Finnish Quarterly National Accounts - methodological description

Chapter 1 Overview of the system of Quarterly National Accounts

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 six to eight other National Accounts experts (most of whom are also involved in compiling Annual National Accounts).

1.2 Publication timetable, revisions policy and dissemination

QNA are published at the lag of 70 days from the end of a quarter. A calendar showing all future release dates for the current year can be found on the web pages of Finnish National Accounts at: http://tilastokeskus.fi/til/ntp/tjulk_en.html.

QNA data are subject to revisions after their first release, so it is advisable to retrieve always the latest version from the QNA web pages when using time series. The revisions to QNA data that are caused by revisions in the quarterly and monthly source data take place within around twelve months from the initial release. Any revisions subsequent to this are usually due to revisions in annual National Accounts. Seasonally adjusted and trend time series always become revised on every calculation round irrespective of whether the original time series becomes revised or not.

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 the data cannot be compiled by summing up from the source data. Instead, use is made of indicators, by means of which annual national accounts data are divided to the quarterly level and extrapolated to the latest quarters.

The compilation of data at current prices takes place in three phases. First the indicator time series are formed and revised for each transaction under calculation. The indicator time series may be individual time series selected direct from source statistics or weighted combinations of the time series of several source statistics. The purpose of the indicator is to describe as well as possible the quarterly development of the transaction being calculated. The indicators to be used are described in Chapters 4 to 8.

In the second phase the indicator time series are benchmarked to annual national accounts using the proportional Denton method (see Chapter 3). As a result of benchmarking, quarterly time series are formed until the latest year of annual national accounts. In the third phase the latest quarters are extrapolated with the help of the indicator using 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).

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 cause to suspect that one or several demand and supply components are erroneously estimated. In that case the most probable transactions causing imbalance are sought and their current price values are adjusted where needed.

1.5 Volume estimates

QNA volume data are published as chain-linked series at reference year 2000 prices. The chain-linking is performed with the annual overlap method in which volume estimates at the average prices of the previous year are used. The volumes at the average prices of the previous year are calculated by deflating the current price data with the change(s) in the price index/indices. Volume time series at previous year’s prices are benchmarked to annual accounts with the pro rata method, that is, each quarter is raised or lowered in the same proportion.

1.6 Seasonal adjustment and working day adjustment

Seasonal adjustment and working day adjustment are performed in QNA with the TRAMO/SEATS method and the Demetra 2.2 software. In addition to the seasonally adjusted series, trend series and working day adjusted series are also published in QNA at both current and reference year 2000 prices. Seasonally adjusted aggregates at current prices are summed up from seasonally adjusted sub-series. All series at reference year 2000 prices, including aggregates, are adjusted individually. Seasonally adjusted, working day adjusted and trend time series are not benchmarked to annual accounts after adjustment.

Chapter 2 Publication timetable, revisions policy and dissemination of QNA

2.1 Release timetable and revisions to data

QNA are published at the lag of 70 days from the end of a quarter. A calendar showing all future release dates for the current year can be found on the web pages of Finnish National Accounts at: http://tilastokeskus.fi/til/ntp/tjulk_en.html. A deviation from the release timetable is the slightly speeded up publication of data for the 4th quarter which takes place simultaneously with the release of preliminary annual accounts data at the turn of February/March.

QNA are not published in between the four regular publications even if revisions in other National Accounts statistics, such as annual accounts or statistics on general government revenue and expenditure, would occur. Such revisions will be included in the next regular publication of QNA.

QNA data become revised after their first release so it is advisable to retrieve always the latest version from the QNA web pages when using time series. 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 from the initial publication. Any revisions after this are usually caused by revisions in new annual accounts and benchmarking of QNA to them.

On account of the characteristics of mathematical/statistical methods used in the compilation, 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 is particularly sensitive to new observations, so each new quarterly data changes seasonally adjusted and trend time series also for the quarters preceding it. The more the new quarterly data differ from the development anticipated by the seasonal adjustment method, the more the preceding quarters become 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. Also available is a charged package of tables in electronic format (PDF) or as paper printouts. The online release (http://tilastokeskus.fi/til/ntp/index_en.html) comprises a brief release text, a longer review text and time series accessible via the ”Tables” link. The tables of the online release contain the entire data content of QNA. The time series are divided into five tables in all of which time series start from the 1st quarter of 1990:

1. Value added of industries quarterly (GDP production approach)

2. National balance of supply and demand quarterly (GDP expenditure approach)

3. GDP income approach quarterly

4. National income quarterly

5. Employment quarterly

Table 1 contains data on value added by activity at the accuracy of 12 industries (code of TOL2002/NACE industrial classification in brackets):

- Agriculture (A, excluding hunting, etc., 015)
- Forestry (B)
- Total industry (C, D, E)
- Manufacturing (D)
- Wood and paper industry (20-21)
- Metal industry (27-35)
- Other manufacturing (15-19, 22-26, 36-37)
- Construction (F)
- Trade (G)
- Transport, storage and communication (I)
- Real estate, renting and business activities (K)
- Other activities (H, J, L, M, N, O, P)

In addition, Table 1 contains data on taxes on products (D21), subsidies on products (D31) and gross domestic product.

Table 2 contains data on national balance of supply and demand, i.e. expenditure aggregates and imports. Exports and imports are separated into goods and services. Final consumption expenditure is broken down to government and private consumption expenditure in which household consumption expenditure is further itemised by five types of goods: durable, semi-durable, non-durable goods, services, and tourism expenditure as net. Investments are broken down to investments in buildings, machinery, equipment and transport equipment, and other investments. Investments are also broken down to public and private investments. Table 2 also contains data on changes in inventories, gross domestic product, total demand and statistical discrepancy.

Table 3 contains data on wages and salaries, and employers' social contributions with the breakdown of seven industries. In addition, the table shows data on operating surplus/mixed income, consumption of fixed capital, taxes on production and imports less subsidies, and gross domestic product.

Table 4 shows data on the terms of trade effect, primary income from/to the rest of the world, gross national income, net national income, current transfers from/to the rest of the world, savings, capital transfers from/to the rest of the worlds and net lending.

Table 5 gives data on numbers of persons employed and hours worked with the breakdown of seven industries. Persons employed and hours worked are additionally broken down to employees and self-employed persons. Moreover, the table gives figures on total population and numbers of unemployed persons.

The data of Tables 1, 2 and 4 are published at both current prices and as chain-linked volume series in which the reference year is 2000. In addition to the original series, all tables also contain seasonally adjusted, working day adjusted and trend series.

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

2.3 Special transmissions

QNA times series updated in connection with annual accounts publishing are produced in July for the Internet database tables and the time series service ASTIKA. These time series do not actually contain new quarterly data, because the data are compiled by benchmarking/extrapolating the indicators used in the June QNA publication with the new Annual National Accounts levels.

The flash estimate on GDP for the national economy, which is summed up from the monthly data on the Trend Indicator of Output, is published in connection with the release of the Trend Indicator of Output at the lag of 45 days from the end of a quarter.

2.4 Policy for metadata

A description of QNA is available on the web page of the publication at:
http://tilastokeskus.fi/meta/til/ntp_en.html

The quality description (in Finnish only) is also available on the QNA pages:
http://tilastokeskus.fi/til/ntp/laa.html

Chapter 3 Compilation of QNA

3.1 Overall compilation approach

3.1.1 General architecture of the QNA system

The compilation of the QNA is based on the use of indicator series together with various mathematical/statistical techniques. The compilation thus differs from the annual national accounts, which are mostly compiled by the so-called direct calculation method[1]. Indicators are quickly released intra-annual statistics or other source data that are considered to correlate with a certain national accounts transaction. Indicators are utilised because unlike in annual accounts, exhaustive data on the values of different transactions are generally not available quarterly or monthly. Even if exhaustive data were available quarterly at some time lag, it would be rare for them to be available in the timetable required by QNA, i.e. within 50 days from the end of a quarter.

The purpose of the indicator is to describe as well as possible the quarterly development of the transaction being calculated. The indicator time series may be individual time series selected direct from source statistics or weighted combinations of the time series of several source statistics. When forming indicators, consideration must also be given to the accuracy of the used indicators, such as constant upward or downward bias. If constant bias is detected in the indicator, the indicator values are revised as needed before benchmarking and extrapolation. The revisions can be either deterministic in nature 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 contained in the indicators and annual national accounts is combined using benchmarking and extrapolation methods.

Volume data are compiled by converting current price data first into the previous year's average prices and by chain-linking these previous year's average price data into reference year 2000 prices using the annual overlap method (see 3.3).

[1] In the direct compilation method raw data are summed from the source data, after which coverage adjustments and so on are made as needed. The use of the direct compilation method requires sufficiently exhaustive source data.

3.2 Benchmarking, extrapolation and balancing

3.2.1 Benchmarking to annual accounts

Current priced QNA time series are formed by benchmarking indicator time series to annual accounts and by extrapolating after that the latest quarters. The purpose of benchmarking is to form the required QNA time series from the corresponding indicator time series so that the annual levels of QNA time series correspond to the euro-denominated levels of annual national accounts. Benchmarking can be thought as a solution to the problem: how a quarterly time series is constructed from the annual data of annual accounts by means of a quarterly indicator so that the quarterly development of the indicator would be kept as well as possible to the complete time series.

It is essential to understand that the *level* of the complete QNA time series is determined by annual accounts, but its quarterly *time path* by the indicator. Thus the indicator values need not be in their size category anywhere near the values of their corresponding transaction, but the indicator may be, say, the 2005=100 index series. Benchmarking requires that all indicator series are formed from the whole timespan QNA covers, that is, starting from 1990N1. As a result of benchmarking the original current priced QNA time series are formed starting from 1990N1 until the latest year of annual accounts.

Benchmarking is done with the proportional Denton method[2], which is basically mechanical. It aims to maintain the original quarter-to-quarter development as closely as possible, i.e. compatible with the indicator time series. If an observation in an indicator series at point in time t is denoted with i_t and an observation in the benchmarked series at point in time t with x_t, the sum of squares equals

$$\sum_{t=2}^{T}\left[\frac{x_t}{i_t}-\frac{x_{t-1}}{i_{t-1}}\right]^2$$, where T denotes the last quarter of the time series.

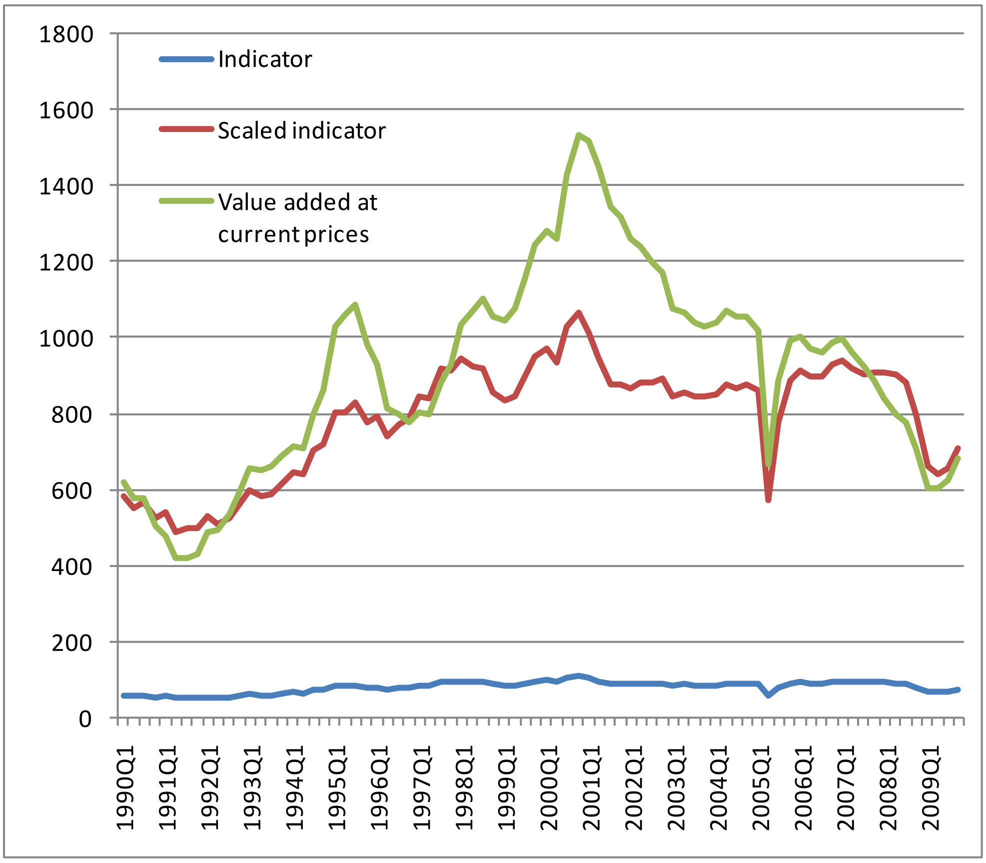
and is minimised under the condition that the sum of all quarters of the year is the annual value obtained from annual accounts. Benchmark to indicator ratio BI_t will thus be estimated for every quarter of the year,

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

which, when the entire time series is considered, deviates as little as possible from the BI ratio of the previous point in time.

[2] 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.

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



The figure above shows the indicator for the pulp- and paper industry of non-financial corporations sector (S.11) and the value added time series formed from it by benchmarking. For the sake of illustration, a scaled indicator was added to the figure where the indicator values are multiplied by ten. When comparing the scaled indicator and the benchmarked value added time series, it can be seen how the Denton method retains the development of the indicator in the benchmarked time series even though the annual development of the annual national accounts seems to be more volatile than the annual development of the indicator. Special attention should be given to the dip in 2005Q2, which was due to shutdown in the paper industry.

There are also various benchmarking methods that are based on time series models and in which the original time series is used as the external regressor. A simple example of this is Chow-Lin[3], and if suitably formulated, the Denton method can also be regarded as a special case of this kind of a model. With the exception of particularly problematic series, the Denton method and methods based on simple time series modelling produce in practice the same benchmarked series, and no reasons for changing the

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[3] 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) s. 372–375.

method have emerged from the examinations made. In addition, the proportional version of the Denton method is recommended by the IMF[4]. More complex models would make it possible to study interesting connections to seasonal adjustment, for example, but then the benchmarking proper would not necessarily succeed equally reliably. Further reading about time series model-based methods is available in the master's thesis written at Statistics Finland (Hakala, 2005)[5].

3.2.2 Extrapolation

Denton benchmarking creates the original current priced QNA time series up till the latest annual accounts, but does not calculate newer quarters than that. Full annual accounts are always released in July, over six months from the end of the statistical reference year. It follows from this that when compiling the QNA data on the first quarter of a year in May, the first quarter of the current year as well as all four quarters of the previous year are still missing from the time series after benchmarking.

These latest quarters, numbering two to five depending on the time of release, are calculated by extrapolating. Extrapolation is made in QNA on the basis of the indicator time series, using the annual level benchmark-to-indicator ratio.

As a result of benchmarking, the sum of the quarters of one year of the benchmarked current priced time series is exactly equal to that in annual accounts. The annual level benchmark-to-indicator ratio used in extrapolation can then be calculated by dividing the sum of the latest year of the benchmarked time series with the sum of the corresponding values of the indicator time series. The annual level BI ratio thus describes the ratio of the latest annual account data and the indicator corresponding to it in QNA.

Extrapolation takes place so that the values of the indicator time series are multiplied by the BI ratio:

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

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

As in benchmarking, the extrapolation method is selected with the view that the produced current priced QNA time series follows as closely as possible the development of the indicator. Current priced data produced as the result

[4] http://www.imf.org/external/pubs/ft/qna/2000/Textbook/ch6.pdf
[5] Hakala, Samu (2005), "Aikasarjojen täsmäyttäminen" (In Finnish only; Benchmarking of time series).

of extrapolation can still be revised, if needed. This is done when available is such additional information that is not yet visible in the indicator.

Table 1: Extrapolation with the annual level BI ratio

Time period	Indicator	Value in QNA (bench-marked), EUR mil.	Value in QNA (extrapolated), EUR mil.
2008Q1	90.7	847	
2008Q2	90.1	809	
2008Q3	88.4	773	
2008Q4	79.8	689	
2009Q1	65.9		((847+809+773+689)/(90.7+90.1+88.4+79.8))*65.9 = **589**
2009Q2	64.2		((847+809+773+689)/(90.7+90.1+88.4+79.8))*64.2 = **574**
2009Q3	65.5		((847+809+773+689)/(90.7+90.1+88.4+79.8))*65.5 = **585**
2009Q4	70.8		((847+809+773+689)/(90.7+90.1+88.4+79.8))*70.8 = **633**

3.2.3 Balancing of demand and supply

Total demand (consumption, investments and exports) and total supply (production and imports) are not fully balanced in QNA but the statistical discrepancy between them is shown separately. However, a large statistical discrepancy signifies that some indicator of demand or supply contains an error or schedules among the quarters differently from other indicators. If a current priced statistical discrepancy in a quarter seems to grow excessively large, the transactions most probably causing imbalance are identified and their current priced values are adjusted as needed.

The most unreliable indicators in QNA are those used in the estimation of investments, changes in inventories, consumption of services, and imports and exports of services.

In addition to coverage problems, the timing and valuation of the indicators of change in inventories can differ from the indicators of turnover on the supply side. Change in inventories is normally the primary target for balancing.

The indicators for the consumption of services and investments have poor coverage. Of them particularly investments in machinery and equipment and other investments are often balanced due to their great volatility.

The problem with the indicators of exports and imports of services is great revisions, which is due to difficulties in measuring these items. Data on imports and exports are not, however, usually changed in connection with balancing, because national accounts seek to retain their congruence with the balance of payments.

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

3.2.4 Estimation in preliminary data

Monthly and quarterly statistics that can serve as indicators are quite well available in Finland, which is why right from the very first publication approximately 90 per cent of QNA data are based on indicators derived from statistical sources. Particularly in the first publication some of the used source data are incomplete so that the quarterly value of the indicator has to be estimated from the data of one or two months of the latest quarter. The main indicators estimated on the basis of incomplete data are the indicator for taxes on products and some of the indicators for value added in the household sector (see Chapter 4).

3.3 Volume estimates

3.3.1 General data policy

Volume refers to data adjusted for price changes. In some connections, volume in Finnish equals amount, but the amount included in volume also comprises changes in quality. For example, the volume of mobile phone production can grow despite the development of unit sales if the quality of new mobile phones (i.e. technical features) is better than that of old ones. In any case, price fluctuations may be even so large on the quarterly frequency that they disturb the monitoring of the development of the "real economy". For this reason, the change percentages of GDP are normally calculated from the volume time series.

QNA volume data are published as chain-linked series at reference year 2000 prices. Chain-linking means that the volume data of each year are first calculated at previous year's prices. From these it is possible to calculate further annual volume changes, which are linked to form a chain-linked volume time series. An alternative way, which was utilised prior to 2006 for forming a volume time series, is to use a fixed base year.

In quarterly national accounts the calculation of volume data starts with deflation, in which time series at current prices are converted to volume series at the average prices of the previous year by dividing current priced figure of each quarter with a deflator. The simplest deflator is the ratio between a price index value for one calculation quarter and the previous year's average value of the price index. The deflator thus expresses the price level of the calculation 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 (arithmetic mean) and D_t the value of the deflator.

Several price indices can be used for forming a deflator for one transaction. Then P in the formula above is the weighted combination of several price indices. The deflators for value added are formed from product level price data, which are weighted from current priced product weights derived from supply and use tables.

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 the value of the deflator in quarter t.

Table 2: Deflation with one price index (NB The average price index for 2006 is 103.8)

Time period	Value in QNA at current prices	Price index	Deflator	Volume in QNA at previous year's average prices
2006Q1	1,478	103.4		
2006Q2	1,499	103.1		
2006Q3	1,530	104.0		
2006Q4	1,590	104.5		
2007Q1	1,518	104.4	104.4 / 103.8 = 1.006	1,518 / 1.006 = 1,509
2007Q2	1,537	104.8	104.8 / 103.8 = 1.010	1,537 / 1.010 = 1,522

2007Q3	1,551	105.2	105.2 / 103.8 = 1.014	1,551 / 1.014 = 1,530
2007Q4	1,610	105.9	105.9 / 103.8 = 1.021	1,610 / 1.021 = 1,577

3.3.3 Chain-linking and benchmarking

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

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

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

The pro rata method is used in this case in place of the Denton benchmarking method because the series at the previous year's prices have a point of discontinuation at each turn of the year. Because 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. 2007Q1/2006Q4) are not comparable with changes occurring within the year (e.g. 2006Q4/2006Q3). The Denton method aims to retain the changes between all quarters of the original series, so like the current priced series the original series must be coherent.

The pro rata method, again, is not recommended for the benchmarking of continuous series because it creates points of discontinuity at year turns even in coherent series (the so-called step problem). The comparability of year turns with other points of time is then also lost. However, the pro rata method is in this case a suitable benchmarking method because points of discontinuity at turns of the year are characteristic of volume series at the previous year's prices.

Benchmarked volume data at previous year's prices are not normally published but they belong to the data content of Eurostat reporting. However, they are available upon request.

When volumes have been benchmarked at the average prices of the previous year, they are chain-linked into volumes at reference year 2000 prices by using the annual overlap method[6]. The chain-linking is done by first calculating the annual chain-linked index:

$$CL_Y = \frac{PYP_Y}{CP_{Y-1}} \times CL_{Y-1}$$

where CL_Y is the value of the annual chain-linked volume index in year Y, PYP_Y is volume at previous year's prices in year Y (summed from benchmarked quarterly volumes), CP_{Y-1} is the current priced value of the previous year (summed from benchmarked quarters), and CL_{Y-1} is the previous year's chain-linked volume index (the value set for the first year of the time series can be, e.g. 1 or 100).

Then, for every quarter, the ratio of the quarterly volume (at previous year's average prices) to the current priced average of the previous year must be calculated. The previous year's volume from the chain-linked annual volume index is then multiplied with these quarterly ratios, to obtain a quarterly chain-linked volume index:

$$CL_Q = \frac{PYP_Q}{\frac{CP_{Y-1}}{4}} \times CL_{Y-1}$$

where CL_Q is the quarterly chain-linked volume index in quarter Q, PYP_Q is quarterly volume at previous year's average prices, $CP_{Y-1}/4$ is the previous year's current priced quarterly average, and CL_{Y-1} is the previous year's value of the chain-linked annual volume index.

The quarterly chain-linked volume index time series can be scaled to the level of, say, year 2000 by multiplying all the quarters of the volume index with the same multiplier (pro rata). Multiplier is simply:

where CP_{VV} is the annual current price value of the desired reference year and ΣCL_Q is the sum of the quarters of the quarterly chain-linked volume index in the same reference year.

In chain-linked series the choice of the reference year is arbitrary and it only indicates that volumes are expressed relative to the current price level of the reference year. Because the weights of prices change annually in chain-linked series, the chain-linked volume series is not actually calculated at year 2000 prices like a base year 2000 volume series would be.

[6] Information on the quarterly accounts volume calculations can be found in Chapter 9 of the IMF's QNA Manual: http://www.imf.org/external/pubs/ft/qna/2000/Textbook/ch9.pdf. Example of Annual overlap on page 159.

The drawback of chain-linked series is loss of additivity, which means that the series cannot be summed up with each other. Thus, for instance, a chain-linked volume of GDP is not equal to the sum of its components.

Because of the properties of the annual overlap chain-linking method, the chain-linked quarterly volumes will automatically be equal to chain-linked annual accounts if series at previous year's prices and series at current prices have first been benchmarked.

3.4 Seasonal adjustment and adjustment for working days[7]

Quarterly national accounts (QNA) time series show seasonal variation typical of short-term economic time series with observations inside the year. The reasons for this are such as variation caused by the time of the year, the difference in the sales of products by season and timings of transactions. In addition to the variation between winter and summer months, consumption over the Christmas and Easter seasons, payments of tax refunds and back taxes that in Finland fall due in December, as well as companies' payments of dividends in spring after 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. Also, 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 which has very little to do with development over a longer time period. The conclusion must not be drawn from this that seasonal adjustment would be constant or deterministic, and that its modelling or adjustment would be a triviality in the way of bigger things (also see Takala 1994, pp. 69-71[8]).

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

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[7] This section is in many parts based on the article by 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).

[8] 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.

It is often suggested that short-term economic time series that contain more frequent than annual observations should be broken down to four components: trend (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 one of these is presumed to be random white noise with no information that would be useful to 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 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.

The ARIMA model-based[9] TRAMO/SEATS method recommended by Eurostat is used in seasonal adjustments of quarterly national accounts series. The ARIMA model-based seasonal adjustment starts by modelling of the variation in the observation series by means of 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 the 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 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[10].

Whenever a time series is seasonally adjusted, the autocorrelation structure of the original series is interfered with. If the used filter (be it a general ad hoc filter or one based on a 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-

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

[10] 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.

adjusted series is utilised when the variation in the time series at different frequencies is broken down to 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 that relates to it, that is, the components are mutually orthogonal. Interpretationally this means that the reasons that cause seasonal variation (such as time of year) in a time series are uncorrelated with the reasons behind a long-term trend, 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. Then each component (with the exception of the irregular term) can be presented by an ARIMA model.

Both the pre-adjusted series and its components are ARIMA modelled while respecting the dynamic 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 numbers 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 outliers (TC)) to random variation. Thus the variation in the entire original time series becomes distributed to the components of 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 is also faced with the identification problem. In the TRAMO/SEATS method the so-called canonical decomposition is used from among different 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[11] of the seasonal ARIMA model family which produces random variation that has quite small variance and is tested to be random.

[11] Notes p,d,q refer to the models' basic ARIMA part and PDQ to seasonal ARIMA part, where p (or P) is the number of AR parameters, d (D) the number of differentiations, 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)[12] according to which the selection of the model is determined by as small variance as possible in random variation, achieved with as small number of estimated parameters as possible.

Thus, 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 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 mentioned other methods 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 on seasonal variation by capturing moving seasonality in time, along with the modelling of working and trading day effects.

In order to reduce the revision of the latest adjusted observations, a forecast a few observations forward must be produced in all seasonal adjustment methods. It is usually done basing 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 become 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 also 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:

TRAMO (**I**) / SEATS (**II**):

I) $y_t = x_t'\beta + z_t$ [13]

[12] 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 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.

[13] In the Tramo phase for a pre-adjusted series, z_t, an ARIMA model $z_t = \frac{\theta}{\psi}$ is identified. In the SEATS phase, the lag polynomials of this model, ϕ and θ, are divided into

Pre-adjustment regressions
- working/trading day effects (WD/TD)
- outliers (LS, AO, TC)

Residual from the pre-adjustment, z_t follows an ARIMA model

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

$$\Longrightarrow \quad = \qquad + \qquad +$$

Residual of the pre-adjusted series after decomposition, random

(pre-adjusted series = (initial)trend +(initial)seasonal-component + random variation)

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

$$y_t \quad = \;{}_t(+\ S) + \;{}_t(+\ D/TD) \quad + \;{}_t(+\ O,TC)$$

Final irregular

observation series = trend + seasonal component + irregular component

The above final decomposition shows that when the seasonal component is being removed, calendar effects are also eliminated in seasonal adjustment.

3.4.1 Policy for seasonal adjustment

Seasonally adjusted time series are published both at current prices and as chain-linked volume series at reference year 2000 prices. Unadjusted, or original, series benchmarked to annual national accounts are also published both at current prices and as chain-linked volume series at reference year 2000 prices. The chain-linked time series at reference year's prices are adjusted with a direct adjustment method and the time series at current prices

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trend and seasonal components based on the frequency domain analysis. Part of ε 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.

with an indirect adjustment method. In the direct method all time series, inclusive of aggregates, are adjusted separately. The indirect method means that seasonally adjusted aggregates at current prices are formed by summing up the adjusted sub-series. The randomness of the residual of the aggregate series that is formed by summing up the residuals of the ARIMA models of the sub-series is then tested. Apart from this methodological description that is publicly available, the 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 sharing of information.

The publication ESS Guidelines on Seasonal Adjustment[14] steering the seasonal adjustment practices of Eurostat and EU Member States is followed in seasonal adjustment and working day adjustment. The governing principle in seasonal adjustments is to make the modellings 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 on each calculation round. An exception to this are outlier observations mid-way through the year, such as a labour dispute, for example. With regard to the main aggregate series, 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 adoption of models does not cause revisions to the history of a seasonally adjusted series on every round. The aim in the updating of parameter values is to produce forecasts with as full information as possible on the past on every calculation round. The objective in this is to reduce revisions to the latest observations in adjusted series when new observations become available.

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 reference year 2000 prices. In principle, the working or trading day adjustment (inclusive of adjustments for a leap year, Easter and national public holidays) is based on the testing of statistical significance during several modelling rounds by using monthly data from the sources used for QNA whenever possible.

Working or trading day adjustment factors (inclusive of omission of working day adjustment of a series) are not changed mid-way through the year between modelling rounds. In the best case, basing on experiences from modelling examinations from several years over an extended time period, efforts are made to find at least for the main series a stable, series-specific solution with meaningful contents by also using the monthly indicators for the phenomenon concerned.

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[14] http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-RA-09-006/EN/KS-RA-09-006-EN.PDF

For the series that are not working or trading day adjusted original series are presented in place of series adjusted for working days. The original series are naturally also published, so the congruence of the said series shows that no adjustment for working days has been done to the data describing the phenomenon concerned. In a case like this, the seasonally adjusted series is of course not calendar adjusted either.

Chapter 4 GDP and components: the production approach

4.1 Gross value added by industry

In QNA gross value added is calculated at the accuracy of 138 industry/sector combinations. The 2-digit level of NACE 2002 is used for the majority of industries, although for a few industries the calculation is done at the 3-digit level. The sector classification is the 2-digit level with the exception that in the general government sector central government (S.1311), local government (S.1313) and compulsory social insurance (S.1314) form sectors of their own.

An indicator for value added is formed for each industry/sector combination, which is benchmarked and extrapolated into current priced value added. With the exception of agriculture, indicators for value added in QNA are output indicators similar to turnover. Good indicators for the value or volume of intermediate consumption are not available on the quarterly frequency, for which reason output and intermediate consumption are not estimated separately in QNA.

In addition, a deflator time series is formed for each industry/sector combination by means of which the current price time series can be deflated to the volume time series at previous year's average prices. Deflators are formed from the price data on the product level (national account supply and use tables contain around 1,000 products) by weighting. The products produced by the industry/sector combinations and their weights are obtained from supply and use tables. Deflators are formed using output 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 some industry/sector, the deflator is adjusted as needed before deflation.

Agriculture (A)

The data sources are the dairy and egg production, and slaughterhouse statistics (monthly statistics), the yield estimates (four annual revisions) and the horticultural indicator of the Information Centre (TIKE) of the Ministry of Agriculture and Forestry.

The value of output is obtained by multiplying the amount of output by basic price, which comprises the producer price and subsidies on products. The volume of output is obtained by multiplying the volume of output by the previous year's average price. Data on agricultural services are added in the third quarter of the year when the first annual estimate becomes available. Efforts are also made to estimate intermediate consumption separately from data on the consumption of feed, fertilisers and energy, so that the indicator for value added is received as the difference between output and intermediate consumption.

Forestry (A)

The sources are the monthly data on market fellings and stumpage prices obtained from the Metinfo forest information service of the Finnish Forest Research Institute. The indicator for value added is a weighted combination of the indicators for forest cultivation (around 70%) and logging (around 30%). The indicator for forest cultivation is calculated by multiplying the "adjusted" quantity of market fellings by stumpage prices. The time series of market fellings is adjusted when calculating the indicator for forest cultivation, because forest growth has an equalising effect on the development of volume. The indicator for logging is calculated by multiplying market fellings with the index of wage and salary earnings in forestry. Stumpage prices have the biggest weight in the deflator.

Fishing (B)

The source data are those on the value of fish production and its price development by the Finnish Game and Fisheries Research Institute.

Manufacturing (C, D, E)

The data sources for the sector of non-financial corporations (S.11) are Statistics Finland's (monthly) Indices of Turnover in Industry[15], (monthly) Volume Index of Industrial Output[16] and Producer Price Indices for Manufactured Goods[17]. For industries 35 (Manufacture of other transport equipment), 40 (Electricity, gas, steam and hot water supply) and 41 (Collection, purification and distribution of water) the indicator for value added is calculated by multiplying the Volume Index of Industrial Output in each industry by the corresponding Producer Price Index. For all other industries in sector S.11 the indicator for value added is the Index of Turnover.

In the household sector (S.14) the source is turnover in the Tax Administration's periodic taxation data[18]. The turnover of the latest quarter is estimated with the ARIMA model (mostly seasonal ARIMA), because data on turnover in the periodic taxation file accumulates slowly.

The deflators for manufacturing are mainly formed from the Producer Price Indices for Manufactured Goods. The share of services, such as maintenance

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[15] http://tilastokeskus.fi/til/tlv/index_en
[16] http://tilastokeskus.fi/til/ttvi/index_en
[17] http://tilastokeskus.fi/til/thi/index_en
[18] Periodic taxation data are monthly data collected by the Tax Administration containing all enterprises' turnover subject to value added tax, and wage and salary sum data.

and product development, in the output of manufacturing industries has been growing constantly. For this reason deflators also contain increasingly producer price indices for services and other price data on services.

Construction (F)

The data sources for building construction are Statistics Finland's (monthly) Volume Index of Newbuilding[19] and (annual) Statistics on Renovation Building. The data sources for civil engineering are the value and volume indices[20] of sales in Statistics Finland's Index of Turnover of Construction.

The indicator for value added in building construction is formed by adding to the current priced index of the Volume Index of Newbuilding an estimate of the output in renovation building. 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.

The indicator for value added in civil engineering is the index of civil engineering in the Index of Turnover of Construction. The deflator is calculated from the implicit price index of volume indices of turnover and sales, which is based on the Cost Index of Civil Engineering Works. The same indicator for building construction and civil engineering is used for all sectors.

Trade (G)

The data sources are monthly value and volume indices for Statistics Finland's Turnover of Trade[21]. The indicators for turnover are value indices for wholesale trade, retail trade and motor vehicle trade of the Index of Turnover. The deflators are price indices used in deflating the volume indices of the Turnover of Trade. According to ESA 95, output and value added for this industry are calculated from sales margin (turnover less bought merchandise). In QNA turnover has to be used as the indicator for value added because quarterly data are not available on the development of the margin.

Hotels and restaurants (H)

The data sources are Statistics Finland's Turnover of Service Industries[22], Producer Price Index for Services[23] and Consumer Price Index[24].

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[19] http://tilastokeskus.fi/til/ras/index_en
[20] http://tilastokeskus.fi/til/rlv/index_en
[21] http://tilastokeskus.fi/til/klv/index_en
[22] http://tilastokeskus.fi/til/plv/index_en
[23] http://tilastokeskus.fi/til/pthi/index_en
[24] http://tilastokeskus.fi/til/khi/index_en

The indicator for the value added of sector S.11 is the value index of the Index of Turnover. The indicator for the value added of sector S.14 is the turnover in the periodic taxation data.

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

Transport, storage and communication (I)

The data sources are Statistics Finland's statistics on Turnover of Service Industries and Producer Price Indices for Services.

The indicator for the value added of sector S.11 is the value index of the Index of Turnover. The indicator for the value added of sector S.14 is the turnover of the periodic taxation data.

In the deflator Producer Price Indices have the biggest weights.

Financial and insurance intermediation (J)

The data sources for financial intermediation (TOL 65) and activities auxiliary to financial intermediation (TOL 67) are Statistics Finland's Statistics on Credit Institutions[25], Consumer Price Index and Producer Price Index for Services.

The indicator for the value added of financial intermediation is comprised of two elements: market output and financial intermediation services indirectly measured FISIM. The indicator for market output is the quarterly commission income of credit institutions in the Statistics on Credit Institutions.

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

The deflator for market output is formed from the Producer Price Index and Consumer Price Index of financial services. The price index for FISIM is calculated by multiplying the implicit interest margin of FISIM with the implicit price index of domestic end demand.

The indicator for the value added of activities auxiliary to financial intermediation is the commission income of investment service companies, which is found in the Statistics on Credit Institutions. The deflator is formed from the Producer Price Index and Consumer Price Index for financial services.

No reliable method has been found for calculating quarterly data on the output/value added of insurance funding, so long-term growth trend is used

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[25] http://tilastokeskus.fi/til/llai/index_en

as the estimate for the latest quarters. The deflator is formed from the insurance services of the Consumer Price Index excluding life insurance, for which the price is estimated separately.

Real estate, renting and business activities (K)

The data sources for industry 70, Real estate activities, are the Tax Administration's payment control data, Statistics Finland's Turnover of Services and (quarterly) Statistics on Rents of Dwellings[26]. The data sources for industries 71, 72, 73 and 74 are Statistics Finland's Turnover of Service Industries and Producer Price Indices.

Output for industry 70 is calculated through four sub-industries. For Real estate activities with own property (TOL 701), Letting of own property (TOL 7022) and Real estate activities on a fee or contract basis (TOL 703) the indicator for value added is the Turnover of Trade (TOL 70). The deflators for these industries are formed from the Producer Price Index for Services and Consumer Price Index.

The indicator for the value added of Letting of dwellings (TOL 7021) 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.

The indicators for the value added of industries 71-74 are obtained from the Turnover of Service Industries. The deflator for industry 71 is mainly formed from the Producer Price Index for Services and Basic Price Index for Domestic Supply. The deflator for industry 72 is formed from the Producer Price Index for Services. The deflator for industry 73 is formed from the Index of Wage and Salary Earnings. The deflator for industry 74 is formed from the Producer Price Index for Services, Building Cost Index, Consumer Price Index and Index of Wage and Salary Earnings.

Public administration and defence; compulsory social security; Education; Health and social work (L, M, N)

Industries 75, 80 and 85 are in Finland mainly activities of the public sector. The data sources for the public sector are the Tax Administration's periodic taxation data, central government's bookkeeping, and the Index of Wage and Salary Earnings[27].

The indicator for value added in the public sector is primarily the wage and salary sum data (variable stpalkat) in the periodic taxation data. For the central government sector (S.1311) the data on wages and salaries in central government's bookkeeping are used as comparison data to the periodic taxation data.

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[26] http://tilastokeskus.fi/til/asvu/index_en
[27] http://tilastokeskus.fi/til/ati/index_en

With regard of the local government sector (S.1313) the problem with the periodic taxation data is that each municipality has only one business ID code in the data so that in practice all wages and salaries paid by municipalities show under industry 75 (Public administration). In the local government sector, only joint municipal boards with their own business ID codes show in the periodic taxation data in the industries of Education and Health and social work. For this reason, a fixed percentage of the wages and salaries in industry 75 is also added to the indicators for value added in industries 80 and 85. The deflators for value added in the public sector are primarily formed from the Index of Wage and Salary Earnings.

The indicator for value added in the non-financial corporation sector's Education and Health and social work is turnover in the periodic taxation data. The deflators of the non-financial corporation sector are derived from the Consumer Price Index.

The indicators for value added in the sector non-profit institutions serving households (S.15) are formed from the wage and salary sum data of the periodic taxation data. The deflators are mainly from the Indices of Wage and Salary Earnings.

Other community, social and personal service activities (O)

The source data are the Index of Turnover, periodic taxation data, Index of Wage and Salary Earnings and Consumer Price Index. The indicator for value added in the non-financial corporation sector is the Index of Turnover in industries 90, 92 and 93. The wage and salary sum data in the periodic taxation data are used as the indicator for value added in industry 91 of sector S.11.

In sectors S.13 and S.15 the indicators for value added are wage and salary sum data in the periodic taxation data. In sector S.14 the indicators for value added are turnover data in the periodic taxation data, except in industry 95 the indicator is wage and salary sum data in the periodic taxation data.

In sectors S.11 and S.14 the deflators are formed mainly from the Consumer Price Index, except for industry 91, where the deflator is the Index of Wage and Salary Earnings. In sectors S.13 and S.15 the deflators are mainly formed from the Index of Wage and Salary Earnings.

4.2 FISIM - Financial intermediation services indirectly measured

Financial intermediation services indirectly measured are calculated quarterly in the same way as in annual accounts. All the balance and profit and loss account data of domestic credit institutions that are needed in the calculations for FISIM are available quarterly from Statistics Finland’s Statistics on Credit Institutions. The only item of FISIM that cannot be estimated quarterly is imports.

The results from the calculations for FISIM are utilised in QNA in calculating value added for financial corporations (see Section 4.1). Allocation of FISIM to user sectors/industries is not done quarterly.

4.3 Taxes on products and subsidies on products

Taxes on products are estimated from cash based monthly data in central government's bookkeeping. Depending on the type of tax, a timing adjustment of one to two months is made to the cash based taxation data in order to bring them closer to accrual basis. Because of this, value added tax for the latest quarter has to be estimated from the data on the first two months of a quarter and from change from 12 months back.

According to the ESA[28], the price of taxes on products should be calculated by weighting from changes in tax bases of different types of taxes. According to the national accounts recommendations, the volume of taxes on products should follow the development of the volume of private consumption, because most taxes on products accumulate from purchases of private consumption. If the volume change and current price value of taxes on products are taken as given, the price of taxes on products remains residual.

In practice the deflator for taxes on products is formed by calculating first the implicit "index of taxes on products" from the time series of the Harmonised Index of Consumer Prices and Harmonised Index of Consumer Prices at Constant Taxes. This produces a basic estimate for price change relative to the average price of the previous year. If the development of the volume of taxes on products formed with this deflator differs significantly from the development of the volume of private consumption, the deflator is adjusted as needed so as to bring the volume development of taxes on products closer to the volume of private consumption.

No data are available quarterly on subsidies on products, so the basic estimate is the level of the previous year.

[28] European System of Accounts 1995 (ESA 1995), Eurostat 1996.

Chapter 5 GDP and components: the demand approach

5.1 Household final consumption

Household final consumption is calculated by extrapolating quarterly values benchmarked to annual accounts by changes in indicators. The changes in the indicators are weighted according to the consumption account of the latest annual accounts. The most important indicators that are used are: Turnover Index of Retail Trade (by type of commodity) of Statistics Finland's Turnover of Trade, Statistics Finland's Statistics on Rent of Dwellings, the Finnish Vehicle Administration's data on first registrations of passenger cars, the Finnish Oil and Gas Federation's data on petrol sales, and data on the number of package tours in Statistics Finland's Tourism Statistics.

In addition, the following supply indicators are used for estimating the consumption of services: transportation, communication, hotel and restaurant, and recreational, cultural and sports services are calculated using change in the index of turnover for the respective industry. In respect of FISIM, the consumption of financial services is based on the FISIM account and in respect of other financial services on data describing the development of commission income in Statistics Finland's Statistics on Credit Institutions.

The deflators are formed from the sub-items of the Consumer Price Index.

5.2 Government final consumption

Government final consumption at current prices is obtained from data in Statistics Finland's Statistics on General Government Revenue and Expenditure[29] (STPFS). The data in the STPFS are mainly based on quarterly statistics on the finances of municipalities and joint municipal boards, and on central government's bookkeeping. The volume of government final consumption is obtained by deflating value at current prices by the implicit deflator for the combined value added of public sector industries (see 4.1), which is mainly formed from indices of wage and salary earnings.

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 value added of industries in sector S.15 (see 4.1). The deflator is the implicit deflator of the value added of sector S.15 (S.15 value added at current prices divided by value added at previous year's average prices), which is mainly formed from indices of wage and salary earnings.

[29] http://tilastokeskus.fi/til/jtume/index_en

5.4 Gross capital formation

Gross fixed capital formation, i.e. investments

The estimates for investments in construction are mainly compiled by using the same sources and methods as in the calculation of value added in construction (4.1).

Data from Statistics Finland’s inquiry about enterprises’ investments are used as the comparison data. The indicator for gross fixed capital formation in machinery and equipment is Statistics Finland’s inquiry about enterprises’ investments, which is conducted quarterly and covers approximately 2,000 largest enterprises in the non-financial corporations sector. The sub-index of investment goods of the Wholesale Price Index is used in the deflation of investments in machinery and equipment.

The estimates on investments in machinery and equipment are based on the Finnish Vehicle Administration’s data on first registrations of motor vehicles. The volume index weighted by vehicle type is formed from data on first registrations of motor vehicles, which is multiplied by the Wholesale Price Index (industry C29) to achieve an indicator at current prices. The deflator is the same Wholesale Price Index.

Other investments are mostly comprised of investments in computer software, for which the indicator is Statistics Finland’s inquiry about enterprises’ investments in software. The index of turnover for industry 72 is used as the comparison data. The deflator is the Producer Price Index for industry 72.

Change in inventories

The source data for change in inventories are the Statistics on Manufacturing Inventories[30] and on Trade Inventories[31]. An estimate for the inventory stock of the whole economy is formed by first summing the inventory stocks of manufacturing and trade inventories and by adding to them an estimate of the value of the grain inventory stock in agriculture. Change in inventories at current prices is obtained as the difference of the inventory stocks of the whole economy:
CPSTOCKt - CPSTOCKt-1.

The volumes of inventory stocks have to be first estimated in order to calculate the volume of change in inventories. The inventory stock of manufacturing is deflated by the Producer Price Index for Manufactured Products (C Manufacturing total). The deflator for the inventory stock of trade is the Basic Price Index for Domestic Supply (total). The deflated inventory stocks are summed to the inventory stock estimate at previous year's average prices for the whole economy.

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[30] http://tilastokeskus.fi/til/tva/index_en
[31] http://tilastokeskus.fi/til/kvr/index_en

Change in inventory at previous year's average prices is the difference of inventory stocks at previous year's prices of the whole economy: PYPSTOCKt - PYPSTOCKt-1. To calculate change in the volume of the first quarter, the inventory stocks of the last quarter of each year also have to be deflated at current year's average prices.

The volume of change in inventories is not chain-linked at reference year's prices, because a chain-linked index cannot be formed due to negative figures in the time series. However, gross fixed capital formation (P.5) is also published at reference year's prices and it also contains the volume of change in inventories.

Estimates for change in inventories are often changed in connection with balancing, so the published data may differ from those in the source data.

5.5 Imports and exports

The principal source of data for exports and imports is the Current Account[32] compiled by the Bank of Finland. Monthly data of the Board of Customs[33] are used as comparison data for the exports and imports of goods. Statistics Finland's Statistics on International Trade in Services[34], on which the data of the Current Account are also based, are used as comparison data for the exports and imports of services. The share of construction services is deducted from the imports and exports of FISIM and added to/deducted from the imports and exports of services in the Current Account. For the calculation of volumes separate deflators are formed for the exports and imports of goods and services by weighting Import and Export Price Indices with weights according to the latest data on imports and exports in the statistics of the Board of Customs and in the Current Account.

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[32] http://www.suomenpankki.fi/fi/tilastot/maksutase/index.htm
[33] http://www.tulli.fi/fi/05_Ulkomaankauppatilastot/05_Tilastokatsaukset/01_Ennakot/index.jsp
[34] http://tilastokeskus.fi/til/pul/index_en

Chapter 6 GDP and components: the income approach

6.1 Compensation of employees

Compensation of employees is comprised of wages and salaries and employer's social contributions. Indicators for wages and salaries are formed from Statistics Finland's Wage and Salary Indices[35]. The comparison data are the Social Insurance Institution's estimate of the wage and salary sum, and the Tax Administration's periodic taxation data and the change percentage obtained as the product of the Index of Wage and Salary Earnings.

Employers' social contributions are estimated by applying to the wage and salary estimates the implicit social contribution percentages of the latest annual accounts, i.e. employers' social contributions relative to wages and salaries. If it is known that changes have taken place in the employers' social contribution percentage since the latest annual accounts, the estimated social contribution percentage is changed accordingly.

6.2 Taxes and subsidies on production

Taxes on production principally comprise taxes on products (see 4.3). Estimation of taxes on products and other taxes on production is based on the calculations of Statistics on General Government Revenue and Expenditure (STPFS) which exploit central government's bookkeeping data. 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.

[35] http://tilastokeskus.fi/til/ktps/index_en

Chapter 7 Population and employment

7.1 Population, unemployed

The data source for the size of population is Statistics Finland’s preliminary Population Statistics. The data source for the number of unemployed persons is Statistics Finland’s Labour Force Survey. The data from these sources are used as they are. Data from both sources are released at the accuracy of 100 persons.

7.2 Employment: persons employed

The number of employed persons is released in QNA in hundreds of persons. The data source is Statistics Finland’s Labour Force Survey[36] from which indicators for the number of persons employed are obtained by industry.

Because the Labour Force Survey is sample-based, 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) 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 up the estimates by industry.

7.3 Employment: hours worked

The data source is Statistics Finland’s Labour Force Survey from which indicators for the number of persons employed 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 to data on wage and salary sums (see 6.1) and employment data. The total number of hours worked is obtained by summing up the estimates by industry. The data are published at the accuracy of 100,000 hours.

[36] http://tilastokeskus.fi/til/tyti/index_en

Chapter 8 From GDP to net lending/borrowing

8.1 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 (D.1), taxes on production and products (D.2), subsidies (D.3) and property income (D.4). The data sources for compensation of employees and property income are the factor returns (compensation of employees and returns on equity) included in the Current Account. Exhaustive quarterly data are not available 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, respectively, primary income paid to the rest of the world deducted from GDP.

Gross national income at reference year prices is calculated by summing first the gross domestic product at previous year's prices and primary income from/to the rest of the world at previous year's prices. The deflator used for primary income is the implicit price index of domestic end 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.

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

No source data indicator is available for consumption of fixed capital (K.1). Its volume can be assumed to develop very stably, because in annual accounts consumption is calculated as a share of the volume of the very stable fixed capital stock.

The formation of quarterly estimates for consumption of fixed capital starts from volume: the starting estimate for the consumption at previous year's average prices is obtained by dividing the whole previous year's consumption at current prices by four. If the volume of investments has changed strongly in a calculated quarter and/or the quarters preceding it, this is taken into consideration by raising or lowering the estimated volume of consumption slightly. However, one quarter’s investments have a minor impact on the stock of capital and consequently on its consumption. Consumption at current prices is obtained by inflating the previous year’s consumption at average prices by change in the price of investments.

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

No quarterly data are available on acquisitions less disposal of non-financial non-produced assets (K.2). Zero is used as the estimate for the latest quarter, because it is a question of a net figure whose final benchmarked value can be either positive or negative.

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

Current transfers are comprised of taxes on income and wealth (D.5), social contributions (D.61), social security benefits in cash (D.62) and other current transfers (D.7). The source data are from current transfers in the Current Account. The Current Account item of current transfers from the rest of the world (income) contains subsidies (D.3) which are deducted by using the latest annual accounts data on the sector rest of the world. The Current Account item of current transfers to the rest of the world (expenditure) contains taxes on production and imports (D.2) which are deducted by using the latest annual accounts data on the sector rest of the world.

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

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

Net saving of the national economy is calculated by deducting all consumption expenditure (P.3, inclusive of general government consumption expenditure and private consumption expenditure) from net national disposable income. Adjustment for the change in net equity of households in pension fund reserves is not calculated in QNA because definitionally it nets to zero at the level of the whole economy and does not thus affect net saving.

8.5 Capital transfers, net lending/borrowing

The data source for capital transfers (D.9) is the capital account contained in the Current Account compiled by the Bank of Finland. Net lending/borrowing (B.9) 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 (D.9) - Capital transfers to the rest of the world (D.9) + Consumption of fixed capital (K.1) - Gross capital formation (P.5) - Acquisition less disposal of non-financial non-produced assets (K.2) - Statistical discrepancy.

Chapter 9 Flash estimates

9.1 Quarterly flash estimate of GDP

A quarterly flash estimate of gross domestic product is calculated by means of the Trend Indicator of Output, by summing up from monthly data. The flash estimate is released in connection with the Trend Indicator of Output at a lag of 45 days from the end of a quarter. 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, fully equivalent data cannot be used, and industries are not split into different sectors. Intermediate consumption as well as taxes and subsidies on products are not estimated in the compilation of the flash estimate, but quarterly GDP is carried forward with an annual change that is based on indicators of output.

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 value and prices of output is mainly estimated basing on data describing turnover and corresponding indices of producer prices, or data on wage and salary sums and indices of wage and salary earnings. The calculation is performed monthly with the annual overlap method. Except for the currently calculated quarter, chain-linked time series are benchmarked to correspond to quarterly and annual accounts. Monthly series are summed up to quarterly series. Quarterly series are seasonally adjusted with the TRAMO/SEATS method.

Literature

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