Producer Price Index for Services 2005=100 User's Handbook

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1 Introduction

The importance of services to the national economy has grown significantly in the past few decades. At the moment the share of the services sector in Finland's gross domestic product exceeds 65 per cent, of which public services account for around 25 per cent and private market services for 75 per cent. The large growth of the services sector has also generated increased demand for statistics on service industries.

The Producer Price Index for Services is a new quarterly index that measures developments in the prices of services enterprises produce for each other and for the public sector. The Index describes relative changes in these prices against a certain comparison point in time. The scope of the Producer Price Index for Services does to extend to services intended for consumers or those produced by the public sector. Developments in the prices of the services purchased by consumers are monitored with the Consumer Prices Index. The base year of the Index is 2005.

One of the key tasks of the Producer Price Index for Services is to function as a deflator in national accounts calculations for converting the value of production or sales to the volume of production. Enterprises can use the data of the Producer Price Index for Services when comparing the development in the prices of their purchases or sales against the average development in their respective industry.

The Index is published on the 17th day of the month following a statistical reference quarter or on the weekday nearest to it. The production of the Index is based on the Finnish Statistics Act (280/2004) and on a Council Regulation (EC) concerning short-term statistics (No 1165/1998).

At the moment Producer Price Indices are calculated for 24 service industries and published quarterly for 23 industries. Indices have been designed for the priority industries specified in the Council Regulation, as well as for a few other nationally important service industries. The lengths of the time series vary depending on when the production of each industry-specific index was started. Industries are classified by the national standard industrial classification TOL2002, confirmed by Statistics Finland and based on the common industrial classification NACE 2002 of the European Union.

The Index currently covers 48 per cent of market services. Statistics Finland continues to improve the coverage by designing indices for additional service industries. The publication of a new index can commence once data on an industry have been collected for at least twelve months from an adequate number of enterprises in it and it has been ascertained that the price data provided by the data suppliers can be used for calculating sufficiently reliably index figures depicting the average price development in the industry concerned.

2 Producer Price Index for Services within the system of statistics on prices

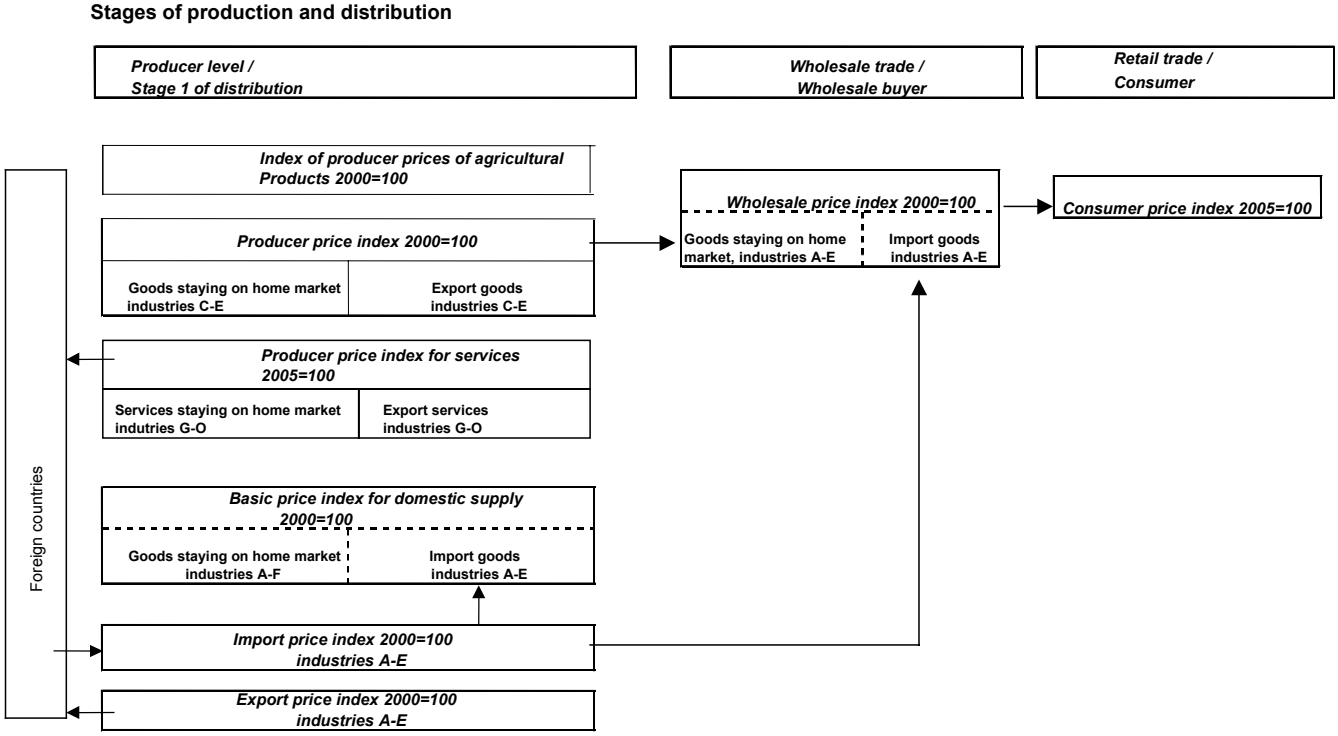
The Producer Price Index for Services describes developments in the prices of services enterprises produce for each other and for the public sector. Thus, it complements the picture the Consumer Price Index and the Producer Price Index for Manufactured Products draw of price changes in the national economy.

The indices of commodity and service prices that Statistics Finland compiles can be described as a system whose aim is to measure the development of prices at different stages of distribution and production (Figure 1). The Producer Price Indices describe how the prices of commodities or services develop at the beginning of price formation as products leave their producer. Producer Price Indices are

calculated for agriculture, manufacturing and services. The Wholesale Price Index describes the second stage of distribution when goods arrive at wholesale buyers[1]. Development in the prices of consumption goods and services at the end use stage is measured by the Consumer Price Index.

The Producer Price Index for Manufactured Products comprises products intended for the domestic market and exported products. Statistics Finland publishes a separate price index describing development in the prices of exported goods. Enterprises also export some of the services they produce but for the time being Statistics Finland does not calculate a separate index for them.

Figure 1 Price Index System



3 Sampling and monitored services

The Producer Price Index for Services is calculated with price data collected from enterprises drawn into a sample. This price Index is considered as being descriptive of the average development in the prices of all services produced for enterprises. To keep the Index up-to-date, the population of the service enterprises included in the sample of the Producer Price Index for Services is reviewed at least every five years.

Statistics Finland's Business Register is used as the sampling frame for the Producer Price Index for Services. The Business Register contains data on the industry and turnover of enterprises. Industry-specific indices have been designed independent of each other; hence the used sampling method varies by industry. Depending on the industry, data suppliers have been selected by applying PPS (Probability Proportional to Size) sampling or judicious sampling, or by combining judicious and probability-based sampling.

[1] In the ideal situation the Wholesale Price Index would describe the sales prices of wholesale traders and would contain in addition to taxes also wholesale trade margins. In the present system the wholesale trade margin is ignored.

The priced services, or variants, were selected in co-operation with the data suppliers. The objective was that the examined variants would be as representative as possible and could be monitored as well as possible. The selection criteria for the variants were:

- The variant is as representative as possible and generates a significant share of the enterprise's turnover
- The variant reflects as closely as possible the average development in the prices of other variants of the same service
- Price for a certain unit (e.g. number or day) and quality can be quoted regularly by quarter (or less frequently) for the variant
- The variant remains on the market for as long as possible.

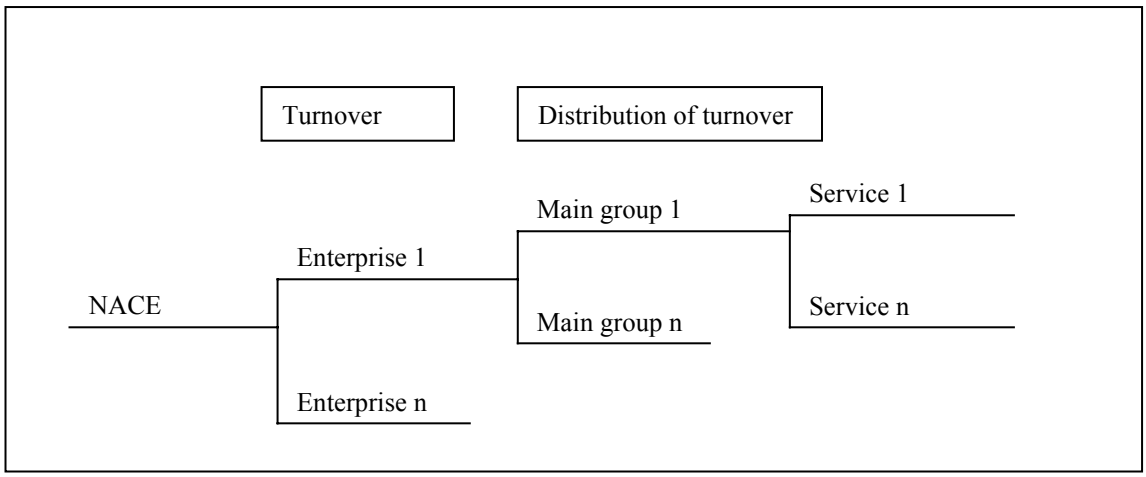
Due to non-response, some of the enterprises drawn to the sample had to be replaced by additional sampling which was implemented judiciously by selecting the replacement from the old frame wherever possible.

The Producer Price Index for Services is calculated using over 17,500 price data items collected from approximately 360 data suppliers. The numbers of price data items and data suppliers vary by industry. Roughly 15,000 of the price data items concern the leasing of office and business premises.

4 Weight structure and its formation

The industry-specific indices of the Producer Price Index for Services describe the average development of prices in the industry concerned. The industry-specific indices are Laspeyres indices with fixed weights. The geometric means of price ratios calculated for individual service products are added up to an enterprise's main group indices which are then weighted to an overall index for the industry with a weighting coefficient assigned for each main group. The weighting coefficients are based on data on the enterprises' turnover and its breakdown by main group in each 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 Business Register. The variants selected by the data suppliers do not have their own weights, but data on them are used to calculate a heading index for each data supplier as a geometric average of the price ratios of the commodities.

Figure 2. Formation of the weight structure of industry-specific indices



The overall index is calculated from the industry-specific indices. The weights for the different industries are based on national accounts data from 2003 on the use of services by enterprises and the public sector. The industry-specific weights have been formed by first dividing the total volume of services expressed in euros to the alphabetical main activity level, then to the 2-digit level and from there on to the 4-digit level according to relative use. The weight structure of the overall index is shown on the next page (Table 1). The table also gives information on the coverage of the Producer Price Index for Services.

Table 1 Weight structure of the Producer Price Index for Services 2005=100[2]

	Service industries accordin to NACE SIC	Industry's share of all services	Coverage of indices	Share of indices of overall index	Internal weight structure of indices
G	**Wholesale and retail trade**	21.6%	-	-	
50	Sale, maintenance and repair of motor vehicles and motorcycles	2.9%	-	-	
51	Wholesale trade and commission trade	15.7%	-	-	
52	Retail trade	3.0%	-	-	
H	**Hotels and restaurants**	2.3%	39.7%	3.2%	
55	Hotels and restaurants	2.3%	39.7%	3.2%	
	5510 Hotels				100.0%
I	**Transport, storage and communication**	24.5%	78.8%	34.2%	
60	Land transport; transport via pipelines	9.2%	83.9%	12.8%	
	6022 Taxi operation				7.0%
	6024 Freight transport by road				93.0%
61	Water transport	1.4%	100.0%	2.0%	
	6110 Sea and coastal water transport				100.0%
62	Air transport	1.8%	100.0%	2.5%	
	6210 Scheduled air transport *)				100.0%
63	Supporting and auxiliary transport activities	4.8%	22.4%	6.7%	
	6311 Cargo handling				64.5%
	6312 Storage and warehousing				35.5%
64	Post and telecommunications	7.3%	100.0%	10.2%	
	6411 National post activities				19.7%
	6412 Courier activities other than national post activities				7.2%
	6420 Telecommunications				73.1%
J	**Financial intermediation**	4.6%	-	-	
65	Financial intermediation	3.5%	-	-	
66	Insurance and pension funding	0.6%	-	-	
67	Activities auxiliary to financial intermediation	0.6%	-	-	
K	**Real estate, renting and business activities**	41.0%	66.0%	57.3%	
70	Real estate activities	10.5%	62.9%	16.8%	
	7020/9 Toimisto- ja liiketilojen vuokrat				100.0%
71	Renting of machinery and equipment	1.3%	38.0%	2.1%	
	7132 Renting of construction and civil engineering machinery and equipment				100.0%
72	Computer and related activities	6.2%	100.0%	10.0%	
73	Research and development	5.3%	-	-	
74	Other business activities	17.7%	77.5%	28.4%	
	7411 Legal servcives				4.0%
	7412 Accounting, book-keeping and auditing activities; tax consultancy				6.7%
	7413 Market research and public opinion polling				1.2%
	7414 Business and management consultancy activities				12.0%
	7420 Architectural and engineering activities				31.3%
	7430 Technical testing and analysis				5.4%
	7440 Advertising				21.8%
	7450 Labour recruitment and provision of personnel				4.3%
	7460 Investigation and security activities				3.2%
	7470 Industrial cleaning				10.0%
L	**Public administration and defence**	0.0%	-	-	
75	Public administration and defence	0.0%	-	-	
M	**Education**	0.9%	-	-	
80	Education	0.9%	-	-	
N	**Health and social work**	1.2%	-	-	
85	Health and social work	1.2%	-	-	
O	**Other community, social and personal service activities**	3.8%	7.0%	5.3%	
90	Sewage and refuse disposal, sanitation and similar activities	1.6%	-	-	
91	Activities of membership organizations	0.3%	-	-	
92	Recreational, cultural and sporting activities	1.6%	-	-	
93	Other service activities	0.3%	93.9%	5.3%	
	9301 Washing and dry-cleaning of textile and fur products				100.0 %
	Total	100.0 %	47.6%	100.0%	

*) The index is included in the calculation of the overall index, but its point figures are not public.

[2] The weights are based on national accounts data from 2003 on the use of market services by enterprises and the public sector.

5 Collection of price data

The price data for the Producer Prices Index for Services are mainly collected from enterprises. The data are collected with an electronic questionnaire via the Internet, or by email, post or fax.

Besides the data collected direct from enterprises, price data and point figures from the Consumer Price Index are also utilised in the compilation of the Producer Price Index for Services. In addition, price data on office and business facilities are provided by the Institute for Real Estate Economics (KTI).

Depending on the industry, the time of quoting the price data collected from enterprises may be the first, second or third month of the quarter under review. In some cases real charged unit prices are collected for the whole quarter under review.

The pricing method used in the Producer Price Index for Services varies by industry and enterprise. The real price can often be used for identically repetitive services. For other services, the employed method could be based on a unit value, model pricing or the time used for producing the service.

The average response rate of the price inquiry has been in the region of 98 per cent.

6 Changes in quality

The Producer Price Indices for Services are “pure” price indices, which should not be affected by changes in the quality of the measured variants. Qualitative changes and their treatment are the main challenges in index calculations. Application of diverse statistical methods for controlling for changes in quality has been widely studied internationally[3]. The methods used in controlling for changes in quality can roughly be divided into two groups; indirect quality measurement methods and direct quality measurement methods.

Methods from both groups are judiciously utilised in the compilation of the Producer Price Index for Services, but most often indirect methods. The following quality adjustment methods are used in the Producer Price Index for Services:

Indirect methods:

- Overlapping observations:
  In this case data are collected on both the new and the old variant at the same point in time. Thus data on the genuine price development are obtained for the time period before and after the change, whereby the price history of the service remains unbroken despite the change in the monitored variant.
- Imputation of price with the mean for the industry:
  Here the development in the price of an individual variant is assumed to be identical to that of all other variants of the same industry.
- Products are assumed to be qualitatively identical:
  In this case no actual adjustment is made for quality, but the index is allowed to change according to the price difference between the new and old variant.

[3] A good source list would be the source list of the chapter concerning this in the OECD manual . http://www.imf.org/external/np/sta/tegppi

- Price change is assumed to derive from change in quality:
  This method is totally reversed from the one described above. In this case the price difference between the new and old variant is assumed to derive from qualitative change, and the index is not allowed to change.
- Old price is carried forward:
  Use of this method is not recommended in quality change cases. The method is applied in the Producer Price Index for Services only if price is not obtained for a monitored variant during the reviewed month for some reason. If the data are not obtained in several successive quarters the service is put under surveillance and the average price development in the industry is imputed as the price for it until such time as genuine price data are found as replacement.

Direct methods:

- Expert assessment:
  Discretionary changes may in certain cases be made to the Index if more accurate data on the development of the price of an examined service are available from some other source. This may also be done if for some reason the employed method does not measure the realised development correct, e.g. by ignoring some significant change that has taken place on the market.
- Quantitative adjustment:
  This is used if the occurred price change derives fully or partially from change in the quantity of the monitored variant.

7 Contents of industry-specific indices

Industry	*Services:*
5510 Hotels	Hotel room on a weekday.
6022 Taxi operation	Same as the index for taxi journeys in the Consumer Price Index (COICOP 07.3.2.2).
6024 Freight transport by road	Transport of parcelled goods, part and full vehicle load transports, road tanker transports, forestry transports, transport services for manufacturing and temperature-controlled vehicle transports.
6110 Sea and coastal water transport	Transport of cargo by sea (containers, transport of frozen and refrigerated goods, tanker transport, transport services for manufacturing, general cargo, e.g. trailers, and dry bulk cargo).
6210 Scheduled air transport	Transport of freight and passengers. The index point figures are not public.
6311 Cargo handling	Stevedoring services for vessels (on and off loading of cargo).
6312 Storage and warehousing	Storage and warehousing proper (in outdoor, indoor, warm, cold, frozen, tank or silo depots) and transhipments of goods.

641 Post and courier activities	Transport of postal items (letters and parcels) and other distribution and courier activity.
6420 Telecommunications	Services in fixed line network, and mobile calls and text messages.
7020 Letting of own property	Separate indices for rents of office and business premises. The index is only calculated twice a year, in the 2nd and 4th quarter.
7132 Renting of construction and civil engineering machinery and equipment	Passenger hoists, scaffolding, weather shelters and site facilities, heating devices, electricity switchboards, pumps, drilling and chipping machines and other machinery and equipment.
72 Computer and related activities	The index is only published at the 2-digit level. The index covers software design, supply and consultancy, data processing, hardware consultancy, and repair and maintenance of office, accounting and computing machinery.
7411 Legal activities	Legal advisory service activities
7412 Accounting, book-keeping and auditing activities; tax consultancy	Book-keeping, compiling of financial statements, payroll accounting, services related to taxation and auditing.
7413 Market research and public opinion polling	Diverse market research and opinion poll surveys.
7414 Business and management consultancy activities	Consultancy services for general administration, consultancy services for financial administration (not connected with corporate taxation), consultancy services for personnel management, consultancy service for production, communication services and other business management consultancy services.
7420 Architectural and engineering activities and related technical consultancy	Architectural services and community planning, technical services for civil engineering, structural engineering services, heating, plumbing and air-conditioning design services, electrical engineering design services and mechanical and process engineering design services.
7430 Technical testing and analysis	Inspection of motor vehicles and other testing, inspection, measurement and validation services
7440 Advertising	Advertising design, sales of advertising space, advertising on radio, newspapers and periodicals, and television advertising.
7450 Labour recruitment and provision of personnel	Labour rental.
7460 Investigation and security activities	Guarding services.

7470 Industrial cleaning	Cleaning services used by enterprises and the public sector.
9301 Washing and dry-cleaning of textile and fur products	Washing and drycleaning services used by enterprises and the public sector.

8 Calculation of the index

The overall index of the Producer Price Index for Services describes average development in the prices of the industries covered by the index. First, geometric means are calculated for the separate services, or main groups, of each enterprise from price ratios (= current price/previous quarter's price) deduced from individual variants. These micro indices are combined into enterprise-specific/industry-specific indices/overall index by weighting each micro index with its own weighting coefficient. Thus, the size of the impact on the Index from changes in the prices of individual enterprises and services varies.

In practice, indices for point in time t are calculated as follows:

The micro index is the enterprise's given service or main group which contains 1–n different variants. First, the price ratios of individual variants of each main group of each enterprise are used to calculate geometric means for them – average change form the previous quarter in the prices of the main group. The micro indices of the previous period (t-1) are carried onwards with this change

$$I_{maingroup,t} = \exp(\frac{1}{n^t}\sum_{i=1}^{n^t}\ln(\frac{p_{it}}{p_{i(t-1)}}))\cdot I_{maingroup,t-1},$$

for all enterprises and all main groups. The number of variants belonging to a main group may fluctuate in time. The essential criterion for the inclusion of a variant in the calculation is that either a genuine or imputed price observation is found for it for both the reference and the comparison period.

Enterprise-specific indices are calculated with these micro indices. Data on the distribution of an enterprise's turnover by main group are used as the fixed weights. The distribution always sums up.

$$I_{enterprise,t} = \sum_{k=1}^{K} w_{maingroup(k)} \cdot I_{maingroup(k),t},$$

where K is the number of main groups of an enterprise.

These indices for individual enterprises are weighted together into an industry-specific price index. Data on an enterprises' pure turnover from each industry are used as the weight.

$$I_{industry,t} = \sum_{s=1}^{S} w_{enterprise(s)} \cdot I_{enterprise(s),t},$$

where S is the number of enterprises included in an industry in the Index. W represents an enterprise's share of the total turnover of all enterprises in the industry.

Finally, the overall Index is obtained by weighting together the industry-specific indices with the weights for each industry.

$$I_{total,t} = \sum_{l=1}^{L} w_{industry(l)} \cdot I_{industry(l),t},$$

where L is the number of industries, i.e. 24, and w an industry's share of the overall Index. It is worth noting that the calculation of the enterprise-specific indices is in a way unnecessary: the same results could be obtained by dividing the weight of an industry direct to the micro level, i.e. enterprises and their main groups. However, to ensure the reliability of the results and facilitate the necessary verifications the calculation proceeds in the manner described above.

9 Publication of the Producer Price Index for Services and provision of other information from it

The Producer Price Index for Services is published quarterly in Statistics Finland's publication Producer Price Index for Services on the 17th day of the month following the end of a statistical reference quarter, or on the nearest weekday after it. The publication contains the following information:

- Point figures and annual change percentages by year since 2005
- Producer Price Indices for Services 2005=100 by industry

In addition, the Producer Price Index for Services is published in Bulletins of Statistics, the Statistical Yearbook of Finland and in the FINSERIES time series database. Point figures of the Producer Price Index for Services can be found at: http://stat.fi/til/pthi/

10 Possible sources of error in the Producer Price Index for Services

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 Index for Services, substitution bias may arise because (when maximising their profits) enterprises react to changes in relative prices and shift the emphasis of their activity. Thus, an index calculated with Laspeyres' formula underestimates price development from enterprises' viewpoint[4]. The significance of the substitution bias depends on the scale and speed at which individual enterprises are able to redirect their activities when relative prices change.

Fixed-weight indices may contain bias arising from the entry of new products or services on the market. When new services are mentioned reference is often made to data processing services the production and sales of which can grow quite rapidly in the course of a five-year time span. If there is vigorous change, an index may not describe sufficiently accurately average development in the prices of the services produced in the economy. However, the bias caused by new services is not very significant in practice, because a new service can be added to the ones monitored with the index if the volumes of its production and sales have increased significantly.

[4] In the Consumer Price Index the possible substitution bias would be exactly the opposite as consumers switch over to a commodity that is cheaper in relative terms.

The objective of producer prices indices is to describe pure price development, therefore, changes in the quality of products must be taken into consideration in their calculations. The problem of quality change is usually encountered either when a data supplier reports that a variant on which data are collected is no longer produced or exported, or that changes have been made to the variant concerned. The quality adjustment methods used in the Producer Price Index for Services are described in Chapter 6.

Other factors that have a bearing on the precision of the Index are accuracy of the sampling frame and the data on which the weight structure is based, possible errors in the processing of individual data items, and non-response.

11 Usages of the Producer Price Index for Services

- 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. Many enterprises, such and investment banks, can also exploit the data in their macroeconomic forecasting models.

- One of the key purposes for which the Producer Price Index for Services is used is as a deflator in national accounts calculations. With it, change in the value of production or sales is converted to change in the volume of production.

- 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. Indexing is a means of seeking protection against inflationary risks. In practice, an index clause is usually attached to long-term agreements. Limitations on the use of an index clause are laid down in the Act on the Restriction of the Use of Index Clauses.

- Enterprises can utilise the data from producer price indices for comparing the prices of their purchases or the services they have sold against the average price development.

- The data from the Producer Price Index for Services can be combined with other data on business trends, such as those on the turnover of service industries in order to analyse business trends more closely. Apart from the ones mentioned here, producer price indices can be used for a host of other practical purposes.

12 Calculating with indices

12.1 Calculating change

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

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

An example: What was the change in the price index for warehousing 2005=100 from the first quarter of 2004 to the third quarter of 2005? The point figure for the first quarter of 2004 was 98.4 and the point figure for the third quarter of 2005 was 100.2. Thus, the change in question was $\frac{100.2 - 98.4}{98.4} \cdot 100 \approx 1.8$, i.e. 1.8 per cent rise.

12.2 Deflation and volume calculations

Price indices, such as the Producer Price Index for Services, can be used as deflators in volume calculations. In this instance, the change in a certain value (value index), such as the value of the sales of an enterprise, for example, 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 Services or one of its sub-indices is used as a deflator. The volume index is calculated according to the following formula:

$$\text{Volume index} = \frac{\text{Value index}}{\text{Price index}} \cdot 100 .$$

An example: The value of the sales of an enterprise went up by 8.9 per cent from 2004 to 2005. At the same time the prices of the services the enterprise sells went up by 0.3 per cent. Thus, the change in the volume of the sales was:

$\frac{108.9}{100.3} \cdot 100 \approx 108.6$. The growth in the volume from 2004 to 2005 was 8.6 per cent.

Further information about index calculations can be found in the Indices module of the eCourse in Statistics on Statistics Finland's website.