

Handbook
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Statistics Finland 

PRODUCER PRICE INDICES FOR MANUFACTURED PRODUCTS AND SERVICES 2015=100

Handbook for users

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Foreword

This handbook was compiled for all who use the data of producer price indices for manufactured products and services and want a more accurate description of the production of the statistics. The handbook describes the enterprise and product samples, formation of the weight structures, index calculation and the classifications used in the calculation of producer price indices. The handbook also contains several calculation examples, to give you a good picture of the typically used applications of the indices.

The calculation of producer price indices was reviewed starting from the index for January 2019 so that the indices are now chain-linked indices. Moving to the chain-linked index method improves the quality of the indices because structural changes in production, exports and imports can be taken into account faster.

The share of services in National Accounts is considerable, around 70 per cent of the gross value added of the national economy (Statistics Finland, National Accounts). It is important to have statistics available on services as well as their producer prices. The content of producer price indices for services has expanded in connection with the 2015=100 base year revision: in addition to the price development of the Business to Business (BtoB) services and services enterprises produce for the public sector, the index will now also describe the price development of Business to Consumers (BtoC) services.

Helsinki, Statistics Finland, October 2020

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1 Producer Price Indices 2015=100

Statistics Finland revised its producer price indices for manufactured products and services at the beginning of 2018. The new base year of the indices is 2015. In connection with the revision, the weight structures of the statistics were updated to correspond with the values of output, exports and imports for 2015. In addition, the product and enterprise samples have been updated. In future, the classification used in the releases will be the CPA product classification instead of the previously used European industry standard classification system NACE. Publishing of data with base years 2010=100 and 2005=100, and in producer prices for manufactured goods also with base year 1949=100, will continue.

Indices of base years 2010=100 and 2005=100, and in producer prices for manufactured goods also of base year 1949=100, will be calculated forward by chaining with the index of the latest base year, so starting from 2018 they will develop in the same way as the base year 2015=100 index.

In connection with changing the base year, the calculation method of the indices was also revised. Starting from 2019, producer price indices are annual chain-linked indices. In practice, the shift to the chain-linked index method means that the weight structure of the producer price indices will be updated every year. The new weight structure will take effect starting from the Index for January of each year. In addition to the weight structure, product categories and the enterprise sample can also be updated annually. The base year of the Index remains unchanged (2015=100). The changes improve the quality of the index, because with their help, changes in production, exports and imports can be taken into account faster.

The scope of the Producer Price Index for Services has expanded in connection with the revision. In addition to the price development of the Business to Business (BtoB) services and services enterprises produce for the public sector, the index will now also describe the price development of Business to Consumers (BtoC) services. These two indices will also be weighted together, which provides the total level (Business to All, BtoAll). In connection with the revision, the Producer

Price Index for Services was expanded to cover entirely new product groups.

In connection with the revision, the following new index series will be published (CPA 2015):

- 49.31 Urban and suburban passenger land transport services
- 49.39 Other passenger land transport services n.e.c.
- 49.50 Transport services via pipeline
- 52.21 Services incidental to land transportation
- 52.29 Other transportation support services
- 77.11 Rental and leasing services of cars and light motor vehicles
- 96.02 Hairdressing and other beauty treatment services
- 96.04 Physical well-being services

Point figures are calculated for 10 CPA sections (character level) and 26 divisions (2-digit level) under which more detailed level index series are also published.

The BtoAll overall index covers around 60 per cent of market services. When the industry G Wholesale and retail trade; repair of motor vehicles and motor-cycles is ignored, the Producer Price Index for Services already covers over 70 per cent of market services.

Published producer price indices 2015=100

- Producer Price Index for Manufactured Products
- Export Price Index
- Import Price Index
- Basic Price Index for Domestic Supply
- Basic Price Index for Domestic Supply, Including Taxes (former Wholesale Price Index)
- Producer Price Index for Services, BtoB
- Producer Price Index for Services, BtoC
- Producer Price Index for Services, BtoAll

2 What are producer price indices?

The producer price indices for manufactured products and services measure development of the prices of products and services produced by enterprises. So, producer price indices depict inflation from the viewpoint of enterprises. Producer price indices belong to short term business statistics that describe the short-term development in various factors and areas of economy. The production of the index is based on the Finnish Statistics Act (280/2004, amend. 361/2013) and the Council Regulation on Short-term business statistics (EC) no. 1165/98 and (EC) no. 1158/2005.

Producer price indices have the following usages:

- Producer price indices can be used for describing short-term inflationary pressures on various sectors of the economy. Especially central banks and government ministries utilise producer price indices for this purpose. Research institutes and enterprises can also exploit the data in their macroeconomic forecasting models.
- One of the key usages is to function as a deflator in National Accounts and volume indices calculations for converting the value of production or sales to the volume of production or sales.
- Producer price indices can be used as an index clause in agreements. An index clause means that the final amount of a payment specified in an agreement is tied to a change in some index.
- Enterprises can use the data of the producer price indices when comparing the price development of their purchases or sales with the average development.
- Data from producer price indices can be combined with other data on business trends, such as those on the Volume Index of Industrial Output, in order to analyse business trends more closely.

Five different indices are produced under the producer price indices for manufacturing: Producer Price Index for Manufactured Products, Export Price Index, Import Price Index, Basic Price Index for Domestic Supply, and Basic Price Index for Domestic Supply, Including Taxes (formerly Wholesale Price Index) The Producer Price Index for Services, in turn, describes the price development

of services provided by enterprises to other enterprises and the public sector (Business to Business, BtoB), to households (Business to Consumers, BtoC) and to all end users (Business to All, BtoAll). All the above-mentioned indices measure price development slightly differently from each other because the price concepts used, and the industries covered vary by index.

The importance of services to the national economy has grown significantly in the past few decades. Currently, the share of the service sector in the gross value added of Finland's National Accounts is around 70 per cent (Statistics Finland, National Accounts). Of this, the share of public services is around 25 per cent and that of private market services 75 per cent. As a result of the large share of the service sector, the need for statistical information from service industries has increased. The Producer Price Index for Services is a relatively new statistics compared to other price indices like the Producer Price Index for Manufactured Products or the Consumer Price Index. The producer price index for services was first released as experimental statistics in 2004 and as official statistics starting from 2006.

2.1 Descriptions of the producer price indices

The Producer Price Index for Manufactured Products measures average changes in the prices of goods sold by domestic producers. The index includes both goods sold at domestic market and goods sold abroad. The price for goods intended for the domestic market is the so-called factory price exclusive of taxes. The price for export goods is the price obtained by the exporter, which is usually the same as the FOB.¹ (free on board) price. The Producer Price Index for Manufactured Products covers the commodities in industries B-E, ranging from minerals to water and waste management services.

1 FOB = free on board. Value of goods at basic price inclusive of transport and delivery to a named border location and possible taxes on export goods less subsidies.

The Producer Price Index for Services describes the price development of services provided by enterprises to other enterprises and the public sector (Business to Business, BtoB), to households (Business to Consumers, BtoC) and to all end users (Business to All, BtoAll).

The Export Price Index measures changes in the FOB prices of export goods. Foreign-currency export prices are converted to EUR using the Bank of Finland's mean rate for the statistical reference month. The Export Price Index covers categories A-E, that is, commodities ranging from agricultural products to water and waste management services.

The Import Price Index measures development in the CIF prices of imported goods. CIF prices² includes costs insurance and freight. Foreign-currency import prices are converted to EUR using the Bank of Finland's mean rate for the statistical reference month. The Import Price Index covers categories A-E, that is, commodities ranging from agricultural products to water and waste management services.

The Basic Price Index for Domestic Supply measures changes in the tax-free prices of goods used in Finland as they first enter the market.³ The index includes both domestic and imported goods. The price for domestic goods is the factory price exclusive of taxes. The price for imported goods is the CIF price of the imports plus customs duties. The Basic Price Index for Domestic Supply covers the commodities in industries A to E, from agricultural products to construction.

2 CIF = cost , insurance and freight. The price includes costs, insurance and freight between the ports of loading and destination. The vendor pays the sea freight fare up to the agreed destination harbour and takes, in the name of the purchaser, sea insurance to guard against risks during transport.

3 As the index measures the tax-free price development of total domestic supply at the stage when products leave the producers and enter the market, and correspondingly as products arrive in the country after customs, it is more accurate to talk of the basic price of a product than of the producer price.

The Basic Price Index for Domestic Supply, Including Taxes (former Wholesale Price Index) corresponds with the basic price index for domestic supply, but shows changes in the value added tax, excise taxes and car taxes. The index includes both domestic and imported goods. The index includes the value-added tax and other indirect taxes. Besides the value-added tax, indirect taxes comprise diverse excise duties, and the vehicle tax. The price for domestic goods comprises the factory price without taxes, the value-added tax and other indirect taxes. The price for imported goods, in turn, comprises the CIF price of the imports, customs duties, value-added tax and other indirect taxes. The Basic Price Index for Domestic Supply covers the commodities in industries A to F, from agricultural products to construction.

Producer price indices are compiled on product basis. Producer price indices for manufactured products describe development in the prices of goods and services in primary and secondary production, and producer price indices for services describe the development of service prices belonging to service industries. The indices are product-based, so the main industry of the enterprises producing products and services is irrelevant. If a service enterprise also produces goods, its goods production is excluded from the scope of the description of the Producer Price Index for Services. On the other hand, an enterprise that mainly produces industrial goods may also produce other services than industrial services, in which case for these services, the enterprise belongs to the scope of the description of the Producer Price Index for Services.

Figure 1 shows the inclusion of domestic, export and import goods in the different indices of the producer price indices for manufactured products.

Figure1. Inclusion of domestic, export and import goods in the Producer Price Indices for Manufactured Products



2.2 Links with other statistics on prices

The price indices concerning commodities compiled by Statistics Finland can be described as a system whose aim is to measure the development of prices at different stages of production and distribution. Producer price indices of agricultural products, manufactured products and services describe the price development at the early stage of price formation as products leave their producers or enter the country.

The price index for wholesale goods would locate in the second stage of distribution. Statistics Finland does not compile a price index for wholesale goods. Wholesale and retail trade margins come under the scope of description of producer price indices for services.

In the classification of products, they mainly belong to categories 46 Wholesale trade, except of motor vehicles and motorcycles and 47 Retail trade (excl. motor vehicles and motorcycles); wholesale and retail trade of motor vehicles and the revision is differentiated into category 45. Statistics Finland does not compile price indices for trade margins.

Development in the prices of consumption goods and services at the end use stage is measured by the Consumer Price Index.

Table 1 describes the commodity price index system and the indices associated with each step of the system. For the time being price indices are not produced for wholesale goods or trade margins.

Table 1.
Commodity price index system

	Producer			Wholesale trade			Retail trade	
Prices of production inputs	Producer's margin	Producer price, price at / to border	Purchase price into wholesale trade	Wholesale trade margin	Sale price of wholesale goods	Purchase price into retail trade	Retail trade margin	Price of retail trade goods and services
Purchase price indices for production inputs, cost indices		Producer price, indices, (incl. PPI for Construction)		Industry G46, Wholesale trade of PPI for services	Wholesale Price Index		Industry G47, Retail trade of PPI for Services	
Indices compiled by Statistics Finland								
Index of Purchase Prices of the Means of Agricultural Production		Index of Producer Prices of Agricultural Products, Producer Price Index for Manufactured Products, Producer Price Index for Services, Export Price Index, Import Price Index						Consumer Price Index

3 Sample

The data collection and calculation of producer price indices are based on a sample. The data sources and methods used in the sampling of producer price indices for manufactured products and services differ from one another based on the availability of data sources. The sampling methods described in sections 3.1 and 3.2 only apply to the producer price indices for manufactured products. The sampling method of producer price indices for services is described separately in section 3.3.

The samples of CPA product categories and enterprise data suppliers included in producer price indices are generally revised annually; starting from 2019, the producer price indices adopted an annual chain-linked index, which means the sample is updated and maintained annually.

3.1 Product sample in the producer price indices for manufactured products

In producer price indices for manufactured products, the sample is formed by first drawing the product sample (CPA product categories) after which the enterprise sample is formed for each CPA product category. Price data are collected from enterprises included in the sample from which the price index is calculated by weighting. This price index is considered to be descriptive of average development in the prices of all commodities included in the population.

The frames of CPA product categories for the producer price indices are formed by using the data of the supply and use tables of National Accounts, the statistics on industrial production and Finnish Customs' statistics on foreign trade. The frames contain the values of production produced in Finland, and exports and imports by product category. Transit exports are deducted from exports, so the figure that remains is the value of exports produced in Finland only. Transit exports are correspondingly deducted from imports so the figure that remains

is the value of imports remaining in Finland only. The value of production staying on the domestic market is obtained by deducting exports from the value of domestic supply.

The most important function of producer price indices is to serve as deflators. Producer price indices are used to deflate the value of production in, for instance, National Accounts calculations. From the deflator perspective it is important that a price index is also compiled for all CPA product categories for which domestic supply/exports/imports is high.

The emphasis on the indices' function as deflator affects the selection of product categories for producer price indices. The cut-off method is applied in sampling the product groups. The CPA product categories with the highest production/export/import values are selected for the price indices. However, the method used is not a pure cut-off method in which all units beyond a certain threshold would be included. Occasionally, a product category that should in fact be included in the sample may be missing and, on the other hand, product categories that do not exceed the threshold value may be included. Table 2 describes the proportion of the value of the included CPA product categories of the total value of domestic supply/exports/imports.

Table 2.

Coverage of 6-digit level CPA product categories included in producer price indices of total value

Statistics	Proportion of included CPA product categories of total value
Producer Price Index for Manufactured Products	80%
Export Price Index	79%
Import Price Index	83%
Basic Price Index for Domestic Supply/Basic Price Index for Domestic Supply, Including Taxes	81%

3.2 Enterprise sample in producer price indices for manufactured products

The frames of the enterprise sample have been formed based on the data of the supply and use tables of the National Accounts, the statistics on industrial output and Finnish Customs' statistics on foreign trade. The enterprise sample frames for exports and imports are formed from data in the supply and use tables of the National Accounts and Finnish Customs' statistics on foreign trade. In terms of production that remains on the domestic market, the enterprise frame is formed on the basis of heading-specific enterprise data obtained from the supply and use tables of the National Accounts, the statistics on industrial output and Finnish Customs' statistics on foreign trade. Data on enterprises' exports by commodity heading were deducted from the values of output, whereby the remaining figure describes domestic output.

The enterprise sample was drawn by using stratified sampling. The basis for the stratification was the value of an enterprise's domestic supply/exports/imports. Simple random sampling was used within the strata. The dominant enterprises in each heading were, however, selected to the sample with a probability of one. The number of enterprises drawn for each product group depended on the number of enterprises under the heading. Table 3 shows the stratification used in the sampling of the producer price indices and the numbers of enterprises selected from the strata.

Table 3.

Stratification of producer price indices' sample and numbers of selected enterprises

Sample group	Breakdown of enterprises	Number of strata	Selected enterprises per stratum
1	1–3 enterprises	1	All
2	1 dominant (>50% of value of heading)	2 (dominant/others)	1/2
3	2 dominant (>80%)	2 (two dominant/others)	2/2
4	4-10 enterprises	2 (large/small)	2/2
5	Enterprises >10	3 (large/medium / small)	2/2/2

3.3 Enterprise and product sample in producer price indices for services

The sampling frame of the Producer Price Index for Services is based on Statistics Finland's Business Register and business services statistics. The Business Register contains data on the industry and turnover of enterprises. The business services statistics describe the service selection and distribution of turnover in industries producing business services. The enterprises have primarily been selected applying PPS sampling (probability proportional to size), but judicious sampling, or a combination of judicious sampling and probability-based sampling has also been used.

3.4 Selecting products for price monitoring

The products belonging to a CPA product category included in the actual price monitoring were selected in co-operation with the enterprises. Here, products also refer to services (service product). The objective is that the monitored product would be as representative as possible, and its price could be monitored as well as possible. The selection criteria for products are:

- The proportion of the product in an enterprise's production that remains on domestic markets, exports or imports of the product category concerned is significant.
- The product reflects as well as possible the average price development for other products or services of similar type.
- The price for the product concerning a certain unit (e.g. number, litre, kilogram, day) and characteristics can be measured regularly each month or quarterly (or less frequently). Characteristics are defined by e.g. a trademark, product code or other such quality description. The price must be comparable between statistical reference months or quarters.

Table 4 shows the numbers of the enterprise responders, CPA product categories and price data of producer price indices for services in 2018. The sample is maintained annually, so the number of enterprises, product categories and price data in the sample can vary slightly between different years.

Table 4.
Numbers of the enterprise responders, CPA product categories and price data of producer price indices for services in 2018

Index	No. of enterprise responders	No. of CPA product categories	No. of price data
Producer Price Index for Manufactured Products	990	600	3,200
Export Price Index	410	320	1,000
Import Price Index	810	600	2,200
Basic Price Index for Domestic Supply/ Basic Price Index for Domestic Supply, Including Taxes	1,550	820	4,300
Producer Price Index for Services BtoAll ⁴	1,300	320	6,000
Producer Price Index for Services BtoB	430	300	3,100
Producer Price Index for Services BtoC ⁴	900	40	2,900

⁴ Also includes price data from the Consumer Price Index

4 Weight structure and classification of producer price indices

4.1 Weight structure of producer price indices for manufactured products

The values of production remaining on domestic markets, imports and exports for the forming of the weights were obtained from the supply and use tables of National Accounts, statistics on industrial output and Finnish Customs' statistics on foreign trade. The latest data from the supply and use tables of National Accounts concerned the year 2014. In respect of domestic supply, imports and exports these were raised by using the data on 2015 that were available from National Accounts. Thus, the data describing value in the indices are from 2015 but the detailed commodity structures are based on data concerning 2014. These weights were used in the 2015=100 index in 2015 to 2018. Starting from 2019, an annual chain index method will be used in the indices, which means that the weight structures of the indices will be updated annually. In this case, the latest available data from national accounts, the statistics on industrial output and Finnish Customs' statistics on foreign trade are used when forming the weight structures.

The forming of weights was started by deducting transit exports from the values of imports and exports, and exports from domestic market production values. This yielded for imports the value of imports remaining in Finland, for export the value of exports of goods produced in Finland only and for domestic supply the value of production remaining in Finland.

The value of the production/exports/imports of small CPA product categories excluded from the sample was also taken into account in the forming of the weight structures. So-called bootstrapping of representative values was used in the calculating of the weights. The bootstrapping of representative values means that the CPA product categories included in the index get their value weight

based on the gross value of the entire industry so that the product categories included from an industry share the gross value of that entire industry. Thus, through their weight structure, the CPA product categories included in the index also represent those product categories in their industry that are not included in the index.

Weights at the enterprise level were formed after the bootstrapping of representative values. The enterprise weights are based on the stratification used in the sampling and they were formed as follows:

- If the product category included dominant enterprises, they were assigned the proportion their own domestic supply/imports/exports represented of the total value of the product category. The remainder of the value of the product category was divided evenly between other enterprises.
- If there were no dominant enterprises in the product category, a certain proportion of the total value of the product category was divided evenly among the enterprises in each stratum. Large enterprises shared a bigger proportion and small enterprises a smaller proportion of the total value of the product category. Table 5 describes the distribution of enterprise weights in the strata.

Table 5.
Distribution of enterprise level weights in producer price indices

Sample group	Strata	Distribution of weights
1	1 (1–3 dominant enterprises)	own weight
2	2 (one dominant/others)	own weight/even distribution
3	2 (two dominant/others)	own weight/even distribution
4	2 (large/small)	65/35
5	3 (large/medium/small)	65/25/10

Individual products selected by enterprises for the price collection do not have their own weights.

The weight structures of the producer price indices are available on the home pages of producer price indices.

4.2 Weight structure of Producer Price Index for Services

The weight structure of the Producer Price Index for Services is based on enterprises' turnover and its distribution between the key services of the enterprise. The used data on turnover are either figures reported by the enterprises themselves on turnover received from services within the industry concerned or figures on turnover obtained from the Register of Enterprises and Establishments or the business services statistics. Individual service products selected by enterprises for the price collection do not have their own weights.

The overall index is calculated using industry-specific product indices. The weights are based on data from 2014 national accounts. The data have been raised with the help of 2015 data to describe the service structure of 2015: so, the value data are from 2015 but more specific structures are based on 2014 distributions. These weights were used in calculating the 2015=100 index in 2015 to 2018. The weights of industry-specific product indices have been formed by first dividing the total volume of services expressed in euros to the main activity sections (character level) of the product classification, then to the 2-digit level divisions and from there on to the 4-digit level classes according to relative use. Starting from 2019, an annual chain index method is used in the indices, which means that the weight structures of the index will be updated annually. In this case, the latest available data from national accounts statistics and business services statistics are used when forming the weight structures.

The weight structures of the producer price indices for services are available on the home pages of producer price indices for services.

4.3 Product classification

Starting from the base year 2015, the classification is the Classification of Products by Activity CPA 2015 (CPA Ver. 2.1) which is the European Statistical Classification of Products by Activity. In addition, the classification by purpose

of use, MIG is used: energy products, raw materials and producer's goods, investment goods, and durable and other consumer goods.

In indices with the base year 2010 or 2005, the publication levels used are the Standard Industrial Classification 2008 based on the European industry standard classification system NACE Rev. 2. The UN's International SITC product classification (Standard International Trade Classification) is used in indices whose base year is 1949. In addition, the UN's International ISIC industry classification (International Standard Industrial Classification) is used in the Producer Price Index for Manufactured Products 1949=100.

4.4 Producer price indices for services by sector

The Producer Price Index for Services 2005=100 is produced specified by the target of the service: Business to Business services and services enterprises produce for the public sector (BtoB), and Business to Consumers (BtoC) services, these two indices will also be weighted together which provides the overall index (Business to All, BtoAll).

5 Collection of price data

5.1 Data collection

As a rule, the price data for the producer price indices are collected directly from enterprises. The majority of the data are collected with a web-based collection system. Starting from January 2018, part of the data of the Building Cost Index have also been collected in connection with the data collection for producer price indices for manufactured products and services. The aim of the change is to reduce the response burden for enterprises and eliminate overlapping data collections as many enterprises have delivered data for both data collections.

In addition to the data collected direct from enterprises, price data or point figures from other statistics of Statistics Finland are also used in calculating the producer price indices. These statistics include e.g. the Index of Producer Prices of Agricultural Products, the Building Cost Index, the Cost Index of Civil Engineering Works, the Consumer Price Index and the Volume Index of Newbuilding.

The data of the Index of Producer Prices of Agricultural Products are used in the monitoring of vegetable prices. The data of the Building Cost Index are used to monitor the prices of certain building products. An implicit price index derived from the Cost Index of Civil Engineering Works and the Volume Index of Newbuilding is used to monitor prices in construction. The data of the Consumer Price Index are used in the price monitoring of consumer services (BtoC sector) in the Producer Price Index for Services. The data of the Consumer Price Index can also be used to approximate the price development of services offered to enterprise if we can assume that the price development of services offered to enterprise customers follows the price development of services offered to consumers.

The development in the prices of certain raw material-based products in imports and exports is measured with the import and export unit value prices obtained from the foreign trade statistics of Finnish Customs. Unit values are only used to measure the price development of homogeneous product groups, such as timber, cereal, and imported and exported electricity.

In addition to data from Finnish Customs, data from the Finnish Forest Research Institute, the Natural Resources Institute Finland, the Energy Authority, the Finnish Energy Industries and some international commodity exchanges, such as the London Metal Exchange, are used in the producer price indices.

The price data collected from enterprises are, as a rule, average prices weighted by sales volume in the month or quarter of the inquiry. If an average price cannot be determined, the price data notation may also be the price for delivery, invoicing or payment on the 15th day of the month.

Export and import prices are generally collected as currency prices. The conversion to euro is performed at Statistics Finland using the monthly average exchange rates per currency published by the Bank of Finland.

The pricing methods used in the Producer Price Index varies by product group and enterprise. The real price of the product can often be used for identically repetitive products. For other products, e.g. methods based on the unit value, model pricing or the time used for producing the products can be used.

The monthly response rate of the price collection ranges between 90 and 95 per cent. The non-response rate is kept low by actively reminding respondents to supply the requested data.

5.2 Collection frequency

Producer price indices for manufactured products are monthly statistics, which means that, as a rule, all prices are collected every month. However, due to practical reasons, when prices remain unchanged, some price data are collected less often.

The Producer Price Index for Services is published quarterly, which means that, as a rule, all prices are collected every quarter. Depending on the industry of the enterprise, the time of quoting the price data collected from enterprises may be the first, second or third month of the quarter. In industries with volatile prices, like goods transport by road and sea, data are, however, collected for the whole quarter. However, due to practical reasons, when prices remain unchanged some price data are collected less often.

Starting from 2019, an annual chain-linked index method is used in the indices, which means that the product and enterprise sample of the indices will be maintained and updated annually. This means that new responders are recruited annually for the indices to replace removed product groups and enterprises that have closed down operations. Structural changes in the economy may also result in responders being recruited in entirely new product categories and new industries.

6 Calculation of producer price indices in practice

The overall indices of the producer price indices describe the average development in the prices of the product categories included in the index and as sample-based statistics this is considered to describe price development in the whole population.

Producer price indices for manufactured products and services have conventionally been revised at fixed intervals, usually once every five years. The base year for the indices is 2015=100. Based on the EU regulation concerning short-term business statistics, the base year should be changed in every five years, so the next base year would be 2020=100. As a result of FRIBS (Framework regulation integrating business statistics) requirements (e.g. expanding producer price indices to new industries), the next base year for both producer price indices for manufactured products and services is likely, however, to exceptionally be 2021=100.

From the beginning of 2019, the producer price indices are calculated as a so-called annual chain-linked indices. In practice, this means, for example, that the weight structure of the indices is updated annually, even though the base year remains the same for five years. The new weight structure will take effect in January of each year. In addition to the weight structure, the product selection (CPA product categories) and the enterprises from which price data are collected can also be updated if necessary. Adoption of the annual chain-linked index improves the quality of the index, because, in future, changes in the economic structure can be taken into consideration more quickly. The annual chain-linked index is also calculated in some other European countries, such as Sweden, Denmark and Estonia.

The calculation of the producer price indices as annual chain-linked indices follows the same calculation principles as before. First, enterprise-specific CPA product category indices, micro indices, are calculated as a geometric average of

the price ratios (see Section 6.1). Then, the micro indices are weighted to the higher levels of the CPA product classification using the Laspeyres formula. A change from earlier practise is, that previously the price of today has been compared to the price of the index's base period, now the price of today is compared to the price of December in the previous year. The December of the previous year is the so-called chaining point for producer price indices. The point figure of the chaining period is carried forward with the change between the chaining period and the current period. This is done for every level of the index. For example, the point figure series of the Producer Price Index for Manufactured Products' group "C Manufacturing" is chained so that first, in accordance with the new weight structure, the change of the group in question is calculated from December of the previous year to the current period and then the point figure from December of the previous year is carried forward in accordance with the change. This is done for every product group (e.g. 17 Paper and paper products, 17.1 Pulp, paper and paperboard, etc.).

In terms of the chain index, it should be noted that the index series are no longer aggregated to the higher levels as before, when the index was based on the base strategy. For instance, the point figure of "17 Paper and paper products" for a certain point in time cannot, in the chain index, be calculated directly by weighting the point figures of the group's subcategories with the weight shares. Calculation of the chain index at each level is done by chaining forward the index series in accordance with the old weight structure with the changes in accordance with the new weight structure. The calculation principle of the chain index is equivalent to the chaining forward of old index series with a so-called chaining coefficient. The chaining coefficients of old base year indices are presented in Appendix 1.

6.1 Calculation of micro indices

The overall index of producer price indices describes the average development in the prices of the product groups included in the index. The individual products whose prices are monitored, or variants, reported by an enterprise do not

have their own weights but the enterprise-specific CPA product category indices, or micro indices, are calculated as the geometric average of the price ratios (=current price/price at reference period) of the products belonging to that category. The micro indices are combined into an overall index with a weight coefficient corresponding to each product category and enterprise. In other words, changes in the price ratios of individual products have different-sized effects on the overall index.

6.2 About index formulae

Annual base index BI for the period t is calculated using the Laspeyres formula

$$BI_t = \sum \frac{P_{(0)i} Q_{(0)i}}{\sum P_{(0)i} Q_{(0)i}} * \frac{P_{(t)i}}{P_{(0)i}} * 100$$

where

$P_{(t)i}$ = price of product i in period t

$P_{(0)i}$ = price of product i in the reference period (December of the year before)

$P_{(0)i} Q_{(0)i}$ = value of product i in the reference period (price*volume, December of the year before)

$\sum P_{(0)i} Q_{(0)i}$ = sum of the values of all products in the reference period (price*volume, December of the year before)

Based on the formula, the price ratios of the products included in the index are weighted according to their value shares in the reference period. The annual base index BI is always set to 100 in the reference period (= December of the year before)

The index point figures of the base year 2015 are scaled so that their average is 100. Starting from 2019, the index for the base year 2015=100 $I_{2015=100,t}$ is chained forward with the monthly changes of the annual base index:

$$I_{2015=100,t} = I_{2015=100, t-1} * \frac{BI_t}{BI_{t-1}}$$

where

$I_{2015=100,t}$ = 2015=100 index in the period t

BI_t = the one year long based index in the period t

6.3 Treatment of missing prices

If a product that is price monitored is no longer produced or imported and the enterprise cannot give a substitutive product in its place, the product is moved to imputation. In that case, the price development of the product is imputed with the average price change in the same commodity group. The imputation is based on the assumption that the prices of products in the same commodity group develop in roughly the same way.

The product and enterprise sample is updated and maintained annually. Then the products and enterprises that are imputed are replaced with new ones. If an enterprise that belongs to the sample, for example no longer produces, imports or exports products that belong to the CPA product categories, a new enterprise is selected in its place.

6.4 Treatment of quality changes

Producer price indices are “pure” price indices, which are not affected by changes in the quality of the products (in statistical terminology, quality changes refer to changes in the characteristics of the product). Efforts are made to eliminate

price changes caused by changes in the characteristics of the products from the index. The physical, technical and financial (such and conditions on financing, guarantee, whether product is sold to a wholesaler or retailer, etc.) characteristics of a product must remain unchanged. In practice, product characteristics change continuously. Changes to the characteristics and their treatment are among the main challenges in index calculations. In producer price indices, several methods are applied to control changes in the characteristics to make sure that the best possible method for measuring price change is always used.

Primarily, efforts are made to collect an overlapping price observation for the changed product. In practice, this means that as the product changes the price for the preceding period is collected in addition to the price for the current period. This allows the true change in the price to be calculated and the price history stays unbroken despite the change in the monitored product. The price for the current period can concern the month or quarter and the preceding period refers to the preceding corresponding period. If overlapping price observations cannot be obtained, various pricing methods can be used to measure/assess the price change, such as model or component pricing.

Expert assessment can also be used to assess price changes. In this case, the responder is asked to assess which proportion of the price change is a genuine change in price and which proportion is due to the change in the characteristics of the product. The expert assessment is based on the idea that the data supplier enterprise is best equipped to estimate the price development of its own products.

If neither an overlapping price observation nor an expert assessment can be obtained and price measurement methods cannot be applied, the price development of the product is imputed with the average change in the prices of other products belonging to the same commodity group. The imputation is based on the assumption that the prices of products in the same commodity group develop in roughly the same way.

If none of the above methods can be used, discretionary use of the following methods is possible:

- The characteristics of the changed product are assumed to be the same as that of the earlier product. In this case, the price change is included in the index as is.
- The price change is assumed to derive entirely from a change in the characteristics, in which case the price change is eliminated, and the index does not change as the product changes.

Price measuring and methodologies to control changes in quality are constantly being developed and international guidelines and recommendations are taken into account when applying different methods.

6.5 Calculation of old base year indices

Producer price indices with old base years are not calculated genuinely but they are chained with the new 2015=100 indices by using a coefficient calculated from December 2017 index point figures. Starting from the chaining period, monthly changes in the new and old indices are the same and annual changes are also identical from December 2018 onwards (due to the calculation method, there may be an occasional up or downward deviation of a tenth in the decimal). The chaining of a certain series of the old index is performed with the corresponding series of the new index. Statistics Finland calculates the coefficients with figures truncated to two decimal places. The coefficients include five decimal places.

The rule in the compilation of these statistics with old base years is that Statistics Finland always compiles and publishes them with the previous base year and with base year 1949=100. Now that indices with base year 2015=100 are in production, indices 2010=100 and 1949=100, as well as 2005=100 indices are also published. However, only total series are chained of the series with the previous base years (for instance, the Basic Price Index for Domestic Supply covers both goods produced at home and imported goods, which together form the total level; only this total series is chained).

The chaining coefficients of old base year overall indices are presented in Appendix 1.

6.6 Biases in producer price indices

6.6.1 Substitution bias

Producer price indices use the Laspeyres index formula. Scientific literature on indices often refers to the substitution bias that Laspeyres' index formula may create. The direction of the bias depends on the target of measurement. In the case of the producer price indices, substitution bias may arise because (when maximising their profits) enterprises react to changes in relative prices by changing their production volumes. For example, if the price of light fuel oil rises relative to petrol, an enterprise engaged in the oil industry can produce more light fuel oil. In such a case, an index calculated with the Laspeyres' formula underestimates price development from the enterprises' viewpoint⁵. The significance of the substitution bias depends on the scale at which individual enterprises are able to redirect their production when relative prices change.

6.6.2 Bias caused by new products

Producer price indices may contain bias arising from the entry of new products or services on the market. When speaking of new products reference is often made to electrotechnical and electrical products or digital services whose production and sales can grow quite rapidly. The structural change is also fast in the service industry and new services are developed constantly. If the change is vigorous, the index may not describe sufficiently accurately the average development in the prices of the commodities produced in the economy.

5 In the Consumer Price Index the possible substitution bias is exactly the opposite as consumers shift their consumption to commodities that become relatively cheaper.

6.6.3 Sample bias

The calculation of producer price indices is based on a sample. Sampling error is always associated with sampling. In the calculation solution, the randomness caused by sampling is reduced by the fact that the statistics is based on a panel design: data has been collected repeatedly from the same respondents over a longer period. This procedure ensures that the price change estimates produced by the index are very precise in a sampling technical respect. Sampling error can be measured with standard error. Confidence intervals have not been estimated for producer price indices.

Other factors that have a bearing on the precision of the index are accuracy of the data on which the sampling frame and weight structure are based, possible errors in the processing of individual data items, and non-response. The monthly non-response rate ranges from five to ten per cent in producer price indices.

6.6.4 Bias caused by quality change

The objective of producer price indices is to describe pure price development, which is why changes in the quality or characteristics of products must be taken into consideration in the index calculation. The problem of quality change is usually encountered either when a data supplier reports that a product included in the collection is no longer produced, imported or exported, or that changes have been made to an existing product. Changes in quality may cause error in the index as the defining of a pure price change can be difficult and, conversely, the proportion of a price change that is due to changed quality is difficult to estimate and eliminate from calculations. If, as a product changes, we assume that the entire price change is due to a change in the characteristics of the product, we may disregard genuine changes in price, whereby the index incorrectly does not change at all for the product in question. If, then again, we assume that the entire price change is due to a genuine change in price, we may disregard changed product characteristics and the index changes too much. The quality change methods used in producer price indices are described in Section 6.4.

7 Publication of producer price indices

7.1 Producer Price Index for Manufactured Products

The producer price indices for manufactured products are published monthly on the 24th day of the month following the statistical reference month or on the first working day following it. As an exception to this rule, the statistics for January is published on the 26th or on the first working day following it due to changes to the weight structure of the index, and the statistics for November is released on the last weekday preceding 24 December. A short release on the latest figures is published on the home page of the statistics http://tilastokeskus.fi/til/thi/index_en.html.

The published producer price indices' point figures are available in Statistics Finland's StatFin database service. The service is free of charge and located under Tables/Database tables on the web page of producer price indices. Time series for the new 2015=100 indices are available starting from index data for January 1995 (however, for the years 1995 to 2009 only at the 2-digit level and without the division of the Producer Price Index for Manufactured Products into domestic and export goods and the division of the Basic Price Index for Domestic Supply and the Basic Price Index for Domestic Supply, Including Taxes into domestic and imported goods). Regarding old indices, 2010=100 and 2005=100 series are produced for the time being, without the division of the Producer Price Index for Manufactured Products into domestic and export goods and the division of the Basic Price Index for Domestic Supply and the Basic Price Index for Domestic Supply, Including Taxes into domestic and imported goods. 2010=100 indices, however, include the above-mentioned division starting from 2010. All publishable point figures are produced from the 1949=100 series.

A monthly publication is produced of the Producer Price Index for Manufactured Products, which can be downloaded free in PDF format from Available products and services link on the web page of producer price indices.

7.2 Producer Price Index for Services

The Producer Price Index for Services is published quarterly on the 24th day of the month following the statistical reference quarter or on the first working day following it. A short release on the latest figures is published on the home page of the statistics: http://stat.fi/til/pthi/index_en.html.

The public point figures of the Producer Price Index for Services are available in Statistics Finland's StatFin database service. The service is free of charge and located under Tables/Database tables on the web page of producer price indices for services. Time series for the new indices 2015=100 are available starting from the index data for January 2015. The series for old indices 2010=100 and 2005=100 are produced for the time being. Monthly index point figures on the Producer Price Index for Services are also published in the StatFin database starting from 2019. The index is still, however, published quarterly.

The publication can be downloaded free of charge in PDF format under Available products and services on the web page of producer price indices.

8 Customer indices

A customer-specific index can be compiled for product groups that are not included in Statistics Finland's regular index production or classification. Such indices can be produced from all price indices and data from Statistics Finland's other statistics can be combined with them.

Customer indices can be created for several product categories. The same price data are used in calculating the customer index as in regular index production. Thus, customer-specific indices can only include product categories that are included in the regular indices. By contrast, as regards the weights for the selected product categories, the customer can either use the index weights or give them

their own value weights. The weights for the CPA product categories of the indices are given in the Appendix to this Handbook.

A customer-specific index is formed in the following way:

- Select the index that is best suited for the customer.
- Select the product categories that interest the customer.
- Select either the value weights of the index or the customer's own value weights.

The compilation of customer-specific indices is subject to the same data protection rules as other published point figures. Customer-specific indices cannot be created so that the price development of an individual enterprise can be deduced from the development of the index.

In response to special user needs, customized products and services can be provided as a charged service. Charge is made in accordance with the Decree of the Ministry of Finance Concerning the Charge Criteria of the Performances of Statistics Finland (873/2017).

Statistics Finland's charged activity is steered by the Act and Decree on Criteria for Charges Payable to the State.

9 Calculating with indices

9.1 Calculating change

The change in index figures between two points in time is usually calculated as a percentage. The change percentage is calculated as follows:

$\frac{(I_t - I_0)}{I_0} * 100$, where I_t = index for the comparison point in time and I_0 = index for the reference point in time.

Monthly, quarterly and annual changes in producer price indices are calculated at Statistics Finland from figures truncated to two decimal places. Statistics Finland publishes the point figures and change percentages of the producer price indices rounded to one decimal place. In the following example, annual and monthly changes in the overall index of the Producer Price Index for Manufactured Products 2015=100 are calculated for March 2018:

Point figure in March 2017: 100.8

Point figure in February 2018: 103.2

Point figure in March 2018: 103.9

$$\text{Monthly change} = \frac{(103.9 - 103.2)}{103.2} * 100 \approx 0.7 \text{ i.e. } 0.7 \text{ per cent}$$

$$\text{Annual change} = \frac{(103.9 - 100.8)}{100.8} * 100 \approx 3.1 \text{ i.e. } 3.1 \text{ per cent}$$

9.2 Change coefficients for value of money

Change coefficients for value of money provide answers to the following questions:

- How much would an amount of money in a previous year be at current value?
- How much would an amount of money at current value be at the value of a previous year?

Change coefficients for value of money are formed from index series. The purpose of use of the coefficient determines which index the coefficient will be calculated from. Usually the coefficient for value of money is calculated from the cost-of-living index, but if the change in the value of money is monitored from the perspective of an enterprises' production, e.g. to ascertain the value of tin

plate production in today's money, it is advisable to use coefficients calculated from the producer price index for manufactured products. If, then again, the change in the value of money is monitored from the perspective of an enterprise's purchases, e.g. to see what the purchase price of an industrial machine would be in today's money, coefficients calculated from the Basic Price Index for Domestic Supply or the Wholesale Price Index should be used.

Example 1: We want to calculate how much a machine that cost EUR 1000 in 2002 would have cost in euros in 2017. We use the point figures of the Basic Price Index for Domestic Supply, Including Taxes 2015=100 to calculate the coefficient for value of money. The index point figure for 2002 is 79.7. In 2017, the corresponding figure is 102.1. Calculated from these, the coefficient for value of money is

$$\frac{102.1}{79.7} \approx 1.28105$$

We can now multiply the EUR 1000 in 2002 by the coefficient for value of money and obtain $1.28105 \cdot 1000 \approx 1281.05$. Thus, in 2017 money, the price of the machine would be EUR 1281,05.

Example 2: We want to calculate how much a machine that cost EUR 1000 in 2017 would have cost in euros in 2002. We use the same point figures of the Basic Price Index for Domestic Supply, Including Taxes 2015=100 as above to calculate the coefficient for value of money. Calculated from these, the coefficient for value of money is

$$\frac{79.7}{102.1} \approx 0.78060$$

We can now multiply the EUR 1000 in 2017 by the coefficient for value of money and obtain $0.78060 \cdot 1000 \approx 780.60$. Thus, in 2002 money, the purchase price for the machine would be EUR 780.60.

9.3 Price adjustment of an agreement with an index clause

If an index clause is used, the agreement should include the following information:

- The exact name of the index and product category to which the agreement is tied.
- The base period of the agreement (month and year) and the corresponding index point figure.
- The agreed amount of money at base period prices.
- The adjustment period and the point in time whose index point figure is used in the adjustment.

Example 1: An agreement is tied to series 73 Transport equipment, of the Wholesale Price Index 1949=100. The agreement sum of EUR 50,000 is adjusted annually on 1 January against the latest known point figure (November) and the index adjustment is taken into account in full. The agreement is signed on 01/01/2014 when the November 2013 point figure 2241 is known.

Name of index: Wholesale Price Index 1949=100, Total, 73 Transport equipment

Base period of agreement and point figure corresponding to it: 1 January 2014, 2,241 (11/2013)

Agreed amount of money at base period prices: EUR 50,000

Point of time of adjustment: annually on 1 January, point figure of November of the previous year

Point in time	Point figure	Coefficient	Change from base period, %	Agreed sum
1 January 2014	2,241	-	-	50,000
1 January 2015	2,278	1.01651	1.65	50,825
1 January 2016	2,315	1.03302	3.30	51,651
1 January 2017	2,317	1.03391	3.39	51,695

The coefficients by which the agreement amount is multiplied at the times of adjustment are obtained by dividing the point figure at time of adjustment by the point figure at base period. In January 2015, the agreement sum rises to EUR 50,825. From the beginning of January 2016, the agreement sum rises to EUR 51,651 and in 2017 to EUR 51,695.

Example 2. In the following example a three-year trade agreement is tied to industry C17 Manufacture of paper and paper products, of the producer price index for manufactured products 2010=100. The trade agreement is signed on 1 March 2014 when the January 2014 index point figure 99.3 is known. The value of the trade agreement is EUR 4.5 million. EUR one million is paid immediately on 1 March 2014 and EUR one million together with the index adjustments on both 1 March 2015 and 1 March 2016. The remaining EUR 1.5 million and the remaining index adjustments are paid on 1 March 2017. The unpaid part of the total sum is tied to the index. It is adjusted three times, always on the 1st of March according to the overall point figure of industry C17 of the producer price index for manufactured products (January).

Point in time	Point figure	Sum, outstanding share, EUR	Paid, agreed sum + index adjustments, EUR
1 March 2014	99.3	4,500,000	1,000,000
1 March 2015	101.9	3,500,000 + (101.9/99.3) = 3,591,641	1,000,000 91,641 to 1,091,641
1 March 2016	103.6	2,500,000 + (103.6/101.9) = 2,541,708	1,000,000 41,708 to 1,041,708
1 March 2017	100.6	1,500,000 + (100.6/103.6) = 1,456,564	1,500,000 - 43,436 = 1,456,564

The total sum paid under the agreement is EUR 4.5 million plus EUR 89,913 index adjustments.

9.4 Deflation and volume calculations

Price indices, such as the producer price indices, can be used as deflators in volume calculations. In such instances, the change in a certain value, such as the value of the sales of an enterprise (value index), is known. To find out the change in the volume over the same time period, a suitable price index, such as the Producer Price Index for Manufactured Products or one of its sub-indices, is used as a deflator. The volume index is calculated with to the following formula:

$$\text{Volume index} = \frac{\text{value index}}{\text{price index}} * 100.$$

Example. The value of the sales of an enterprise went up by 8.9 per cent from 2017 to 2018. The prices of the products the enterprise sells rose by 0.3 per cent over the same period. Thus, the change in the volume of the sales was:

$$\frac{108.9}{100.3} * 100 \approx 108.6. \text{ The growth in the volume from 2017 to 2018 was 8.6 per cent.}$$

The unit value index is a price index which measures the development of unit value prices, such as price per tonne. A unit value index can be calculated with the value index and the volume index in the following way:

$$\text{Unit value index} = \frac{\text{value index}}{\text{volume index}} * 100$$

More information on index calculation can be found, for example, on Statistics Finland's web pages under the indices section of the eCourse in statistics (only in Finnish) at https://tilastokoulu.stat.fi/verkkokoulu_v2.xql

Appendix 1. Chaining coefficients of old base year overall indices

Index / base year	1949=100	1975=100	1080=100	1985=100	1990=100	1995=100	2000=100	2005=100	2010=100
PPI for Manufactured Products / Production Price Index	19.24280	3.20612	2.03167	1.47803	1.33594	1.19375	1.09882	1.13056	1.04390
PPI for Manufactured Products, domestic goods	-	-	-	-	-	1.39086	1.29202	1.26890	1.06811
Basic Price Index for Domestic Supply	-	3.61224	2.22691	1.62400	1.47004	1.37594	1.26288	1.22017	1.06780
Export Price Index	16.59859	2.53571	1.69728	1.29097	1.19517	0.99357	0.91917	0.99885	1.01675
Import Price Index	15.33122	3.14541	1.79300	1.43460	1.54312	1.26956	1.14166	1.12163	1.02731
Basic Price Index for Domestic Supply, Including Taxes / Wholesale Price index	22.13588	-	2.37686	1.70851	1.54949	1.39851	1.27186	1.25170	1.10042
Producer Price Indices for Services, BtoAll	-	-	-	-	-	-	-	-	-
Producer Price Indices for Services, BtoB	-	-	-	-	-	-	-	1.22688	1.07723
Producer Price Indices for Services, BtoC	-	-	-	-	-	-	-	-	-

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