Methodological description of Quarterly National Accounts

28/02/2025

Statistics Finland

Contents

1 Overview of Quarterly National Accounts

This methodological description describes the data content for release, the source data used and the compiling methods for the Quarterly National Accounts. The updating process of this methodological description has been funded by the Statistical Office of the European Union, Eurostat (i.e. Grant project funding).

1.1 Organisation

Quarterly National Accounts (hereafter referred to as QNA) are compiled at the National Accounts Unit of Statistics Finland's Economic Statistics Department. The compiling process involves one full-time person (team leader) and eight to ten other National Accounts experts.

1.2 Publication schedule, revisions policy and dissemination

QNA are published two months after the end of a quarter. A release calendar showing all future release dates for the current year can be found on the webpages of the statistics at: https://stat.fi/en/statistics/ntp.

QNA data are subject to revisions after their first release, so it is advisable to search always for the latest version of QNA database tables when using time series. The revisions to transactions that are caused by revisions in the quarterly and monthly source data take place within around twelve months of the initial release. Any subsequent revisions are usually due to revisions in the annual national accounts. Annual accounts data will be revised until the supply and use tables are published, that is, around two years from the end of the statistical reference year. However, seasonally adjusted and trend time series are always revised with every release, irrespective of whether or not the original time series has been revised.

1.3 Compilation of QNA

QNA are derived statistics, the compilation of which is based on the use of indicators formed from basic statistics or other source data. Unlike for annual accounts, exhaustive data on different transactions are generally not available quarterly. Lack of coverage means that in most cases, the data cannot be compiled directly by summing the source data. Instead, annual national accounts data are interpolated into quarters and extrapolated for the latest quarters with indicators.

The compilation of data takes place in several phases, depending on the indicator used. First, the indicator time series are constructed and reviewed for each QNA transaction. The indicator time series may be individual time series directly taken from the source data or a weighted combination of several source data time series. They can represent the development of either a current priced value[1] transaction or the transaction volume[2]. The indicator should reflect the quarterly development of the respective QNA transaction as well as possible. The indicators used are described in Chapters 4–9.

The indicator time series are then benchmarked to the annual national accounts using the proportional Denton method (see Chapter 3.2). As a result of benchmarking, quarterly time series are formed until the latest year of the annual national accounts. In the next phase, the latest quarters are extrapolated with the help of the indicator, using either the ratio of the value of the latest annual accounts and the annual sum of the indicator (the so-called annual benchmark-to-indicator method) or the volume indicator. Current priced data are deflated at the average prices of the previous year and chain-linked to produce a continuous volume series. In industries, where the monthly Trend Indicator of Output[3] has the same source data available as quarterly national accounts, the quarterly data to be extrapolated can be summed from the monthly data in the Trend Indicator of Output.

QNA data are compiled according to European System of Accounts ESA 2010. ESA 2010 is broadly consistent with the System of National Accounts of the United Nations (SNA 2008).

1.4 Balancing

Total demand and supply are not fully balanced in QNA, but the statistical discrepancy between them is shown separately. If the statistical discrepancy becomes excessive, there is reason to suspect that one or several demand and supply components are erroneously estimated. In this case, the transactions most likely to cause an imbalance are sought, and their values are adjusted where necessary.

[1] E.g. the turnover index represents the development of a current priced output.

[2] E.g. the volume index of industrial output represents the development of the output volume.

[3] The calculation method of the Trend Indicator of Output is the same as the calculation of value added in quarterly national accounts. In addition to the monthly calculation, the only difference is that the calculation schedule for the Trend Indicator of Output lacks all the source materials used in the quarterly national accounts available for all industries.

1.5 Volume estimates

QNA volume data are published as chain-linked time series. The chain-linking is performed with the annual overlap method, in which volume estimates at the average prices of the previous year are used. Volumes at the average prices of the previous year are calculated either by deflating the current price data with the change in the price index or by deriving the estimate at the previous year’s price from the annual overlap chain calculated from the volume indicator. Before chain-linking, volume time series at the previous year’s prices are benchmarked to the annual accounts with the pro rata method, in which each quarter of the same year is raised or lowered in the same proportion.

1.6 Seasonal adjustment and working day adjustment

Seasonal adjustment and working day adjustment are performed using the TRAMO/SEATS method in JDemetra+ software. In addition to seasonally adjusted time series, trend time series and working day adjusted time series are published in QNA, both at current prices and as a chain-linked volume series. In series at current prices, the aggregates are summed from seasonally adjusted sub-series. Chain-linked volume series are not additive, so their aggregation is a little more complicated: seasonally adjusted volume series are unlinked to seasonally adjusted values at the previous year’s price to aggregate the data, after which they are chain-linked again. Seasonally adjusted, working day adjusted and trend time series are benchmarked again to the annual accounts with the Denton method after the seasonal adjustment.

2 Publication schedule, revisions policy and distribution of QNA

2.1 Release schedule and revisions to data

QNA are released two months after the end of a quarter. A calendar showing all future release dates for the current year can be found on the webpages of the Quarterly National Accounts at: https://stat.fi/en/statistics/ntp.

QNA data are subject to revisions after their first release, so it is advisable to search always for the latest version of QNA database tables when using time series. In addition, the data can be updated between the actual statistics releases within two to three weeks after the release date once new information is available from the statistics on quarterly sector accounts or annual national accounts. In this case, the database tables of QNA are updated, but no actual statistical release is made.

The revisions can be divided into those arising from changes in the source data of QNA, those caused by benchmarking to annual accounts and revisions due to other, mainly methodological reasons. The revisions of QNA data that arise from changes in their quarterly and monthly source data take place within around twelve months of the initial release. Any revisions after this are usually caused by revisions in the new annual accounts and benchmarking of QNA to them.

The characteristics of mathematical/statistical methods used in the compilation mean it is also always possible that the time series become slightly revised in connection with a new release, even if no changes took place in the source data or annual accounts. The seasonal adjustment methods, in particular, are sensitive to new observations, so each new quarterly data set will change seasonally adjusted and trend time series for the quarters preceding it as well. The more the new quarterly data differ from the development anticipated by the seasonal adjustment method, the more the preceding quarters are revised in the seasonally adjusted time series.

2.2 Contents published

The principal publication format of QNA is a free-of-charge release on the Internet. The online release[4] comprises a brief release text, a longer review text and database tables in the Statfin database accessible via the “Database tables” link. The database tables of the online release contain the entire data content of QNA. The tables include the ESA 2010 time series, as well as older “historical” QNA time series that are not regularly updated. The ESA 2010 time series are divided into three tables, in all of which the time series start from the first quarter of 1990:

1. Employment and hours worked, quarterly
2. Income and production by industry, quarterly
3. Gross domestic product and national income, supply and demand, quarterly

Table 1 contains data on numbers of persons employed and hours worked with a breakdown of eleven industries. Persons employed and hours worked are additionally broken down into employees and self-employed persons, and for all industries, into private and public sectors. Moreover, the table gives figures on total population and employed persons according to the national concept.

[4] https://stat.fi/en/statistics/ntp

Table 2 contains data on the value added at the accuracy of 24 industries and paid salaries, as well as the social security contributions paid by employers at an accuracy of 11 industries. Under “Industries in total” and under “Services in total” for the value added, these details are broken down into private and public sectors. Taxes on products, subsidies on products, their difference, gross domestic product at market prices, consumption of fixed capital, taxes on production and imports minus subsidies and operating surplus at the level of the total national economy are presented at the level of the total national economy. In quarterly national accounts, the classification used is the Standard Industrial Classification (TOL2008), which complies with the EU’s NACE Rev. 2 and the UN’s ISIC industrial classifications.

The industries in Table 2 (industry code in brackets):

- in total (A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T)
- primary production (A)
- agriculture (01)
- forestry (02)
- secondary production (B, C, D, E, F)
- industry (B, C, D, E)
- manufacturing (C)
- forest industry (16–17)
- chemical industry (19–22)
- metal industry (24, 25, 28–30, 33)
- electrical and electronics industry (26–27)
- energy supply, water supply and waste management (D, E)
- construction (F)
- services (G, H, I, J, K, L, M, N, O, P, Q, R, S, T)
- trade; transport; accommodation and food service activities (G, H, I)
- trade (G)
- services, excl. trade (H, I, J, K, L, M, N, O, P, Q, R, S, T)
- transport (H)

- accommodation and food service activities (I)
- information and communication (J)
- financial and insurance activities (K)
- real estate activities (L)
- professional, scientific and technical activities; administrative and support service activities (M, N)
- public administration; education; health and social work (O, P, Q)
- other service activities (R, S, T)

Table 3 contains data on the national balance of supply and demand, i.e. the items of total supply and total demand. Total supply is composed of gross domestic product and imports. Total demand is composed of exports, consumption, gross fixed capital formation, changes in inventories, net acquisitions of valuables and statistical discrepancy.

Exports and imports are broken down into goods and services in the table. Final consumption expenditure is broken down into public and private (households and non-profit institutions serving households) sectors, in which household final consumption is further itemised into five types of goods (durable, semi-durable, non-durable goods, services and tourism expenditure as net). Gross fixed capital formation is broken down into buildings, machinery, equipment and transport equipment, cultivated assets and intellectual property products. Gross fixed capital formation is also broken down into private and public sectors. Table 3 also includes primary income items from/to the rest of the world, gross national income, consumption of fixed capital, net national income, current transfers from/to the rest of the world, disposable income, savings, capital transfers from/to the rest of the world and net lending.

In addition to original series, all tables include seasonally adjusted, per working day adjusted and trend series. The data in Tables 2 and 3 are released both with current prices and as chain-linked volume series.

Change percentages of the original and working day adjusted series compared with the respective quarter of the previous year can also be seen in the tables. Change percentages from the previous quarter can additionally be seen from the seasonally adjusted and trend series.

2.3 Other transmissions

The flash estimate on gross domestic product and employment is published with the release of the Trend Indicator of Output at the lag of 30 days from the end of a quarter.

2.4 Metadata

A description of QNA is available on the webpage of the publication at: https://stat.fi/en/statistics/documentation/ntp

3 Compilation of QNA

3.1 Overview of the compilation

The compilation of QNA in Finland is based on the use of indicator time series with benchmarking, extrapolation, volume and seasonal adjustment methods. The compilation thus differs from the annual national accounts, which are mostly compiled using a direct compilation method[5]. Indicators in QNA are quickly released intra-annual statistics or other source data that are considered to represent or be correlated with national accounts transactions. Indicators are utilised because unlike in the annual accounts, exhaustive data on the values of national accounts transactions are generally unavailable quarterly or monthly. Even if exhaustive data were available quarterly at some time lag, it would be rare for them to be available within the timeframe required by QNA, i.e. within 50 days of the end of a quarter.

The indicator should reflect the quarterly development of the respective QNA transaction as well as possible. The indicator time series may be individual time series selected directly from source statistics or weighted combinations of the time series of several source statistics. When constructing indicators, one must take into account the specific characteristics of the used indicators, such as constant upward or downward bias over time. If constant bias is detected in the indicator, the indicator values are adjusted as required before benchmarking and extrapolation. The adjustments can be deterministic or based on a statistical model. They may concern the whole time series or only one observation of the indicator time series.

In the calculation of current price data, the information of the indicators and the information of annual national accounts are combined using benchmarking and extrapolation methods. Current price data are calculated using value indicators, or

[5] In the direct compilation method, the source data are first summed. Coverage adjustments and other adjustments are then made if required. The use of the direct compilation method requires sufficiently exhaustive source data.

volume indicators and price information. Volume data at the previous year's prices are compiled either by converting current price data into the previous year's average prices or by deriving them using the volume indicator. Continuous volume series are formed by chain-linking these previous year's average price data using the annual overlap method.

3.2 Benchmarking, extrapolation and balancing

3.2.1 Benchmarking to annual accounts

Current price QNA time series are compiled by first benchmarking the current price indicator time series to annual accounts and then extrapolating the latest quarters with the same indicator. The purpose of benchmarking is to estimate the QNA time series using the indicator time series so that the annual levels of QNA time series are equal to the levels of annual national accounts. Benchmarking can be considered a solution to the problem: how to combine the annual data of annual accounts with quarterly indicator data, so that the quarterly path of the result time series follows the indicator as closely as possible.

It is essential to understand that the level of the benchmarked QNA time series is determined by the annual accounts, but its quarterly path is determined by the indicator. The level of the indicator values therefore does not need to be anywhere near the values in euros of their corresponding QNA transaction, but the indicator can be an index series, for example. Benchmarking requires that all indicator time series are complete and cover the entire timeframe of QNA, i.e. starting from the beginning of 1990. As a result of benchmarking, the current priced time series are formed up to the latest year of annual national accounts.

Benchmarking is done using the proportional Denton method[6], which is primarily a mechanical process. Its objective is to retain the original quarter-to-quarter development of the indicator time series in the resulting QNA time series. If an observation in an indicator series at time t is denoted with i_t and an observation in the benchmarked QNA series at time t with x_t, the benchmarked values are those that minimise the equation

$$\min \sum_{t=2}^{T} \left[\frac{x_t}{i_t} - \frac{x_{t-1}}{i_{t-1}}\right]^2$$

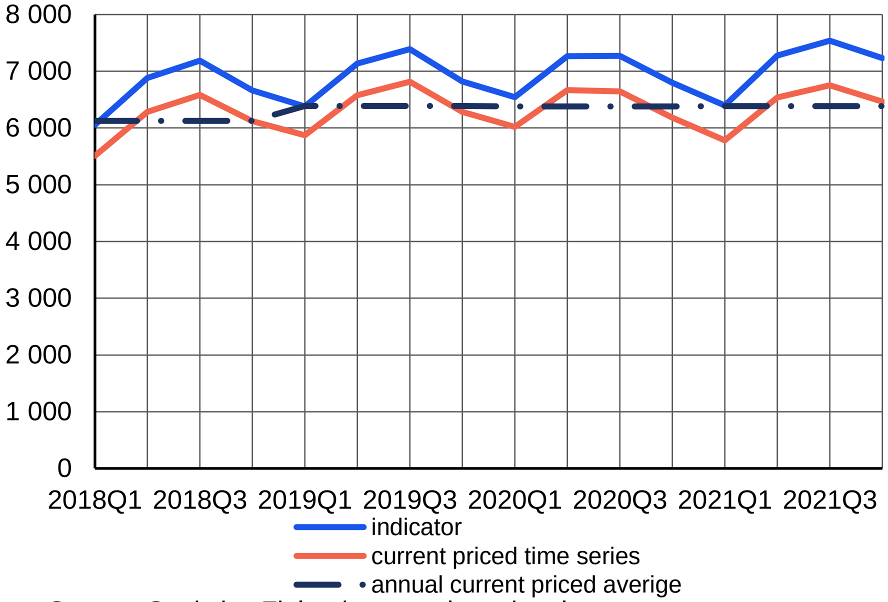
[6] Denton, F.T. (1971), "Adjustment of monthly or quarterly series to annual totals: An approach based on quadratic minimization." Journal of the American Statistical Association, 82, 99–102.

where T denotes the last quarter of the benchmarked time series. The sum of squares is minimised subject to annual constraints, i.e. that the sum of all quarters of the year must be equal to the corresponding value in annual accounts. The benchmark to indicator ratio BI_t will thus be estimated for every quarter of the year,

$$BI_t = \frac{x_t}{i_t}$$

which, when the entire time series is considered, deviates as little as possible from the BI ratio of the previous point in time. When the BI ratio changes only a little when moving from one moment in time to the next, the development of the benchmarked series also differs only a little from the indicator.

Figure 1: Indicator and a time series benchmarked with the proportional Denton method



Source: Statistics Finland, quarterly national accounts

Figure 1 shows the indicator (blue) for the non-financial corporations sector (S11) in building construction (412+432_439) and the output's current priced time series (orange) formed from it by benchmarking. When comparing the indicator and the benchmarked time series, it can be seen that the proportional Denton method retains the development of the indicator in the benchmarked time series. The annual level of the time series in accordance with annual accounts differs from the indicator, but the benchmarking determines the current price time series for the level determined in annual national accounts while retaining the economic trend of the indicator.

For benchmarking some time series, the Denton difference method is also used in QNA. The Denton difference method is almost identical to proportional Denton, except in this case, the differences minimised are based on actual differences of the benchmark and the indicator instead of differences in proportional BI ratios:

$$\min \sum_{t=2}^{T} [(x_t - i_t) - (x_{t-1} - i_{t-1})]^2$$

The choice between these two Denton methods boils down to whether we want to retain the proportional quarterly changes (proportional Denton) or the actual quarterly changes (the Denton difference method) of the indicator in the benchmarked time series. The Denton difference method is used in a few QNA time series in which the quarterly growth rates of the indicator are too volatile to represent the actual quarterly growth rates of the benchmarked transaction, usually due to a small sample size.

There are also various benchmarking methods that are based on time series models and in which the indicator time series is used as the external regressor. A simple example of this is Chow-Lin[7], and if suitably formulated, the Denton method can also be regarded as a special case of such a model. With the exception of particularly problematic series, the Denton method and methods based on simple time series modelling in practice produce the same benchmarked series[8]. The proportional version of the Denton method is also recommended for benchmarking in the IMF's QNA manual[9].

3.2.2 Extrapolation

Benchmarking yields the current price QNA time series until the latest year of annual national accounts, after which the latest quarters missing from the time series are calculated by extrapolation. Extrapolation is done in two ways in QNA: current price data are extrapolated using either current price indicator time series or volume index and related price data.

As a result of benchmarking, the sum of the quarters in any year of the benchmarked current priced time series is exactly equal to that in the annual accounts. When extrapolating using a current priced value indicator, the annual benchmark-to-indicator ratio used in extrapolation can then be calculated by dividing the annual sum of the latest benchmarked QNA values by the annual sum of the respective indicator time

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[7] Chow, G.C. – Lin, A.-L. (1971), "Best Linear Unbiased Interpolation, Distribution and Extrapolation of Time Series by Related Series". The Review of Economics and Statistics, 53 (4), 372–375.

[8] Further reading about time series model-based methods is available in a master's thesis written at Statistics Finland: Hakala, Samu (2005), "Aikasarjojen täsmäyttäminen" (in Finnish only; Benchmarking of time series).

[9] https://www.imf.org/external/pubs/ft/qna/pdf/2017/chapterv6.pdf

series. The annual BI ratio is thus the ratio of the latest annual account data to the respective quarterly indicator values.

In extrapolation using a current price indicator, the values of the indicator time series are multiplied by the BI ratio of the latest benchmarked year

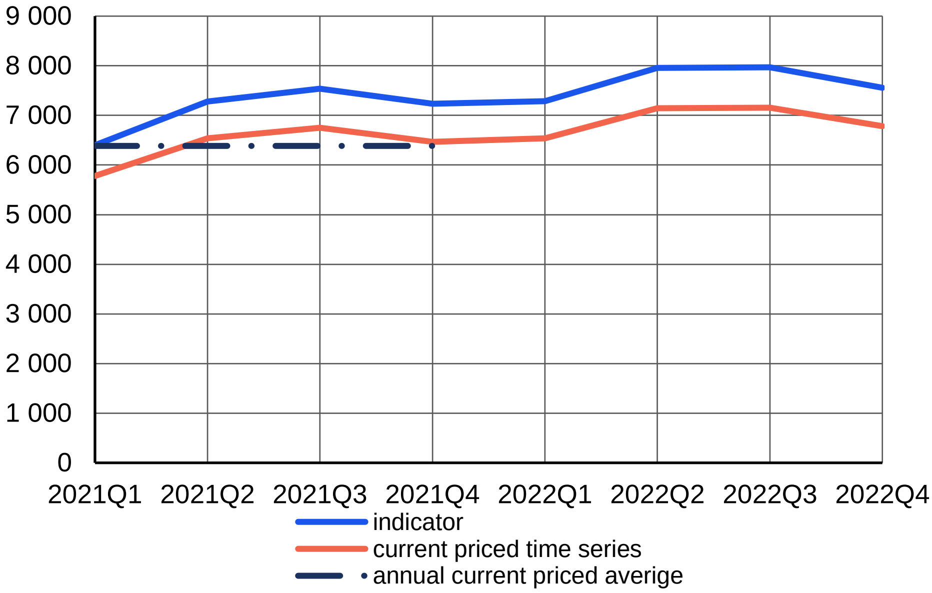
$$x_t = \frac{x_{Y-1}}{i_{Y-1}} \times i_t$$

where x_t is the extrapolated QNA value for quarter t, x_{Y-1} is the sum of the QNA values in the latest benchmarked year, i_{Y-1} is the sum of the indicator values in the same year, and i_t is the value of the indicator in quarter t.

As in benchmarking, the extrapolation method is selected with a criteria that the resulting current priced QNA time series should follow the development of the indicator as closely as possible. Extrapolated current price QNA estimates can still be adjusted if necessary. Adjustments are made when some additional information not included in the indicator is available.

Figure 2 and Tables 2a and 2b illustrate extrapolation in a situation where the current price time series (the same as above in the benchmarking example) benchmarked to annual data covers the period up to the end of 2021, in which case the quarters in 2022 must be calculated by extrapolation, using the indicator and the BI ratio of 2021.

Figure 2: Extrapolation with the value indicator and the annual BI ratio



Source: Statistics Finland, quarterly national accounts

Figure 2 shows that the extrapolated QNA time series (orange) runs at a different level than the indicator (blue), but this development is retained in the extrapolated quarters (see Table 2c). Tables 2a and 2b show how the extrapolated values in Figure 2 were calculated.

Table 2a: Calculating the BI ratio

Time	Benchmarked value, € million	Value indicator	BI ratio
2021Q1	5780	6399	5780 / 6399 = 0,903266
2021Q2	6541	7278	6541 / 7278 = 0,898735
2021Q3	6753	7539	6753 / 7539 = 0,895742
2021Q4	6467	7232	6467 / 7232 = 0,894220
2021	**25541**	**28448**	**25541 / 28448 = 0,897814**

Table 2b: Extrapolation with the value indicator and the BI ratio

Time	Value indicator	Extrapolated value, € million
2022Q1	7286	0,897814 * 7286 = 6541
2022Q2	7960	0,897814 * 7960 = 7147
2022Q3	7969	0,897814 * 7969 = 7155
2022Q4	7558	0,897814 * 7558 = 6786

Table 2a shows that a separate BI ratio is formed for each quarter. Similarly, the BI ratio can be calculated for the entire year 2021, which is then used to extrapolate the observations for the year 2022 in Table 2b. The changes in the extrapolated series from the previous observation are therefore the same as in the indicator series, except for the first quarter, as the BI ratio remained unchanged for the quarters in 2022. The change in the first quarter of 2022 from the previous observation differs from the indicator series, as the BI ratio of the previous observation, i.e. the last quarter of 2021, differs slightly from the BI ratio of the first quarter of 2022.

Table 2c: Value change from the previous quarter

Time	Value indicator	Extrapolated value
2022Q1	0,7 %	1,1 %
2022Q2	9,3 %	9,3 %
2022Q3	0,1 %	0,1 %
2022Q4	-5,2 %	-5,2 %

When new observations are calculated by extrapolation using the volume indicator, it is used differently from the value indicator to retain the methodological consistency by chain-linking the time series: first, the annual overlap chain (see 3.3.2) used in chain-linking is calculated based on the volume indicator.

$$AO_t = \frac{CL_t}{\frac{1}{4} \times {CL_{Y-1}}_t}$$

It is then used to extrapolate the values at the previous year's price.

$$CL_t = \frac{PYP_t}{\frac{CP_{Y-1}}{4}} \times \frac{CL_{Y-1}}{4} \Leftrightarrow PYP_t = \frac{CL_t}{\frac{1}{4} \times CL_{Y-1}} \times \frac{1}{4} \times CP_{Y-1}$$

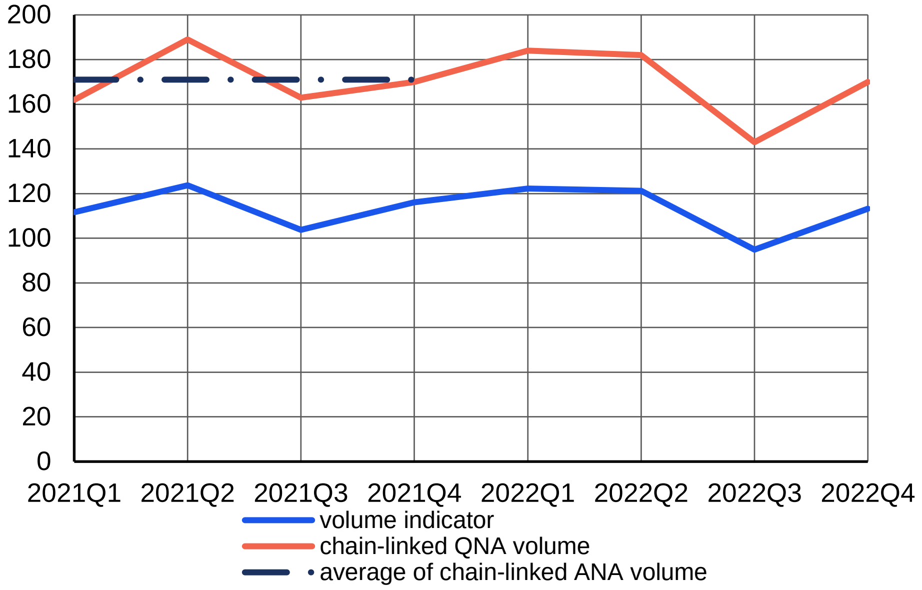
where PYP_t is the extrapolated value at the previous year's price for quarter t, CL_t is the point figure of the volume indicator used in this case for quarter t, CL_{Y-1} is the annual sum of the previous year's point figures of the volume indicator, and CP_{Y-1} is the sum of the previous year's current price values of the extrapolated series. Thus, the value at the previous year's price is reached by multiplying the previous year's current price average by the volume change from the previous year's average according to the volume indicator. The current price value is then reached by multiplying the value at the previous year's price by the deflator (cf. 3.3.1), as

$$PYP_t = \frac{CP_t}{D_t} \Leftrightarrow CP_t = PYP_t \times D_t$$

where D_t is the value of the time series deflator for quarter t.

Figure 3 and Tables 3a and 3b illustrate extrapolation with the volume indicator in a simplified situation where the chain-linked time series benchmarked to annual data covers the period until the end of 2021 and the quarters in 2022 are calculated by extrapolation with the volume indicator.

Figure 3: Extrapolation with the volume indicator



Source: Statistics Finland, quarterly national accounts

Figure 3 shows that the chain-linked and extrapolated QNA time series (orange) runs at a different level than the volume indicator (blue), but this development is retained in the extrapolated quarters (see Table 3c). Tables 3a and 3b show how the extrapolated values were calculated.

Table 3a: Forming the annual overlap chain

Time	Volume indicator	Annual overlap chain
2021Q1	111,7	
2021Q2	123,7	
2021Q3	103,7	
2021Q4	116,1	
2021	**455,2**	
2022Q1	122,2	122,2 / (455,2 / 4) = 1,073813708
2022Q2	121,2	121,2 / (455,2 / 4) = 1,065026362
2022Q3	94,9	94,9 / (455,2 / 4) = 0,833919156
2022Q4	113,2	113,2 / (455,2 / 4) = 0,994727592

Table 3b: Extrapolation with the annual overlap chain

Time	Benchmarked and chain-linked volume series	Extrapolated and chain-linked volume series
2021Q1	162	
2021Q2	189	
2021Q3	163	
2021Q4	170	
2021	**684**	
2022Q1		1,073813708 * (684 / 4) = 183,6221441
2022Q2		1,065026362 * (684 / 4) = 182,1195079
2022Q3		0,833919156 * (684 / 4) = 142,6001757
2022Q4		0,994727592 * (684 / 4) = 170,0984183

Table 3c: Volume change from the previous quarter

Time	Volume indicator	Extrapolated and chain-linked volume series
2022Q1	5,3 %	8,0 %
2022Q2	-0,8 %	-0,8 %
2022Q3	-21,7 %	-21,7 %
2022Q4	19,3 %	19,3 %

Table 3c shows that the changes in the extrapolated series compared to the previous are the same as in the indicator series, except for the first quarter. The change in the first quarter differs from the volume indicator, as the reference period 2021Q4 has been benchmarked to the annual accounts data, so it is not entirely in line with the volume indicator.

3.2.3 Balancing of demand and supply

Demand and supply are not fully balanced in QNA, but the statistical discrepancy between them is shown separately. However, a large statistical discrepancy signifies that some indicators of demand or supply may have problems, or that their time of recording within the quarters differs from that of other indicators. If the quarterly statistical discrepancy in current prices seems to grow excessively large, the probable transactions causing the imbalance are identified, and their current price values are adjusted if necessary.

The most unreliable indicators in QNA are those used in the estimation of gross fixed capital formation, changes in inventories and consumption of services.

In addition to problems related to coverage, the indicators used to estimate the change in inventories might be recorded at a different time than the turnover indicators at the supply side.

The problem with the indicators for the consumption of services and gross fixed capital formation is that they have relatively poor coverage. The gross fixed capital formation in machinery and equipment and in intangible assets such as software are often adjusted due to their great volatility.

GDP calculated using income approach always balances with GDP calculated using supply approach because operating surplus is a residual transaction in QNA (see Chapter 6).

3.2.4 Estimation in preliminary data

The availability of monthly and quarterly source statistics that can be used as indicators is good in Finland. From the initial release, the vast majority of QNA data are based on indicators derived from statistical sources. That said, some of the source data are incomplete, in which case the quarterly value of the indicator must be estimated based on the information covering one or two months. The most important indicators in which the first QNA estimate is based on incomplete data are the indicators for taxes on products and some indicators for the value added in the household sector (see Chapter 4).

3.3 Volume data

3.3.1 Volume data in QNA

Volume refers to data adjusted for price changes. In some context, volume is used as a measure of quantity, but in addition to quantity, volume comprises changes in quality[10]. Price changes can be so high that they make it difficult to monitor economic

[10] For example, the volume of mobile phone production can grow even if the quantity produced does not change. This happens if the quality (i.e. technical features) of new mobile phones is better than that of old ones.

development. The percentage change of GDP is therefore normally derived from the volume time series.

QNA volume data are published as chain-linked time series at the reference year's prices. The volume data of each year are first calculated at the previous year's prices, which are then linked to form a chain-linked volume time series. An alternative way of calculating volume series, used prior to 2006, is to use a fixed base year, which means that the weight structure of the selected base year is also applied to the coming years. The benefit of using the chain-linked volume series is that its weight structure is updated every year, so it is also fairly up-to-date for the latest observations.

In QNA, the calculation of volume data starts with deflation, in which current price time series are converted to volume series at the average prices of the previous year by dividing current price values of each quarter with a deflator.

At its simplest, the deflator is formed by calculating the ratio between the quarterly point figure of one price index and the previous year's average point figure of the index. The deflator in this ratio form thus expresses the price level of each quarter relative to the average price level of the previous year:

$$D_t = \frac{P_t}{P_{Y-1}}$$

where P_t is the price of quarter t, P_{Y-1} is the average price of the previous year, and D_t is the deflator value.

Several price indices can be used for constructing a deflator for one transaction. In this case, the price change of each price index used for the transaction is weighted into one price change, using the product weights in the supply and use tables.

In QNA, the output and intermediate consumption deflators for value added by industry are constructed from product level price data[11], which are weighted with the product weights of current price output derived from the supply and use tables. Price indices and their weights are therefore the same as in the corresponding industry in annual national accounts, except for those few products whose final price data are obtained only at an annual frequency.

Because the supply and use tables are completed with a lag of around two years after the end of the statistical reference year, the weight structure of the latest supply and use table is used for several years. To improve the deflation quality for the latest years

[11] The supply and use tables have approx. 800 products, for each of which a specific price index is defined.

and ensure the most up-to-date weight structure possible, price adjustments and possible other adjustments are made to the weight structure.

Deflation with the same prices and weights as in annual accounts improves the accuracy of the volume estimates of the QNA value added and GDP. Actual data about the development of intermediate consumption are missing when compiling QNA, so their volume is estimated to develop in line with the output.

When deflators have been constructed for all transactions and their industries, deflation can be started. The volume at the average prices of the previous year for quarter t is:

$$PYP_t = \frac{CP_t}{D_t}$$

where CP_t is the current priced value, and D_t is the deflator value in quarter t.

Table 4: Deflation

Time	Benchmarked value, € million	Deflator	The value at the average price of the previous year, € million
2021Q1	5780	1,013226184	5780 / 1,013226184 = 5705
2021Q2	6541	1,017615373	6541 / 1,017615373 = 6428
2021Q3	6753	1,026526316	6753 / 1,026526316 = 6578
2021Q4	6467	1,032361986	6467 / 1,032361986 = 6264
2022Q1	6541	1,039574062	6541 / 1,039574062 = 6292
2022Q2	7147	1,050257164	7147 / 1,050257164 = 6805
2022Q3	7155	1,061572700	7155 / 1,061572700 = 6740
2022Q4	6786	1,110274869	6786 / 1,110274869 = 6112

Volume estimates at the previous year's average prices are benchmarked to the annual accounts with the pro rata method, that is, each quarter of a year is raised or lowered in equal proportion:

$$x_t = \frac{x_Y}{i_Y} \times i_t$$

where x_t is the benchmarked quarterly volume at the previous year's average prices, x_Y is the volume at the previous year's prices in the annual accounts, i_Y is the annual sum of the non-benchmarked quarterly volumes at the previous year's average prices, and i_t is the non-benchmarked quarterly volume at the previous year's average prices.

The pro rata method is used in this case instead of the Denton benchmarking method because the previous year's price time series have break points at each turn of the year. As the quarters of each year are deflated to the previous year's prices, changes at the turn of the year in the time series (e.g. 2023Q1/2022Q4) are not comparable with the changes within the year (e.g. 2023Q2/2023Q1). The Denton method aims to retain the changes between all quarters of the original series, which is why the data of the original series should be continuous, as in the current price time series.

The pro rata method is not recommended for the benchmarking of continuous series because it creates break points at year turns (step problem). This means that the comparability of year turns with other periods is lost. However, the pro rata method is used in this case[12] because the characteristics of the volume time series at the previous year's prices include break points at each turn of the year.

Benchmarked volume data at the previous year's prices are not normally published, but they are included in Eurostat's ESA transmission programme. They are available to users on request.

3.3.2 Chain-linking

Volume time series are constructed using the annual overlap (Laspeyres) chain-linking method. When observations from various years are chain-linked to form a continuous volume series, the reference point is always the average of the year preceding the observation. The volume change from the previous year's average, i.e. annual overlap chain, plays an important role in various phases of calculation.

1. The annual overlap chain required for chain-linking can be calculated using the value at the previous year's prices and the current price average of the previous year,

$$AO_t = \frac{PYP_t}{\frac{CP_{Y-1}}{4}}$$

   where PYP_t is the volume at the previous year's prices in quarter t, and $CP_{Y-1}/4$ is the quarterly average at current prices in the previous year. Be-cause both the numerator and denominator have the same price (the year preceding the

[12] In the future, changing the volume benchmarking method should be considered: instead of the previous year's price data, chain-linked volume series could be benchmarked, in which case, as with current price data, it would be justified to use the Denton method or another recommended method. If this is done, the data at the previous year's prices would be derived from continuous volume series.

observation t)[13], the annual overlap chain shows the volume change compared to the previous year's average.

2. The chain-linking is done using the equation

$$CL_t = AO_t \times \frac{CL_{Y-1}}{4} = \frac{PYP_t}{\frac{CP_{Y-1}}{4}} \times \frac{CL_{Y-1}}{4}$$

   where CL_t is the observation of the chain-linked volume series in quarter t, $CL_{Y-1}/4$ is the previous year's average of the chain-linked volume series, and AO_t and PYP_t are as above. The chain-linking can be started by selecting the average for the year preceding the first chain-linked observation. The selected value can be 1 or 100 (or any other value). Once the entire time series has been chain-linked, it can be scaled to the level desired by multiplying all the observations in the chain-linked volume time series by the same multiplier[14].

3. The chain-linking equation 2 could also be formulated as

$$CL_t = AO_t \times \frac{CL_{Y-1}}{4} \Leftrightarrow AO_t = \frac{CL_t}{\frac{1}{4} \times CL_{Y-1}}$$

   with the same symbols as above. From the chain-linked volume series, it is thus possible to calculate the annual overlap chain, which can then be used to calculate values at the previous year's prices, using the equation 1, when the current priced annual value of the previous year is known:

$$AO_t = \frac{PYP_t}{\frac{CP_{Y-1}}{4}} \Leftrightarrow PYP_t = AO_t \times \frac{CP_{Y-1}}{4}$$

   This option is used when new observations should be calculated by extrapolation with the volume indicator (see 3.2.2). In addition, this equation is needed in aggregation when continuous volume series are seasonally adjusted, using the "indirect" method (see 3.4.1).

The above equations are presented for QNA, but they can also be used in monthly calculations by replacing the denominator 4 (quarters in a year) with 12 (months in a year) when counting averages.

[13] Moreover, the current price data of the previous year should be averages, so that they also represent the average price like the average data of the previous year in the QNA. In practice, this has not been done in QNA for the time being.

[14] E.g. in national accounts, the desired reference year is selected, and the annual value of the chain-linked volume for this year is determined at the current priced annual value, i.e. the multiplier is calculated with the ratio $\frac{CP_{VV}}{\sum_{VV} CL_t}$, where CP_{VV} is the current priced annual value of the desired reference year, and $\sum_{VV} CL_t$ is the sum of the point figures of the chain-linked volume series in the same year.

Chain-linked volume series are expressed in accordance with the selected reference year. The reference year in chain-linked series indicates that volumes are expressed relative to the current price level of the reference year. Because the structure and price weights change annually in chain-linked volume time series, it cannot be accurately said that the price of the chain-linked volume series matched the price of the selected reference year.

The drawback of chain-linked time series is loss of additivity, which means that the series cannot be summed with each other. For example, a chain-linked volume of GDP is therefore not equal to the sum of its components. Instead, additivity is not lost with current priced values (CP_t above) and values at the previous year's prices (PYP_t). Thus, GDP and other aggregates constructed from sub-series must be summed at current prices and the previous year's prices before chain-linking.

A benefit of using the annual overlap chain-linking method is that the chain-linked quarterly volumes will automatically be equal to annual accounts when the current price data and the data at the previous year's prices are equal to the values in annual accounts, and chain-linked time series do not have to be separately benchmarked.

3.4 Seasonal adjustment and working day adjustments[15]

The publication ESS Guidelines on Seasonal Adjustment[16] steering the seasonal adjustment practices of Eurostat and EU Member States is followed in seasonal and working day adjustments.

3.4.1 Policy for seasonal adjustment

Quarterly national accounts (QNA) time series show seasonal variation typical of short-term economic time series with observations inside the year. Time series are seasonally

[15] This chapter was originally written by Arto Kokkinen. Faiz Alsuhail and Samu Hakala commented on it and participated in editing the text. In many parts, this chapter is based on the article
Arto Kokkinen and Faiz Alsuhail (2005). Aikasarjan ARIMA-mallipohjaisesta kausitasoituksesta (in Finnish only; About ARIMA-based seasonal adjustment of time series). The Finnish Economic Journal, 4/2005, Volume 101
http://www.ktyhdistys.net/Aikakauskirja/sisallys/PDFtiedostot/KAK42005/KAK42005Kokkinen.pdf
and materials of Statistics Finland's courses on seasonal adjustment (2006) (Kokkinen). The latest additions to the indirect seasonal adjustment method have been made by Samu Hakala.

[16] https://ec.europa.eu/eurostat/documents/3859598/6830795/KS-GQ-15-001-EN-N.pdf/d8f1e5f5-251b-4a69-93e3-079031b74bd3

adjusted for regular seasonal variation and to facilitate the monitoring of the economic outlook. The reasons for seasonal variation include variation caused by the time of the year, the difference in the sales of products by season for the phenomenon under review and timings of transactions. In addition to the variation between the winter and summer months, consumption over the Christmas and Easter seasons, payments of tax refunds and back taxes, and companies' payments of dividends in the spring after the closing of accounts are examples of causes of seasonal variation in quarterly series.

Seasonal variation in short-term economic time series makes the detection of turning points difficult. Moreover, the longer-term development is difficult to detect from the original series. Indeed, in a time series containing observations at intervals shorter than one year, seasonal variation is often seen as a nuisance that has very little to do with development over a longer period. The conclusion must not be drawn from this that seasonal adjustment is constant or deterministic, and that its modelling or adjustment is just a trivial detail on the way to bigger things (see also Takala 1994, 69–71[17]).

When QNA time series are analysed, in addition to the calculation of the change from the quarter a year ago (Q/Q-4), the change should preferably be calculated from the previous quarter (Q/Q-1) as well. Turning points in the examined variable can only be observed by comparing the development from the previous observation. However, to do this, a time series must be broken down into its components and seasonal variation within the year removed.

It is often suggested that short-term economic time series that contain observations that are more frequent than annual should be broken down into four components: trend (the development in the long run); business cycle (medium-term variation caused by economic cycles); seasonal variation (variation within one year); and irregular variation. The last of these is presumed to be random white noise with no information useful for the analysis of the series. Because making an unambiguous and clear distinction between the trend and the business cycle is difficult, these components are usually estimated together, referring to the trendcycle. When the concept of trend is used in this methodological description, it refers to the trendcycle, as is typical in analyses of short-term time series. When seasonal variation is removed, a seasonally adjusted series is obtained containing the trendcycle and irregular variation.

[17] Takala, K. (1994): "Kahden kausipuhdistusmenetelmän vertailua; X11 ja STAMP" (in Finnish only; Comparison of two seasonal adjustment methods; X11 and STAMP), in Suhdannekäänne ja taloudelliset aikasarjat (in Finnish only; Upturn in the economy and the role of economic time series), pp. 67–103, Statistics Finland. Surveys 210, Helsinki.

The ARIMA model-based[18] TRAMO/SEATS method recommended by Eurostat is used in seasonal adjustments of QNA series. The ARIMA model-based seasonal adjustment starts by modelling the variation in the observation series using an ARIMA model. The obtained ARIMA model is then utilised in breaking down the variation in the time series into its trend, seasonal and irregular components. The division into components is done so that the obtained components can be expressed with ARIMA models. The most significant difference from the ad hoc approach (e.g. methods X11/X12, Dainties, Sabl, BV4) is that in TRAMO/SEATS, its own specific filter formulas are formed for each time series for the adjustment of the data.

The method also contains an efficient procedure for making adjustments for working and trading days and for identifying outliers. TRAMO/SEATS makes it possible to forecast the components and to calculate standard errors and confidence intervals for them. The program and the method were created by Agustín Maravall and Victor Gomez[19].

Whenever a time series is seasonally adjusted, the autocorrelation structure of the original time series is interfered with. If the used filter (whether a general ad hoc filter or one based on the wrong model) fails to screen out expressly and only the seasonal variation frequencies of a time series, or trend frequencies when a trend is being estimated, the autocorrelation structure of the original time series becomes skewed with the temporally repeated characteristics of the original phenomenon.

The ARIMA model-based seasonal adjustment and the TRAMO/SEATS method offer one analytical solution to this problem. In the TRAMO phase, the original series is pre-adjusted for outliers and variation in numbers of working and trading days so that the pre-adjusted series can be ARIMA modelled. This modelling of the autocorrelation structure of the entire pre-adjusted series is used when the variation in the time series at different frequencies is broken down into its components in the SEATS phase.

The point of departure in the decomposition is that each component should only describe the precise part of the autocorrelation structure of the whole series and the variation which relates to it, that is, the components are mutually orthogonal. In terms of interpretation, this means that the reasons that cause seasonal variation (such as the time of year) in a time series are uncorrelated with the reasons behind a long-term trend

[18] More about ARIMA models, e.g. in Brockwell and Davis (2003): Introduction to Time Series and Forecasting, Chapter 3.

[19] See e.g. V. Gomez and A. Maravall (1996): Programs TRAMO and SEATS. Instructions for the User, (with some updates). Working Paper 9628, Servicio de Estudios, Banco de España.

such as investments or R&D activity. In addition, it is presumed that a time series is made up of components that are realisations of linear stochastic processes. Each component (with the exception of the irregular term) can then be presented by an ARIMA model.

Both the pre-adjusted series and its components are ARIMA modelled while respecting the dynamic and temporally repeated characteristics of the original series. Finally, the deterministic factors observed in the pre-adjustment, outliers, and working or trading day variation are assigned to the components as follows: level change (level shift (LS)) to trend; variation caused by the number of working days and trading days (working day/trading day effects (WD/TD)) to seasonal variation; and individual outlier observations (additive outliers (AO)) and momentary outlier observations lasting for the duration of several observations (transitory changes (TC)) to random variation. The variation in the entire original time series thus becomes distributed to the components of the final trendcycle, final seasonal variation and final irregular variation.

The components mentioned are unobservable in the original time series, and they can be formed in numerous ways. When dividing the observation series into components, the ARIMA model-based approach also faces the identification problem. In the TRAMO/SEATS method, so-called canonical decomposition is used from among various alternatives. In this, the variance of random components is maximised, and the components of the pre-adjusted time series can be defined unambiguously.

When comparing the variance of the random variation produced by means of canonical decomposition with random variation in other methods such as the other model-based method, STAMP and the aforementioned ad hoc methods, it is good to bear in mind that:

1. The modelling of a pre-adjusted time series is made with diverse (pdq)*(PDQ) models[20] of the seasonal ARIMA model family, which produces random variation that has quite small variance and is tested as random.

[20] Notes p,d,q refer to the models' basic ARIMA part, and PDQ to the seasonal ARIMA part, where p (or P) is the number of AR parameters, d (D) the number of differentiations, and q (Q) is the number of MA parameters. The T/S model selection is based on the following maximum limits p=3,d=2,q=2; P=1,D=1,Q=1. More about SARIMA models by e.g. Brockwell and Davis (2003): Introduction to Time Series and Forecasting, Chapter 6.5.

2. The identification of the seasonal ARIMA model for a pre-adjusted series is based on the Bayesian Information Criterion (BIC),[21] according to which the selection of the model is determined by the smallest possible variance in random variation, achieved with the smallest possible number of estimated parameters.

Before the decomposing SEATS phase, the variance of random variation, i.e. the residual of the seasonal ARIMA model fitted to the pre-adjusted time series, is therefore quite small. The assignment of most of this random variation of an entire time series to the random variation component in the SEATS decomposition phase (and minimising the random variation in other components) cannot be assumed to lead to any greater variance of the random variation component than in the other methods mentioned, in which the whole time series is not first modelled with a model of the seasonal ARIMA model family. By contrast, the combination of the deterministic modelling of working and trading day variation often results in a greater variance of the seasonal component in TRAMO/SEATS. In addition, the stochastic modelling strategy of seasonal variation improves the explanatory power of seasonal variation by capturing moving seasonality in time, along with the modelling of working and trading day effects.

To reduce the revision of the latest adjusted observations, a forecast for a few observations forward must be produced in all seasonal adjustment methods. This is usually done based on an ARIMA model, as in X11/X12 ARIMA, even when the seasonal adjustment filter is not at all associated with the model concerned. One logical justification of ARIMA model-based seasonal adjustment is that the filter used in the adjustment of a series is based on the same series-specific ARIMA model with which the forecast is made. In all eventualities, the latest one to three adjusted observations will be revised against new statistical observations in all methods. The revisions are due to a forecast error, that is, new observations differ from the development predicted earlier by the ARIMA model. The larger the differences, the greater is the revision of the already published seasonally adjusted and trend series.

With standard regression and ARIMA model symbols, the two-phase TRAMO/SEATS method can be presented as follows:

[21] $Min\,BIC(p,q) = \log\sigma^2 + \log(p+q)\,T^{-1}\log T$, where p and q are the numbers of AR and MA parameters in the model, and T is the number of time series observations. When T gets close to infinity, BIC finds the model that produced the time path based on simulations. See more, e.g. Brockwell and Davis (2003): Introduction to Time Series and Forecasting, p. 173.

TRAMO (I) / SEATS (II)

I. In the TRAMO phase, for an unadjusted series,

$$y_t = x_t'\beta + z_t$$

pre-adjustment regressions $x_t'\beta$, including working/trading day effects (WD/TD) and outliers (LS, AO, TC), are estimated. For a pre-adjusted series, z_t, an ARIMA model $z_t = \frac{\theta(B)}{\varphi(B)}\varepsilon_t$ is identified.

II. In the SEATS phase, the lag polynomials of this model, $\varphi(B)$ ja $\theta(B)$, are divided into trend and seasonal components based on the frequency domain analysis. Part of ε_t is divided into trend and seasonal components, again based on the frequency domain analysis, and the remaining part forms a random residual after decomposition, u_t. In the canonical decomposition, the variance of u_t is maximised.

$$z_t = \quad p_t \quad + \quad s_t \quad + u_t$$

$$\Rightarrow z_t = \frac{\theta_p(B)}{\varphi_p(B)}a_{pt} + \frac{\theta_s(B)}{\varphi_s(B)}a_{st} + u_t,$$

where $\frac{\theta_p(B)}{\varphi_p(B)}a_{pt}$ is the stochastic part of trend and $\frac{\theta_s(B)}{\varphi_s(B)}a_{st}$ is the stochastic part of seasonal component, and u_t is the random residual of the pre-adjusted series after decomposition.

Finally, the deterministic factors of part I and the stochastic factors of part II are combined, and the original series is divided into its final components:

$$y_t = p_t(+\mathrm{LS}) + s_t(+\mathrm{WD/TD}) + u_t(+AO, TC),$$

where $p_t(+LS)$ is the trend, $s_t(+\mathrm{WD/TD})$ is the seasonal component and $u_t(+AO, TC)$ is the irregular component of an unadjusted series. The above final decomposition shows that when the seasonal component is being removed, calendar effects are also eliminated in seasonal adjustment.

Both chain-linked time series and current priced time series are seasonally adjusted using the indirect method (indirect adjustment), where seasonally adjusted aggregates are formed by summing the adjusted sub-series. The randomness of the residual of the aggregate series that is formed by summing the residuals of the ARIMA models of the sub-series is then tested.

Summing the sub-series for time series at current prices is simple because series at current prices can be directly added up. Chain-linked volume series do not directly add up, so their aggregation is a little more complicated: a seasonally adjusted volume series must first be unlinked to obtain seasonally adjusted series at the previous year's prices that can be added up. This unlinking is done using the above equations (see 3.3.2) related to annual overlap chains. Using a continuous seasonally adjusted volume series, it is possible to calculate the annual overlap chains of seasonally adjusted volume

$$AO_t = \frac{CL_t}{\frac{1}{4} \times CL_{Y-1}}$$

and as the current priced annual values are known, they can be used to calculate seasonally adjusted volumes at the previous year's prices

$$PYP_t = AO_t \times \frac{CP_{Y-1}}{4}$$

with the same symbols as in Chapter 3.3.2. The values at the previous year's prices are additive, so they can be used to sum seasonally adjusted aggregates (i.e. gross exports = exports of goods + exports of services). After aggregation, the seasonally adjusted values at the previous year's prices are chain-linked to continuous seasonally adjusted volume time series.

The aggregation solution of seasonally adjusted volume series enables the seasonal adjustment on a monthly basis of some sub-series, while the aggregate series on a quarterly basis are constructed by summing the results of the seasonal adjustment on a monthly and quarterly basis. Most of the time series of the value added by industry are seasonally adjusted on a monthly basis.

Apart from this methodological description, which is publicly available, users can also receive information about the implementation of seasonal adjustment on courses organised by Statistics Finland and simply by asking about it. The policies applied in describing the modelling of time series are openness and the sharing of information.

3.4.2 Policy for working day adjustment

Working day adjusted (more generally calendar adjusted) time series are published both at current prices and as chain-linked volume series at the reference year's prices. In principle, the working or trading day adjustment (inclusive of adjustments for a leap day, Easter and national public holidays) is based on the testing of statistical significance during several modelling rounds using monthly data whenever possible.

Working or trading day adjustment factors (inclusive of omission of working day adjustment of a series) are only changed when the seasonal adjustment models are updated. Based on experiences from modelling examinations from several years over an extended period, efforts are made to find a stable series-specific solution for working or trading day adjustment with meaningful content by also using the monthly indicators for the phenomenon concerned.

For the series that are not working or trading day adjusted, an original series is presented instead of a series adjusted for working days. (Naturally, the original series are also published, so the congruence of the said series shows that no adjustment for working days has been made to the data describing the phenomenon concerned.) In a case like this, the seasonally adjusted series is not calendar adjusted either.

3.4.3 Revisions for seasonally adjusted data

The governing principle in seasonal adjustment is to make the series-specific modelling carefully once a year and keep both the deterministic pre-adjustment factors and the identified ARIMA model fixed between annual reviews of the modelling, yet so that the parameter values are re-estimated in each calculation round. An exception to this is outlier observations mid-way through the year, such as a labour dispute. The model of a certain series might be revised if the modelling no longer fits the data due to new observations. The main principle is to keep the specifications of the model identified for a series (apart from the estimation of model parameters) unchanged so that the adoption of models does not cause revisions to the history of a seasonally adjusted series in every round. The aim in the updating of parameter values is to produce forecasts with the fullest possible information about the past in every calculation round. The objective in this is to reduce revisions to the latest observations in adjusted series when new observations become available.

4 GDP and components: the production approach

4.1 Gross value added by industry

In national accounts, the value added is obtained by deducting the inputs used to produce it, i.e. the intermediate consumption, from the output. In QNA, gross value added is calculated at an accuracy of 200 industry/sector combinations. The 2-digit level of NACE rev. 2 classification is applied for the majority of industries, and some industries are divided even further for greater accuracy. The sector classification is the 2-digit level with the exception that in the general government sector, central government, local government, employment pension schemes and compulsory social insurance form sectors of their own.

An indicator of output is constructed for each industry/sector combination. The value indicator is then benchmarked and extrapolated to the current priced output. If the volume indicator is used, the indicator used in benchmarking is the previously calculated series at current prices, and the volume indicator is only used for extrapolating new observations. No reliable indicators for the value or volume of intermediate consumption are available in a monthly or quarterly frequency, so it is estimated that intermediate consumption develops in line with the output volume. In benchmarking intermediate consumption, the indicator used is the previously calculated series at current prices.

In addition, a deflator time series is formed for each industry/sector combination for output and intermediate consumption, by means of which the current price time series can be deflated to the volume time series at the previous year's average prices, or the volume data at the previous year's average prices derived from the volume index can be inflated to current prices. Deflators are formed from the price data on the product level by weighting. The products produced by the industry/sector combinations and their weights are obtained from supply and use tables containing around 800 products. Deflators are formed using output and intermediate consumption prices and weights because there are no price indices or product structures for value added.

The price weights of the latest available supply and use table are applied to the latest quarters. Because supply and use tables are complete at a delay of around two years, the price weights of the latest deflators of value added are also at least two years old. If the weight structure is known to have changed in a certain industry/sector, the deflator is adjusted as required before deflation.

The value added by industry is calculated on a monthly basis if possible because the source data are available monthly in the majority of industries. In these industries, the volume calculation and seasonal adjustment are also performed on a monthly basis.

Primary production (A)

Agriculture (01)

The data sources are statistics on producer prices compiled monthly by Natural Resources Institute Finland (Luke). Data on production volumes for domestic animal production are obtained from Luke's statistics on dairy, egg and slaughterhouse production. For crop production, the production volume data are based on Luke's crop statistics, which are revised four times a year.

The current price indicator for the agricultural production of crops is based on wheat, rye, barley and oat crops, and it is divided into quarters according to estimates of how the production costs for crops are allocated. The crops for the first and second quarter are calculated based on the crops in the previous year, while the crops for the third and fourth quarter are based on the crops in the year for which the calculations are made. Quarterly crops are then multiplied by the corresponding quarterly average prices.

The current price indicator for domestic animal production has five products: milk, beef, pork, poultry and eggs. The indicator is calculated by multiplying the volumes of outputs by the basic prices of the corresponding quarter. The basic price comprises the producer price and product subsidies.

The volumes are calculated for each product by multiplying the output volumes by the previous year's average prices. The price estimate for the entire agricultural sector is obtained implicitly from the ratio of total value and total volume.

Forestry (02)

The sources are the monthly data on market fellings and stumpage prices compiled by Natural Resources Institute Finland (Luke). The indicator for output is a weighted combination of the indicators for forest cultivation (around 75%) and logging (around 25%).

When calculating the indicator for forest cultivation, both the market fellings and the net growth of forests are considered. The data on market fellings are available monthly. The estimate for the net growth of forests is based on the annual data evenly divided between months, taking market fellings into account. The indicator for forest cultivation is calculated by multiplying the quantity of market fellings and the net growth of forests by stumpage prices. The indicator for logging is calculated by multiplying the market fellings by the index of wage and salary earnings in forestry.

Stumpage prices have the biggest weight in the deflator.

Fishing (03)

The production indicator is estimated to the monthly level, using the total value of annual national accounts and the quarterly estimate of the distribution of production. If there is no corresponding quarterly value for a piece of monthly data, it is estimated using the ARIMA model. Quarterly data are obtained using the monthly estimates.

Price data are not available within the time frame required by QNA.

Industry (B, C, D, E)

The data sources for the non-financial corporations sector (S11) are the Volume Index of Industrial Output[22] (monthly) for almost all industries and Indices of Turnover in Industry[23] (monthly) for industries 36–39.

The Volume Index of Industrial Output is used so that the data at previous year's prices are derived from the previous year's average using the vol-ume change in line with the volume index. Current priced data are obtained by multiplying the data at the previous year's prices by the deflator of the industry. The Index of Turnover in Industry is used directly as the value in-dicator for the corresponding industry.

In the household sector (S14), the source is the turnover in the Tax Admin-istration's self-assessed taxation data[24]. The turnover of the latest quarter is estimated with the ARIMA model (mostly Seasonal ARIMA), because data on turnover in the taxation data accumulate slowly.

The deflators for manufacturing are mainly formed from the Producer Price Indices for Manufactured Goods. The share of services such as maintenance and product development in the output of manufacturing industries has been growing constantly. Deflators therefore also contain producer price indices for services, indices of wage and salary earnings, and other price data on services.

Construction (F)

The data source for building construction is the Volume Index of Newbuilding[25] (monthly). Data on renovation are mainly available annually.

The indicator for output in building construction is formed by adding an estimate of the output in renovation building to the current priced index of the Volume Index of Newbuilding. The estimate is based on information about the price development in renovation building and the trend indicator for renovation building. However, these involve scheduling challenges, and some of the data are available only afterwards. In the deflator for building construction, the weights are biggest in the price indices derived from the Volume Index of Newbuilding, which are based on the price index of the Haahtela consulting company.

[22] https://stat.fi/en/statistics/ttvi
[23] https://stat.fi/en/statistics/tlv
[24] Periodic tax return data are monthly data collected by the Tax Administration containing all enterprises' and corporations' turnover subject to value added tax, and wage and salary sum data.
[25] https://stat.fi/en/statistics/ras

The indicator for output in civil engineering is obtained by multiplying the volume value based on the annual trend by the deflator. The reference data are the civil engineering index of the Index of Turnover of Construction[26]. The deflator of the industry is based on the MIG2 Capital goods index series in the producer price indices and the 20 Road maintenance index series in the cost index for civil engineering works. The same indicator for building construction and civil engineering is used for all sectors.

Trade (G)

The data sources are the monthly value indices from the Turnover of Trade[27] for wholesale, retail and vehicle trade. The deflators are price indices used in the deflation of the “volume of turnover” indices of the Turnover of Trade. These price indices are weighted from the Consumer Price Indices.

According to ESA 2010, output and value added for this industry are calculated from sales margin (turnover less bought merchandise). In practice, turnover must be used as the indicator for output because quarterly data on the development of the margin are unavailable.

Transport and storage (H)

For non-financial corporations sector (S11), the data sources are the volume indices of the Turnover of Service Industries[28] which are used similarly to the Volume Index of Industrial Output in manufacturing industries (see above). The value indicator in the household sector (S14) is the turnover in the self-assessed taxation data.

In the deflator, the Producer Price Indices have the biggest weights.

Accommodation and food service activities (I)

For non-financial corporations sector (S11), the data sources are the volume indices of the Turnover of Service Industries[29] which are used similarly to the Volume Index of Industrial Output in manufacturing industries (see above). The value indicator in the household sector (S14) is the turnover in the self-assessed taxation data.

In the deflator, the Consumer Price Index (food service industries) and Producer Price Index (accommodation services) have the biggest weights.

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[26] https://stat.fi/en/statistics/rlv
[27] https://stat.fi/en/statistics/klv
[28] https://stat.fi/en/statistics/plv
[29] https://stat.fi/en/statistics/plv

Information and communication (J)

For the non-financial corporations sector (S11), the data sources used in industries 58 and 61 are the volume indices of the Turnover of Service Industries[30] which are used similarly to the Volume Index of Industrial Output in manufacturing industries (see above). For industries 59–60, the value indicator is the Index of Turnover. The value indicator in the household sector (S14) is the turnover in the self-assessed taxation data.

In the deflator, the Producer Price Indices have the biggest weights.

Financial and insurance activities (K)

The data sources for financial service activities (NACE 64) and activities auxiliary to financial services and insurance activities (NACE 66) are FIN-FSA's FINREP survey data, the Consumer Price Index and the Producer Price Index for Services.

Unlike for other industries, the value added in financial service activities is derived separately as output less intermediate consumption. The indicator of output is comprised of two elements: market output and financial intermediation services indirectly measured (FISIM). The indicator for market output is the quarterly commission income.

FISIMs at current prices are calculated quarterly in national accounts. The calculation is based on sector-specific credit and deposit stock data and the corresponding interest data.

Operating expenses are the indicator for intermediate consumption.

The deflator for market output is formed from the Consumer Price Index of financial services. The price of FISIMs is derived implicitly from the volume ratio of the current priced and the previous year's average price estimates. FISIMs at the previous year's average prices are calculated by applying the previous year's average loan and deposit margins to the stock of loans and deposits of the calculation quarter. The stocks of loans and deposits are deflated by the price index of domestic final demand. The price/volume method for FISIMs is similar to the annual accounts.

The deflator for intermediate consumption is formed from the Consumer Price Index of financial services and the producer price indices for services.

The indicator for value added of activities auxiliary to financial services is also derived as output less intermediate consumption. The source data are the commission income

[30] https://stat.fi/en/statistics/plv

and operating expenses of investment service and financial companies. The deflator is formed from the Producer Price Index for financial services and the Consumer Price Index.

There is no sufficiently detailed and timely source data for the estimation of quarterly output/value added of insurance services (NACE 65). Long-term trend growth is used as an estimate for the latest quarters. An exception is the release for the final quarter of the year, where intermediate consumption is formed from insurance companies' operating expenses in accordance with the source materials.

The deflator for life insurance is the Index of wage and salary earnings for the insurance sector. The deflator for non-life insurance is formed from the insurance services in the Consumer Price Index.

Real estate activities (L)

The source data for NACE 68 (Real estate activities) are the Turnover of Service Industries, data on self-assessed taxation data and the Statistics on Rents of Dwellings[31] (quarterly).

Output for NACE 68 is calculated through four sub-industries. For buying, selling and letting of other real estate (NACE 681+68209) and real estate activities on a fee or contract basis (NACE 683), the indicator for output is the Index of Turnover. The deflators for these sub-industries are formed from the Producer Price Indices for Services and the Consumer Price Index.

The indicator for the output of letting of dwellings (NACE 68201) and operation of dwellings and residential real estate (NACE 68202) is obtained by multiplying the volume estimate based on annual trend by the quarterly index of rents in the Statistics on Rents of Dwellings. The deflator is formed from the index of the Statistics on Rents of Dwellings.

Professional, scientific and technical activities; administrative and support service activities (M, N)

For the non-financial corporations sector (S11), the data source for NACE 70 is the Turnover of Service Industries. In other industries, the volume indices of the Turnover of Service Industries[32] are used similarly to the Volume Index of Industrial Output in manufacturing industries (see above). For the public sector (S13), the value indicator

[31] https://stat.fi/en/statistics/asvu
[32] https://stat.fi/en/statistics/plv

used is the sum of wages and salaries in the self-assessed taxation data, while turnover is used for the household sector (S14).

The deflators for the industries are mainly formed from the Producer Price Indices for Services, but the Basic Price Index for Domestic Supply, the Index of Wage and Salary Earnings, the Building Cost Index and the Consumer Price Index are also used in some industries.

Public administration; education; health and social work (O, P, Q)

The indicator for output in the public sector is primarily the wage and salary sum data in the self-assessed taxation data. For the central government sector (S1311), the data on wages and salaries in central government accounts are used as comparison data with the self-assessed taxation data.

Regarding the local government sector (S1313), the problem with the self-assessed taxation data is that each municipality has only one Business ID code in the data, meaning almost all wages and salaries paid by municipalities show under industry 84 (Public administration). In the local government sector, only joint municipal boards with their own Business ID codes show in the taxation data in the industries of Education and Health and social work. A fixed percentage of the wages and salaries in industry 84 is therefore also added to the indicators for output in industries 85, 86 and 87–88.

The deflators in the public sector are primarily formed from the Index of Wage and Salary Earnings[33].

The indicator for output in the non-financial corporations sector’s education and health and social work industries is the wage and salary index. The deflators are derived from the Consumer Price Index.

The indicators in the household sector are formed from the turnover data of the self-assessed taxation data. The indicators in the non-profit institutions serving households sector (S15) are formed from the wage and salary sum data of the self-assessed taxation data. The deflators are mainly from the Indices of Wage and Salary Earnings.

Other service activities (R, S, T)

The value indicator in the non-financial corporations sector (S11) is the Indices of Turnover in industries 90–91, 92 and 93. In industries 94, 95 and 96, the volume indices of the Turnover of Service Industries are used similarly to the Volume Index of Industrial Output in manufacturing industries (see above).

[33] https://stat.fi/en/statistics/ati

In the industries in the public sector (S13) and the non-profit institutions serving households sector (S15), as well as in industries 97–98 in the household sector, the indicators are the wage and salary sum data in the self-assessed taxation data. In other industries of the household sector, the turnover data are used.

In the public and household sectors (S11, S14), the deflators are formed mainly from the Consumer Price Indices, except for industry 94, where the deflator is the Index of Wage and Salary Earnings. In general government and non-profit institutions serving households (S13, S15), the deflators are mainly formed from the Index of Wage and Salary Earnings.

4.2 FISIM – Financial intermediation services indirectly measured

All the balance sheet and interest rate data of domestic credit institutions that are needed in the calculations for FISIM are available from the Bank of Finland's data collection for monetary financial institutions (RATI). In addition, FISIM imports are calculated using the financial balance data on foreign deposits and loans in the balance of payments.

The results from the calculations for FISIM are utilised in QNA in calculating value added for financial corporations (see Chapter 4.1). FISIM is allocated to user sectors in QNA, and the allocation to industries is made in annual accounts.

4.3 Taxes on products and subsidies on products

Taxes on products are estimated from cash-based monthly data in central government accounts and based on the wellbeing services counties' financial reporting. Depending on the type of tax, a timing adjustment of one to two months is made to the cash-based taxation data to bring them closer to an accrual basis. Value added tax for the latest quarter must be estimated from the data on the first two months of a quarter due to this timing adjustment.

VAT has the biggest weight in the taxes on products. If no changes occur in the tariff of VAT, the Consumer Price Index gives an accurate approximation of its price change[34].

[34] Previously, the deflator for taxes on products was obtained by weighting the changes in various tax tariffs (value added tax, vehicle tax, fuel taxes, etc.) with the previous year's tax receipts. Using the Consumer Price Index has proved a more accurate approximation than the previous tax tariff weighting when estimating the rate for taxes on products.

Data on subsidies on products are available from central government accounts. No data are available quarterly on subsidies on products.

5 GDP and components: the expenditure approach

5.1 Household final consumption

Compiling household final consumption is based on 233 ECOICOP categories, each with a quarterly indicator time series. The most important source data for indicators is the index of Turnover of Trade (by type of commodity), which presents the goods-specific retail turnover indices. Other source data include the Statistics on Rents of Dwellings, the Finnish Transport and Communications Agency Traficom's data on first registrations of passenger cars, data on petrol sales, the Finnish Energy Industries' data on electricity consumption, VR Group's data on railway trips, Finavia's data on flight passengers and the Finnish Transport Agency's data on cruise ship passengers. Some source data are expressed in volume terms, but they are converted to value indicators by multiplying them by the suitable Consumer Price Index.

For FISIM, the estimated consumption of financial services is based on the centralised FISIM calculation. For other financial services, the estimation is based on the data on the development of commission income in the Financial Statement Statistics on Credit Institutions. The Social Insurance Institution of Finland's (KELA) data on health service costs and compensations are the source data for the consumption of health services. In addition, supply indicators are used to estimate households' consumption of services: transport, communication, hotel and restaurant services, and recreational, cultural, and sports services have the index of turnover of the respective service industry as an indicator.

The deflators for all ECOICOP categories except for tourism are obtained from the sub-items of the Consumer Price Index. For tourism (i.e. Finnish households' consumption abroad), the EU's Harmonised Indices of Consumer Prices (EU28-HICP) are used as the price.

The indicators are benchmarked, extrapolated and deflated as described in Chapter 3. The final current price and previous year price time series are then summed to five ECOICOP durability categories (see Chapter 2.2.) for publication. These five time series and their sum, "household final consumption", are subsequently chain-linked to a continuous volume series and seasonally adjusted.

5.2 Government final consumption

Government final consumption at current prices is obtained from the data in the Quarterly Sector Accounts (QSA)[35]. The data in QSA are mainly based on municipalities' and wellbeing services counties' financial reporting data collected by the State Treasury and on central government accounts.

Government final consumption is derived as a sum of collective consumption and individual consumption of general government.

The volume of government final consumption is calculated by deflating the current priced value with the implicit QNA deflator of the output of the public sector (see 4.1), which is mainly based on Indices of Wage and Salary Earnings. Collective consumption is deflated with the implicit deflator of central government NACE 84. Individual consumption is deflated with the implicit deflator of all other industries of general government.

5.3 NPISH final consumption

The indicator for consumption expenditure of non-profit institutions serving households (NPISH) at current prices is obtained by summing the output of industries in sector S15 (see 4.1). The deflator is the implicit deflator of the output of sector S15 (output at current prices divided by output at the previous year's average prices), which is mainly formed from Indices of Wage and Salary Earnings.

5.4 Gross capital formation

Gross fixed capital formation (investments)

The estimates for construction investments (N111+N112) are compiled using the same sources and methods as in the calculation of value added in construction (4.1). Data from the inquiry on enterprises' fixed assets are used as comparison data.

The indicator for gross fixed capital formation in machinery and equipment including weapon systems (N113+N114) is Statistics Finland's inquiry on enterprises' fixed assets, which is conducted quarterly and covers approximately 2,000 of the largest enterprises in the non-financial corporations sector.

Gross fixed capital formation in transport equipment (N1131) is based on Traficom's data on first registrations of motor vehicles. The volume index weighted by vehicle type

[35] https://stat.fi/en/statistics/sekn

is formed from data on first registrations of motor vehicles, which is multiplied by the Basic price index for domestic supply, including taxes (NACE C29), to achieve an indicator at current prices.

Cultivated biological resources (N115) are insignificantly small in Finland, and it is estimated by dividing the previous year's annual national accounts (ANA) value by four.

Intellectual property products (N117) are compiled with a weighted indicator that consists of research and development activities (around 70%), and computer software and databases (around 30%). The source data for R&D are Statistics Finland's Research and development statistics[36], of which the final results are published only 10 months after the end of the statistical year. Preliminary estimates for the previous and current years are collected from the respondents, and they are used for the indicator. The source data for computer software and databases are the inquiry on enterprises' fixed assets.

The deflators for investments are formed based on the structure of the supply and use tables (cf. deflation of production 4.1) by sector/industry asset types. Despite the very detailed calculation level, the data are only published by asset types at the level of the total national economy, and gross investments are broken down into private and public sectors.

Change in inventories

The source data for change in inventories are Statistics Finland's inventory inquiry[37], which covers around 500 of the most significant enterprises in manufacturing and trade in terms of their inventory value and turnover. The change in inventories according to the inventory inquiry is divided between industries based on the breakdown of the latest annual national accounts at an accuracy of ten industries. The change in inventories in primary production uses the estimate on forest growth obtained in forestry value added calculation. However, the data are only published at the level of the total national economy.

The deflators for change in inventories are formed based on the structure of the supply and use tables (cf. deflation of production 4.1) at an accuracy of ten industries.

The volume series of change in inventories chain-linked at the reference year's prices is not published because the chain-linked index does not always meaningfully represent the development due to negative figures. However, gross capital formation (P5) is also

[36] https://stat.fi/en/statistics/tkke
[37] https://www.stat.fi/en/surveys/var

published at the reference year's prices, and it also contains the volume of change in inventories.

Estimates for change in inventories are often adjusted with the balancing of QNA, because the coverage of the source data and their price/valuation bases do not allow the application of the methods and calculation accuracy used in the annual accounts as such. Changes in inventories in QNA may therefore be considerably revised when the annual accounts are completed, and the published data may differ from those in the source data.

5.5 Imports and exports

The main data source for exports and imports is the current account data included in the Balance of Payments[38]. Monthly data of the Board of Customs are used as comparison data for the export and import of goods. Statistics on International Trade in Services[39], on which the current account data are based, are used as comparison data for the export and import of services.

For volume calculations, separate deflators for the export and import of goods and services are constructed by weighting the import and export price indices of the Producer Price Indices. Product weights for these indices are obtained from the latest annual import/export data of Finnish Customs.

6 GDP and components: the income approach

6.1 Compensation of employees

Compensation of employees is comprised of wages and salaries and employers' social contributions. Indicators for wages and salaries are formed from the Wage and Salary Indices[40]. The Labour Cost Index[41] provides comparison data.

Employers' social contributions are estimated by applying social contribution percentage rates confirmed by the Ministry of Social Affairs and Health to the wage and salary estimates. The social contribution rates are estimated quarterly for eleven industries. Because social contribution rates vary slightly by industry, the implicit social contribution percentages from the annual accounts, i.e. employers' social contributions

[38] https://stat.fi/en/statistics/mata
[39] https://stat.fi/en/statistics/tpulk
[40] https://stat.fi/en/statistics/ktps
[41] https://stat.fi/en/statistics/tvki

ratio to wages and salaries, are also used to estimate the industry-specific quarterly rates.

The indicator for employers' social contributions is derived by multiplying the wage and salary estimate by the social contribution rate of the corresponding industry. If it is known that changes have taken place in employers' social contribution rates during the year, the rates are adjusted accordingly.

6.2 Taxes and subsidies on production

Taxes on production principally comprise taxes on products (see 4.3). The estimation of taxes on products and other taxes on production is based on General Government Revenue and Expenditure statistics, which have central government accounts as their source. Data on subsidies on production are not available quarterly.

6.3 Gross operating surplus and mixed income

Source data on gross operating surplus and mixed income are not available quarterly, so they are calculated as a residual item by deducting compensation of employees, taxes on production and consumption of fixed capital from GDP calculated via output.

7 Population and employment

7.1 Population, unemployed

The data source for population is the preliminary Population Statistics. The source data are used as such and released at an accuracy of 100 persons. The number of the population is not published as a seasonally adjusted or trend time series because there is no seasonal variation.

Unemployment data are not published in QNA. Data on unemployment are released in the Labour Force Survey[42].

7.2 Employment: persons employed

The number of employed persons is released in QNA in hundreds of persons. The data source is the Labour Force Survey[43], from which indicators for the number of persons employed are obtained by industry.

[42] https://stat.fi/en/statistics/tyti
[43] https://stat.fi/en/statistics/tyti

Because the Labour Force Survey is a sample-based survey, the change percentages for the numbers of persons employed in the smallest industries can be highly volatile. Hence, the estimates for indicators for the numbers of employed persons obtained from the Labour Force Survey are compared with the development of wages and salaries (see 6.1), the Index of Wage and Salary Earnings and hours worked. The final estimate for the numbers of employed persons is formed based on this examination. The total number of employed persons is obtained by summing the estimates by industry.

7.3 Employment: hours worked

The data source is the Labour Force Survey, from which indicators for the number of hours worked are obtained by industry. The final estimate of the number of hours worked is formed by comparing the change percentages calculated from the Labour Force Survey with data on the development of wages and salaries (see 6.1), the Index of Wage and Salary Earnings and employment. The total number of hours worked is obtained by summing the estimates by industry. The data are published at an accuracy of 100,000 hours.

8 Flash estimates

8.1 Quarterly flash estimate of GDP

The quarterly flash estimate of gross domestic product is calculated by means of the Trend Indicator of Output, by summing from monthly data. The flash estimate is released with the Trend Indicator of Output with a lag of 30 days from the end of a quarter. The data of the last month of the latest quarter is based on an estimate method which makes use of revenue surveys of the largest companies. The data are submitted simultaneously to Eurostat.

The same data sources as in QNA are utilised as exhaustively as possible in the calculation of the flash estimate. Due to the fast release timetable, it is impossible to use exactly the same data, so the taxes and subsidies on products are forecast based on the history of the time series and in the case of taxes on products, using the total value added.

Apart from the aforementioned exceptions, the same methods are used in the calculation of the flash estimate as in the calculation of QNA. Development in the volume of output and value added is mainly estimated based on volume indices, the Indices of Turnover, and corresponding indices of producer prices, or wage and salary indices and Indices of Wage and Salary Earnings. Except for the currently calculated quarter, the time series are benchmarked to correspond to quarterly and annual accounts. The volume calculation of value added and seasonal adjustment are performed monthly with the annual overlap chain-linking method. The time series for taxes and subsidies on products are seasonally adjusted using the same time series models as in QNA.

8.2 Quarterly flash estimate of employment

The quarterly flash estimate of employment is released with the Trend Indicator of Output with a lag of 30 days from the end of a quarter. The data are submitted simultaneously to Eurostat.

The data from the Labour Force Survey are used to calculate the flash estimate, just as in QNA. The data can be revised as the QNA is released when the data on wages and salaries, hours worked and employment are balanced. The flash estimate data are seasonally adjusted using the TRAMO/SEATS method and the same time series model as in QNA.

9 From GDP to net lending/borrowing

9.1 Primary income from/to the rest of the world, gross national income

Primary income from/to the rest of the world is comprised of compensations employees received from/paid to the rest of the world (D1), taxes on production and products (D2), subsidies (D3) and property income (D4). The data sources for compensation of employees and property income are the factor returns (compensation of employees and returns on equity) included in the Balance of Payments. Exhaustive quarterly data are unavailable on taxes and subsidies on products paid to/received from the rest of the world, so these items must be estimated from the latest annual accounts data.

Gross national income is obtained when primary income received from the rest of the world is added to and primary income paid to the rest of the world is deducted from GDP.

The continuous volume series of gross national income at reference year prices is calculated using the primary income items deflated to the previous year’s prices: The gross domestic product at the previous year’s prices and primary income from/to the rest of the world at the previous year’s prices are summed. The deflator used for primary income is the implicit price index of domestic final demand (consumption and gross fixed capital formation). The terms of trade effect, which measures the net change in export and import prices, is added to the volume of gross national income before chain-linking.

9.2 Consumption of fixed capital, net national income, acquisition less disposal of non-financial non-produced assets

No quarterly source data indicator is available for consumption of fixed capital (P51C). However, its volume should be very stable because in annual accounts, the consumption of fixed capital is calculated as a share of the fixed capital stock.

The estimation of quarterly consumption of fixed capital starts with volume: the starting estimate for the volume at the previous year's average prices is the quarterly average of the previous year's current price value. If the volume of gross fixed capital formation has changed heavily in this quarter and/or the quarters preceding it, this is taken into consideration by raising or lowering the estimated volume slightly. However, the gross fixed capital formation of one quarter cannot have a major impact on the fixed capital stock and consequently on the consumption of fixed capital. Consumption of fixed capital at current prices is obtained by inflating the consumption at the previous year's average prices with the price change of gross fixed capital formation.

Net national income is obtained by deducting the consumption of fixed capital from gross national income.

No quarterly data are available on acquisitions less disposal of non-financial non-produced assets (NP). Zero is used as an estimate for the latest quarter, because NP is a net transaction whose final benchmarked value can be either positive or negative.

9.3 Current transfers from/to the rest of the world, net national disposable income

Current transfers are comprised of taxes on income and wealth (D5), social contributions (D61), social security benefits in cash (D62) and other current transfers (D7). The source data are from current transfers in the Balance of Payments. The Balance of Payments item of current transfers from the rest of the world (income) contains subsidies (D3) which are deducted using the latest annual accounts data on the rest of the world sector. The Balance of Payments item of current transfers to the rest of the world (expenditure) contains taxes on production and imports (D2), which are deducted using the latest annual accounts data on the rest of the world sector.

Net national disposable income is obtained by adding current transfers from the rest of the world to net national income and deducting current transfers to the rest of the world from it.

9.4 Adjustment for the change in net equity of households in pension fund reserves, net savings

The net saving of the national economy is calculated by deducting all consumption expenditure (P3, inclusive of general government consumption expenditure and private consumption expenditure) from net national disposable income. An adjustment for the change in the net equity of households in pension fund reserves (D8) is not calculated in QNA because by definition it nets to zero at the level of the whole economy and does not therefore affect net saving.

9.5 Capital transfers, net lending/borrowing

The data source for capital transfers (D9) is the capital account contained in the Balance of Payments compiled by Statistics Finland. The net lending/borrowing (B9) of the national economy is obtained with the following formula: Net saving of national economy (B.8n) + Capital transfers from the rest of the world (D9) - Capital transfers to the rest of the world (D9) + Consumption of fixed capital (P51C) - Gross capital formation (P5) - Acquisition less disposal of non-financial non-produced assets (NP) - Statistical discrepancy.

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