).
2004–10	We carried out a rolling review to supply national accounts with updated product breakdowns, and to review the entire set of PPI output industry indexes.
May 2011	We implemented a new industrial classification (ANZSIC06). This included implementing the 2006 National Accounts Commodity Classification (NA06CC) level within the PPI hierarchical structure. We linked the PPI representative commodities to the NA06CC level and then used 2008 national accounts supply and use data to weight these NA06CC commodities by industry. We published the first PPI release with this new structure in May 2011, for the March 2011 quarter.
Jul 2011	We started a rolling review in which industries are being reviewed every three, six, or 12 years (subsequently changed to every four, eight, or 12 years).
Jan 2015	We completed a review of the scope and purpose of the PPI, resulting in 17 recommendations, six of which involved change. We began introducing these changes from the March 2015 quarter. See Review of scope and purpose of the producers price index for more information.



Appendix 1: Glossary of terms

Key terms and definitions relating to the producers price index (PPI).

All industries index: The index series showing price movements for the weighted combination of all industry indexes.

ANZSIC06: Australian and New Zealand Standard Industrial Classification 2006.

Basket of goods and services: The representative selection of goods and services for a price index, including product specifications and expenditure weights.

Building block structure: A hierarchical structure used to organise the PPI indexes. Under this structure commodity indexes feed into industry indexes, which in turn feed into the all industries index.

Commodity: A good or service, for which a price is collected, commonly referred to as an item.

Commodity Data Collection Survey: A survey that collects income and expenditure information, by commodity, from a representative sample of businesses in each industry of the economy.

Deflator: A price index used to remove the effect of price change so we can measure change in the volume of goods and services produced in the economy.

Fixed weight price index (or base-weighted index): A price index in which the quantity of an item purchased is assumed to be constant or fixed at the weight reference period. The PPI is a fixed-weight index, with the industry and NA06CC commodity weights updated annually.

Imputation: The estimation/calculation of an unknown price (or quantity) based on relevant available information.

Index number: A weighted average of the price ratios of selected goods, services, commodities, or financial assets measured over time.

Industry: Collectively organised economic activity as defined by the Australian and New Zealand Standard Industrial Classification 2006 (ANZSIC06). An industry outputs index includes commodities of goods and services produced within an industry. Also included is capital formation, which is capital work undertaken by a firm's own employees.

Index reference period: The reference period used for comparison of index numbers. The index reference period for the PPI is set to 1000.

Inflation: An increase in the general or average level of prices of goods and services over a period of time.

Item: A good or service for which a price is collected/calculated.

Judgement sampling: The selection of items to price using information from a variety of sources, including the Commodity Data Collection Survey and contacting suppliers. It involves an element of judgement in the selection process.

NA06CC: National Accounts 2006 Commodity Classification. The commodity classification used by National Accounts in their supply and use system.

NZSIOC: New Zealand Standard Industrial Output Categories. The primary output view for all aggregated outputs for industry data collected using ANZSIC06. NZSIOC was introduced to obtain standardisation across all aggregated economic outputs. With

NZSIOC, we decided on what is considered to be the important minimum levels for producing our economic statistics.

Price reference period: The calendar quarter that the latest quarter's prices are compared with in order to calculate indexes.

Quarter: The PPI is produced on a calendar quarterly basis: March, June, September, and December quarters.

System of National Accounts 2008 (SNA08): The conceptual framework we use to compile New Zealand's national accounts. The SNA08 is jointly published by the United Nations, the Commission of the European Communities, the International Monetary Fund, the Organisation for Economic Co-operation and Development, and the World Bank. The SNA08 was first introduced into New Zealand accounts at the end of 2014.

Weight: The relative importance assigned to an item when compiling an index. Estimated based on the dollar value of production or intermediate consumption (price multiplied by quantity). It is an estimate of the overall significance of each of the different items in the price index basket of goods and services.

Weight reference period: The period of an index refers to the year or years from which the weighting data was derived.