Inventory of the sources and methods for national accounts volume estimates

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Contents

1 Introduction

The GDP volume growth described in the national accounts compiled by Statistics Finland is one of the most important macroeconomic indicators. When we are talking about economic growth, we are specifically referring to GDP volume growth. To calculate productivity, we also need information on the volume of value added or the volume of output.

This document describes the methods and sources used to produce the price and volume calculations contained in Finland's national accounts. The methods to calculate price and volume estimates concern the methods used to break down the current-price values of transactions in products into price and volume components.

The methods to compile the price and volume estimates were fundamentally changed in the calendar year 2006 and the changes have been applied since the statistical year 2001. The changes are based on the following five methodological decisions, which are still in effect:

- Chain index calculation method (instead of base index)
- Deflation as the primary method
- Double deflation of value added
- Calculating individual non-market services by means of the volume indicator method (instead of the input method)
- Balancing supply and use tables in previous years prices in addition to current prices in the final estimates

The principles are based on the objective of the European Commission to have unified price and volume methods for all EU Member States. The European Commission has also specified three important methodological principles for the calculation of prices and volumes.

1. The elementary level of aggregation: the minimum level of detail is 64 industries and 64 products.
2. The choice of index formula: The Laspeyres index formula must be used to aggregate the volume data and the price data must be aggregated using the Paasche index formula.
3. The choice of base year: the volume data are aggregated using the Laspeyres index formula by weighting data from the previous year.

1.1 General methods

The volume calculation contained in the national accounts is based on supply and use tables. Supply and use tables are used to calculate price changes for all transactions in products. Price changes are calculated separately for all relevant classification combinations of the transactions.

Table 1 Combinations of transactions in products

Transaction in products/classification	ESA 2010 transaction code	ESA 2010 Institutional sector	NACE industries	Producer type	Consumption class (ECOICOP)	ESA 2010 Fixed assets
Output	P1	•	•	•		
Intermediate consumption	P2	•	•	•		

Private consumption expenditure, S.13	P31	•				
Private consumption expenditure, S.14	P31	•			•	
Private consumption expenditure, S.15	P31	•				
Collective consumption expenditure	P32	•				
Gross fixed capital formation	P51	•	•	•		•
Changes in inventories	P52	•	•	•		•
Net acquisition of valuables	P53	•	•	•		•
Imports	P7	•				
Exports	P6	•				

In the national accounts, current-price values are deflated by combination using price changes derived from the supply and use tables. In addition to the classifications of transactions in products listed in the national accounts, supply and use tables also contain the product dimension. The estimates for the national accounts' aggregates are calculated by summing up all products in the aggregate.

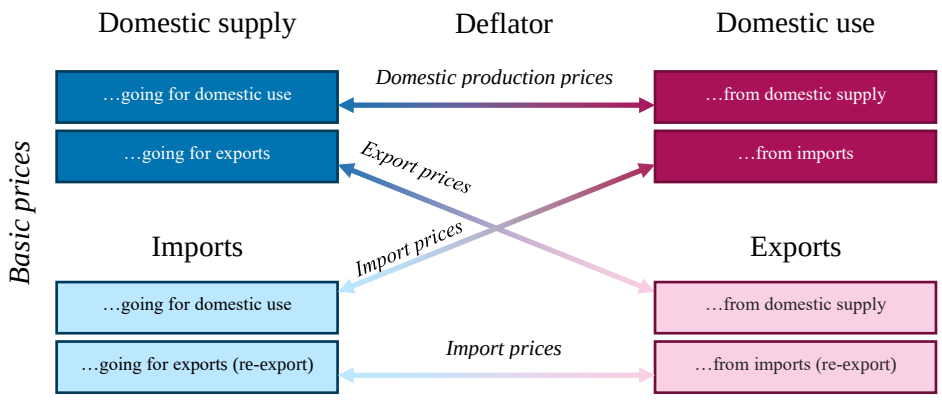
Before the supply and use tables can be used in the volume calculation for the national accounts, each product in the current-price supply and use tables must be calculated in terms of previous years prices. There are two alternative methods for calculating the fixed-price value:

1. Deflation
   Current-price values are divided by the price change (deflated) to calculate the volume data or
2. Volume extrapolation
   The base year value is extrapolated by the volume index, which gives the value of the year in question at base year prices. After this, the price component can be calculated.

Deflation is the primary method for all product transaction categories and all products and it is used for most of the combinations.

The price change estimate of supply must be in balance with the price change estimate of use, for each product. For this reason, there are dependencies between supply and use price data as shown in the table below.

Figure 1 Supply and use prices interdependencies.



1.2 Price, volume, quantity, and quality

The volume estimates differ in nature from the estimates of current-price values. The estimates of the current-price values of the main aggregates contained in the national accounts are based on real, observable transactions. Ultimately, current-price aggregates are sums of these transactions.

At the same time, however, the volume estimates describe a world where these identical transactions would have been realised at previous year's prices. In other words, these volume euro amounts are not a direct result of real transactions.

By definition, the price of a single product is the same as the value of a single product. For a single homogeneous product, the value of a transaction (v) is the product of the product unit price (p) and the number of units (q):

(1)

$$v = p \times q$$

In the case of a single product, the matters are quite simple and we can add up the number of units produced. For example, if 1,000 litres (q) of liquid milk (KTTL 105110) is produced at a price of EUR 0.5/litre (p), we get the value (v)

Example 1

$$value_{milk} = price_{milk} \times amount_{milk}$$

$$value_{milk} = \frac{EUR\ 0.5}{I} \times 1{,}000l = EUR\ 500$$

However, the number of units of dissimilar products cannot simply be added up. For example, let us imagine the entire economic output as a single aggregate comprising all possible products. How could we add up the amounts of the following products?

- *Oats (011133)*
- *Liquid milk (105110)*
- *Processed paper (171270)*
- *Flat rolled products of steel (241000)*
- *Passenger air transport services (511000)*
- *Computer programming services (620100)*

The units of measurement are the first problem that we encounter when trying to sum up these amounts: some of them would probably be measured by mass, others by volume and some by piece. Even if all of them were measured by piece, weighting of the number of pieces according to their economic significance would still be a problem: one milk carton is not as significant as one air passage. *Aggregating* the products by using a weight structure is the solution. For such product aggregates (sum levels consisting of more than one product), the term 'volume' is used (instead of 'quantity'). Instead of litres, grammes and pieces, volume euros are used as units of measurement for individual

products and aggregates. Price and volume decompositions must be calculated for all aggregates of transactions in products so that the following equation holds:

(2)

$$value\ index = price\ index \times volume\ index$$

This formula indicates that all changes in value must arise from changes in prices or volumes or a combination of the two. Changes in prices may only contain changes in prices of homogenous products. All other changes belong to the volume change component.

When price changes are left in the price component, both the quantity and qualitative changes are left in the volume component. In everyday language, quality is usually considered a term describing the attractiveness of the product (for example, ‘of high quality’ or ‘of poor quality’). However, the earlier example of product summing shows that, in its simplest form, quality refers to differences between products. Oats and milk are two different products at the level of the economy as a whole, whereas oats and wheat are two products of different quality in the agricultural products sub-aggregate. At the product-specific level, there are also differences in product quality; for example, there are many different varieties of potatoes and they can all be interpreted of being of different quality. Moreover, they can also be sold as soil-covered, brushed or washed and ultimately, the number of different quality combinations can be huge. Identifying different products based on physical properties is the easiest part of identifying qualitative differences. However, quality is more than just the physical product properties. The qualitative differences between products also cover the terms of transaction and such features as the characteristics of the sales location. This means that a T-shirt purchased online is of different quality than an identical T-shirt bought from a corner shop.

As the price change component only includes the changes in the prices of homogeneous products, the changes in quality are included in the volume change component.

In theory, the volume index could be further decomposed into a quality index and a volume index. This is not mandatory in practice, but it may be useful to produce imaginary decompositions for qualitative and quantitative changes at the aggregate level. This may help to analyse the credibility of the figures. For example, comparison data related to electronic products stating that quantities are decreasing, does not mean that volume is necessarily decreasing. This is easy to believe because rapid qualitative changes are typical of electronic products.

In the light of what is said above, it is easy to conclude that making direct volume measurements is difficult. Fortunately, however, to make indirect measurements, we only need to know two of the three variables of Formula 2. The value and price data observed in real life help us to derive the missing piece, volume index.

1.3 Index formulas

It was specified in Formula 2 that the value index consists of the price index and the volume index. This definition should be further specified. As the price index and the volume index are aggregated as weighted averages, the index formulas used to carry out the aggregation must be

defined. The Laspeyres, Paasche and Fisher index formulas are the most commonly used formulas in national accounts internationally. They can be paired as follows:

(3)

1. $value\ index = Paasche\ price\ index \times Laspeyres$ volume index
2. $value\ index = \ Laspeyres\ price\ index \times Paasche$ volume index
3. $value\ index = \ Fisher\ price\ index \times Fisher$ volume index

As already mentioned at the beginning of section 1, as stated in European Commission decision 98/715, the volume index must be aggregated using the Laspeyres index formula and the price index using the Paasche index formula (Alternative 1). As constructing the volume index directly would be difficult, we first need the value index and the Paasche price index so that we can produce the Laspeyres volume index as the ratio of the two.

(4)

$$Laspeyres\ volume\ index = \frac{Value\ index}{Paasche\ price\ index}$$

As the value index can be obtained from current-price calculation, only the Paasche price index must be calculated.

(5)

$$Paasche\ price\ index\ = \frac{\sum_{i=1}^{n} p_i^t q_i^t}{\sum_{i=1}^{n} p_i^0 q_i^t}$$

The sum of the products of current price and quantity is the formula numerator. No data on the quantities of individual homogeneous products are available but, as Formula 1 shows, the product of price and quantity corresponds to the current-price value of the product. In other words, current-price product values are summed up in the numerator $\sum_{i=1}^{n} v_i^t$. These values can be found in the current-price supply and use tables.

In the Paasche index formula denominator, current quantities are multiplied by prices of period 0 (previous year) and the sum of these products is calculated. To make it easier to use the formula in combination with supply and use tables, it should first be edited with the help of an $v_i^t = p_i^t \times q_i^t$ identifier.

(6)

$$\frac{\sum_{i=1}^{n} p_i^t q_i^t}{\sum_{i=1}^{n} p_i^0 q_i^t} \equiv \left[\sum_{i=1}^{n} \left(\frac{p_i^t}{p_i^0}\right)^{-1} \frac{v_i^t}{\sum v_i^t}\right]^{-1} \equiv \frac{\sum_{i=1}^{n} v_i^t}{\sum_{i=1}^{n} \left(\frac{v_i^t}{p_i^t / p_i^0}\right)}$$

The current-price product values are now summed up in the formula numerator, while in the denominator the same is done to the current-price values that are divided by price change p_i^t / p_i^0. In other words, deflated (fixed-price) product values are summed up in the denominator. Product-specific deflation is part of the preparation of supply and use tables and it results in fixed-price supply and use tables. When the current-price and fixed-price supply and use tables are ready, the price indices based on the Paasche index formula for transactions in products can be calculated as quotients of the current-price and fixed-price product sums.

This same calculation principle is repeated in the calculation examples of all transactions in products that are presented in this methodological description of price and volume calculations.

Index formulas used in price statistics and national accounts

Most of the price indices produced by Statistics Finland for its price statistics, such as the producer price indices and consumer price indices, are calculated using the Laspeyres index formula. The *volume* based on the Laspeyres formula is used in the national accounts and in the supply and use tables and this volume is produced by carrying out the deflation by the price index calculated based on the *Paasche* index formula. However, this discrepancy is not an issue because with more than 800 products, the supply and use tables are fairly accurate. Even though the price indices are in accordance with the Laspeyres formula at the 800 product compilation level of detail, from that level of detail upwards, the aggregation for the national account classifications are carried out in accordance with the Paasche formula. According to the Handbook on prices and volume measures in national accounts by Eurostat, the second acceptable reason for using prices based on the Laspeyres formula is the fact that both formulas may produce very similar price changes. In other words, the price indices based on the Laspeyres formula are approximating sufficiently the price changes based on the Paasche formula.

1.4 Chain index calculation and the problem of non-additivity

In addition to current-price value data, the fixed-price value data (value data at previous year's prices) deflated using the Paasche price index are also published in Finland's national accounts. As the values at previous year's prices are calculated using the Paasche price index, the Laspeyres volume index can be derived based on the data at the previous year's prices and current-price data, if necessary. Annual volume change data expressed in percentages as well as the volume series at reference year prices, where the reference period is set to the latest year, the year 2010 and the year 2015, can be found in the StatFin database tables.

In volume data, the focus is often on the relative change between two successive years and in such cases, the figures can be obtained from the StatFin table by using the 'Changes in volume %' variable. You can also

calculate the changes yourself based on current-price and fixed-price data by dividing the fixed-price value of the year in question by the current-price value of the previous year.

However, it is sometimes necessary to examine trends in individual main aggregates or sub-aggregates over a longer period. In such cases, fixed-price values or change percentages over two successive years are not enough. In both cases, the previous year is always used as the reference period and thus in such cases, changes over longer periods are not identifiable. For example, it might be necessary to examine the recovery of a transaction from a shock, such as the 2008 financial crisis. For such purposes, we must examine the volume figures for the current year and the year 2008. However, comparisons between these two years can only be made if both have the same reference period.

The process in which the volume data for more than one year are set for the same reference period is called chain-linking. In chain-linking, only the reference period for fixed-price figures is changed while the base period remains the same. Thus it is also important that in a chain-linked index, the relative changes between two successive years are the same as the changes before the chain-linking process. In the chain-linking process, the sums of the chain-linked sub-items no longer act in accordance with the original change percentage. Thus the sub-items and their sums must be chain-linked separately so that the prerequisite for changing volume figures holds at all levels. The gaps between the sums of the chain-linked aggregate and its chain-linked sub-items can widen as we go further from the reference period.

1.4.1 Additivity problem – calculation example

Calculation of the chain-linked volume series for industries 16 Manufacture of wood and of products of wood and cork (except furniture); manufacture of articles of straw and plaiting materials, and 17 Manufacture of paper and paper products, and their aggregate 16–17 Forest industry market output (P1R).

The chain-linking starts with the examination of changes in volumes between successive years. Deflation by the Paasche price index formula, producing volume figures that are in accordance with the Laspeyres volume index formula, is the method used in the national accounts.

Year	NACE 16 P1R CuP, EUR million	NACE 17 P1R CuP, EUR million	NACE 16–17 P1R CuP, EUR million	NACE 16 P1R FP, EUR million	NACE 17 P1R FP, EUR million	NACE 16–17 P1R FP, EUR million
2010	5,498	13,474	5,498 + 13,474 = 18,972	5,141	12,433	5,141 + 12,433 = 17,574
2011	5,637	13,637	19,274	5,557	13,049	18,606
2012	5,509	13,423	18,932	5,524	13,791	19,315
2013	5,745	13,283	19,028	5,641	13,445	19,086
2014	5,778	13,068	18,846	5,633	13,151	18,784
2015	5,663	13,584	19,247	5,760	13,059	18,819
2016	5,859	13,270	19,129	5,915	13,639	19,554
2017	6,412	14,191	20,603	6,332	14,062	20,394
2018	6,671	15,410	22,081	6,388	13,961	20,349
2019	6,440	15,179	21,619	6,427	15,457	21,884
2020	6,187	12,748	18,935	6,322	13,990	20,312

For current-price (CuP) and fixed-price (FP) values, the aggregate is identical to the sums of its sub-items. Changes in volumes can be calculated using

$$Laspeyres\text{-}volume\ index_T = FP_T / CuP_{T-1}$$

Changes between successive years can thus be treated as Laspeyres volume index figures in which the previous year is used as the reference period and the reference period is given the value 1.

Year	16 Volume index	17 Volume index	16–17 Volume index
2010	*Cannot be calculated with the data given in the example as t-1 (i.e. 2009) is not available in this example.*		
2011	EUR 5,557 million/EUR 5,498 million = 1.011	0.968	0.981
2012	0.980	1.011	1.002
2013	1.024	1.002	1.008
2014	0.981	0.990	0.987
2015	0.997	0.999	0.999
2016	1.044	1.004	1.016
2017	1.081	1.060	1.066
2018	0.996	0.984	0.988
2019	0.963	1.003	0.991
2020	0.982	0.922	0.940

The reference period is selected when the volume change figures based on the Laspeyres index formula for successive years are available. Any year can be selected as the reference period. Years divisible by five (such as 2010 and 2015) are usually selected as reference periods. Moreover, a chain-linked volume index series is available in all StatFin tables, where the latest year for which the calculations have been made is used as the reference period.

In this example, the year 2015 is used as the reference period. The current-price value for 2015 is used as the value for the reference period because it is expressed in the quantities and prices of the year 2015. The chain-linking is taken forward from the year 2015 by multiplying it by the volume change in 2016/2015, its product by the change in 2017/2016, etc. Chain-linking backwards is done by multiplying it by the reciprocal for 2015/2014 (change figure for 2014/2015), while its product is multiplied by the change figure for 2013/2014 and then further backwards, using the same formula for each year.

Year	16 Chain-linked volume, year 2015, EUR million	17 Chain-linked volume, year 2015, EUR million	16–17 Chain-linked volume, year 2015, EUR million
2010	5,713	13,996	19,707
2011	5,774	13,554	19,326
2012	5,658	13,707	19,367
2013	5,681/0.981 = 5,794	13,730	19,525
2014	5,663/0.997 = 5,681	13,593	19,275
2015 (reference year)	**5,663**	**13,584**	**19,247**
2016	5,663* 1.044 = 5,915	13,639	19,554
2017	5,915* 1.081 = 6,393	14,453	20,847
2018	6,369	14,219	20,590
2019	6,136	14,262	20,406
2020	6,023	13,145	19,173

In the previous table, 16–17 Forest industry output aggregate is chain-linked separately. The calculations below show the sums of the chain-linked sub-item values and the difference to the separately chain-linked aggregate.

Year	16–17 Chain-linked volume, year 2015, , EUR million	16 Chain-linked volume + 17 Chain-linked volume, EUR million	Difference, EUR million
1975	7,828	7,739	89
…	…	…	…
2010	19,707	5,713 + 13,996 = 19,708	-1.7
2011	19,326	19,328	-1.8
2012	19,367	19,365	2.0
2013	19,525	19,523	1.5
2014	19,275	19,274	0.6
2015 (reference year)	**19,247**	19,247	0.0
2016	19,554	19,554	0.0
2017	20,847	20,846	1.6
2018	20,590	20,587	2.7
2019	20,406	20,398	8.6
2020	19,173	19,168	4.5

The further we go from the reference period, the larger the average differences become. However, it is important to remember that the separately chain-linked value for the aggregate is the correct figure and it should not be adjusted in accordance with the sum of the sub-items.

2 Most important sources and methods

The most important sources for volume calculations in the national accounts describe prices and volume trends. In fact, measuring the prices and volumes can be approached from two different directions:

1. Current-price values are divided by price change (deflated) so that the volume data can be calculated or
2. The base year value is extrapolated by the volume index, which gives the value of the year in question valued at base year prices. After this, the price data can be calculated.

Thus we only need to know the change in prices or volumes because the missing component can be obtained as a calculation residue.

The first method, in which the deflation is carried out by a suitable price index, is the most common (and the recommended) method. Most common case for using volume data is that no price data are available. Certain public services (such as education and public healthcare) are services for which no price can be determined in the market. Alternatively, the volumes of such non-market services can be calculated by deflating the production inputs instead of the output.

This section describes the most important sources and methods for price and volume calculations, especially in connection with the processing of qualitative changes. For more detailed descriptions of the sources, see the pages of individual statistics on Statistics Finland's website. The sources of prices and volumes used are listed in the table below (Table 1).

Table 2: Data sources for price and volume calculations

Data source	Price/volume data	Organisation
Producer price indices	Price	Statistics Finland
Producer price indices for services	Price	Statistics Finland
Index of producer prices of agricultural products	Price	Statistics Finland
Consumer price index	Price	Statistics Finland
Index of wage and salary earnings	Price	Statistics Finland
Rents of dwellings	Price	Statistics Finland
Index of real estate maintenance costs	Price	Statistics Finland

Price index of public expenditure	Price	Statistics Finland
Building cost index	Price	Statistics Finland
Cost index of civil engineering works	Price	Statistics Finland
Industrial roundwood trade	Price	Natural Resources Institute Finland
The following price data produced by the national accounts: agriculture, berries, fish, game meat, drugs, forestry (excl. industrial roundwood trade) and taxes	Price	Statistics Finland
Price indicator for renovation construction	Price	Statistics Finland
Building and dwelling production: volume index of newbuilding	Volume	Statistics Finland
Turnover of trade: volume index of sales in trade	Volume	Statistics Finland
Volume indicators produced by the national accounts: education services, health services, compulsory social security services	Volume	Statistics Finland

2.1 Price and volume sources

2.1.1 Producer price indices

Data description

Producer price indices for manufactured products measure the price trends in products and industrial services produced by enterprises. Separate indices are produced within the framework of producer price indices and of these indices, the producer price index for manufactured products, the export price index and the import price index are used in the volume calculations for the national accounts.

The producer price index for manufactured products measures the average changes in the prices of the goods sold by domestic producers. The index contains the goods sold at home and abroad. The index series used in deflation only contain the goods intended for use at home. The factory price exclusive of taxes is the price charged for them.

The export price index used in export deflation measures trends in the FOB prices[1] of export goods. Export prices in foreign currencies are converted into euros at the mean rate of the statistical reference month.

The import price index measures trends in CIF prices[2] for imported goods (inclusive costs, insurance and freight). Import prices in foreign currencies

[1]FOB = Free on Board. Value of goods at basic price inclusive of transport and delivery to the designated border location and any taxes on export goods less subsidies.
[2]CIF = Cost, Insurance and Freight. The price includes costs, insurance and freight between the ports of loading and the destination. The seller pays the sea freight to the agreed port of destination and takes out marine insurance for the goods in the buyer's favour.

are converted into euros at the mean rate of the statistical reference month.

Producer price indices are prepared on product basis and in such cases, the principal activity of the enterprises is irrelevant. If a manufacturing enterprise also produces services, its service production is excluded from the scope of the producer price index for manufactured products.

Coverage

Producer price indices cover the following product categories of the CPA 2015 classification (European Classification of Products by Activity):

- Producer price index for manufactured products B–E (from minerals to water and environmental management services)
- Export price index A–E (from agriculture to water and environmental management services)
- Import price index A–E (from agriculture to water and environmental management services)

Sample

The data collection and calculation for producer price indices for manufactured products are sample-based. It is generated by first selecting the product sample (CPA product categories) after which the enterprise sample is generated for each CPA product category. The frames of the CPA product categories and enterprise sample are constructed by using the data contained in the supply and use tables of the national accounts, the statistics on industrial output and the statistics on foreign trade compiled by the Finnish Customs.

The frames of the CPA product categories contain the values of the output produced in Finland and exports and imports by product category. Transit exports are deducted from the exports and thus the figure that remains is the value of exports produced in Finland only. Transit exports are correspondingly deducted from the imports and thus the figure that remains is the value of imports remaining in Finland only. The value of production staying in the domestic market is obtained by deducting exports from the value of domestic supply.

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, this is not a pure cut-off method in which all units beyond a certain threshold would be included. Occasionally, a product category that should 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.

Stratified sampling is used for the sampling of enterprises. The value of the enterprise’s production/imports/exports is used as the basis for stratification. Simple random sampling has been carried out within the stratum. However, the dominant enterprises under each heading have been selected for the sample with the probability of one. The number of enterprises selected for each product category depends on the number of enterprises under the heading.

The products of the CPA product category included in the price monitoring have been selected in cooperation with the enterprises. The aim is that the

monitored products are as representative as possible and that their prices can be easily monitored.

Data source

Most of the price data for the producer price indices are collected directly from the enterprises. Price data or point figures from other statistics of Statistics Finland are also used in the preparation of producer price indices. These statistics include 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. Trends in the prices of certain raw material-based products in imports and exports are measured with the import and export unit value prices obtained from the foreign trade statistics compiled by Finnish Customs. Unit values are only used to measure price trends in homogeneous product groups, such as roundwood, cereal and imported and exported electricity. In addition to data from Finnish Customs, data from the Natural Resources Institute Finland, the Energy Authority, Finnish Energy and international commodity exchanges are also used in the producer price indices.

In 2022, more than 5,500 prices were monitored but the numbers vary by index: The producer price index for manufactured products 2015=100 contained about 600 CPA product categories and 3,200 prices. The export price index 2015=100 contained about 320 CPA product categories and 1,000 prices, while the import price index 2015=100 contained about 600 CPA product categories and 2,200 prices.

Supply and use tables, statistics on industrial output and the foreign trade statistics compiled by Finnish Customs are used in the preparation of the weight structures for the producer price indices for manufactured products.

Calculation

The overall indices of producer price indices describe the average price trends in the product categories included in the index. The individual products whose prices are monitored (variants) do not have weights of their own but the enterprise-specific CPA product category indices (micro indices) are calculated as the geometric average of the price ratios (=current price/price at comparison period) of the products belonging to that category. After this, these micro indices are combined into an overall index in accordance with the Laspeyres formula using the 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.

The producer price indices are annual chain indices. The weight structure of the chain indices is updated each year but the base year remains the same for five years. The new weight structure takes effect in January each year. In addition to the weight structure, the range of products (CPA product categories) collected for the index and the group of enterprises for which price data are collected can also be updated if necessary.

2.1.2 Producer price indices for services

Data description

The producer price index for services measures price trends in the services produced by enterprises. The index describes the price trends in Business to Business (BtoB) and Business to Consumer (BtoC) services.

The volume calculation for the national accounts uses an index series in which Business to All (BtoAll) are included.

The producer price index for services is compiled on product basis. The index describes the trends in the prices of specific service products irrespective of the enterprise's principal activity. If a service enterprise also produces goods, its goods production is excluded from the scope of the producer price index for services. However, an enterprise that mainly produces manufactured goods may also produce services, in which case the services produced by the enterprise fall within the scope of the producer price index for services.

Coverage

The producer price index for services covers the following main categories of the CPA 2015 product classification:

- H Transportation and storage services
- I Accommodation and food services
- J Information and communication services
- L Real estate services
- M Professional, scientific and technical services
- N Administrative and support services
- P Education services
- Q Human health and social work services
- R Arts, entertainment and recreation services
- S Other services

Sample

The sampling framework of the producer price index for services is based on Statistics Finland's Business Register and the statistics on service industry commodities. The Business Register contains the details of the enterprise's industry and turnover. The statistics on service industry commodities describe the structure of turnover and the service selection in the industries producing services.

Most of the enterprises have been selected using PPS sampling (probability proportional to size) but convenience sampling or a combination of convenience and PPS sampling are also used. The products for the price monitoring are selected in cooperation with the enterprises.

Data source

The calculation of the producer price index for services for 2022 was based on more than 3,200 prices supplied by about 420 respondents. Moreover, for a small number of service categories, datasets containing about 20,000 price observations at the time were used. Other indices produced by Statistics Finland, such as the consumer price index, are also used in the compilation of the index. The amount of price data and the number of data suppliers vary by service.

The index weight structure is based on the enterprises' turnover data and their distribution between the key services provided by the enterprises. The turnover details of the enterprises are obtained from the statistics on

service industry commodities and the register of enterprises and establishments or by asking the enterprises to supply the details of the turnover generated by the service in question.

The overall index of the producer price index for services is calculated based on industry-specific product indices. The weights are based on the data obtained from the supply and use tables.

Calculation

The producer price index for services is calculated in the same manner as the producer price index for manufactured products, which is described in section 2.1.1 above.

2.1.3 Index of producer prices for agricultural products

Data description

The index of producer prices of agricultural products measures trends in producer prices for plant-based and animal products from the point of view of the farmer. It shows by how much agricultural producer prices have changed compared to the index base period.

Coverage

The index of producer prices of agricultural products covers the whole of Finland and no regional divisions are used. The field of observation of the statistics is plant-based products, animals and animal products produced by farmers in Finland that are sold to other farmers or to operators outside the agricultural sector (excluding households). The commodities included in the index cover the entire index population. Prices of low-value products are not separately monitored but their sales values are rolled over to other agricultural commodities in the index weight structure. Thus due to the weight structure, the products in the index also represent products not included in the index.

The index covers the following products: cereals, industrial crops, fodder crops, vegetables and garden products, potatoes, fruits, animals and animal products.

Data source

Most of the product price data required for the compilation of the statistics are obtained from the statistics on producer prices of agricultural products compiled by the Natural Resources Institute Finland (Luke). The price data obtained from Luke cover around 70 per cent of the index of producer prices of agricultural products when measured by the index weights. Luke’s statistics cover products sold unprocessed and unpacked from farms to industry, packing centres and intermediate businesses. However, trade between farms is excluded from the statistics. In the index of producer prices of agricultural products, it is assumed that the market price level also applies to trade between farms, such as in the trade of feed grains. As a rule, Luke’s statistics cover more than 80 per cent of the monitored product flows for meat, milk, cereals, turnip rape and rape (The coverage for food potatoes is more limited).

The index of producer prices of agricultural products also uses the price statistics of Kasvistieto Oy for monitoring the price of vegetables. These data account for about 12 per cent of the index as a whole. Kasvistieto Oy estimates that in the main product groups, its price statistics cover between 10 and 40 per cent of the volume of domestic fresh production.

The rest of the price data required for the index are derived from other statistics or Statistics Finland requests the data from data suppliers (this method is used to obtain the data on fodder crops, sugar beet, starch potatoes, certain flowers, honey and furs). Some of the price data on flowers, seedlings and vegetables are derived from the price statistics of the Finnish Glasshouse Growers' Association. The association members cover half of the total area of Finnish greenhouse production. The price data on the products monitored by the Finnish Glasshouse Growers' Association have a weight of five per cent in the index.

The price data collected by Statistics Finland have a weight of less than 13 per cent in the index and the data mostly concerns furskins. Statistics Finland collects fur prices from fur auctions, which are the main point of sale for furskins.

The index weight structure is based on the economic accounts for agriculture compiled by Statistics Finland. The value weights used in the calculation of the index are values of sales outside the agricultural sector and between farms.

Calculation

The index point figures are calculated using the Laspeyres index formula and the base strategy. The observations are aggregated by weight coefficients for products and data suppliers to higher product group levels and ultimately into the overall index. The weight coefficients are used to estimate the price changes and the index point figures describing the population.

2.1.4 Consumer price index

Data description

The consumer price index is the most widely used inflation indicator. The consumer price index describes trends in the prices of goods and services purchased by households in Finland.

Sample

The consumer price index is based on a sample survey to the extent that complete data are not available. Two matters must be defined in the sample survey: the commodity sample (the commodities included in the index) and the outlet sample (the outlets from which data on commodities are collected).

The commodity sample of the consumer price index is based on retail trade sales data, the Household Budget Survey and other sources. The most important methods used in the selection are:

- The selection of the best-selling products measured by sales value (such as daily consumer goods),
- Convenience sampling and sampling based on expert opinions if comprehensive sales data are not available (this method is used for such categories as optical products and meals served in restaurants) and
- Other methods (for example, for new cars, cluster sampling by mark and price category).

The outlets from which the data for the outlet sample are collected are selected to represent the structure of retail trade as closely as possible

with regard to the size of central retail corporations and outlets. Regional differences are also taken into account. Statistics Finland's Register of Enterprises and Establishments is used as the sampling frame. The outlets for the sample are obtained from the frame on a random basis so that different size categories are represented. In addition to turnover, local knowledge of Statistics Finland's interviewers is also utilised in the sampling, which can help to include new important outlets in data collection even if they were not yet shown in the Business Register statistics.

Data source

The price data for the consumer price index are based on the price data collected by Statistics Finland's interviewers, mass data supplied by enterprises, prices collected by means of web scraping and the data collected by consumer price index experts on a centralised basis.

The weight structure of the consumer price index is based on the private consumption expenditure figures contained in the national accounts. The private consumption expenditure is based on the Household Budget Survey and other data sources. The consumption expenditure figures contained in the national accounts are only available at an approximate level. To the extent that the division into consumption items for the national accounts is not sufficiently accurate, sum-level weighting is divided into sub-items, primarily using the sales data supplied by central retail corporations and federations. The Household Budget Survey, statistical data generated by other statistics and Bank of Finland statistics are also used.

For the consumer price index, expenditure on drugs and prostitution and the producers' own consumption are removed from the private consumption expenditure figures contained in the national accounts. The consumption expenditure of non-profit institutions is removed from the consumption expenditure figures contained in the national accounts while foreigners' consumption expenditure in Finland is added to them.

The overall consumption calculated based on the national accounts is adjusted with the calculation methods used for the weights of the dwelling category in question. Vehicle tax and the interest on consumer credits are added to the value weight of the consumer price index. Claims paid are deducted from the value weights of insurance premiums and the difference between measuring financial services and the addition of motor vehicle acquisition costs are taken into account in the process. After this, the value weights are raised to the level of the calculation year using commodity-specific price indices.

Calculation

The calculation starts with the calculation of the micro index (lowest-level index). In the consumer price index, micro indices are indices divided into commodity headings and major regions (for example, rice from Uusimaa). Micro indices are calculated as the geometric average of the changes in the price of each commodity heading in a specific major area.

These micro indices are first weighted into nationwide commodity indices by commodity weights specific to major areas, after which the commodity indices are weighted into an overall index by nationwide commodity weights.

The Laspeyres price index formula is used in the calculation of the consumer price index and according to this formula, commodity price ratios are weighted together by the consumption expenditure percentages of their reference periods. Thus the Laspeyres index describes the price trends in the consumption basket of the reference period.

The consumption price index is calculated as an annual chain index. In practice this means that the index weight structure is updated each year. The new weight structure takes effect in January each year. In addition to the weight structure, the range of commodities collected for the index and the group of outlets from which price data are collected can also be updated if necessary.

2.1.5 Index for wage and salary earnings

Data description

The index of wage and salary earnings describes the trends in average earnings of full-time wage and salary earners for regular working hours. Taxes or social security contributions have not been deducted from the average earnings. The index of wages and salary earnings includes performance-based bonuses and agreement-based non-recurring items.

Data source

The data used in the index for wage and salary earnings and the index for regular earnings are based on the wage and salary data collected from the following employer sectors: private, central government, local government (including joint municipal authorities) and other. The index of wage and salary earnings contains the data on more than one million full-time wage and salary earners.

For central and local government, the data from Statistics Finland’s statistics on wages and salaries are used. In these sectors, the data cover practically the entire staff.

The private sector is divided according to the wage and salary data. The largest private-sector datasets are those comprising the wages and salaries of the industries and service sector member companies of the Confederation of Finnish Industries (EK). In addition to the EK data, the index of wage and salary earnings also includes wage and salary data from a number of smaller employer organisations. Statistics Finland’s own inquiry on wages and salaries complements the statistics on wages and salaries compiled by organised employers in industries where the degree of organisation of employers is lower than average, for example due to the prevalence of small enterprises. Sample-based inquiry plays a significant role in the calculation of the indices of wage and salary earnings for such sectors as construction, trade, motor vehicle traffic and business services.

The weight structure of the index of wage and salary earnings by employer sector is in accordance with the previous year’s structure of the sum of wages and salaries contained in the national accounts. The sums of wages and salaries contained in the national accounts describe all wages and salaries paid in the national economy (including those paid in the grey economy).

In all sectors, the industry-specific weights of the index are in accordance with the private sector sums of wages and salaries contained in the national accounts. However, in the public sector, industry-specific weights are determined based on sector-specific wage and salary statistics.

Calculation

The index for wage and salary earnings is calculated as an annual chain index in accordance with the Laspeyres index formula. The index is calculated as follows: the changes in the earnings of each group of wage and salary earners from the last quarter of the previous year are calculated for each year and the resulting relative changes in earnings are weighted together by the weights of the previous year's sums of wages and salaries. Relative changes in earnings each year are chain-linked to produce the overall change in earnings from the base year.

2.1.6 Rents of dwellings

Data description

The quarterly statistics on rents of dwellings describe rent levels and changes in rents on a quarterly basis. The statistics contain rental data classified by area, type of financing and the number of rooms.

Coverage

The index for dwelling rents covers non-subsidised rental dwellings and government-subsidised rental dwellings rented in Finland. The observations included in the statistics represent rental dwellings in terraced houses and blocks of flats.

Data source

The framework for the rental dwelling stock used in the calculation of the statistics on rents is based on the Building and Dwelling Register of the Digital and Population Data Services Agency. All dwellings in blocks of flats and terraced houses in permanent use that are not institutional dwellings (student dormitories, sheltered accommodation and old people's homes) and that tenants occupy based on a rental agreement are obtained from the register. The calculation is based on exhaustive register and dwelling stock data concerning both recipients of housing allowance and dwellings owned by rental housing companies.

The rent levels of dwellings rented by private persons is concluded based on the rents paid by housing allowance recipients obtained from the housing allowance register of the Social Insurance Institution of Finland. The dwelling where the housing allowance recipient lives is combined with the building and dwelling data kept by the Digital and Population Data Services Agency. Non-subsidised rental dwellings are obtained from the building and dwelling data compiled by the Digital and Population Data Services Agency and these dwellings are divided into dwellings owned by companies and dwellings owned by private persons. The selection is made on the basis of the Finnish Tax Administration's register of owner-occupied dwellings and the dwellings freed from restrictions related to government-subsidised rental dwellings. In practice, company-owned non-subsidised rental dwellings are specified first and the rest of the rental dwellings are defined as rental dwellings owned by private persons. Rental dwellings owned by private persons are dwellings in which the owner does not live but according to the Finnish Tax Administration, the owner receives a rental income. Private rental dwellings also include dwellings which are not owned by enterprises and which the tenant has reported as a rental dwelling by submitting a change of address notification.

Calculation

The rent index describes changes in rent and it is calculated using the Törnqvist index formula. The index is calculated by monitoring the rents of the same dwellings over time so that the quality differences between the rental dwellings at different periods of time can be taken into account. The previous year is used as the base period in the statistics. The data are stratified based on the type of financing, area and the number of rooms and the lowest-level indices are calculated based on this stratification. Higher-level indices are calculated by weighting the micro indices together with weights according to the rental dwelling stock. The actual index series is calculated by chain-linking the indices into a long time series.

2.1.7 Index of real estate maintenance costs

Data description

The index for real estate maintenance costs describes average trends in the prices of a range of different real estate maintenance cost items in Finland as a whole, comprising administration, use and maintenance, upkeep of outdoor areas, cleaning, heating, water supply and sewage, electricity, waste management, insurance against loss or damage and running maintenance.

The index describes how much real estate maintenance costs have risen from the base period when no changes have taken place in the demand for the maintenance cost items.

Coverage

The index for real estate maintenance costs describes the cost trends in the maintenance of real estate located in Finland.

Data source

The data in the following Statistics Finland’s indices are used in the index of real estate maintenance costs: consumer price index, producer price indices for services, building cost index, labour cost index and the volume index of newbuilding.

Statistics on maintenance cost comparisons produced by KTI Finland and the comparisons between municipal real estate indicators produced by KTI are the main sources of statistics in the calculation of cost distributions for the index. The KTI data comprise the real estate owned by major professional real estate investors and the real estate owned by municipalities or rental housing companies owned by municipalities. In the comparisons, the details of the actual maintenance costs of the previous year are collected from the owners each spring. Statistics on the finances of housing companies collected by Statistics Finland are also used in the calculation of cost distributions in blocks of flats.

Calculation

The index for real estate maintenance costs is produced on the basis of a fixed-weight index calculation (Laspeyres index formula) in which changes in the prices of selected cost factors are used to monitor trends in the maintenance costs of standard real estate when the maintenance cost structure remains unchanged. For example, the severity of winters does not increase maintenance costs even if the energy consumption increases if energy prices have remained unchanged. The changes in the prices of the cost factors included in the index are the only factors changing the index of real estate maintenance costs.

The overall index is calculated as the weighted average of a residential block of flats, commercial building, office building, health centre, school building, industrial building and a building used as a daycare centre. The buildings selected for the index are standard buildings constructed to represent and describe optimally the costs arising from the maintenance of the building category in question and their distribution among maintenance cost headings during the base year. The weight structure of the index of real estate maintenance costs is reviewed every five years.

2.1.8 Price index of public expenditure

Data description

The price index of public expenditure measures trends in prices in the expenditure of central government and local government (municipalities and joint municipal authorities). Only the data on central government finances are used in the volume calculations for the national accounts. The price index of central government expenditure measures trends in the prices of expenditure from the perspective of on-budget activities.

Data source

The weight structure of central government finances has been produced on the basis of the final central government accounts (central government financial statements). Value added tax has been eliminated from central government acquisition cost. In the accounts, expenditure can be classified according to the main title, class and item of the budget as well as according to the general account and the accounting office.

The wage, price or cost index produced by Statistics Finland that reliably describes the price trend has been determined for each type of expenditure. In addition to these data, price and tariff data are also collected on such items as non-wage labour costs, changes in the index on employment and old age pension, child benefits, conscripts' daily allowances, central government sickness insurance expenditure and interest expenditure arising from business-related transfers.

Calculation

The index point figures are calculated using the Laspeyres index formula and the base strategy. The observations are aggregated by weight coefficients for products and data suppliers to higher product group levels and ultimately into the overall index. The weight coefficients are used to estimate the price changes and the index point figures describing the population.

2.1.9 Building cost index

Data description

Building cost indices are input price indices that describe the price trends in the production inputs used in building construction relative to the selected base period. The index describing the costs arising from the renovation of dwellings in residential buildings is used in the volume calculation for the national accounts.

Data source

Price observations obtained from Statistics Finland's own data collection and other price indices of Statistics Finland are used as the source data for the building cost index.

Statistics Finland collects price data from producers of building materials and wholesale and retail trade stores. The distribution route of the inquired products is taken into account in the weight structure of the building cost index. The same product is usually asked from different distribution channels in the supply chain and price changes collected from different sales locations are weighted by the distribution weights specified for each product.

Data on the cost index of civil engineering works, the consumer price index, the producer price index for services and the producer price index are also used in the calculations. To measure labour costs, the index of wage and salary earnings is used and the updated social cost data received from employer organisations each year are combined with this index.

The calculation of the building cost index is based on about 1,100 prices provided by approximately 260 data suppliers. Sales data obtained from hardware stores as well as web-scraped price data are also used. With this overall data, ten or even one hundred times more observations can be generated than if normal data collection methods were used. The data obtained from hardware stores are only used in a limited number of product groups in addition to other distribution channels.

Calculation

The building cost index is calculated in accordance with the Laspeyres price index. The index weights are from the base period and they are kept fixed throughout the base year calculation period (about five years).

2.1.10 Cost index for civil engineering works

Data description

The cost index for civil engineering works describes the changes in the costs incurred by civil engineering entrepreneurs from the purchase and use of inputs in different types of civil engineering works.

Data source

The calculation of the cost index for civil engineering works is based on the collection of price data by Statistics Finland. Other indices, such as the consumer price index, the producer price index for manufactured products and the building cost index are also used in calculating the index.

Calculation

The index point figures are calculated using the Laspeyres index formula and the base strategy. The observations are aggregated by weight coefficients for products and data suppliers to higher product group levels and ultimately into the overall index. The weights are used to estimate the price changes and the index point figures describing the population.

2.1.11 Price data produced by the national accounts

For some products in the KTTL product classification the price index is formed in the National Accounts. These products include for example some agricultural products, berries, fish, game meat, drugs, forestry products, financial services (FISIM), taxes. As all of these prices are

related to the production approach, each one is either directly or indirectly presented in chapter 3.

2.1.12 Price indicator for renovation construction

Data description

The price indicator for renovation construction describes average price trends in renovation projects from the customer's perspective. The price indicator is published twice a year and it describes changes in renovation construction over a period of 12 months, expressed in percentage terms.

Sample

The sample of housing company managers is collected on a random basis from the enterprises in industry 68320 (Management services of real estate, N2008) with a turnover of at least EUR 100,000 in 2019. For enterprises with more than one establishment, the sample units are collected by establishment. The size of the sample of housing company managers is about 600 housing management enterprises or establishments.

General government (S.13 Statistics Finland's Classification of Sectors 2012) comprises central government, local government and social security funds. The sample comprises the 80 general government actors owning the largest number of buildings. The sampling comprises office and commercial buildings, industrial buildings, educational buildings and buildings for institutional care.

The sample of rental dwelling companies comprises the 70 companies owning the largest number of residential buildings. The sample comprises companies in sector S.1122 (Other housing corporations, Statistics Finland's Classification of Sectors 2012) and the size of the building stock ownership is determined based on the gross floor area. Most of the companies included in the sample of rental dwelling companies are housing investment companies, student housing companies and municipal rental dwelling companies.

Other enterprises or private persons are not included in the sample. These parties are not considered to own a sufficient amount of building stock resulting in frequent renovation contracts. As these parties are not included in the sample, the owner perspective in the price indicator for renovation construction remains inadequate, especially for office and commercial buildings, industrial buildings, warehouse buildings and single-family houses.

Data source

The data on the price indicator for renovation construction are compiled using a questionnaire sent to real estate owners and construction companies twice a year. Housing company managers, general government actors and rental dwelling companies are considered as real estate owners in the data collection. The survey is carried out each spring and autumn.

The respondents are asked to provide an estimate of the development of renovation construction prices over the preceding 12 months. The survey produces estimates of price changes in percentage terms. The respondents are asked to produce estimates on the basis of their

experiences of ordered renovation projects. Construction companies are asked to provide the information based on subcontracts that they have purchased, while other respondents are asked to provide the information based on the tendered renovation projects in the real estate under their management.

Housing company managers, rental dwelling companies and general government actors are asked to provide details of the price trends concerning the following renovation projects: piping renovations, roof renovations, facade renovations, annual renovations and price trends in renovation construction in general.

Calculation

Weighted arithmetic averages are calculated on the basis of the responses submitted by the real estate owners, producing the price indicators for renovation construction by respondent type, indicators for renovation construction of residential buildings and office buildings as well as indicators for individual renovation categories.

The indicators are weighted at three different levels. At the most accurate level, a weighted average is calculated based on unit-level responses. The turnover of the housing management enterprises is used as weighting data for housing company managers and in stratification, the size category is also used. Rental dwelling companies and general government actors are weighted by the gross floor area of the buildings in their ownership.

The results calculated for different respondent categories are then aggregated by building type in the manner shown in the table. The weighting is based on the expert estimate produced based on the annual statistics on the renovation of buildings and dwellings.

2.1.13 Building and dwelling production: volume index of newbuilding

There are no price sources that would be directly applicable to newbuilding. For this reason, such data as volume data are used for building and dwelling production in the price and volume calculations for the national accounts. The statistics on building and dwelling production contain the volume index for newbuilding and the calculation of this index also produces the price index.

Data description

The volume index of newbuilding describes the fixed-price value of ongoing newbuilding relative to the comparison period (index base year).

The basis for the calculation of the volume index of newbuilding is to estimate the value of the building to be started at base year prices by means of the characteristics data of the building and to stratify the estimated value over the expected building period. The estimation of the expected building period is based on a model developed for this purpose. The time of construction and the time of completion are determined on the basis of the estimated imputed construction period and not according to the completion time in the register. This method improves substantially the ability of the volume index to monitor economic cycles. The volume of newbuilding in the period under review is produced by adding up the value shares of all buildings under construction for this period at base year prices. When this value is proportioned to the corresponding value of the corresponding period in the base year, the result is the volume index.

2.1.14 Turnover of trade: volume index of sales in trade

Unlike in newbuilding, there are no price sources that would be directly applicable to services of trade. For this reason, in the price and volume calculations for the national accounts, the prices of the services of trade are produced based on the volume index and value data on trade sales. The prices for trade services are derived for the national accounts so that the volume of the trade sector products is in accordance with the sales volume index at a two-digit level.

Data description

The volume index for sales in trade describes changes in sales volumes. It is produced by deflating turnover indices by suitable price and cost indices or by the index of wage and salary earnings.

The volume index of sales in trade cannot be called a production volume index because there is only a weak correspondence between sales and production in trade. In trade, production (services of trade) is equal to the input used for the sales and the intermediation of the products sold by enterprises in trade. At the same time, in addition to the trade services, sales also include the value generated in the production of the product. Thus if we want to describe production in the trade sectors with sales, the value generated by the production of the product should first be deducted from the sale of the product. As Statistics Finland does not possess monthly data on the value generated by the production of trade services, the volume index for sales in trade is published (instead of the production volume index).

Calculation

The deflators used in the calculation of the volume index of sales in trade have been constructed from product-specific price indices. The deflators have been created by weighting so that each deflator describes price trends in a group of products (product basket) corresponding to the sales in the industry. The weights of the product basket are updated as the base year changes. Weights in accordance with the earlier base year are used for years older than the base year and for this reason, changes in the consumption structure are also considered in the trends of volume indices.

The volume index of sales in trade is created by dividing turnover value indices by deflators. The resulting quotient is multiplied by 100.

(7)

$$volume\ index\ of\ sales\ in\ trade = 100\ x\ (\frac{value\ index}{deflator})$$

Sales volume indices for more approximate industry levels have been aggregated (weighted using more accurate sales volume indices). The turnover of the industry in the base year is used as a weight in the aggregation.

2.1.15 Volume indicators produced by the national accounts

Volume indicators for the most important individual services of other non-market output are calculated in the national accounts. They concern the education and health and social services provided by the public sector as well as employment pension and other obligatory social security schemes. Section 3 describes the calculation of other non-market output at general

level and gives a more detailed description of the methods and data sources for individual products.

2.2 Processing qualitative changes in price indices

P/PPI

Producer price indices are ‘pure’ price indices, which are not affected by changes in the quality of the products (in statistical jargon, qualitative changes refer to changes in product characteristics). Every effort is made to eliminate from the index the price changes caused by changes in product characteristics. The physical, technical and financial characteristics of a product (conditions on financing, guarantee, whether the product is sold to a wholesaler or retailer, etc.) must remain unchanged. In practice, the characteristics change continuously. Changes in the characteristics and their treatment are among the key challenges in index calculations. In producer price indices, a number of different methods are applied to control changes in the characteristics to ensure that the best possible method for measuring price change is always used.

In the first place, 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 reference 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 reference period may concern a month or a quarter and the preceding period refers to the preceding corresponding period. If overlapping price observations cannot be obtained, various pricing methods, such as model or component pricing, can be used to measure/assess the price change.

Expert assessments can also be used to assess price changes. In that case, the respondent is asked to determine which proportion of the price change is a genuine change in price and which proportion is due to the change in the product characteristics. The expert assessment assumes that the enterprise providing the information can produce the best estimate of the price trends concerning its own products.

If overlapping price observations or an expert assessment cannot be obtained and price measurement methods cannot be applied, the price trends of the product are imputed with the average change in the prices of other products in the same commodity group. The imputation is based on the assumption that the prices of products in the same commodity group develop in approximately the same manner.

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

- The characteristics of the replacement product are assumed to be same as those of the earlier product. In that case, the price change is included in the index as is.
- The entire price change is assumed to have resulted from changes in characteristics and in that case, the price change is eliminated and the index remains unchanged when the product is replaced.

Price measuring and methodologies to control qualitative changes are constantly being developed and international guidelines and

recommendations are taken into account when applying different methods.

CPI

The purpose of the consumer price index is to measure ‘pure’ price development. This means that as products are replaced, efforts are made to eliminate the price changes arising from any qualitative changes. Any bias arising from qualitative changes is considered the most serious problem affecting the consumer price index and for this reason, a great deal of attention has been paid to this matter in recent years.

Qualitative changes must be considered in the preparation of the consumer price index when a product until then used in the index must be replaced by another one. The replacement may be prompted because the product has been removed from the range sold by the outlet. The product may also be outdated and a better model representing the product group in question has entered the market. In both cases, the product is replaced by another one and every effort is made to assess the qualitative differences between the new and the old product as comprehensively as possible.

A range of different methods is used in the assessment of the qualitative changes. An expert assessment is the most common method and it is used when prices of consumer durables are collected. In most cases, two different categories of qualitative change are used:

- The two products are of identical quality, which means that the price difference is incorporated in the index

  or

- The products are totally different and no comparisons can be made; the product is only included in the calculations in the following month when comparisons between the two products can be made.

The hedonic method is the second method to assess qualitative changes used in the Finnish consumer price index. In this method, the price of the commodity is described as a function of its characteristics. When the characteristics are standardised at a specific level, the price of a quality-standardised commodity can be monitored. Currently, the method is used in the monitoring of prices for second-hand cars and housing.

Consumer durables (such as household appliances, household goods, entertainment electronics and durables for recreation and culture) and a number of services are the categories with particularly serious problems concerning qualitative changes. These items are frequently replaced with new ones and it is often difficult to assess the qualitative differences. At the same time, daily consumer goods are less frequently affected by product replacements and the assessment of qualitative differences in them is also easier.

Continuous work is carried out to develop the measurement and assessment of qualitative changes in the indices and the development work is carried out at national and international level. The work is guided

by the recommendations of Eurostat, the statistical office of the European Commission.

3 Methodological descriptions of the output by product

In this section, we review the methods for calculating output prices and volumes by product group. If necessary, the methods are described separately for different output types and there is particular attention to separating other non-market output. A methodological description per product category is preceded by general methodological descriptions of individual output types. At the end of this section, an example of how to calculate output prices and volumes is presented.

The product classification of the national accounts (KTTL), which is the Finnish national version of the statistical classification of products by activity (CPA) of the European Union, is used as the classification system. Product categories are divided into 20 sections in accordance with the character-level classification. In most of the character-level categories, the methods must be reviewed at a level that is one hierarchical level higher (at two-digit level). Occasionally, matters are reviewed at the highest level (six-digit level) as the calculations in the supply and use tables are made at this level.

The section for the product category at each character level starts with a brief description of the product category, giving the number of the compilation-level products in the product category, the current-price output for the product category for 2020, the percentage of the total economic output of the current-price output in the product category, all price sources used and the weighted average of the method.

The methods are classified in accordance with the A/B/C classification presented in the Handbook on prices and volume measures in national accounts by Eurostat. One of these three classifications is specified for the compilation-level products. Character-level classifications are converted into numerical values by assigning A the value 2, B the value 1 and C the value 0. Numerical grades are then weighted by the current-price value of the products for 2020 to obtain the A/B/C grade for the whole product category. Weighted grades are rounded in accordance with standard rounding rules.

The methods are assessed based on data for 2020. This means that the data on the price and volume indices must have existed in 2019 and 2020 so that they could have been used a basis for calculating the change figures for 2020. In particular, the producer price index for services is being continuously developed and expanded and as a result, there are already price indices that are better suited for service product categories than the indices available in 2020.

3.1 General output methods

Market output P11

There are two main alternatives for calculating output volumes:

1. Deflation, in which the current-price value for the same year is divided by price index
2. Volume extrapolation, in which the current-price value for the previous year is multiplied by volume index

Deflation is the most commonly used method for market output. Volume extrapolation is only applied to a very small number of products. In supply and use tables, both deflation and volume extrapolation are carried out at compilation level (at six-digit level in KTTL). The six-digit level contains more than 800 products.

The output remaining in the domestic market and the output that is exported are treated separately in the deflation of market output. As a rule, the goods output remaining in the domestic market is deflated by the sub-index of the producer index for manufactured products that only contains the prices of products intended for the domestic market. Exports are deflated by the export price index of the producer price indices for manufactured products if such an index is available. The export price index contains CPA-classified products between A and E and these product categories have separate export deflation whenever the index is available. In other product categories, the exports are deflated by the same price change data as the domestic portion of the output.

Output for own final use P12

The output for own final use is deflated in the same manner as the market output because according to the definition of the ESA 2010 methodological handbook, P12 output is valued in the same manner as similar products sold in the market.

P131 Non-market products, sales or purchases

As the non-market output is specified in accordance with the producer and not the product, it is also necessary to separate the sales of products of non-market producers. The separation is necessary when the other non-market output P132 is calculated as a residual. The sales of non-market products follow the market output method.

Other non-market output P132

The range of methods used for non-market output is different because, by definition, there are no market prices for these products. As a result, the deflation method normally used for market output is out of the question. Instead, we can act in accordance with the current-price calculation definition and deflate the inputs defining the output instead of the output, or directly calculate the volume by extrapolating it from the previous year using a volume indicator.

The other non-market output can be further divided into outputs of two different types: individually consumed goods and services used by private households and collective services, which are offered simultaneously to society at large.

Other non-market output – collective services

Regarding collective services, the input method is always applied to non-market output in the supply and use tables of Finland’s national accounts. In this method, the volume of each input is calculated separately by deflation. The inputs are as follows: intermediate consumption, compensation of employees, other taxes on production, other subsidies on production and consumption of fixed capital. The output volume is the sum

of deflated inputs. In the Eurostat's Handbook on prices and volume measures in national accounts, this method is classified as a B method for collective services.

Other non-market output – individual services

The volume of the non-market output of individual services is always estimated with output indicators.

To understand the idea of volume calculation used in this method, one should first examine current-price calculation. In practice, the current-price calculation can be carried out as a sum of costs. In theory, the current-price (CuP) output can always be considered as the product of unit costs and the number of produced units.

(8)

$$Total\ output_{CP,T} = total\ cost_{CuP,T} = number\ of\ units_T * unit\ cost_T$$

With the same principle, the fixed-price value (FP) can be considered as the product of the number of units and the unit costs of the previous year.

(9)

$$Total\ output_{FP,T} = total\ cost_{FP,T} = number\ of\ units_T * unit\ cost_{T-1}$$

This principle can be used to identify the relevant measures when the output volume indicator is calculated.

3.2 KTTL A Agriculture, forestry and fishing (01–03)

Key data

Products	**62**
Total output (EUR million)	10,135
Percentage of the economic output	2.3 %
Price sources used	• Natural Resources Institute Finland (Luke) • Finnish Food Authority • Energy prices
Weighted average of the method	A

017100 Game meat

The output is deflated by the Paasche price index. The prices and quantities are obtained from Luke's hunting statistics. The statistics contain the pieces and euro value of game catch by species.

023100 Forest berries

The publication ‘Luonnonmarjojen ja sienten kauppaantulomäärät’ produced by the Finnish Food Authority gives the amounts of berries delivered for sale (in kilos) and the picking income (in euros) based upon which the price per kilo for the berries is calculated. The deflator is produced by dividing the price per kilo for the year in question by the price per kilo for the previous year.

023200 Forest mushrooms

The publication ‘Luonnonmarjojen ja sienten kauppaantulomäärät’ produced by the Finnish Food Authority gives the amount of mushrooms delivered for sale (in kilos) and the picking income (in euros) on the basis of which the price per kilo for the mushrooms is calculated. The deflator is produced by dividing the price per kilo for the year in question by the price per kilo for the previous year.

Price data on forestry products

Changes in product prices, the collection of which is not primarily the responsibility of Statistics Finland, are calculated in the national accounts. In Finland, the price data on forestry products are collected by the Natural Resources Institute Finland (Luke). Luke produces the Official Statistics of Finland (OSF) on the following: industrial roundwood trade, silvicultural and forest improvement work, wood in energy generation and total roundwood removals and drain. The statistics on the energy wood trade and fuelwood consumption in small-scale housing are part of the European Statistical System (ESS) but they are not OSF statistics. For some of the products and services, no price data are available and in such cases, the changes in prices have been calculated based on the changes in costs.

The statistics on the industrial roundwood trade produced by Luke present data on the prices and volumes of the industrial roundwood purchased by the forest industry. The stemwood and wood residue purchased for energy generation are not included in the statistics. The statistics are based on the quantities and prices entered in roundwood sales agreements. The statistics are prepared by type of timber, type of trade (standing and delivery sales), by region and by felling method. Any other margins and services or subsequent price adjustments are not included in the statistics. Prices of special roundwood are not entered in the statistics and their sales volumes are not given by type of trade. Most of the data for the statistics are collected by the Finnish Forest Industries Federation, which supplies the roundwood sales data of its member enterprises to Luke. Member enterprises of the Finnish Sawmills Association and forestry management associations also supply data for the statistics. Roundwood purchased in the Region of Åland is not included in the statistics. Luke combines the roundwood sales data and calculates average prices for standing and delivery sales weighted by roundwood volumes. The data for the monthly and annual roundwood sales statistics for private forests account for more than 90 per cent of the industrial roundwood purchased in privately owned forests in Finland. The roundwood sales of the enterprises included in the statistics are entered in the statistics as such and the volumes are not increased to correspond to the total volume of industrial roundwood trade.

The statistics on silvicultural and forest improvement work compiled by Luke describe the volumes of annual silvicultural and forest improvement work carried

out by forestry management associations, other forestry service enterprises, the forest industry and the state and the costs arising from them. The statistics are compiled by means of a questionnaire survey carried out among the enterprises providing forestry services. The work carried out by forest owners in their own forests without external assistance is not included in the statistics.

The total roundwood removals and drain are calculated on the basis of the other statistics and data published by Luke. The basic data for industrial roundwood removals are obtained from the annual statistics on industrial roundwood removals by region, which cover almost all roundwood and pulpwood felled in Finland. The stemwood sawn by private forest owners in their own forests is added to the figures. This amount is determined with surveys carried out among small sawmills approximately every ten years. Removals of wood for energy generation comprises stemwood used as fuelwood in small-scale housing and domestic stemwood for energy generation in heat and power plants. The drain figures are produced by adding estimated cutting loss and natural thinning to total roundwood removals. These figures are based on the measurements and calculations carried out in field plots as part of the national forest inventory.

Luke's statistics on the energy wood trade present data on prices and volumes of energy wood purchased from forest owners as raw material for forest chips. The data are collected from the enterprises purchasing energy wood and forestry management associations. They deliver the energy wood to heat and power plants directly or through intermediaries for use as forest chips. The prices for energy wood are entered in the statistics without value added tax or subsidies for young forest management and harvesting of small-diameter wood. It is, however, impossible to separate the feed-in tariff for renewable energy paid to forest chip users from the sales prices. This increases the prices paid for forest chips and their raw materials and thus also the unit prices entered in the statistics. The average prices for different types of energy wood are averages of the prices entered in roundwood sales contracts weighted by the purchase volumes. Any conditional margins and items, separately unpriced tilling included in the sales contract or any other work are not included in the prices. The prices and volumes of energy wood are based on the roundwood sales contracts concluded between the sellers and the purchasers. Data obtained by various means are combined with the statistics. Most of the data for the statistics are collected from large actors in the energy wood trade. The Finnish Forest Industries Federation collects the data on roundwood purchases by its member enterprises and delivers them to Luke in aggregated form. Luke also collects data directly from about 20 forestry management associations and from between five and ten middle-sized to large enterprises purchasing energy wood. Luke combines the statistical data and calculates average unit prices weighted by roundwood volumes. The parties supplying data for the statistics have not been selected by sampling and no enlargement coefficients or weights based on purchaser groups or other factors are used when the results are calculated.

The statistics on fuelwood consumption in small-scale housing compiled by Luke describe the use of fuelwood in small-scale housing in Finland by type of fuelwood and species and by type of real estate, building and fireplace. The data for the statistics are primarily supplied by residents of the residential buildings in the real properties concerned and secondarily by the owners of the real estate. The data on fuelwood use are collected by means of a questionnaire sent by post, on an online form or by phone. Statistics Finland's building and dwelling database is used as the sampling frame for the survey. The real estate and buildings owned by

persons and other owners are included in the statistics and sampling and thus they also include estates and housing companies. The statistics are compiled every ten years and the latest set of statistics is from the year 2017 (for the heating season 2016–2017). The sampling frame for the latest survey comprised a total of about 1.03 million one-dwelling houses, 137,000 two-dwelling houses, 401,000 terraced houses and 514,000 free-time residences. They formed the basis for an overall sample of 10,000 buildings in which the sampling ratio varied by stratum. Farms, one-dwelling houses, two-dwelling houses, terraced houses and free-time residences were used as strata. The sampling was carried out as stratified systematic random sampling, which ensured even distribution of the samples throughout the population. The latest data comprise a total of about 4,100 responses of which 3,700 were collected in postal or online inquiries and about 400 by phone.

Luke's statistics on wood for energy generation comprise data on solid wood fuels used by heat and power plants each year. The data are available as volume and energy units. The use data are collected directly from heat and power plants each year, mostly by questionnaires sent by post or on an online form. From some of the smallest plants, the data are collected on a rolling basis at intervals of two to three years during which the data on these plants remain unchanged.

Statistics Finland's statistics on energy prices are used as a source for forest chip prices. The data on forest chip prices are not collected by Statistics Finland as the prices are based on the data on forest chip purchases by enterprises collected by FOEX Indexes Oy. FOEX Indexes Oy is a private enterprise producing price and market information on forest industry products.

Statistics Finland and Luke do not produce data on the prices of harvesting or short-distance transport services. For this reason, the changes in prices are estimated through costs based on the data collected and published by Metsäteho Oy. Metsäteho Oy is a private Finnish company studying and working to develop supply of timber, harvesting and transport methods and efficiency of operations. The cost data are collected each year from Metsäteho Oy's shareholders, which are Finland's largest forest industry companies purchasing timber. The VAT-free costs paid to harvesting and transport enterprises for removal of timber are used as costs in the statistics.

Price data on fisheries products

030010 Fish, live: The output is deflated by the Paasche price index. The prices and amounts are obtained from Luke's aquaculture statistics. The statistics contain the amount of food fish production in kilos and its value in euros. The statistics comprise the production of rainbow trout and whitefish in marine areas and inland waterways.

030021 Fresh or chilled fish: The output is deflated by the Paasche price index. The prices and amounts are obtained from the following statistics compiled by Luke: commercial marine fisheries, commercial inland fisheries and aquaculture. They give the value for fisheries/aquaculture in euros and the amounts in kilos for each fish species. The Paasche price index is calculated for each set of statistics. The product is deflated by the index based on these sets of statistics and in the index, aquaculture, marine fisheries and inland fisheries are weighted in accordance with the value of the production.

030029 Fish, recreational fishing: The output is deflated by the Paasche price index. The prices and amounts are obtained from Luke's recreational fishing statistics. The set of statistics contains the total catch for recreational fishing and its value by species in marine areas and inland waterways. The set of statistics is only published in even years. In odd years, the quantitative data contained in the recreational fishing statistics for the previous year are used. The data for these statistics are obtained from Luke's statistics on producer prices for fish, which give the average prices paid by first buyers of fish to fishers by fish species.

030080 Other fisheries products: The output of this product category is deflated by the Paasche price index. The prices and amounts are obtained from Luke's recreational fishing statistics. The set of statistics contains total catch of recreational fishing and its value by species in marine areas and inland waterways. The set of statistics is only published in even years. In odd years, the quantitative data contained in recreational fishing statistics of the previous year are used. The data for these statistics are obtained from Luke's statistics on producer prices for fish, which give the average prices paid by first buyers of fish to fishers by fish species.

3.3 KTTL B Mining and quarrying (05–09)

Key data

Products	**13**
Total output (EUR million)	2,018
Percentage of the economic output	0.5 %
Price sources used	• Producer price index for manufactured products: domestic goods • Export price index
Weighted average of the method	A

Mining and quarrying products comprise materials occurring naturally as solids (coal and ores), liquids (petroleum) or gases. Processing of these materials is outside the scope of this category.

Methods

Price and volume calculations for all products in this product category are based on deflation by price indices. Producer price indices are used as the price source for all products. The domestic input remaining in the domestic market is deflated by the index for domestic goods of the producer price index for manufactured products. The exported output is deflated by the export price index for the producer price indices.

According to the Handbook on prices and volume measures in national accounts by Eurostat, this product category can be deflated by a suitable producer price index series using the A method and for this reason, the A method can be considered as the deflation method for the mining and quarrying product category. A small number of compilation-level products

are classified as method B products (in A/B/C classification) because the most accurate index series available is not sufficiently accurate. Some of the price data on the export price indices for products starting with 07 and 08 are obtained from the unit price indices of Finnish Customs. These unit price indices contain fully homogeneous products and for this reason, they are classified as A method as well.

3.4 KTTL C Manufacturing (10–33)

Key data

Products	465
Total output (EUR million)	97,092
Percentage of the economic output	22.2 %
Price sources used	• Producer price index for manufactured products: domestic goods • Export price index • Import price index • Basic price index for domestic supply
Weighted average of the method	A

The category of manufactured products is the category with the largest number of products at different calculation levels. This category comprises manufactured products, such as foodstuffs, clothing, processed petroleum products, chemicals, rubber and plastic products, a wide variety of different machines and equipment as well as consumer durables.

Methods

Using suitable producer price indices is the A grade deflation method for the output of product category C (Manufacturing). The producer price indices must be representative and basic prices and qualitative changes must be considered. The indices must also be sufficiently fine-grained so that deflation can be carried out with maximum accuracy.

Most of the KTTL products at this calculation level meet these criteria and as a result, the grade for the whole product category is rounded to A. Some of the products are at a less accurate level and import prices are applied to some of the products. The methods for these products are classified as grade B. However, the products with grade B are on average less significant for the product category as a whole.

Heavy machinery and equipment

Heavy machinery and equipment are treated separately in the Eurostat's Handbook on prices and volume measures in national accounts. This is because heavy machinery and equipment are often constructed on a one-off basis, which means that comparing prices between time periods is

difficult. For the Finnish economy, ships and paper machines are key products of this category. The price data for them are obtained from the producer price index for manufactured products. The component pricing method is used for them in the producer price index. In the handbook, this method is classified as an A method for these products.

3.5 KTTL D Electricity, gas, steam and air conditioning supply (35)

Products	5
Total output (EUR million)	7,995
Percentage of the economic output	1.8 %
Price sources used	• Producer price index for manufactured products: domestic goods
Weighted average of the method	B

This product category comprises electricity and transmission of electricity, manufactured gas, distribution services of gaseous fuels and steam, hot and cooled air water supply services for enterprises and households.

The products in this category are highly homogeneous in nature. In addition to deflation by price data, this also allows reliable volume calculations with quantities. For example, electricity generation can be measured in kilowatt hours.

Differences in quality or prices

The quality of one kilowatt hour of electricity remains the same, regardless of whether it is supplied to a small enterprise or a household. These two customers may, however, pay a totally different unit price for electricity. This price is mostly a matter of price discrimination, and it should manifest itself in a price difference and not in a qualitative difference visible in volumes.

However, the difference between the prices of daytime and night-time electricity or higher prices for electricity produced in an environmentally friendly manner are examples of products with qualitative differences.

Method

Until 2020, the price and volume calculations for electricity products carried out in the supply and use tables of Finland's national accounts were based on the change in electricity price in the produce price indices for manufactured products. Thus deflation by price data was used instead of deriving volumes by quantitative data. According to the Handbook on prices and volume measures in national accounts (Eurostat, 2016), this is an A method.

It is often difficult to reconcile the fixed-price values of the supply and use of electricity when price change data in the consumer price index are compared with price change data in the producer price index. Even if

consideration is given to the transmission of electricity, taxes and trade services, the differences concerning changes in price affecting supply and the change in price affecting households cannot always be fully explained. Because of the uncertainty arising from the differences, we place the method in category B rather than in category A. For this reason, the aim is to use the data on the supply and use of electricity detailed in Statistics Finland's statistics on energy supply and consumption as a basis for price and volume calculations for electricity products from 2021 onwards. This means that the method will change from deflation with price change data to volume extrapolation method.

3.6 KTTL E Water supply; sewerage, waste management and remediation activities (36–39)

Products	10
Total output (EUR million)	3,461
Percentage of the economic output	0.8 %
Price sources used	• Producer price index for manufactured products: domestic goods • Index of real estate maintenance costs • Consumer price index
Weighted average of the method	B

Method

For all products, the price and volume calculation method is based on deflation by price change data. The sources of the price change data are evenly distributed between the producer price index for manufactured products (grade A) and the consumer price index (grade B). Price change data based on cost indices are used for one product.

3.7 KTTL F Construction (41–43)

	Output, excl. other non-market output	Other non-market output
Products	9	3
Total output (EUR million)	40,610	407
Percentage of the economic output	9.3 %	0.1 %

Price sources used	• Volume index of newbuilding • Cost index of civil engineering works • Building cost index
Weighted average of the method	A

Method

Output, excl. other non-market output

In product category F Construction, both volume change and cost data are used in the calculation of volumes and prices.

The volume index for newbuilding is applied to newbuilding. Implicit price changes are derived from the index and turnover data, which means the prices and volumes in the supply and use tables are calculated by deflation based on the price change. In this method, the aim is to minimise the difference between trends in newbuilding described in the national accounts and the volume index of newbuilding. The calculation for the volume index of newbuilding meets the criteria for the model pricing option described in the handbook on prices and volume measures. Model pricing is based on price data obtained by data collection and using a range of different area-based and construction type models. A large amount of stratification can be incorporated in the overall index, which enhances the quality of volume calculation. Thus the method used to calculate output volumes in supply and use tables can be considered as an A method.

The building cost index is used as the price source for annual repairs. Cost indices are C methods.

The data calculated based on the volume index for newbuilding were used for renovations until 2020. From 2021 onwards, the price and volume calculations for renovation outputs have been carried out by using the price change data for the price indicator for renovation construction. The price indicator for renovation construction is preferred because it describes actual output prices.

Other non-market output

In this product category, the other non-market output only comprises collective products. In collective services, the input method is applied to non-market output.

3.8 KTTL G Wholesale and retail trade; repair of motor vehicles and motorcycles (45–47)

Products	7
Total output (EUR million)	36,175
Percentage of the economic output	8.3 %

Price sources used	• Volume index of sales in trade • Consumer price index
Weighted average of the method	B

The output of product category G mainly consists of margins for the wholesale and retail trade. Roughly speaking, the distribution margin is the difference between the sales and purchase prices of the products subject to the transaction. The margin can be considered to represent the part of the product price that the buyer pays for the services offered by the vendor even if there is no separate transaction.

This product category also includes repair services for motor vehicles and motorcycles.

Method

Price and volume calculations of wholesale and retail services are based on extrapolation by volume data. The volume index for sales in trade is used as the volume data. Trade volume indices are based on deflated turnover data. Thus in the national accounts, too, the method is indirectly based on the assumption that the volume of trade services will grow at the same rate as the volume of goods for resale. In other words, a fixed ratio exists between the distribution margin and the volume of sales of goods for resale. This method is specified as a B method.

In the repair services for motor vehicles, deflation by price change data derived from the consumer price index is used. This method is classified as a B method.

3.9 KTTL H Transportation and storage (49–53)

	Output, excl. other non-market output	Other non-market output
Products	21	4
Total output (EUR million)	21,150	358
Percentage of the economic output	4.8 %	0.1 %
Price sources used	• Producer price index for services • Consumer price index	
Weighted average of the method	A	

As product category H comprises a range of different services, we have decided to review the methods applied to each of them separately. In

addition to transportation, the category also includes warehousing and support services for transportation as well as postal and courier services. In transportation, a division is made into passenger transport and freight services.

Method

Output, excl. other non-market output

For land transport, deflation by price change data for the producer price index for services is used for both passenger transport and freight transport products. For them, the method is graded A. Tram, metro, bus and coach transport are an exception to this as the price change data of the consumer price index are applied to them. These two compilation-level products are graded B.

Passenger and freight water transport services are deflated by corresponding price change data for the producer price index for services. These methods are graded A.

Passenger and freight air transport services are also deflated by corresponding price change data for the producer price index for services. These methods are also graded A.

Warehousing and support services for transportation are also deflated by the producer price index for services. The accuracy of the index series levels brings variety to the grades of the methods of compilation level products. Some of the products receive grade B (because of insufficient accuracy) while the accuracy of the other products is sufficient, and they are graded A.

There are two compilation-level products for postal and courier services in deflation use, and both have nominally very similar series of the producer price index for services. The mutual weighting of these two products (531000 Postal services under universal service obligation and 532000 Other postal and courier services) has been a source of problems in supply and use tables and in the producer price index for services. Since 2020, industry 53 has been included in the updated statistics on service industry commodities and these statistics provide more detailed data for the weighting of these products. For 2020, these products were graded B but since 2021, the grade A criteria for appropriateness and representativeness have been met.

Other non-market output

In this product category, other non-market output only comprises collective products. In collective services, the input method is applied to non-market output.

3.10 KTTL I Accommodation and food services (55–56)

	Output, excl. other non-market output	Other non-market output
Products	5	1

Total output (EUR million)	7,978	38
Percentage of the economic output	1.8 %	0.0 %
Price sources used	• Producer price index for services • Consumer price index	
Weighted average of the method	B	

This product category comprises the accommodation services for different types of accommodation, such as cottages and hotels. The product category also includes food services, and it should be noted that a wide range of such services are also available outside the industry. At a more specific industry level, a broad range of products included in product category 56 Food and beverage services are offered under industry 55 Accommodation. Accommodation and food services are also offered in such industries as water transport.

Method

Output, excl. other non-market output

The product 551000 Hotels and similar accommodation is the only compilation-level product in this product category to which the price change data of the producer price index for services are applied in deflation and that receives a grade A in the A/B/C classification. In all other accommodation and food services, the consumer price index is used and as a result, the services are graded B for their method.

The consumer price index has been selected as the price source instead of the series of producer price index for services, because the consumer price index is more fine-grained for these products and it thus better meets the appropriateness and representativeness criteria. At the same time, however, consumer price indices only describe the matter from the consumers' perspective and for this reason, the grade is B instead of A. The existing producer price indices for services would also receive a grade B as they give a more correct picture of the output aspect, even though the grade is weakened using a more approximate level.

Other non-market output

In this product category, other non-market output only comprises collective products. In collective services, the input method is applied to non-market output.

3.11 KTTL J Information and communication (58–63)

	Output, excl. other non-market output	Other non-market output
Products	25	2
Total output (EUR million)	29,356	563
Percentage of the economic output	6.7 %	0.1 %
Price sources used	• Producer price index for services • Consumer price index • Index of wage and salary earnings • Producer price index for manufactured products	•
Weighted average of the method	B	

Product category J comprises a wide variety of very different services from the production of films to computer programming services and from telecommunication services to computer game publishing services. The fine-grained nature of the 25 products of the compilation level enhances the accuracy of the volume calculation. With an output share of 6.7 %, this product category is also fairly important. As there are major differences between the services in this category, the methods must also be reviewed more carefully.

Method

Output, excl. other non-market output

The product category 58 Publishing activities comprises six compilation-level products and for each of them, the volume calculations are based on deflation by the price change data of the producer price index for services. Products starting with 581 (books, periodicals and other publishing activities) are deflated by slightly more approximate-level index series and they are thus graded B in A/B/C classifications. Product 582000 (Software publishing), the most important product in category 58 (and one of the most important products in category J) is deflated by a highly appropriate and representative index and thus its method is graded A.

Volume calculations for product category 59 (Motion picture, video and television programme production, sound recording and music publishing activities) are based on price change data of the index of wage and salary earnings and the consumer price index, which are less suited for the

purpose. The one-off nature of the products is a problem in this product category. In this connection, the handbook only mentions a small number of possible B methods but does not list any A or C methods. In ambiguous situations, we give the method a lower grade and thus the methods of this category receive grade C. The weight of these products is fairly low.

Product 600000 (Programming and broadcasting activities) is the only compilation-level product starting with 60 and it is deflated by the producer price index for services. The one-off nature of the products is also a problem in this product category and for this reason, there are practically no A methods and the method for this product is thus graded B.

Product category 61 Telecommunications is characterised by a high degree of complexity. There are different types of components in the prices of the products (such as one-off payments, repeated fixed charges and use-based charges). Pricing of the products is usually a combination at least two such components. Moreover, the products are often grouped together, or the main product may be accompanied by giveaways making them combination products. Telecommunication services have also developed quite rapidly over the last few decades and as a result, it is particularly important to process qualitative changes in a correct manner.

However, extensive information provided by the key operators is available for the calculation of the producer price index for services and the services have also been broken down into sufficiently specific product levels. Thus volume calculation based on price change data of the producer price index for services can be considered as an A method for all products starting with 61.

The products in product category 62 (Computer programming, consultancy and related services) are deflated by the price change data of the producer price index for services. The series used for deflation are based on programming and consultancy with time-based pricing as well as prices of licences for using services or product packages. The description partially suits the description of category A and partially the description of grade B contained in the handbook on prices and volume measures. In borderline cases, a lower category is selected and thus the volume method of the compilation-level products in category 62 is graded B.

By far the most significant compilation-level product in product category 63 Information service activities is 631100 Data processing, hosting and related services. The volume of this product is calculated by deflating the current-price value by the price change data of the producer price index for services. There are many observations for this product category and the price index would seem to meet the criteria for general appropriateness and representativeness. Nevertheless, determining the A/B/C classification is difficult because the handbook mainly deals with volume-based methods. We evaluate this to be a B-method.

Other non-market output

In this product category, other non-market output only comprises collective products. In collective services, the input method is applied to non-market output.

3.12 KTTL K Financial and insurance activities (64–66)

	Output, excl. other non-market output	Other non-market output
Products	17	
Total output (EUR million)	13,344	
Percentage of the economic output	3.0 %	
Price sources used	• National accounts calculations • Consumer price index • Index of wage and salary earnings	
Weighted average of the method	B	

The measuring of the current-price value of the product categories of financial and insurance services for the national accounts is based on agreed practices. This makes the measuring of the volume difficult because, as a rule, the output price indices corresponding to agreed practices do not exist. The financial services are divided into direct financial services and indirect financial services and the latter category is often referred to as FISIM (Financial intermediation services indirectly measured).

Method

The B method described in the Eurostat's handbook on prices and volume measures is applied to indirect financial services. There are no references to alternative methods in the handbook. The price for FISIM consists of two components. In the case of loans, the first is the difference between the interest charged by the bank and the reference rate (the margin earned by the financial intermediary) and the second is the price index used to deflate the loan portfolios to base period prices. In the case of deposits, the margin is calculated the other way round and for the second price component, deposit portfolios are used instead of loan portfolios. The implicit price index for the total economic output is used as the general price index.

Volume for FISIM loans

(10)

$$\frac{CuP\ value\ for\ FISIM\ loans}{Implicit\ output\ price\ index} \times \frac{base\ period\ loan\ margin}{current\ loan\ margin}$$

Volume for FISIM deposits

(11)

$$\frac{CuP\ value\ for\ FISIM\ deposits}{Implicit\ output\ price\ index} \times \frac{base\ period\ deposit\ margin}{current\ margin\ for\ deposits}$$

Deriving the volume of direct financial services is more straightforward. 641900 Other monetary intermediation services are the most important of the compilation-level products. Deflating the current-price value by the price change data obtained from the consumer price index is the method used. The consumer price index series contains typical monetary intermediation services used by consumers. The weakness of the method is that the deflation is based on an index that does not contain any services intended for enterprises. As a result, the method is classified as a B method.

3.13 KTTL L Real estate services (68)

	Output, excl. other non-market output	Other non-market output
Products	5	2
Total output (EUR million)	39,249	10
Percentage of the economic output	9.0 %	0.0 %
Price sources used	• Producer price index for services • Rents of dwellings	•
Weighted average of the method	B	

Product category L Real estate services comprises the following products: 682010 Letting of dwellings, 682020 Operation of dwellings and residential real estate, 682030 Letting of other real estate, 683100 Real estate agencies and 683200 Management services for real estate. The first three of these, in particular the operation of dwellings and residential real estate, are extremely important for the total output of the national economy.

Method

Output, excl. other non-market output

The classification method based on actual rents (stratification method) is used in the calculation of the current-price output of rental of dwellings and owner-occupied housing. You can read more about this in the methodological description of Finland's gross national income (GNI

inventory). Selection of the current-price method also guides the A/B/C classification of the volume calculation. In the supply and use tables of the national accounts, the volume calculations of rental of dwellings and owner-occupied housing are based on deflating the current-price value by the data on changes in rental prices contained in the statistics on rents of dwellings. The method is not sufficiently close to the current-price calculation method and for this reason, it is classified as a B method.

Deflation by the producer price index for services is used as the method in all other services of this category. The methods are category A or B methods, depending on the representativeness of the index.

Other non-market output

In this product category, other non-market output only comprises collective products. In collective services, the input method is applied to non-market output.

3.14 KTTL M Professional, scientific and technical services (69–75)

	Output, excl. other non-market output	Other non-market output
Products	25	6
Total output (EUR million)	32,572	1,562
Percentage of the economic output	7.4 %	0.4 %
Price sources used	• Producer price index for services • Consumer price index • Index of wage and salary earnings	
Weighted average of the method	B	

Product category M comprises a large number of services in which the service offered ultimately involves expertise applied to a specific need. For example, in a product offered by a lawyer, the professional expertise of the lawyer is applied to a specific case. As a result, many of the products in this category are on a one-off basis. One-off products are always problematic from the perspective of measuring changes in prices. Even though the number of different types of legal cases could be easily calculated, standardising quality is almost impossible. The same applies to many other services in this product category.

Method

Output, excl. other non-market output

Product categories 69 Legal and accounting activities and 70 Activities of head offices; management consultancy activities both contain two compilation-level products. For these four products, deflation by the producer price index for services is used as the volume calculation method. In the producer price index for services, enterprises are asked to provide prices of representative products and as a result, the criteria for an A method are met.

The product category 71 Architectural and engineering activities; technical testing and analysis comprises 11 compilation-level products. In all of them, deflation by the producer price index for services is used as the volume-calculation method. The method is classified as a B method.

It is not even theoretically possible to use a method meeting the criteria for category A for the product category 72 Scientific research and development. For this reason, input methods can be used as B methods. Volume calculations in this product category are based on deflation by the index on wage and salary earnings and they are classified as a B method.

The three products comprising the product category 73 Advertising and market research are deflated by the producer price index for services. The method is classified as an A method.

The handbook on prices and volume measures does not provide any A/B/C classifications for the different methods in product category 74 Other professional, scientific and technical activities. Deflation by the index on wage and salary earnings (the method used) is classified as a C method.

Product category 75 Veterinary activities comprises one product. Its volume calculations are based on deflation by the consumer price index. The method is classified as a B method.

Other non-market output

In this product category, other non-market output only comprises collective products. In collective services, the input method is applied to non-market output.

3.15 KTTL N Administrative and support services (77–82)

	Output, excl. other non-market output	Other non-market output
Products	30	4
Total output (EUR million)	16,112	132
Percentage of the economic output	3.7 %	0.0 %
Price sources used	• Producer price index for services	

	• Consumer price index • Cost index of civil engineering works • Index of wage and salary earnings • Producer price index for manufactured products • National accounts calculations
Weighted average of the method	B

Product category N Administrative and support services comprises rental and leasing services, employment services, travel agencies, tour operators and other reservation services and related services, security and investigation services, services for buildings and landscape activities and office administration, office support and other business support services.

Method

Output, excl. other non-market output

It is again necessary to review the methods by describing each of the two-digit product categories.

In the volume calculation for product category 77 Rental and leasing services, we have access to a fairly good selection of producer price indices for services. Some of them are in accordance with the KTTL categories of the supply and use tables while others are less accurate. They include both A and B methods. The most problematic and at the same time, the most important product in this category is KTTL 774000 Licensing services for the right to use intellectual property and similar products, except copyrighted works.

This product suffers from the same problems as product category 72 Scientific research and development referred to above. Even though the Eurostat handbook does not give any specific A/B/C definitions for this product, it presents deflation by an index describing the general price trends in the national economy (such as the produce price index) as the best alternative. This is also the method used in the supply and use tables for Finland’s national accounts.

Product category 78 Employment services comprises the activities of employment placement services, temporary employment agency services broken down by industry into seven different products and other human resources provision. All products are deflated by the producer price index for services. In 2020, the level of accuracy was not yet sufficiently high for category A and for this reason, all products are classified as category B products. However, the producer price index for services for these product categories is now more comprehensive than in the past and in the future, representative price indices at more accurate levels can be produced.

Product category 79 Travel agencies, tour operators and other reservation and related services comprises one compilation-level product. It is deflated by the consumer price index, which is classified as a B method.

For product categories 80, 81 and 82, it is necessary to rely on the index of wage and salary earnings in most of the compilation-level services. Furthermore, KTTL 813000 is deflated by the cost index of civil engineering works. These are all classified as C methods. For these product categories, too, the producer price index for services has developed since 2020 and new indices are continuously introduced for deflation purposes.

Other non-market output

In this product category, the other non-market output only comprises collective products. In collective services, the input method is applied to non-market output.

3.16 KTTL O Public administration and defence services; compulsory social security services (84)

	Output, excl. other non-market output	Other non-market output
Products	6	8
Total output (EUR million)	3,880	17,033
Percentage of the economic output	0.9 %	3.9 %
Price sources used	• Index of wage and salary earnings • Price index of public expenditure	• Finnish Centre for Pensions • Social Insurance Institution of Finland
Weighted average of the method	B	

Most of the services in product category O are non-market public services.

Method

Output, excl. other non-market output

The value of the market services in this product category is low for most of the products. However, KTTL 841100 General public administration services is a single substantial sized product in this category. The price index of public expenditure is applied to this product. The handbook on prices and volume measures does not specify any market output methods

for this product category. We classify the methods for this product category as B methods.

Other non-market output

In this category, the other non-market output comprises the compulsory social security services. It consists of individual services and their volume calculation is based on extrapolation by volume data. The volume indicators for the extrapolation are calculated separately for sectors S.13141 Employment pension schemes and S.13149 Other social security funds.

For employment pension schemes, the number of persons retiring on an employment pension is monitored. The information is obtained from the pocket statistics published by the Finnish Centre for Pensions.

For other social security funds, the number of benefit decisions made by the Social Insurance Institution of Finland and unemployment funds is monitored. The number of benefit decisions is weighted together based on the cost contributions.

The methods of both sectors meet the criteria for individual non-market services and they can be classified as an A method.

3.17 KTTL P Education services (85)

	Output, excl. other non-market output	Other non-market output
Products	3	2
Total output (EUR million)	2,050	11,371
Percentage of the economic output	0.5 %	2.6 %
Price sources used	• Index of wage and salary earnings • Consumer price index	• Finnish National Agency for Education • Education statistics
Weighted average of the method	B	

In this product category, too, non-market services play a more important role. Market producers also provide education services.

Method

Output, excl. other non-market output

The volume calculation of the market output of this product category is based on deflation by the price change data of the consumer price index and the index of wage and salary earnings. Deflation according to the

index of wage and salary earnings is specified as a C method and deflation using the consumer price index as a B method.

Other non-market output

Education services are individual services and as a result, for the other non-market output, the volume calculation is based on the extrapolation of the previous year's current-price value by the output volume indicator. Both central and local government have their own indicators. More education services are produced by local government than central government.

The number of pupils or students is the quantity monitored in local government. The Eurostat's handbook on prices and volume measures mentions the number of student-hours as the quantity that should be used. However, in a situation where the number of hours for each student remains unchanged over the years included in the comparisons, using the number of students as the only criterion produces approximately the same end results.

When the output indicator is calculated, it is important to break down and weigh the data as accurately as possible. In local government, the first division is into education levels: pre-primary education, basic education, general upper secondary education, vocational education and studying for a university of applied sciences degree. In basic education, a further division is made into students with severe disabilities, other students with disabilities, students with special needs and all other students (except those listed above). In general upper secondary education, adult students are treated as a separate group. In vocational education and in universities of applied sciences, the division is into fields of education. The data are obtained from Statistics Finland's statistics on education, the statistical service of Finland's education administration and other datasets compiled by the Finnish National Agency for Education.

University education is the most important sector of education falling under the responsibility of central government. In it, the division is also by field of education. The quantity monitored for universities are the number of FTE students. In the weighting of the number of university students, consideration is given to attendance and study performance based on completed courses. The data are obtained from the statistical service of Finland's education administration.

3.18 KTTL Q Human health and social work services (86–88)

	Output, excl. other non-market output	Other non-market output
Products	6	6
Total output (EUR million)	13,480	19,158
Percentage of the economic output	3.1 %	4.4 %
Price sources used	• Producer price index for services • Consumer price index	• Finnish Institute for Health and Welfare
Weighted average of the method	B	

This product category comprises human health services, residential care services and social work services without accommodation. The product category is characterised by substantial market output values but the values of non-market output are even more substantial. When all output types are considered, this product category is one of the most important in the Finnish economy.

Method

Output, excl. other non-market output

The market output of the product KTTL 862100 General medical practice services is deflated by the producer price index for services. The market outputs for all other human health and social work services are deflated by the consumer price index. In this product category, the consumer price index is more acceptable than in the other product categories and for most of the products, it is specified as an A method (in addition to the producer price index for services).

Other non-market output

Human health and social work services are individual services and as a result, for the other non-market output, volume calculation is based on the extrapolation of the previous year's current-price value by output volume indicator. Both central government and local government have their own indicators. Local government produces substantially more human health and social work services than central government.

The other non-market output of product category Q is divided between local government and central government. The volume indicators of the outputs of this category are based on the data compiled by the Finnish Institute for Health and Welfare. The obligation of the service providers to

submit data makes the calculation process easier. The Finnish Institute for Health and Welfare and thus also Statistics Finland (for the national accounts) receive highly accurate data. This enhances the quality of the volume calculation. The high-quality volume data on the output of public services also allow the productivity of the public services in question to be examined.

Human health services local government S.1313

This is the most important of the combinations in product category Q and it is also a highly important item at the level of the economy as a whole. Human health services are further divided into many products and an output volume indicator is calculated for each of them.

KTTL 861000 Hospital services or specialised healthcare are the most important of the human health products. The statistics on productivity in hospitals produced by the Finnish Institute for Health and Welfare are used as the source for the non-market output indicator. The stratification and especially the use of the DRG (Diagnosis Related Group) background variable are the strengths of this source data. In this classification, specialised healthcare activities are classified as products instead of specific activities. Thus the whole indicator gives an indication of the direct output and not of an activity, which would have an indirect link with the output. The data are weighted by costs by region and even by hospital. The method meets the criteria for a B method. There are no references to optional A methods in the Eurostat handbook.

KTTL 862100 General medical practice services or basic healthcare are weighted together as outpatient and inpatient care. Today, this is mostly in the form of outpatient care. Calculation of the outpatient care indicator is further divided into a combination of 18 services and occupational groups, which are weighted together by cost data.

Inpatient care is divided into the following three services: sheltered housing, long-term care in health centres and nursing homes. These services are further divided in accordance with the intensity of care required by the patient. Different combinations are weighted together by the cost data. The volume method for general medical practice services meets the criteria for an A method.

KTTL 862300 Dental practice services are a separate product. In the output indicator for these services, a distinction is made between visits to dental hygienists and dentists. The data are weighted by the salaries of individual occupational groups. For visits to dentists, consideration is given to the fact that both a dentist and a dental nurse are present. The pay data are obtained from the statistics on local government sector wages and salaries compiled by Statistics Finland. The volume method meets the criteria for a B method.

Human health services central government S.1311

Only a limited number of human health services are provided by central government. The number of outputs from state-owned mental health institutions is used as the output indicator. As there is not enough separation or weighting by cost data in the calculations, the method is classified as a C method.

Social work services local government S.1313

In addition to human health services, the social work services provided by local government are the second major non-market output item. The social work services are divided into KTTL 870000 Residential care services and 880000 Social work services without accommodation.

The calculation of the output indicator for KTTL 870000 Residential care services comprises the following services:

- Residential care for the elderly
- Residential care services for the elderly provided on a 24-hour basis
- Residential care for the disabled
- Residential care activities for the disabled provided on a 24-hour basis

Residential care services for the elderly provided on a 24-hour basis is the most important of these services. Care days are the most important of the quantities to be monitored. Data on the complexity of the care required by the patients are also used in the calculations. The alternatives to the non-market output in this product category are not discussed in detail in the Eurostat guidance but the assumption is that the method meets at least the criteria for a B method.

The calculation of the output indicator for the product KTTL 880000 Social work services without accommodation comprises the following services:

- Other services for the elderly
- Home care
- Early childhood education and care

Early childhood education and care are the most important of these services, but home care too is fairly important at the level of the social work services as a whole. Care days are the quantity monitored in early childhood education and care. A division is made between family day care and day care centres as well as between services provided by municipalities and outsourced services. A distinction is also made between full-time day care and part-time day care. The number of visits is monitored in home care.

The alternatives to the non-market output in this product category are not discussed in detail in the Eurostat guidance but the assumption is that the method meets at least the criteria for a B method.

Social work services central government S.1311

Only residential care services are produced in this sector and they only play a minor role. The output indicator is generated based on the number of outputs at state-owned reformatory schools. The method can be classified as a B method. There are practically no sub-divisions in this sector as there is so little diversity in the activities that they are not required.

3.19 KTTL R Arts, entertainment and recreation services (90–93)

	Output, excl. other non-market output	Other non-market output
Products	8	6
Total output (EUR million)	2,809	2,151
Percentage of the economic output	0.6 %	0.5 %
Price sources used	• Index of wage and salary earnings • Consumer price index	
Weighted average of the method	B	

Most of the output of this product category is consumed by households. For this reason, basing the volume calculation on deflation by the consumer price index is the method suited for this product category.

Method

Output, excl. other non-market output

The services provided by arts institutions, libraries, archives, botanical and zoological gardens and nature reserves are deflated by the data contained in the index for wage and salary earnings. Their method is classified as a C method.

Performing arts and creative work, museum services, gambling and betting services and sports, amusement and recreation activities are deflated by the consumer price index. Some of these activities are classified as A methods while others are classified as B methods.

Other non-market output

In this product category, the other non-market output only comprises collective products. In collective services, the input method is applied to non-market output.

3.20 KTTL S Other services (94–96)

	Output, excl. other non-market output	Other non-market output
Products	8	4
Total output (EUR million)	2,883	2,788

Percentage of the economic output	0.7 %	1.0 %
Price sources used	• Producer price index for services • Consumer price index • Index of wage and salary earnings	
Weighted average of the method	B	

This product category comprises the services provided by membership organisations, repair of computers and personal and household goods and other personal services.

Method

Output, excl. other non-market output

The services provided by membership organisations are deflated by the index of wage and salary earnings. The method is classified as a C method. Few of the services provided by membership organisations are provided as market output.

The repair services are deflated by the producer price index for services. The method is classified as a B method.

Depending on the compilation-level product, other personal services are deflated by the producer price index for services, the consumer price index or the index for wage and salary earnings. Most are deflated by the producer price index for services and the consumer price index and the methods of these two indices are classified as A methods. The rest are classified as C methods.

Other non-market output

In this product category, the other non-market output only comprises collective products. In collective services, the input method is applied to non-market output.

3.21 KTTL T Services of households (97–98)

Products	**1**
Total output (EUR million)	253
Percentage of the economic output	0.1 %
Price sources used	• Consumer price index
Weighted average of the method	B

This product category only comprises one compilation-level product and its volume calculation is based on deflation by the consumer price index. The method is classified as a B method.

3.22 Price and volume calculation of market output – example

Example. Calculating price and volume data for industry NACE 105 Dairy products. All current-price and fixed-price calculations of the output are made in basic prices.

In the current-price (CuP) calculation for the national accounts, the output of the manufacture of dairy products in 2019 totalled EUR 2,147 million. The value of the output in 2020 was about 4.2 per cent higher, amounting to EUR 2,237 million.

Industry NACE	2019 CuP, EUR million	2020 CuP, EUR million	2020 change from the previous year	2020 value index, 2019=1
105 Dairy products	*2,147*	*2,237*	*+4.2 %*	*1.042*

In the preparation of the current-price supply table, the total value of the output of the manufacture of dairy products is broken down into products. The output is broken down into products in the manner described in the table below.

Product, KTTL	2019 CuP, EUR million	2020 CuP, EUR million	2020 change from the previous year	2020 value index, 2019=1
105110 Processed liquid milk and cream	*539*	*546*	*+1.3 %*	*1.013*
105130 Butter and dairy spreads	*241*	*222*	*-7.9 %*	*0.921*
105140 Cheese and curd	*472*	*486*	*+3.0 %*	*1.030*
105150 Other dairy products	*515*	*501*	*-2.7 %*	*0.973*
108910 Other food products, not elsewhere classified	*380*	*482*	*+26.8 %*	*1.268*

The products are then given fixed prices by dividing the current-price values by the price change data. Before this can be done, it must be determined for which purposes the domestic output is used. The output intended for domestic use is deflated by domestic market prices while the output intended for exports is deflated by export prices. In practice, the data on output percentages are used as the basis for the average price weighted by domestic market and export prices, which is applied to the current-price value of the entire domestic output. The division into domestic and export use is shown by the current-price use table.

Product	Domestic share 2020	Change in domestic market prices 2020/2019	Export share 2020	Change in export prices 2020/2019	Weighted output price change
105110 Processed liquid milk and cream	*97 %*	*+4.5 %*	*3 %*	*+2.8 %*	*0.97*4.5 %+ 0.03*2.8 %= +4.45%*
105130 Butter and dairy spreads	*50 %*	*+1.3 %*	*50 %*	*-13.2 %*	*-5.95 %*

105140 Cheese and curd	*93 %*	*0.5 %*	*7 %*	*6.7 %*	*+0.93 %*
105150 Other dairy products	*86 %*	*0.9 %*	*14 %*	*2.6 %*	*+1.14 %*
108910 Other food products, not elsewhere classified	*87 %*	*-0.2 %*	*13 %*	*-0.8 %*	*-0.28 %*

As the value and prices of the products are now known, we can calculate the fixed-price (FP) values and volume changes.

$$FP_{2020} = CuP_{2020}/Price\ index$$

Product	2020 CuP, EUR million	2020/2019 price change	2020 price index, 2019=1	2020 FP, EUR million
105110 Processed liquid milk and cream	*546*	*+4.45 %*	*1.0445*	*546/1.0445 = 523*
105130 Butter and dairy spreads	*222*	*-5.95 %*	*0.9405*	*236*
105140 Cheese and curd	*486*	*+0.93 %*	*1.0093*	*482*
105150 Other dairy products	*501*	*+1.14 %*	*1.0114*	*495*
108910 Other food products, not elsewhere classified	*482*	*-0.28 %*	*0.9972*	*483*

The fixed-price output value for industry 105 in 2020 is the sum of the fixed-price values of the products of the industry.

Product	2019 CuP, EUR million	2020 CuP, EUR million	2020 FP, EUR million
Products A–Z, total	*2,147*	*2,237*	*2,130*

To derive the price index for the industry, the price index presented in the previous formula can now be calculated.

$$Price\ index = CuP_{2020}/FP_{2020}$$

Industry	2020 CuP, EUR million	2020 FP, EUR million	2020 price index, 2019=1
105 Dairy products	*2,237*	*2,130*	*1.050*

The volume index can be calculated by

$$Volume\ index = FP_{2020}/CuP_{2019}$$

or

$$Volume\ index = Value\ index/Price\ index$$

Industry	2020 CuP, EUR million	2020 FP, EUR million	2020 value index, 2019=1	2020 price index, 2019=1	2020 volume index, 2019=1
105 Dairy products	*2,237*	*2,130*	*1.042*	*1.050*	*1.042/1.050=0.992*

4 Methodological descriptions by end use category

4.1 Household consumption expenditure

Household consumption expenditure comprises the goods and services purchased by households in the market and the commodities that they have produced for their own end use. The household consumption expenditure calculation for the national accounts is based on the ECOICOP product classification based on the purpose of use for individual consumption. This classification is harmonised at the EU level. The classification has 229 compilation-level (five-digit level) goods and service headings.

The prices and volumes for these 229 ECOICOP products are calculated in the supply and use table framework. Household consumption expenditure data are expressed in current prices at the purchasers' price because the transaction in question is an end-use transaction. Thus the deflators (price change data) are also expressed at the purchasers' prices. The fixed-price value at the purchasers' price is formed from the current-price value at the purchasers' prices and the deflator at the purchasers' prices.

Creating deflators

The product classification of the national accounts (KTTL) is used for the compilation-level classification in the supply and use tables and thus the ECOICOP categories for household consumption expenditure must be divided into KTTL categories accordingly. One ECOICOP category can be divided into several KTTL categories and the values of more than one ECOICOP category can end up in a single KTTL category.

Preliminary estimates

For the national accounts, the data are calculated six times on a preliminary basis (T+6, T+9, T+12, T+15, T+18, T+21). About 24 months after the end of the statistical year, balanced supply and use tables for each product are calculated and based on these, the final current-price and fixed-price data for the national accounts are produced.

The price change data for household consumption expenditure figures contained in the national accounts are produced by summing up the values of the KTTL categories contained in each ECOICOP category at current and fixed prices and by then calculating the quotients of the current-price and fixed-price sums. These quotients act as deflators by which the current-price values of the household consumption expenditure contained in the national accounts can be divided to produce the fixed-price values for each ECOICOP category. The identity value index = volume index x price index is used in this calculation.

In the preliminary calculations, the supply and use data given in the supply and use tables are not balanced by product. In that case, the price index series of the consumer price index directly linked to products are used to provide the household consumer expenditure with fixed prices for all products for which it can be done. The consumer price index measures prices at the purchasers' prices and for this reason, the fixed-price value

at the purchasers' prices can be calculated by dividing the current-price value at the purchaser's prices by the price change data obtained from the consumer price index.

The products for household consumption are produced domestically or imported. In other words, on the supply side, domestic output and imports of goods and services comprise the transactions in products. The supply data are determined at the basic price. In addition to the basic-price value, the value at the purchasers' prices also includes taxes and subsidies on products and trade and transport margins. When supply and use are deflated by a variety of different price sources, it is highly likely that only a small proportion of the products will have the same price change for both supply and use. In the preliminary calculations, price changes in supply and use are not forced to be the same as the current-price product data are not yet in balance. Thus, it is not yet known how different price sources should be weighted together.

Final estimates

The final calculations must produce value, volume and price indices for all products that are identical in both supply and use. Thus, the difference between price change data for the price sources used for supply and use must be corrected in the final calculations. The difference is partially corrected via the purchaser-price deflator and partially via the price change data concerning the taxes on products.

4.1.1 Household consumption expenditure – calculation example 1: Preliminary calculation

The price and volume calculations for household consumption expenditure category 01.2 Non-alcoholic beverages for 2020 at the purchasers' prices using preliminary calculation methods.

According to the preliminary current-price (CuP) calculation for household consumption expenditure for the national accounts, the purchaser-price (OH) value of consumption category 01.2 Non-alcoholic beverages stood at EUR 1,247 million in 2019. The value of the consumption of non-alcoholic beverages increased by about 6.6 per cent in 2020, totalling EUR 1,329 million.

Consumption category	2019 CuP, EUR million	2020 CuP, EUR million	2020 change from the previous year	2020 value index, 2019=1
01.2 Non-alcoholic beverages	*1,247*	*1,329*	*+6.6 %*	*1.066*

As the calculation is of a preliminary nature, deflation can be carried out using purchaser-price deflators obtained from the consumer price index. However, the compilation always takes place in the framework of the supply and use tables and for this purpose, consumption categories must be combined with the product classification of the national accounts (KTTL). Consumption category 01.2 Non-alcoholic beverages is divided into more specific consumption categories in accordance with the table below. The KTTL categories combined with them are shown on the right.

This example shows a situation in which the consumption categories are more specific than the KTTL classification.

Consumption category (COICOP)	Product classification of the national accounts (KTTL)
01.2.1.1.ND Coffee	*108300 Processed tea and coffee*
01.2.1.2.ND Tea	*108300 Processed tea and coffee*
01.2.1.3.ND Cocoa and powdered chocolate	*108210 Cocoa paste, whether or not defatted, cocoa butter, fat and oil, cocoa powder*
01.2.2.1.ND Mineral or spring waters	*110700 Soft drinks; mineral waters and other bottled waters*
01.2.2.2.ND Soft drinks	*110700 Soft drinks; mineral waters and other bottled waters*
01.2.2.3.ND Fruit, berry and vegetable juices	*103200 Fruit and vegetable juices*

More accurate current-price values of consumption categories for supply and use tables are obtained from the national accounts and they are combined with the KTTL product category. For price and volume calculations, the current-price product values are obtained from the use table and are combined with price change data. In this case, all price change data are obtained from the consumer price index at purchasers' prices.

Consumption category (COICOP)	KTTL	CuP 2020, EUR million	Price change 2020/2019	2020 price index, 2019=1
01.2.1.1.ND Coffee	*108300*	*367*	*+1.7 %*	*1.017*
01.2.1.2.ND Tea	*108300*	*46*	*+1.7 %*	*1.017*
01.2.1.3.ND Cocoa and powdered chocolate	*108210*	*27*	*0.0 %*	*1.000*
01.2.2.1.ND Mineral or spring waters	*110700*	*156*	*+4.1 %*	*1.041*
01.2.2.2.ND Soft drinks	*110700*	*407*	*+4.1 %*	*1.041*

01.2.2.3.ND Fruit, berry and vegetable juices	*103200*	*326*	*+2.8 %*	*1.028*

As the product price data are combined using the KTTL classification, one price in the coffee and tea price indices of the consumer price index is weighted for KTTL category 108300 Processed coffee and tea. This is also the case with soft drinks and mineral and spring waters.

The products are then given fixed prices by dividing current-price values by price change data.

$$Fixed-price\ value\ (FP)_{2020} = CuP_{2020}/Price\ index$$

Consumption category (COICOP)	KTTL	CuP 2020, EUR million	2020 price index, 2019=1	FP 2020, EUR million
01.2.1.1.ND Coffee	*108300*	*367*	*1.017*	*367/1.017 =361*
01.2.1.2.ND Tea	*108300*	*46*	*1.017*	*45*
01.2.1.3.ND Cocoa and powdered chocolate	*108210*	*27*	*1.000*	*27*
01.2.2.1.ND Mineral or spring waters	*110700*	*156*	*1.041*	*150*
01.2.2.2.ND Soft drinks	*110700*	*407*	*1.041*	*391*
01.2.2.2.ND Fruit, berry and vegetable juices	*103200*	*326*	*1.028*	*317*

Fixed-price (FP) value of the non-alcoholic beverages for 2020 can be calculated as the sum of the fixed-price product values.

Product	2019 CuP, EUR million	2020 CuP, EUR million	2020 FP, EUR million
Products A–Z, total	*1,247*	*1,329*	*1,291*

To derive the price index for the consumption category of non-alcoholic beverages, the price index presented in the previous formula can now be calculated.

$$Price\ index = CuP_{2020}/FP_{2020}$$

Consumption category	2020 CuP, EUR million	2020 FP, EUR million	2020 price index, 2019=1
01.2 Non-alcoholic beverages	1,329	1,291	1,329/1,291=1.029

The volume index can be calculated by

$$Volume\ index = FP_{2020}/CuP_{2019}$$

or

$$Volume\ index = Value\ index/Price\ index$$

Consumption category	2020 CuP, EUR million	2020 FP, EUR million	2020 value index, 2019=1	2020 price index, 2019=1	2020 volume index, 2019=1
01.2 Non-alcoholic beverages	*1,329*	*1,291*	*1.066*	*1.029*	*1.066/1.029=1.035*

Based on this calculation, in 2020, the price for non-alcoholic beverages increased by 2.9 per cent and the volume by 3.5 per cent from the previous year.

4.1.2 Household consumption expenditure – calculation example 2: Final calculation

The calculation of prices and volumes for electricity (KTTL 351000) in household consumption expenditure in the final preparation of supply and use tables.

According to the final current-price (CuP) calculation of household consumption expenditure for the national accounts, the purchaser-price (OH) value of electricity for 2020 stood at EUR 1,528 million. The value of electricity consumption increased by about 6.4 per cent from 2019.

Product	2019 CuP, EUR million	2020 CuP, EUR million	2020 change from the previous year	2020 value index, 2019=1
351000 Electricity	*1,436*	*1,528*	*+6.4 %*	*1.064*

If we progressed in the same manner as in the preliminary calculation, we would now deflate the current-price value of electricity by the price change based on the consumer price index.

$$FP_{2020} = CuP_{2020}/Price\ index$$

According to the consumer price index, the price of electricity increased by 0.3 per cent between 2019 and 2020.

Product	2020 CuP, EUR million	Price change 2020/2019	2020 price index, 2019=1	2020 FP, EUR million
351000 Electricity	*1,528*	*+0.3 %*	*1.003*	*1,528/1.003 =1,523*

In the final calculation, the values, prices and volumes of each product must be in balance for supply and use. When we examine electricity at the level of overall use and supply, we identify problems in the price and volume calculations. These problems arise from the differences in price change data between price sources: supply and other use categories are based on producer price indices and the consumer price index is only used in household consumption expenditure. As the purchaser-price value of electricity includes tax on products, trade margin and value added tax, it is natural that the purchaser-price change in price and volume differs from the basic-price change. However, no differences should exist when the basic-price value of use is compared to the basic-price value of supply.

Product	Value variable	Price source	Price change 2020/2019	2020 price index, 2019=1	2020 CuP, EUR million	2020 FP, EUR million
351000 Electricity	*Basic price (PH)*	*Producer price indices*	*-18.9 %*	*0.811*	*691*	*691/0.811 =852*
	Other product taxes (D214)		*+5.2 %*	*1.052*	*387*	*368*
	Trade margin (P118W)		*-22.3 %*	*0.777*	*87*	*112*
	Value added tax (D211)		*-12.5 %*	*0.875*	*363*	*415*
	Purchasers' price, PH+D214+P118W+D211				*1,528*	*1,747*

The implicit purchaser-price price index can be calculated as the ratio between the current-price value and the fixed-price value:

$$Price\ index = CuP_{2020}/FP_{2020}$$

The change in price would amount to -12.5 per cent. The price change differs significantly from the price change in the consumer price index (+0.3 per cent).

Value variable	Price source	Price change 2020/2019	2020 price index, 2019=1	2020 CuP, EUR million	2020 FP, EUR million
Purchasers' price, PH+D214+P118W+D211	*Implicit, supply-based*	*-12.5 %*	*1,528/1,747=0.875*	*1,528*	*1,747*
Purchasers' price, directly deflated	*Consumer price index*	*+0.03 %*	*1.003*	*1,528*	*1,523*
Error term		***12.84 %***	***0.128***	*0*	***-224***

When calculated in this manner, the fixed-price value of the electricity consumed by households is more than EUR 200 million higher than the value deflated by the consumer price index. In theory, the difference could be corrected in any price-formation item: in basic price, taxes on products, trade margin, value added tax or purchasers' price. In practice, the problem with the correction of items is that the changes might have impacts elsewhere in the supply and use tables and thus create new imbalances. For electricity, support for determining which of the price sources is better from the perspective of the national accounts is provided by the statistics on production of electricity and heat and energy supply and consumption compiled by Statistics Finland. The production and consumption volumes obtained from the energy statistics seem to match better with the volume based on supply and use tables produced using supply figures.

The purchase-price value of electricity and other product taxes on electricity were selected for correction because they only concern this particular product. As the change in the price of value added tax is based on the VAT-free product price, it also changes when other product taxes are corrected.

Value variable	Price source	2020 FP, EUR million	FP correction, EUR million	2020 FP final, EUR million
Basic price (PH)	*Producer price indices*	*691/0.811 =852*	*0*	*852*
Other taxes on products (D214)		*368*	*-85*	*283*
Trade margin (P118W)		*112*		*112*
Value added tax (D211)		*415*	*-27*	*388*
Purchasers' price, PH+D214+P118W+D211		*1,747*		*1,635*
Purchasers' price, directly deflated	*Consumer price index*	*1,523*	*+112*	*1,635*
Error term		***-224***		***0***

Half of the correction of EUR 224 million (EUR 112 million) is made to the purchasers' price and a correction amounting to EUR 85 million is made to other taxes on products. As a result, the VAT value also changes by EUR 27 million, which means that the tax correction totals EUR 112 million.

The weakness of this solution is that there is a difference between the price change data contained in the consumer price index and the final national accounts and that the calculation of volume-based product taxes differs from the value produced by its basic method. On the plus side, all value, price and volume data concerning supply and use are balanced

because the change chain between basic-price and purchaser-price data remains unbroken.

Electricity is an extreme example of a product. On average, the most substantial corrections to it must be made to the final price and volume calculations for the national accounts. Corrections to other products are usually significantly less extensive. The corrections also go in different directions for different products and thus their net impact may be less substantial than that of an extreme example.

4.2 General government (sector S.13) consumption expenditure

The general government consumption expenditure is calculated by sector. There are a five compilation-level sectors for general government:

- S.1311 Central government
- S.1313 Local government
- S.13141 Employment pension schemes
- S.13149 Other social security funds

The general government consumption expenditure is also divided into individual and collective consumption expenditure. The volume estimates of the general government consumption expenditure for the national accounts are produced by dividing current-price general government consumption expenditure by the price change data by sector and transaction.

Forming deflators

Sector-specific and transaction-specific price change data (deflators) are formed in the framework of supply and use tables. The data classification in the tables is used to break down the data on individual supply and use categories. The consumption expenditure of the central government, local government and social security funds each have their own data category.

There is no classifying variable for individual or collective consumption expenditure in the supply and use tables. A separate link table is needed for this purpose. The link table is used to determine which of the KTTL categories refer to individual consumption and which concern collective consumption. The Classification of the Functions of Government (COFOG) is used as an aid in the linking. The COFOG specifies individual and collective tasks separately.

Product-level deflation in the framework of supply and use tables is the first stage in the calculation of deflators for the national accounts. This is part of the calculation of a fixed-price use table. Prices for products are obtained from the supply side.

In the second stage of the derivation of deflators, the products are summed up by data category and by sector and divided into individual and collective consumption at current and fixed prices. In the third stage, current-price sums are divided by fixed-price sums. These quotients act as deflators for general government consumption expenditure.

In the last stage, the current-price data contained in the national accounts are divided by these deflators, producing the fixed-price values of general government consumption expenditure.

4.3 Gross fixed capital formation

Gross fixed capital formation (investments) is calculated by sector, industry and asset category.

Asset categories with values in 2020:

- N111 Residential buildings
- N112 Other buildings and structures
  - N1121 Other buildings
  - N1122 Civil engineering and other structures
  - N1123 Land improvements
- N113 Machinery, equipment and transport equipment
  - N1131 Transport equipment
  - N11321 Computers and peripheral equipment
  - N11322 Other communications technology equipment
  - N1139 Other machinery and equipment
- N114 Weapons systems
- N115 Cultivated biological assets
  - N1151 Animal resources
- N117 Intellectual property products
  - N1171 Research and development
  - N1172 Mineral exploration and evaluation
  - N1173 Software and databases
  - N1174 Entertainment, literary and art originals
  - N1179 Other intellectual property products

Forming deflators

Sector-specific, industry-specific and asset-specific price change data (deflators) are formed in the framework of supply and use tables. The data classification in the tables is used to break down the data on individual supply and use categories. All investment assets in the national accounts are assigned to a specific data category.

Product-level deflation in the framework of supply and use tables is the first stage in the calculation of deflators for the national accounts. This is part of the calculation of a fixed-price use table. Prices for the products are obtained from the supply side. The supply may consist of domestic output or imports or a combination of the two. Basic-price price changes in the gross fixed capital formation are weighted by current-price output and import data. This keeps basic-price changes in prices identical in supply and use.

In the second stage of the derivation of deflators, the products are summed up by asset category using data classification by sector and by industry at current and fixed prices. In the third stage, current-price sums

are divided by fixed-price sums. These quotients act as deflators for combinations of gross fixed capital formations.

In the last stage, the current-price data contained in the national accounts are divided by these deflators, producing the fixed-price values of gross fixed capital formation.

4.3.1 Gross fixed capital formation volume calculation – example

Calculating the price and volume data for gross fixed capital formation (investments) of industry NACE *105 Dairy products* for asset N1139 Other machinery and equipment.

According to the current-price (CuP) calculation of investments for the national accounts, the purchaser-price (OH) value of the machinery and equipment investments in industry 105 totalled EUR 19 million in 2019. The value of machinery and equipment investments increased by about 42 per cent in 2020, totalling EUR 27 million.

Investment asset	2019 CuP, EUR million	2020 CuP, EUR million	2020 change from the previous year	2020 value index, 2019=1
N1139 Other machinery and equipment	*19*	*27*	*+42.1 %*	*1.421*

In the preparation of the current-price use table, the total value of asset N1139 Other machinery and equipment is broken down into products. The investments are broken down into products in the manner described in the table below.

Product	2019 CuP, EUR million	2020 CuP, EUR million	2020 change from the previous year	2020 value index, 2019=1
289300 Manufacture of machinery for food, beverage and tobacco processing and its parts	*7*	*10*	*+42.9 %*	*1.429*
331225 Repair and maintenance services of machinery for food, beverage and tobacco processing	*3.7*	*5*	*+35.1 %*	*1.351*
281310 Pumps for liquids; liquid elevators, air or vacuum pumps; air or other gas compressors	*3.2*	*5*	*+56.3 %*	*1.563*
282921 Machinery for cleaning, filling, packing or wrapping bottles or other containers	*2.9*	*4*	*+37.9 %*	*1.379*
711270 Mechanical and process engineering design	*2.1*	*3*	*+42.9 %*	*1.429*

The purchaser-price (OH) volume of the products is calculated as the sum of the basic-price fixed-price value and the fixed-price values of the price-formation items. Thus in addition to the basic-price value (PH), the following price-formation items must also be deflated separately: other taxes on products (D214), transport margins (P118I), trade margins (P118R, P118W), value added tax (D211) and subsidies on products (D31).

$$\begin{aligned} Value\ at\ purchasers'\ prices_{FP} \\ = Value\ at\ basic\ price_{FP} + Other\ taxes\ on\ products_{FP} \\ + Transport\ margins_{FP} + Trade\ margins_{FP} \\ + Value\ added\ tax_{FP} - Subsidies\ on\ products_{FP} \end{aligned}$$

The deflators for the basic-price value, transport, margins and trade margins are obtained from supply data. The deflation of taxes and subsidies is presented in a separate section.

Calculating the basic-price value of the products is examined in detail below.

Product	2020 CuP OH, EUR million	2020 CuP Price formation items, EUR million	2020 CuP PH, EUR million
289300 Manufacture of machinery for food, beverage and tobacco processing and its parts	*10*	*0.1*	*10-0.1=9.9*
331225 Repair and maintenance services of machinery for food, beverage and tobacco processing	*5*	*0*	*5*
281310 Pumps for liquids; liquid elevators, air or vacuum pumps; air or other gas compressors	*5*	*1.1*	*3.9*
282921 Machinery for cleaning, filling, packing or wrapping bottles or other containers	*4*	*1.0*	*3*
711270 Mechanical and process engineering design	*3*	*0*	*3*

The table shows that in this particular example, price formation items play a fairly minor role; the purchaser-price and basic-price values are fairly close to each other for all products and for two of them they are identical.

The products for gross fixed capital formation in the Finnish economy are either imported or produced domestically. A product may be priced differently, depending on whether it is imported or purchased in Finland and for this reason, the domestic share and the imported share of each product should be determined. This division can be obtained from the current-price supply and use tables.

Product	Domestic output	Imported output
289300 Manufacture of machinery for food, beverage and tobacco processing and its parts	*18 %*	*82 %*
331225 Repair and maintenance services of machinery for food, beverage and tobacco processing	*100 %*	*0 %*
281310 Pumps for liquids; liquid elevators, air or vacuum pumps; air or other gas compressors	*33 %*	*67 %*
282921 Machinery for cleaning, filling, packing or wrapping bottles or other containers	*50 %*	*50 %*
711270 Mechanical and process engineering design	*81 %*	*19 %*

The percentage of domestic output is combined with the price of domestic output and the imported output with the import price. The basic-price price change data for the products are weighted from them.

Product	Domestic output	Change in domestic output price	Imported output	Change in import price	Weighted price change
289300 Manufacture of machinery for food, beverage and tobacco processing and its parts	*18 %*	*0.44 %*	*82 %*	*-0.2 %*	*0.18*(0.44 %)+ 0.82*(-0.2 %)= -0.08 %*
331225 Repair and maintenance services of machinery for food, beverage and tobacco processing	*100 %*	*2.5 %*	*0 %*		*2.5 %*
281310 Pumps for liquids; liquid elevators, air or vacuum pumps; air or other gas compressors	*33 %*	*2.1 %*	*67 %*	*-0.17 %*	*0.59 %*
282921 Machinery for cleaning, filling, packing or wrapping bottles or other containers	*50 %*	*0.94 %*	*50 %*	*-1.19 %*	*-0.14 %*
711270 Mechanical and process engineering design	*81 %*	*-0.2 %*	*19 %*	*-0.3 %*	*-0.22 %*

The value and prices of the products are now known, and we can calculate the fixed-price (FP) basic-price values and volume changes.

$$FP_{2020} = CuP_{2020}/Price\ index$$

Product	2020 CuP (PH), EUR million	Price change 2020/2019	2020 price index, 2019=1	2020 FP (PH), EUR million
289300 Manufacture of machinery for food, beverage and tobacco processing and its parts	*9.9*	*-0.08 %*	*0.999*	*9.95*
331225 Repair and maintenance services of machinery for food, beverage and tobacco processing	*5*	*2.5 %*	*1.025*	*4.88*
281310 Pumps for liquids; liquid elevators, air or vacuum pumps; air or other gas compressors	*3.9*	*0.59 %*	*1.006*	*3.87*
282921 Machinery for cleaning, filling, packing or wrapping bottles or other containers	*3*	*-0.14 %*	*0.999*	*2.97*
711270 Mechanical and process engineering design	*3*	*-0.22 %*	*0.998*	*3.01*

Next, the price formation items are given fixed prices so that the fixed-price values at the purchasers' prices can be generated. In this example, two of the five products do not have any price formation items and the basic-price and purchaser-price values are of equal size. Three of the products have trade or transport margins.

The wholesale margin (P118W) prices are obtained from the basic-price price change of the wholesale services listed in the supply table.

The transport margin (P118I) prices are obtained by weighting together basic-price price-change data on more than one transport service product listed in the supply table.

Product	2020 CuP, price formation items, EUR million	Price change 2020/2019, price formation items	2020 price index, 2019=1	2020 FP, price formation items, EUR million
289300 Manufacture of machinery for food, beverage and tobacco processing and its parts, P118I Transport margins	*0.055*	*0.006 %*	*1.000*	*0.055*
281310 Pumps for liquids; liquid elevators, air or vacuum pumps; air or other gas compressors, P118W wholesale margins	*1.11*	*0.397 %*	*0.9960*	*1.115*
28921 Machinery for cleaning, filling, packing or wrapping bottles or other containers, P118W wholesale margins	*1.04*	*0.397 %*	*0.9960*	*1.041*

The fixed-price value for the purchaser price can be calculated per product by summing up the basic-price fixed-price value and the fixed-price values of the price-formation items.

Product	2020 FP, at basic price, EUR million	2020 FP, price formation items, EUR million	2020 FP, at purchasers' price, EUR million
289300 Manufacture of machinery for food, beverage and tobacco processing and its parts	*9.95*	*0.055*	*9.95+ 0.055=10,01*
331225 Repair and maintenance services of machinery for food, beverage and tobacco processing	*4.88*	*0*	*4.88*
281310 Pumps for liquids; liquid elevators, air or vacuum pumps; air or other gas compressors	*3.87*	*1.115*	*4.98*

282921 Machinery for cleaning, filling, packing or wrapping bottles or other containers	*2.97*	*1.041*	*4.01*
711270 Mechanical and process engineering design	*3.01*	*0*	*3.01*

The purchaser-price fixed-price value of asset N1139 Other machinery and equipment for industry NACE 105 Dairy products for 2020 is the sum of the purchase-price fixed-price values of the products in the combination industry asset.

Product	2019 CuP, OH, EUR million	2020 CuP, OH, EUR million	2020 FP, OH, EUR million
Products A–Z, total	*18.9*	*27.0*	*26.9*

To derive the price index for asset N1139 Other machinery and equipment for the industry, the price index presented in the previous formula can now be calculated.

$$Price\ index = CuP_{2020}/FP_{2020}$$

Investment asset	2020 CuP, OH, EUR million	2020 FP, OH, EUR million	2020 price index, 2019=1
N1139 Other machinery and equipment	*27.0*	*26.9*	*27/26.9 = 1.004*

The volume index can be calculated by

$$Volume\ index = FP_{2020}/CuP_{2019}$$

or

$$Volume\ index = Value\ index/Price\ index$$

Investment asset	2020 CuP, OH, EUR million	2020 FP, OH, EUR million	2020 value index, 2019=1	2020 price index, 2019=1	2020 volume index, 2019=1
N1139 Other machinery and equipment	*27.0*	*26.9*	*1.429*	*1.004*	*1.429/1.004=1.422*

Based on this calculation, in 2020 the price of investment asset N1139 Other machinery and equipment in industry NACE 105 Dairy products increased by 0.4 per cent and volume by 42.2 per cent from the previous year.

4.4 Net acquisition of valuables

There are net acquisitions of valuables in four sectors: S.1311 Central government, S.1313 Local government, S.14 Households and S.15 Non-profit institutions serving households. There are three compilation-level assets comprising valuables: N131 Precious metals and stones, N132 Antiquities and other art objects and N133 Other valuables.

Creating deflators

Sector-specific and asset-specific price change data (deflators) are created in the framework of supply and use tables. The data classification in the tables is used to break down the data on individual supply and use categories. Each of the three assets comprising valuables constitutes a separate data category.

Product-level deflation in the framework of supply and use tables is the first stage in the calculation of deflators for the national accounts. This is part of the calculation of a fixed-price use table. Prices for the products are obtained from the supply side. The supply may consist of domestic output or imports or a combination of the two. Basic-price price change in the acquisition of valuables is weighted by current-price output and import data. This keeps basic-price changes in prices in supply and use identical.

In the second stage of the derivation of deflators, the products are summed up by asset category using data classification, by sector and by industry at current and fixed prices. In the third stage, current-price sums are divided by fixed-price sums. These quotients act as deflators in the combinations of net acquisitions of valuables.

In the last stage, the current-price data contained in the national accounts are divided by these deflators, producing the fixed-price values of net acquisitions of valuables.

4.5 Changes in inventories

Changes in inventories are measured in five sectors: S.11 Non-financial corporations, S.1311 Central government, S.1313 Local government, S.14 Households and S.15 Non-profit institutions serving households. Changes in inventories are observed in nearly all industries.

The changes in inventories are also classified by inventory type. The inventory types are specified in ESA 2010. There are four main categories and the two first ones are divided into two sub-categories:

- N121 Materials and supplies
  - N1211 Fuels
  - N1219 Other materials and supplies
- N122 Work in progress
  - N1221 Work in progress on cultivated biological assets
  - N1229 Other work in progress
- N123 Finished goods
- N125 Goods for resale

Forming deflators

Sector-specific, industry-specific and inventory-specific price change data (deflators) are created in the framework of supply and use tables. The data classification in the tables is used to break down the data on individual supply and use categories. Each of the six classification level inventory types has its own data category.

Product-level deflation in the framework of supply and use tables is the first stage in the calculation of deflators for the national accounts. This is part of the calculation of a fixed-price use table. Prices for the products are obtained from the supply side. The supply may consist of domestic output or imports or a combination of the two. Basic-price price change in changes in inventories is weighted by current-price output and import data. This keeps basic-price changes in prices in supply and use identical.

In the second stage of the derivation of deflators, products are summed up by type of inventory using data classification, by sector and by industry at current and fixed prices. In the third stage, current-price sums are divided by fixed-price sums. These quotients act as deflators in the combinations of changes in inventories.

In the last stage, the current-price data contained in the national accounts are divided by these deflators, producing the fixed-price values of changes in inventories.

4.6 Exports and imports of goods and services

The accounts of the exports and imports of goods and services used in the national accounts and in the balance of payments are identical and they are produced on an integrated basis. This section is divided into the description of the calculation of the volumes of goods exports and imports and a description of the calculation of volumes of service exports and imports.

A description of the calculation of current-price exports and imports of goods and services can be found in sections 5.13 and 5.14 of the methodological description for Finland's gross national income. In addition to sections 5.13 and 5.14, information on the phenomena of global production and the processing concerning this can also be found in section 5.17 Foreign trade and global production. In section 6.1.2.2 of the methodological description, you can find a description of the relevant current-price supply and use tables.

Deflation

The quarterly dimension is a feature distinguishing the calculation of foreign trade transactions from all other transactions. The import and export data in the current-price supply and use tables are first deflated by product, sector, data category and quarter. The product dimension is then summed up at current and fixed prices, in other words: data-sector sums are calculated at current and fixed prices per quarter.

Preliminary calculation

In the preliminary calculation, the quarterly fixed-price values calculated in the previous stage are first entered in the quarterly accounts. A fixed-price annual estimate is entered in the national accounts from the quarterly accounts as the sum of quarters. As the quarterly dimension is a component in the preliminary calculation, there are slight differences between the national accounts and the fixed-price foreign trade data contained in the preliminary supply and use tables.

Final calculation

The difference between the final and preliminary calculations is that the differences between the annual sums calculated per quarter and the annual sums produced by the calculation of supply and use tables by directly deflating the annual values are eliminated. This is done by benchmarking the figure calculated for the quarters with the annual value calculated through supply and use tables. As a result, the variation during a year is still shown in the quarterly accounts, but the annual sums and thus also the supply and use of the economy as a whole and the supply and use described in the supply and use tables are in balance at fixed prices.

In the final calculation, all products are balanced at current prices for supply and use, which may change the aggregate sum ratios between products in imports and exports. As the prices of products do not change in the same manner, balancing products also leads to slight changes in the price and volume calculations.

The preliminary method is more accurate because it makes use of the matching of quarterly price data and quarterly value data. However, using it in the final figures is problematic because it is not known how product data on imports (supply data) and domestic use data match on a quarterly basis and how quarterly export data match with their supply data (domestic output).

4.6.1 Exports and imports of goods

Current-priced product structures

The foreign trade data for the national accounts are obtained from the balance of payments statistics, which are primarily based on the foreign trade statistics compiled by Finnish Customs. This data is linked to the KTTL-product classification used in supply and use tables.

The foreign trade data on the balance of payments also contain a regional dimension, which in the national accounts and in the supply and use tables corresponds to the sub-sectoral division of the Rest of the world (S2) sector.

Price data

Product-specific price index series are specified for exports and imports for the deflation of supply and use tables. In the exports and imports of goods, import and export price indices of the producer price indices are used. They help to make price and volume calculations more accurate. If no separate import or export price is available for the product, we use a more approximate import or export price or a more accurate domestic market producer price index for manufactured products.

According to Eurostat (2016) when domestic market prices are applied to imports and exports, they could be adjusted using exchange rates. This is not done in the price and volume calculations for Finland’s national accounts. However, for goods, import and export price indices are extensively available.

4.6.2 Exports and imports of services

Price data

For services, the sources for import and export prices are the same as the price sources for domestic output. Currently, import or export price indices are not separately available in the producer price indices for services. It is stated (without any differentiation between prices) in the producer price index series for services whether the services are intended for exports or for domestic use. In other words, the index series contain the export prices but no breakdown into prices is made.

4.6.3 Calculation of import prices and volumes – example

Calculating price and volume data for imports of goods (P71) from the euro area (S2111) for 2020. All current-price and fixed-price calculations of imports are made at basic price.

According to the current-price (CuP) figures for the national accounts, the value of goods imports from the euro area totalled EUR 26,798 million in 2019. In 2020, the value of the goods imports decreased by about six per cent, to EUR 25,189 million.

Transaction, sector	2019 CuP, EUR million	2020 CuP, EUR million	2020 change from the previous year	2020 value index, 2019=1
P71 Imports of goods, S2111 euro area	*26,798*	*25,189*	*-6.0 %*	*0.94*

In the preparation of the current-price supply table, the total value of goods imports from the euro area is broken down into products. The five import products with the highest value are specified in the table below and the other products are shown as a total sum. The goods import category comprises about 500 products.

Product	2019 CuP, EUR million	2020 CuP, EUR million	2020 change from the previous year	2020 value index, 2019=1
291020 Passenger cars, new	*1,234*	*1,277*	*+3.5 %*	*1.035*
212010 Pharmaceutical preparations	*1,130*	*1,236*	*+9.4 %*	*1.094*
262000 Computers and peripheral equipment	*1,038*	*1,005*	*-3.2 %*	*0.968*
201600 Plastics in primary form	*1,230*	*686*	*-44.2 %*	*0.558*
293200 Other parts and accessories for motor vehicles	*640*	*496*	*-22.5 %*	*0.775*
All other products	*21,526*	*20,489*	*-4.8 %*	*0.952*

The products are then given fixed prices by dividing current-price values by price change data. In the deflation of goods imports, the import price index for producer price indices compiled by Statistics Finland is the most important data source for price changes.

$$FP_{2020} = CuP_{2020}/Price\ index$$

Product	2020 CuP, EUR million	2020/2019 price change	2020 price index, 2019=1	2020 FP, EUR million
291020 Passenger cars, new	*1,277*	*2.6 %*	*1.026*	*1,277/1.026 =1,245*
212010 Pharmaceutical preparations	*1,236*	*0.1 %*	*1.001*	*1,235*
262000 Computers and peripheral equipment	*1,005*	*-0.2 %*	*0.998*	*1,007*
201600 Plastics in primary forms	*686*	*-7.7 %*	*0.923*	*743*

293200 Other parts and accessories for motor vehicles	*496*	*0.8 %t*	*1.008*	*492*
All other products	*20,489*	*-2.9 %*	*0.971*	*21,106*

Fixed-price value of goods imports from the euro area in 2020 can be calculated as the sum of the fixed-price product values.

Product	2019 CuP, EUR million	2020 CuP, EUR million	2020 FP, EUR million
Products A–Z, total	*26,798*	*25,189*	*25,828*

To derive the price index for goods imports from the euro area, the price index presented in the previous formula can now the calculated.

$$Price\ index = CuP_{2020}/FP_{2020}$$

Transaction, sector	2020 CuP, EUR million	2020 FP, EUR million	2020 price index, 2019=1
P71 Imports of goods, S2111 euro area	*25,189*	*25,828*	*25,189/25,828= 0.975*

The volume index can be calculated by

$$Volume\ index = FP_{2020}/CuP_{2019}$$

or

$$Volume\ index = Value\ index/Price\ index$$

Industry, sector	2020 CuP, EUR million	2020 FP, EUR million	2020 value index, 2019=1	2020 price index, 2019=1	2020 volume index, 2019=1
P71 Imports of goods, S2111 euro area	*25,189*	*25,828*	*0.940*	*0.975*	*0.940/0.975=0.964*

Based on this calculation, the price of goods imports from the euro area decreased by 2.5 per cent and the volume by 3.6 per cent in 2020.

5 Methodological descriptions of the other parts of the system

5.1 Value added

Value added is a balancing transaction. It is calculated at current prices as the difference between the basic-price output and purchaser-price intermediate consumption. No unambiguous price or volume interpretation for value added exists. However, in preliminary figures, calculation of the gross domestic product for Finland's national accounts is always based on the production approach. This means that the gross domestic product is calculated as follows:

(12)

$$GDP = \mathrm{P1} - \mathrm{P2} + \mathrm{D21} - \mathrm{D31}$$

or

$$GDP = \text{Value added} + \text{taxes on products} - \text{subsidies on products}$$

Thus, to calculate the volume of GDP, the volume of value added must also be determined. In ESA 2010, the calculation of the volume of value added is defined as the difference between output volume and intermediate consumption volume. This is called double deflation. The essential feature of double deflation is that the volumes of output and intermediate consumption are calculated independently of each other. Double deflation does not require that all data are prepared by dividing the data by price changes as some of the data can also be calculated by extrapolating the volume data.

In the national accounts, all output and intermediate consumption data are also independent of each other at fixed prices and thus the volume calculation of the value added for Finland's national accounts is carried out in accordance with the principle of double deflation.

In the quarterly accounts, the price change data for output and intermediate consumption are independent of each other but the volume data on intermediate consumption are directly dependent on output volume data. Thus the method used to calculate the volume of valued added in the quarterly accounts cannot be considered double deflation.

5.2 Taxes and subsidies on products

Taxes and subsidies on products are an important part of product-specific price and volume calculations because they are part of the difference between the purchaser-price and basic-price value (in addition to trade and transport margins). Furthermore, the price and volume calculations of the taxes on all products are part of the price and volume calculations for the gross domestic product. This is because in the formation of the fixed-price gross domestic product, the fixed-price value of product taxes is added to the gross value added and the fixed-price value of product subsidies is deducted from the gross value added.

There are two types of taxes on products. Some of them (such as the value added tax) are tied to product value. However, some of the taxes on products (such as the tax on liquid fuels) are tied to product volumes. There are differences between these two tax types concerning the manner in which the changes in their price are calculated and for this reason, the two tax types are described separately below.

The underlying principle for all taxes is that the volume of the taxes is closely tied to the volume of the associated product. However, it is not always easy to apply this principle in practice and thus the price component must also be separately specified.

The methods applied to product taxes are also applied to product subsidies and for this reason they are not separately reviewed.

5.2.1 Quantity-based taxes and subsidies on products

A change in the price of quantity-based taxes means a change in the total tax ratio. The tax value at previous year’s price can be calculated when the change in the total tax ratio is eliminated by dividing current-price tax value by the change in the total tax ratio.

5.2.2 Value-based taxes and subsidies on products

The price of value-based taxes on products can change through two different components. First, changes in the total tax ratio are interpreted as changes in tax prices in the same manner as in the case of quantity-based taxes. The changes in the price of the product that the tax concerns also have an impact on the tax price change.

5.2.3 Price and volume calculation of product taxes – example

Calculating the volume and price for quantity-based product tax

Between 2019 and 2020, the current-price value of the product tax on motor gasoline paid by households decreased from EUR 760 million to EUR 388 million.

Variable	2019	2020	2020 change from the previous year
Motor gasoline, CP, product tax	*EUR 760 million*	*EUR 388 million*	*-48.9 %*

On 1 August 2020, the tax on motor gasoline was raised from 70.25 cents per litre to 75.96 cents per litre. The average for the tax for 2020 was about 72.63 cents per litre.

Variable	2019	2020	2020 change from the previous year
Motor gasoline, total tax ratio cents/litre	*70.25*	*72.63*	*+3.4 %*

As the tax is quantity-based, the change in the tax ratio can be directly used as price change data.

Variable	2019	2020	2020 change from the previous year
Motor gasoline, product tax price index	*1*	*1.034*	*+3.4 %*

The fixed-price value (FP) of the tax for 2020 can be calculated by dividing the current-price value EUR 388 million by the tax price index 1.034.

$$FP_{2020} = CuP_{2020}/Price\ index$$

or EUR 388 million/1.034 = about EUR 376 million.

The volume change in product tax is the ratio between the fixed-price product tax value for 2020 and the current-price product tax value for 2019.
EUR 376 million/EUR 760 million = about 0.494

The decrease of 48.9 per cent in the value of the tax revenue from motor gasoline is divided between a price change of +3.4 per cent and a volume change of -50.6 per cent.

Variable	2019	2020	2020 change from the previous year
Motor gasoline, product tax, value index	*1*	*0.511*	*-48.9 %*
Motor gasoline, product tax, price index	*1*	*1.034*	*+3.4 %*
Motor gasoline, product tax, volume index	*1*	*0.494*	*-50.6 %*

The current-price (CuP) basic-price (PH) value of motor gasoline in private consumption totalled EUR 850 million in 2019 and decreased to EUR 300 million in 2020. In 2020, the first year of the COVID-19 pandemic, the demand for motor gasoline decreased globally and as a result, prices also fell. The price paid by households for motor gasoline decreased by almost 29 per cent from the basic price while the volume decreased by about 51 per cent. The basic-price volume decreased by the same amount as the tax volume.

Variable	2019	2020	2020 change from the previous year
Motor gasoline, CP, basic price	*EUR 850 million*	*EUR 300 million*	*-64.7 %*
Motor gasoline, basic price, value index	*1*	*0.353*	*-64.7 %*
Motor gasoline, basic price, price index	*1*	*0.714*	*-28.6 %*
Motor gasoline, basic price, volume index	*1*	*0.494*	*-50.6 %*

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