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Quarterly National Accounts Inventory of Austria

Description of Applied Methods and Data Sources

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Research assistance: Martina Agwi, Waltraud Popp

April 2007

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Research Study by the Austrian Institute of Economic Research commissioned by the European Commission, Eurostat, Statistics Austria

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Table of Contents

Chapter 1 Overview of the system of quarterly national accounts

This chapter gives an overview and can be read independently of the following. As for that, repetitions in the following chapters are quite intended in order to allow their separation.

1.1 Organisation and institutional arrangements

Whereas in Austria annual national accounts are set up by Statistics Austria, quarterly national accounts, as well as flash estimates are compiled by the Austrian Institute of Economic Research. The Austrian Institute of Economic Research is a private non-profit institute, independent in the choice of methods and data, which is laid down by the statutes of the Institute of May 6, 1952 rev. May 28, 1996. These statutes were deposited with the Austrian register of articles of association under no. XV-63.

The publication of quarterly national accounts is a public service, ordered and financed partly by the Austrian Ministry of Finance and partly by Statistics Austria. Flash estimates have been ordered and financed only by the Austrian Ministry of Finance.

1.2 Publication timetable, revisions policy and dissemination of QNA

Flash estimates are released within 45 days after the end of the reference quarter, at the latest. The exact date of publication is coordinated between the national statistic institutes and *Eurostat* to guarantee the simultaneous publication of the results with all EU member states. Regular disseminations are released within 70 days after the end of the reference period.

Revisions for the most recent quarters take place with every new publication of the quarterly figures. Theoretically, all those quarterly figures can be revised backwards for which no annual national accounts calculation, estimated independently from quarters, is available at the moment of revision. So, only data in the current and the preceding year are revised at most, if no new annual accounts information comes up.

For the regular publication, the results of the flash estimates are replaced by the regular national accounts estimation. At the time of setting up flash estimates, a revision of the results of the regular calculation of the previous quarter takes place. If new annual data are available, new econometric relationships are estimated on an annual basis. Hence, the quarters of the reference year and those of the preceding years are being revised. In Austria, this procedure is usually done at the same time as calculations for the regular dissemination of the second quarter (in September) are made.

1.3 QNA compilation approach

In principal, the Austrian QNA follows a top-down approach, where annual figures are broken down by appropriate indicator series of higher frequencies. This is also known as the benchmarking approach. Balancing is not based on supply-use tables, but some aggregates of the expenditure side of GDP are estimated by the commodity flow method, ensuring implicitly some supply-use consistency.

1.4 Balancing, benchmarking and other reconciliation procedures

In Austria, data on output are in general more reliable than concerning the expenditure or income side. This is true for annual as well as for quarterly national accounts. Therefore, GDP is mainly determined by the production side of national accounts. A mismatch between the production and expenditure side is recorded as statistical discrepancy in annual and quarterly national accounts. Nevertheless, the size of this discrepancy is used as an indicator for balancing both sides. This balanced GDP fully determines the income side with 'gross operating surplus and gross mixed income' (B.2*g+B.3*g) calculated as the residual, so that on the income side no statistical discrepancy is shown.

As in quarterly national accounts some components of the expenditure side are estimated by a commodity-flow approach, some consistency between supply and use is considered implicitly. In Austrian QNA the balancing process is only done for nominal values, as there does not exist any series of chained inventories.

In Austria, benchmarking can be seen as the general principal approach for distributing annual figures over quarters and for extrapolating beyond the time horizon of annuals. The decision for choosing the benchmarking approach in QNA is based on the fact that ANA is formed on a host of single series, which are either not available on a quarterly or monthly frequency or the consideration would be too much time consuming for providing fast QNA releases.

For benchmarking, two methodical approaches basically exist: Purely mathematical as well as statistical benchmarking techniques, where the distribution of annual to quarterly figures relies on their statistical relation at annual frequency, are applied.

1.5 Volume estimates

In order to derive volume estimates, in a first step price changes reflected in annual accounts are chain-linked for deriving index series. This annual index series is broken down to quarters by benchmarking techniques using indicator series available at subannual frequencies theoretically related to this and which are statistically significant in explaining annual variations. After applying this quarterly index series, a further benchmarking procedure is necessary in order to assure time consistency of resulting volume estimates.

The procedure is somewhat different for all components of the production side, where value added is not directly derived but as the difference between output and intermediate consumption. In this case, output prices are benchmarked as described before with a consecutive transformation of their benchmarked values by a benchmarked net quota in order to derive volume estimates. These resulting estimates are benchmarked with their annual equivalents. Following this, a value added deflator is derived directly in order to derive value added at current prices.

1.6 Seasonal adjustment and working day correction

In addition to original uncorrected data seasonally and working day adjusted data are published. At the moment only data adjusted for seasonal and working day effects are available, but no time series corrected for just one of the two effects. The working day correction is done within the framework of seasonal adjustment and relies on a regression approach. Depending on theoretical as well as on statistical properties, either only the number of working days as a whole, or separated by different weekdays are considered. They are derived from an Austrian specific calendar. Furthermore, the significance of potentially included leap year and Easter effects is tested.

Seasonal adjustment is done with the TRAMO-SEATS procedure, which enables a smooth change in the seasonal pattern over time. As this procedure requires good time series properties for making them suitable for statistical modelling no adjustment for chained series (in order to meet annual totals) is made. As chain linked volume series are not additive by definition, all series are adjusted by the direct approach. So aggregates are not calculated by summing up the several components.

1.7 Additional information

The publication time table for regular as well as flash estimates can be downloaded under:

http://www.wifo.ac.at/wwa/servlet/wwa.upload.DownloadServlet/documentpool/WIFO-KONJUNKTURBERICHTERSTATTUNG-ZEITPLAN.PDF

Results are available under http://www.oenb.at/ebusinesssdds/sdds#real

Related press releases are to be downloaded under
http://www.wifo.ac.at/wwa/jsp/index.jsp?&fid=12.

Chapter 2 Publication timetable, revisions policy and dissemination of QNA

2.1 Release policy

The flash estimates are released within 45 days after the end of the reference quarter. This is coordinated between the national statistic institutes and *Eurostat* to guarantee the simultaneous publication of the results with the other member states. Regular disseminations are released within 70 days. The precise dates for the release are published approximately one year in advance at the *WIFO* homepage

http://sww.wifo.ac.at/wifo/news/Publikationstermine_Schnellschaetzung.pdf

as well as on the IMF's Standard Bulletin Board (DSBB) at

http://dsbb.imf.org/Applications/web/sddsctycatarclist/?strcode=AUT

Using new information available, revisions take place with every new publication of the quarterly figures. They comprise only the reference year, the figures in the previous quarters are fixed. The results of the flash estimates are replaced by the regular national accounts estimation, and the actual flash estimates are revising the results of the regular calculation of the previous quarter. When new annual data are available, new econometric relationships are estimated on an annual basis. Then the quarterly figures in the reference year and those in the preceding years are revised. This process is usually done within the calculations for the regular dissemination of the second quarter (in September). For consistency, the calculation of quarterly institutional sector accounts uses the QNA as the benchmark, in order to be fully consistent with QNA.

2.2 Contents published

2.2.1 Regular disseminations

The press release of the regular calculation covers mainly the GDP expenditure approach. Regarding the production approach only the position 'Manufacturing' and 'Mining and quarrying' (NACE C+D) is displayed separately. Besides the unadjusted series, also seasonally and working day adjusted series are shown, whereas the former are published as year-on-year growth rates and the latter as quarter-on-quarter growth rates. A period of minimum two year is covered.

Actual press releases can be found at:

http://publikationen.wifo.ac.at/pls/wifosite/wifosite.wifo_search.search?p_typeid=98&p_language=1&p_type=0

The following components of the GDP expenditure approach are published in the press release:

- Final total consumption expenditure
  Final consumption expenditure of households (incl. NPISH[1])
  Final consumption expenditure of general government
- Gross capital formation
  Gross fixed capital formation
    Machinery and equipment capital formation
    Construction capital formation
- Gross domestic final expenditure
- Exports broken down in goods and services
- Imports broken down in goods and services

[1] Non-profit institutions serving households.

A more detailed disaggregation is published in the monthly bulletin of the WIFO, the *WIFO-Monatsberichte* as well as on the *WIFO homepage* at:

http://sww.wifo.ac.at/(en)/cgi-bin/tabellen/transtb2.cgi?3++netkonj+++++0+5913++1

These figures cover GDP production, GDP expenditure, and GDP income. Chained 2000 series are published in billion euros and in percentage changes from previous year.

Concerning the production approach, the aggregation level in the *WIFO-Monatsberichte* and on the *WIFO homepage* comprises the following activities (according to *NACE Rev.1)*:

- 'Agriculture, hunting and foresting' and 'Fishing' *(NACE A+B)*
- 'Manufacturing' and 'Mining and quarrying' *(NACE C+D)*
- Electricity, gas and water supply *(NACE E)*
- Construction industries *(NACE F)*
- Wholesale and retail trade, repair of motor vehicles, motorcycles and personal and household goods *(NACE G)*
- Hotels and restaurants (NACE H)
- Transport, storage and communication *(NACE I)*
- Financial intermediation *(NACE J)*
- Real estate, renting and business activities *(NACE K)*
- 'Public administration and defence, compulsory social defence', 'Education' and 'Health and social work' *(NACE L–N)*
- Other community, social and personal service activities *(NACE O)*.

The following components of the GDP expenditure approach are published:

- Final total consumption expenditure
  - Final consumption expenditure of households (incl. NPISHs)
  - Final consumption expenditure of general government
- Gross capital formation
  - Gross fixed capital formation
    - Machinery and equipment capital formation
    - Construction capital formation
- Gross domestic final expenditure
- Exports, goods and services
- Imports, goods and services

Regarding GDP side of income, the following time series are published in billion euros and as percentage changes from the previous year, at current prices and in volume (chain linked):

- Gross national income
- Consumption of fixed capital
- Net national income
- Net national disposable income

2.2.2 *Flash estimates*

The press release for the flash estimates shows only chain-linked quarter-on-quarter seasonally and working day adjusted series.

The production approach is broken down on the industry level A6:

- 'Agriculture, hunting and foresting' and 'Fishing' *(NACE A+B)*
- Goods producing sector excl. construction *(NACE C–E)*
- Construction industries *(NACE F)*
- 'Wholesale and retail trade, repair of motor vehicles, motorcycles and personal and household goods', 'Hotels and restaurants', 'Transport, storage and communications' *(NACE G–I)*
- 'Financial intermediation' and 'Real estate, renting and business activities' *(NACE J–K)*
- Other services *(NACE L–P).*

The following components of the GDP expenditure approach are published in the press release of flash estimates:

- Final total consumption expenditure
  - Final consumption expenditure of households (incl. NPISH[1])
  - Final consumption expenditure of general government
- Gross capital formation
- Exports
- Imports

[1] Non-profit institutions serving households.

Additionally, the regular *Business Cycle Report* appearing in the *WIFO-Monatsberichte,* covers and discusses the results of the actual flash estimates.

2.3 Special transmissions

Some institutions have access to the results one day before the official release:

In case of the regular release they are sent to:

Statistics Austria, Austrian Ministry of Finance and to the Austrian National Bank.

The results of the flash estimates are additionally sent to the *European Commission* one day before the official dissemination.

The units sent are similar to the publications mentioned above, completing the *ESA 95 Questionnaire*. No special data are generated for these institutions.

2.4 Policy for metadata

Austria's National Accounts subscribe to the *IMF's Special Data Dissemination Standard* (*SDDS)*. For details see:

http://dsbb.imf.org/Applications/web/basepagesmreport/?strcode=AUT&strcat=NAG00

Therefore we are following the commitment to observe a given standard and to provide information about the data production process and the data dissemination practices. In the new converted format, the *Data Quality Assessment Framework (DQAF),* the benchmark of the *IMF* ensures an even more comprehensive view on these facts.

Chapter 3 Overall QNA compilation approach

3.1 General architecture of the QNA system

In principal the Austrian QNA follows a top-down approach, where annual figures are broken down by appropriate indicator series of higher frequencies. This is also known as the benchmarking approach. Balancing is not based on supply-use tables. Some aggregates of the expenditure side of GDP are estimated by the commodity flow method, ensuring implicitly some supply-use consistency.

3.2 Balancing, benchmarking and other reconciliation procedures

3.2.1 Quarterly GDP balancing procedure

In Austria, data on output are in general more reliable than concerning the expenditure side. This is true for annual as well as for quarterly national accounts. Therefore, GDP is mainly determined by the production side of national accounts. A mismatch between the production and expenditure side is recorded as statistical discrepancy in annual and quarterly national accounts. Nevertheless, the size of this discrepancy is used as an indicator for balancing both sides. This balanced GDP fully determines the income side with 'gross operating surplus and gross mixed income' (B.2*g+B.3*g) calculated as the residual, so the statistical discrepancy is shown on the income side.

As some components of the expenditure side are estimated by a commodity-flow approach, some consistency between supply and use is considered implicitly. In Austrian QNA the balancing process is only done for nominal values, as there is no such series of chained inventories.

3.2.2 Benchmarking of QNA and ANA

Benchmarking can be seen as the general principal approach for distributing annual figures over quarters and for extrapolating beyond the time horizon of annuals. The decision for choosing the benchmarking approach in QNA is based on the fact, that ANA makes use of a host of single time series, which are either not available on a quarterly or monthly basis or the consideration would be too much time consuming for the provision of fast QNA releases.

As a principal, in Austria benchmarking is done by using indicators for distributing annual to quarterly figures accordingly. There are basically two methodical approaches. One is using an indicator series for a purely mathematical distribution of annuals to quarters and the other relies on establishing a statistical relation between annual data and the indicator series based on which the distribution is made.

The most prominent example for the first approach is the Proportional Denton Method, which is strongly recommended by the IMF[1]. For the second approach, the most appropriate method is based on the optimal regression method as proposed by *Chow – Lin* (1971), which is favoured by Eurostat[2].

Apart from being recommended by Eurostat, this approach has several appealing features, making it most appropriate for compiling Austrian QNA:

- More than one indicator can be used, which corresponds to the fact that annual aggregates to be distributed over quarters very often consist of many single series. So benchmarking can be made using at least a sub-sample of them.
- The appropriateness of the indicators cannot only be done on theoretical reasonings but also on the information given by the test statistics of the estimation procedure. Furthermore, some impression of the reliability of the output can be gained.
- The relation estimated can be used for extrapolating quarterly series beyond the time horizon covered by the annual benchmarks.
- For the residuals which cannot be explained by the indicator series, and explicit assumption for its evolvement can and has to be made. In the literature, several approaches for modelling the behaviour of this residual over time have been proposed.

For this kind of regression approach, the residuals unexplained by the indicator regression have to be modelled under the restriction that the quarterly totals sum up to annual benchmarks. In the original approach developed by *Chow – Lin* (1971) an AR (1) time series process had been assumed. Since then several further models have been proposed. *Fernandez* (1981) suggested a random walk behaviour and *Litterman* (1983) a development according to an ARIMA (1,1,0) process[3]. For both models the implicit assumption that residuals develop as an I(1) process is problematic because this would imply that the benchmark series and the indicator series are not cointegrated. Furthermore – according to a study of *Proietti* (2006) – the model proposed by *Litterman* (1983) is difficult to estimate in practice. As for that, in the Austrian QNA the *Chow – Lin* (1971) approach is favoured.

In those cases, where the test statistics suggests a modelling strategy as proposed by *Fernandez* (1981) or by *Litterman* (1983), outliers or breaks in the series are the reason in most cases. After modelling them by setting dummy variables, the *Chow – Lin* (1971) approach is suggested very often. If not, the model with the best test statistics is preferred. Depending of the plausibility of the resulting parameters and their statistical properties either the maximum likelihood or the least-square estimation method is applied.

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[1] See *IMF* (2001).

[2] See Handbook of Quarterly National Accounts (1999).

[3] Further amendments have been made by *Santos Silva – Cardoso* (2001) and *Di Fonzo* (2002) for a dynamic extension of the models.

When looking at the model's test statistics the following parameters are considered:

- The F-test for the overall fit of the model
- The t-test for the significance of the linear relation for each indicator
- The Durbin-Watson test statistic
- The Akaike Information Criterion
- The Jarque-Bera normality statistic
- The Box-Pierce and Ljung Box Q-statistics on normal as well as squared residuals
- The log-likelihood test statistic

Furthermore, the parameters of the regression are checked for their plausibility concerning their transfer of subannual variations like the seasonal pattern. So a regression parameter close to one – with the constant term close to zero – would mean a proportional transfer of the seasonal pattern from the indicator series to the quarterly output; values above one would indicate an amplification and below one a moderation.

All information like a variation in the number of working days, seasonal variation, special events, weather conditions, etc. are implicitly transferred to the output series, as long as they are reflected by the indicator series. The size of this transfer depends on the regression parameter which is itself determined by the fit between the annual benchmark series and the indicator series aggregated to annual sums or averages.

So if for some kind of service activities, monthly (average) employment figures are used as indicator series, no working day effect can be expected to show up in the quarterly output data, because employment itself shows no variation to a changing number of working days.

Nevertheless, there are some drawbacks connected to this regression approach. So it is implicitly assumed that the fit between the annuals acting as benchmarks and the sub-annual indicators aggregated to annuals carries information about size and the timing of the seasonal pattern of the 'true' quarterly figures. This can be problematic if the indicator series lags the 'true' values represented by the annual totals. This shift cannot be detected by this procedure. Instead the seasonal pattern of the regression output behaves only contemporaneously and adjusts wrongly the amplitude of the seasonal pattern according to the resulting misfit of annual series. So this method should be applied only if the indicator series seems to be appropriate for theoretical reasons, too and not only according to its test statistics.

For those series for which no appropriate indicator series is available, a distribution according a mathematical procedure is done. As a division by four would lead to steps in the series at the beginning of each year, the method (*BFL*) proposed by *Boot – Feibes – Lisman* (1967) is applied. This method disaggregates annual totals by minimizing their sum of squared differences between successive quarters under the restriction that they sum (or average) up to the annuals. The great advantage of this method is that produced time series evolve rather smooth over the whole time span, which implies rather low growth rates between successive quarters. Doing this such output only minimally distorts the behaviour of higher aggregates to which such series are summed up with others containing more information.

3.2.3 Other reconciliations of QNA different from balancing and benchmarking

No such reconciliations are applied.

3.2.4 Amount of estimation in various releases

As regards estimations due to benchmarking, nearly all series are concerned. In the first regular release, the last month of each quarter of the indicator series is missing for industries NACE C to G. This is the case also for some taxes and expenditure side positions like foreign trade and investment. This lack is covered by estimating based on econometric models. Considering the reduced weight resulting from the fact that only one month of the quarter is missing, approximately 20 percent of the first release is based on model estimates. The first revision, which is published with the following flash estimates, already covers the whole data set.

For other series, indicators are available in full or in a way that the data generation process is the same as for the regular release, apart from occasional balancing requirement.

3.3 Volume estimates

3.3.1 General volume policy

As the Austrian QNA system is based on benchmarking in principal, this goes also for prices used in the QNA framework. So, indicator series have to be found which are able to explain price developments of ANA in the past. For this, official index series are statistically checked for their appropriateness to do so. This series cover a wide area like retail and whole sale series, investment prices, deflators of wage series, export prices in other countries, etc. These Laspeyres type indices are taken to explain implicit price development of ANA.

Quarters at nominal values, at average prices of the current year and at average prices of the previous year are derived by this approach. Whereas the first both sum up to nominal annual figures of the ANA, the last sums up at previous year's price figures as published in the ANA. Using these three series, the one-quarter-overlap technique is applied in order to calculated growth rates. These growth rates compare the respective quarter with the fourth quarter of the previous years and are chained accordingly in order to construct an index. This index is rebased using the year 2000 as a reference in order to calculate absolute values.

Clearly this implies a loss of additivity possibly growing with the distance from the reference year. In the cross-section dimension, no procedures to force sub-aggregates to sum up to their higher aggregates are applied. Only in the time domain, quarters are adjusted to make them summing up to their chained totals.

3.3.2 Chain-linking and benchmarking

Benchmarking concerning volume estimates is done by regressing annual chained series from the ANA on quarterly indicators in order to get time series of absolute benchmarked values. This intermediate chaining process should not be confused with the chain-linking process according to the quarterly overlap procedure, which constructs volume estimates from quarters at average previous year's and average current years prices. Instead, this chaining process is necessary to apply benchmarking techniques which are based on absolute values[4]. For several industries of the supply-side, a net quota in absolute values (giving the input-output relation between chained annuals) is used to derive quarterly value added volumes form quarterly output. This quarterly net quota is derived by benchmarking it to give annual totals of chained net quota.

3.3.3 Chain-linking and seasonal adjustment

In Austria, seasonally adjustment is done after chain-linking volume series. This chain-linked series are corrected for neither in order to achieve additivity in the cross-section dimension (over aggregates) nor to make them summing up to annual chain-linked totals. This strategy has been chosen in order not to obstruct the time-series behaviour by adding some kind of difference. For the same reason, the one-quarter overlap method has been regarded as superior for constructing time series.

As chain-linking implies non-additivity, the direct approach for seasonally adjusted economic time series has been chosen in Austria. Consequently, all series are adjusted separately with the current price series derived from volume and price adjustment.

There are no figures available covering seasonally adjusted values at previous year's prices as they do not constitute time series in the narrower sense.

3.4 Seasonal adjustment and working day correction

Generally, in Austrian QNA Tramo-Seats is used for adjusting special effects like seasonal variation, calendar effects and detecting outliers. As for that, series to be cleaned for that have to show time series properties in order to enable a modelling strategy for adjustment. So no values at previous year's prices but only chain-linked series according to the one-quarter overlap method are used for processing, with no preceding correction for cross-section or time domain non-additivity.

Publication covers original (unadjusted) series as well as those adjusted for seasonal and working day effects. At the moment, no series adjusted just for seasonal or just for the working day component are produced.

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[4] In order to allow a clear distinction, in the following 'chaining' is used for the procedure at the intermediate level, whereas 'chain-linking' for the procedure to construct volume estimates from values at average previous and current year's prices.

Once a year with the upcoming of new ANA information, not only the benchmarking models are revised but also those used for seasonal adjustment. Parameters of these models are re-estimated every time a new quarter is calculated. Revisions following the adjustment process are covering the total length of the series.

In Austria, the estimation and correction of calendar and seasonal effects is only done on a quarterly basis, as there is no calculation of value added on a monthly basis.

Before seasonal adjustment is done a correction of possibly included outliers in the series has to be made. The following outliers are tried to be located:

- Additive outliers affecting the time series only at one point in time.
- Level shifts which shift permanently the mean of the series.
- Transitory components which influence the development of the series only for a limited time period. They can appear either as ramp effects, growing slowly over time and ending suddenly or appearing suddenly and dying out slowly.

These outlier effects are first of all estimated by an automatic procedure as it is implemented in the Tramo-Seats software package. This is a kind of stepwise detection of outliers according to a t-value criterion. The value of the t-value acting as the significance threshold can be either determined automatically or manually. In Austria, the latter option is used if there exists some additional external information about some outliers or the test statistics concerning the reliability of the model can be significantly improved by clearing for more outliers.

If there is a close contact between the observation of economic developments, the production of QNA and seasonal adjustment considerably improves the detection of outliers. As for that, the Austrian Institute of Economic Research sometimes models separate outliers with a complex structure which improve considerably the output.

3.4.1 Policy for seasonal adjustment

In Austrian QNA, Tramo-Seats is used for seasonal adjustment. Before running the seasonal detection process, time series are pre-cleaned for calendar effects, outliers and other possible deterministic elements. Seasonal factors or components (depending on whether the model is additive or multiplicative) are modelled as ARIMA processes, allowing a smooth change of the seasonal pattern over time.

For construction industry a weather effect is estimated additionally, as the seasonal component captures only average seasonal effects which can be better identified by preceding clearance for deterministic effects. This effect is only isolated for the proper identification of the seasonal variation but is included in the seasonally adjusted series.

No identities are preserved for volume data in order to not obstruct the time series properties of chain-linked data. This is only done after the seasonal adjustment process and makes only the quarters summing up to annual chain-linked totals. No cross-section additivity is resurrected.

3.4.2 Policy for working-day correction

Working-day correction is done before the seasonal adjustment process. The effects are estimated in a regression analysis framework as it is the case for other deterministic effects like other calendar effects (Eastern and leap year), outliers or weather effects.

All calendar effects are tested for their significance before they are considered in the final estimation process for extraction. The calendar used is Austrian specific as integrated in the Demetra software package. Only those calendar effects are submitted to statistical tests, which are theoretically founded. So for agriculture, no trading day is tested as production should not vary on the different number of working- or holidays but only a leap year variable is checked. For cleaning the output of the trading sector all days of a week are tested separately as the effect of the number of Fridays is possibly different from that of other days of the week.

Only working days of the Austrian calendar are used. This is important to notice because working days of other countries can potentially influence Austrian economic variables. So the tourism sector is not only subjected to working days of Austria but also of those of other countries[5]. In special cases artificial working days are additionally imputed. This can be the case if there is only a minor number of working days in-between two vacations, which make it likely that employees will bridge them with holidays. The same goes for the Easter effect, where in Austria usually an adequate number of days are located to the first and second quarter of the year.

Furthermore it has to be noted, that – at the moment – only one calendar is used for estimating all series. This can be a problem in some industries where working in shifts over the weekend (like in the paper or automobile production) is quite normal.

All this calendar effects are modelled that way that they cancel out over their respective time span. So the sum of the effects of the seven weekdays is by construction zero and also the sum of the leap year effects over a four year time span.

Contrary to the seasonal effect, calendar effects are supposed to be fixed over time. This assumption is sometimes challenged by innovations in the production process, changing working patterns or reactions to the business cycle. So the estimated working day effect can be regarded only as an average with the actual effect being higher in times of a booming economy and lower during recessions.

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[5] Based on theoretical reasonings this working day effect should be negative.

Chapter 4 GDP and components: the production approach

In Austria, results obtained from the production approach of national accounts are usually statistically more reliable compared to the expenditure approach. While for QNA publication the detail of breakdown is given by the ESA regulation, it is in most cases more detailed for the calculation process.

All input data used are tested for plausibility by benchmark quotas (like productivity) as well as by statistical techniques related to time series analysis. The special environment of the *WIFO* enables the additional use of expert knowledge of the individual research fields situated in the institute. So, occurring data problems (like outliers and breaks in the time series) can be interpreted neatly which improves considerably the models taking care for such specific features.

4.1 Gross value added, including industry breakdowns

Following the guidelines of the *IMF* (2001), quarterly value added should preferably be derived indirectly as the difference between output and intermediate consumption. Austrian QNA aims at this principle, as net quota are calculated in order to derive value added. In this case, the procedure is the following:

Production output is benchmarked by an indicator sub-annually available, which can be regarded as suitable on theoretical and statistical grounds. Implicit annual deflators (for output as well as for value added) are chained and benchmarked by appropriate subannual price series. The relation between output and value added is estimated by benchmarking the implicit net quota by the *BFL* (1967) method. Chained series and prices series are combined in order to derive values at average previous year's prices and average current year's prices.

4.1.1 'Agriculture, hunting and foresting' and 'Fishing' (NACE A+B)

Agricultural products being finalised within one quarter (like milk and eggs) are assigned to their respective period. Goods for which production takes longer than one quarter (nearly all plant products and other livestock products) are assigned to several quarters according their accrued costs. The approach is conforming to the 'alternative' method suggested for agriculture (*Eurostat,* 1999). Labour input is allocated according to production standards developed by *Handler et al.* (2006), labour costs are based on collective wage bargaining outcomes for hired labour for the year in question. Information on the allocation of other inputs and technology parameters are based on *BMLFUW* (2002). Factor shares of single activities are derived from the base-run result for 2003 of an agricultural sector model which is consistent with the EAA methodology (*Sinabell – Schmid,* 2003). The output of forestry is measured as the wood accumulated by the growth of trees and the expansion of forest land. The parameters of the estimates are derived from the recent Austrian forest inventory

(BFW, s.a.). The growth increment per quarter is based on the work of *Hasenauer* (2005) who differentiates between deciduous trees and conifers.

For compiling the volume measures, producer prices of agricultural products serve as indicator for temporal disaggregation of the annual deflator. A univariate optimal estimation technique is applied. The error structure of the residual suggests estimating the specification proposed by *Chow – Lin* (1971) with Maximum Likelihood.

4.1.2 Industrial sector (NACE C–E)

Value added of these industries is derived indirectly according the principles laid down in section 4.1. Therefore output and value added – both, at current prices and in volume terms – are identified separately.

For benchmarking annual production output, monthly indicators from the EU harmonized short term business cycle statistics covering the production of the relevant industry are used. For the temporal disaggregation the regression approach proposed by *Chow – Lin* (1971) as presented in section 3.2.2 is applied. Regarding the structure of the error term in the regression model, it is tried to model it as an AR(1) process and to estimate it by the Maximum Likelihood method as this approach possesses the best theoretical properties[6].

To find a quarterly output deflator, the implicit annual deflators are benchmarked by applying the same econometric technique as described above. As indicator series, whole sale price data covering crude oil products (NACE C), paper, machinery, steel and processed food (NACE D), electricity, gas and district heating (NACE E) are used.

Annual net quota, used for deriving value added from production output, are disaggregated by the mathematical *BFL* (1967) technique. So a smooth evolving net quota of which annual averages co-incide with the annual totals is derived. Clearly, this series does not show any seasonal variation.

Compiled quarterly value added volumes are cross-checked with employment figures in order to find possibly striking productivity abnormalities.

As at the time of compilation of the regular QNA estimates still one month of the respective quarter is missing, some imputation has to be made. For NACE D this is done by forecasting the indicator series for one month with an Autoregressive Distributed Lag Model. Doing this, a time series model is amended by using external information based on the monthly business survey, conducted by the Austrian Institute of Economic Research on behalf of the European Commission. For NACE C and E no such business survey information is available and a pure univariate time series approach has to be used instead.

[6] See, e.g., section 3.2.2 or *Santos Silva – Cardoso* (2001) or *Proietti* (2006).

4.1.3 Construction industries (NACE F):

Value added of the construction industry is derived indirectly according the principles laid down in section 4.1. Therefore output and value added – both, at current prices and in volume terms – are identified separately.

For benchmarking annual production output, monthly indicators from the EU harmonized short-term business cycle statistics covering the production of the relevant industry are used. For the temporal disaggregation the regression approach proposed by *Chow* – Lin (1971) as presented in section 3.2.2 is applied. Regarding the structure of the error term in the regression model, it is tried to model it as an AR(1) process and to estimate it by the Maximum Likelihood method as this approach possesses the best theoretical properties as already mentioned in section 4.1.2.

To find a quarterly output deflator, the implicit annual deflators are benchmarked by applying the same econometric technique as described above. As indicator series, price indices concerning building construction and civil engineering as published by Statistics Austria are used.

Annual net quota, used for deriving value added from production output, are disaggregated by the mathematical *BFL* (1967) technique. So a smooth evolving net quota of which annual averages co-incide with the annual totals is derived. Clearly, this series does not show any seasonal variation.

Compiled quarterly value added volumes are cross-checked with employment figures in order to find possibly striking productivity abnormalities.

As at the time of compilation of the regular QNA estimates still one month of the respective quarter is missing, some imputation has to be made. For NACE F this is done by forecasting the indicator series for one month with an Autoregressive Distributed Lag Model. Doing this, a time series model is amended by using external information based on the monthly business survey, conducted by the Austrian Institute of Economic Research on behalf of the European Commission.

4.1.4 Wholesale and retail trade, repair of motor vehicles, motorcycles and personal and household goods (NACE G)

Value added of NACE G is estimated indirectly with output and value added – both at current prices and in volume terms – being identified separately. For benchmarking annual production output, monthly turnover series from the EU harmonized short term business cycle statistics are used. So the assumption is implicitly made, that the trade margin (representing the output of NACE G) is linearly related to the turnover.

For the temporal disaggregation the regression approach proposed by *Chow – Lin* (1971) as presented in section 3.2.2 is applied. Regarding the structure of the error term in the regression model, it is tried to model it as an AR(1) process and to estimate it by the Maximum Likelihood method as this approach possesses the best theoretical properties as already mentioned in section 4.1.2.

The *IMF* (2001) points out, because of the trading margin, wholesaling and retailing encounter special difficulties in identifying the price dimension. Therefore, the price index for goods should not be used as a proxy deflator. But as there should be at least some minor linear relationship between gross value added deflators and turnover prices the *Chow – Lin* (1971) approach is applied here again. To find a quarterly output deflator, the implicit annual deflators are benchmarked by applying the same econometric technique as described above. As indicator series, price indexes covering retail sale, whole sale and motor vehicle trade as published by Statistics Austria are used.

Annual net quota, used for deriving value added from production output, are disaggregated by the mathematical *BFL* (1967) technique. So a smooth evolving net quota of which annual averages co-incide with the annual totals is derived. Again, this series does not show any seasonal variation.

As at the time of compilation of the regular QNA estimates still one month of the respective quarter is missing, some imputation has to be made. For NACE G this is done by forecasting the indicator series for one month with an Autoregressive Distributed Lag Model. Doing this, a time series model is amended by using external information based on the monthly business survey, conducted by the 'KMU-Forschung'.

4.1.5 Hotels and restaurants (NACE H):

Value added of NACE H is derived indirectly with output and value added – both at current prices and in volume terms – being identified separately. For benchmarking annual production output, monthly turnover series concerning foreign guests as well as domestic are used. The information of the number of nights spent in hotels is additionally taken into account for plausibility checks.

For the temporal disaggregation the regression approach proposed by *Chow – Lin* (1971) as presented in section 3.2.2 is applied. Regarding the structure of the error term in the regression model, it is tried to model it as an AR(1) process and to estimate it by the Maximum Likelihood method as this approach possesses the best theoretical properties as already mentioned in section 4.1.2.

To find a quarterly output deflator, the implicit annual deflators are benchmarked by applying the same econometric technique as described above. As indicator series, the COICOP 11 group covering tourism services of the Austrian harmonized consumer price index is used. Annual net quota, used for deriving value added from production output, are disaggregated by the mathematical *BFL* (1967) technique. So a smooth evolving net quota of which annual averages co-incide with the annual totals is derived. Again, this series does not show any seasonal variation.

4.1.6 Transport, storage and communication (NACE I):

For this GDP component so far all possible indicators failed to show a significant relationship with both, annual output and annual value added. Up to now the short-term business statistic concerning the service sector is still too short in order to establish a reliable and comparable temporal disaggregation. Therefore at the moment an approach where annual value added is directly broken down to quarters without estimating gross production value before is employed. This is done with the purely mathematical *BFL* (1967) distribution procedure, as described in section 3.2.2. It constructs the quarterly pattern based on past trends in the annual data. Following the assessment of the *IMF (2001)*, this process avoids any unexplained steps in the time series.

As no prices related to gross value added are available and value added deflators should show some dependency to price developments of intermediate consumption, a weighted price index covering indexes for electricity, gas and heating showed to be a proper indicator for the quarterly movements in the deflator.

4.1.7 Financial intermediation (NACE J)

4.1.7.1 Financial intermediation, except insurance and pension funding (NACE 65)

Value added of this industry is derived indirectly according the principles laid down in section 4.1. Therefore output and value added – both, at current prices and in volume terms – are identified separately.

For benchmarking annual production output, quarterly indicators of the Austrian banking statistics compiled by the National Bank are used. These are the sum of the returns of various banking activities and different interest rates combined with volumes of savings deposits and credits to households and firms, which should explain the FISIM component of production.

For the temporal disaggregation the regression approach proposed by *Chow – Lin* (1971) as presented in section 3.2.2 is applied. Regarding the structure of the error term in the regression model, it is tried to model it as an AR(1) process and to estimate it by the Maximum Likelihood method as this approach possesses the best theoretical properties as already mentioned in section 4.1.2.

To find a quarterly output deflator, the implicit annual deflators are benchmarked by applying the same econometric technique as described above. As indicator series for the quarterly deflator, a weighted sum of a calculated interest margin and of the published returns turned out to be a significant indicator for the quarterly pattern of the deflator. In order to find an appropriate fit of the annual series and the indicator series, the error term was constructed as proposed by *Litterman* (1983).

Annual net quota, used for deriving value added from production output, is disaggregated by the mathematical *BFL* (1967) technique. So a smooth evolving net quota with annual averages co-inciding with the annual totals is derived.

4.1.7.2 Insurance and pension funding, except compulsory social security (NACE 66)

Value added of NACE 66 is derived indirectly with output and intermediate consumption – both at current prices and in volume terms – being identified separately. As published data are not available within time limits, the computation of nominal output for other insurance services is based on the one-quarter-ahead forecast of the output indicator used for benchmarking. The forecast is based on timely available indicators used in a series of ARMAX-models for actual premiums earned and claims due in the life, health, property and liability insurance, respectively. Premium supplements and changes in technical provisions are forecasted at the aggregate level. The forecasts are then combined into an output indicator which differs from annual data for nominal output mainly due to reinsurance production and the omission of pension funds. The indicator is then used in the *Chow – Lin* (1971) approach with the error term estimated according to *Litterman* (1983). With a lag of one quarter, forecasts are substituted by actual data. The CPI items for insurance products serve as a timely indicator to distribute the annual change in the deflator over quarters and to compute the current quarters, using again the *Chow – Lin* (1971) approach. Nominal intermediate consumption is benchmarked using two indicators: claims due in the property liability insurance and imports of insurance services from the balance of payments statistics (not available at the moment). For the interpolation of the deflator for intermediate consumption the GDP deflator and a wage index in the insurance industry are used in a *Chow – Lin* (1971) approach.

4.1.7.3 Activities auxiliary to financial intermediation

For this GDP component so far all possible indicators failed to show a significant relationship with both, annual output and annual value added. Therefore an approach where annual value added is directly broken down to quarters without estimating gross production value before is employed. This is done with the purely mathematical *BFL* (1967) distribution procedure, as described in section 3.2.2. It constructs the quarterly pattern based on past trends in the annual data. Following the assessment of the *IMF* (2001), this process avoids any unexplained steps in the time series.

As no price series are available, too, again the *BFL* (1967) procedure is applied for inflating disaggregated value added in volume terms.

4.1.8 Real estate, renting and business activities (NACE K)

As data of activities belonging to this industry are rather scarce, the value added is directly disaggregated here, without calculating gross production value as an intermediate step. The table below gives for all subcategories the used indicators for benchmarking gross value added in volume terms and their respective inflators. In all cases where one or more indicators have been used, this was done with the *Chow – Lin* (1971) approach. If there were no indicators available the mathematical procedure proposed by *Boot – Fibes – Lisman* (1967) is used and *BFL* (1967) is indicated.

NACE	Description	Indicator for value added volumes	Indicator for value added deflator
NACE 70	Real estate activities	*BFL* (1967)	renting services out of CPI
NACE 71	Renting of machinery and equipment without operator and of personal and household goods	number of employees	*BFL* (1967)
NACE 72	Computer and related activities	number of employees	*BFL* (1967)
NACE 73	Research and development	*BFL* (1967)	*BFL* (1967)
NACE 74	Other business activities	number of employees	*BFL* (1967)

Up to now, series from the short-term business statistic concerning the service sector are still too short in order to establish a reliable and comparable temporal disaggregation. This will improve in the coming years and a change-over to this data source is planned.

4.1.9 Public administration and defence, compulsory social defence, Education, Health and social work (NACE L–N):

For these three activities value added is estimated directly by benchmarking chained volumes according to the number of employees using the *Chow – Lin* (1971) approach.

The estimation of the quarterly deflator incorporates the public sector wage index as regressor in the *Chow – Lin* (1971) benchmarking procedure. In this case the variability of the quarterly inflator was implausible high so that parameters had to be calibrated. From chained quarterly estimates and the inflator series, value added at average previous year's prices, at average current year's prices and nominal values are calculated. If necessary some benchmarking process has to follow in order to adjust results to their annual equivalents.

4.1.10 Other community, social and personal service activities (NACE O):

As data of activities belonging to this industry are rather scarce, the value added is directly disaggregated here, without calculating gross production value as an intermediate step. The table below gives for all subcategories the used indicators for benchmarking gross value added in volume terms and their respective inflators. In all cases where one or more indicators have been used, this was done with the *Chow – Lin* (1967) approach. If there were no indicators available the mathematical procedure proposed by *Boot – Fibes – Lisman* (1967) is used and *BFL* (1967) is indicated.

NACE	Description	Indicator for value added volumes	Indicator for value added deflator
NACE 90	Sewage and refuse disposal, sanitation and similar activities	*BFL* (1967)	sewage and refuse services out of CPI
NACE 91	Activities of membership organizations n. e. c.	number of employees	wage index of membership organizations
NACE 92	Recreational, cultural and sporting activities	number of employees	*BFL* (1967)
NACE 93	Other service activities	number of employees	hairdressing out of CPI

Up to now, series from the short-term business statistic concerning the service sector are still too short in order to establish a reliable and comparable temporal disaggregation. This will improve in the coming years and a change-over to this data source is planned.

4.1.11 Private Households (NACE P)

For this GDP component no indicators are available for disaggregation annual output and annual value added. Therefore an approach where annual value added is directly broken down to quarters without estimating gross production value before is employed. This is done with the purely mathematical *BFL* (1967) distribution procedure, as described in section 3.2.2. Like in the annual accounts, the ratio of output and value added is assumed to be 100 percent. This assumes that no intermediate consumption takes place and value added prices are fully determined by wage rises. As for that, it is assumed that prices change only at the beginning of each year and are held constant thereafter on a quarterly basis.

4.2 FISIM

According to the *Council Regulation 448/98* and the *Commission Regulation 1889/2002*, FISIM is regarded as intermediate consumption for the industries and as final consumption expenses and/or as exports or imports on the expenditure side.

Quarterly FISIM estimates are established using quarterly information on variations in the relevant interest rates and on the volume of savings deposits and credits of households and firms (for generation of FISIM see section 4.1.7.1. Regarding the allocation on the production side of GDP, intermediate consumption at industry level is not explicitly broken down into FISIM and other intermediate consumption. So FISIM consumed by production units is treated like any other intermediate product, e.g., like energy. It is implicitly considered by the development of net quota in the respective industry activity.

4.3 Taxes less subsidies on products

4.3.1 Taxes on production and imports (D.211, D.212, D.214)

Cash figures of taxes are adjusted to an accrual basis in order to relate better to the consumption activity of the reference period. Plausibility checks of the overall tax/spending ratio are made regularly.

4.3.1.1 Value Added Tax (D.211)

As the seasonal pattern on consumption is well pronounced, regarding the Value Added Tax (D211), heavy distorting effects can arise using intra-annually cash receipts. Therefore receipts are lagged by two months before aggregating to quarters, as it is done in ANA. At time of compilation, cash tax revenues of the federal government cover all three months of the reference quarter as well as one month of the following. The principle of accrual requires at least information of one additional month. To estimate this month, a univariate seasonal

ARIMA model is used. Furthermore, an adjustment in order to improve the relation to underlying consumption is made.

In order to derive quarters in volume terms, CPI is used for benchmarking the annual deflator, which possesses a rather good explanatory power. Benchmarking is done according to the *Chow – Lin* (1971) technique.

4.3.1.2 Taxes on imports (D.212)

Taxes on imports also comprise a quarterly estimate for the duties collected by countries located at the EU border but which are implicitly paid by Austrian importing units (the so called Rotterdam effect). This component is estimated using data on extra-EU trade in a regression model. The other part is determined by cash revenues from duties as recorded by the fiscal authority.

4.3.1.3 Other taxes on production (D.214)

Other taxes on production (D214) include recurrent taxes levied on products, property and fixed asses. In order to disaggregate annual data at current prices, an indicator is constructed by summing up all cash revenues at a monthly basis which contribute to this aggregate. Again, to deal with the accrual problem, a specific lag structure is used in the temporal disaggregation process, which is made according to the *Chow – Lin* (1971) approach.

4.3.2 Subsidies (D.31)

Distributing subsidies on quarterly figures is rather difficult. First of all they are very often granted at an annual basis and, secondly, even if they would be granted on a quarterly basis, cash payments have to be adjusted in order to get accrued data. Linking subsidies to production could be a method, but premiums for leaving fields uncultivated (set-aside premium) remain an open question. As there is a lack of specific information, the mathematical disaggregation method *BFL* (1967) of annual chain linked volumes is applied to estimate the quarterly subsidies, following the suggestions of *Eurostat* (1999). In special cases, additional background information concerning the seasonal structure is incorporated.

Chapter 5 GDP components: the expenditure approach

5.1 Household final consumption (P.31, S.14)

As household final consumption is the largest component of GDP by expenditure, a very detailed estimation procedure is used. The aggregate is classified into 12 groups according to the COICOP-System. Sources for the estimation of these components are usually sales and revenue statistics of the respective retail trade. As at the time when the estimates are compiled the quartely retail sales published by Statistics Austria are not yet available for the whole reference quarter, missing monthly data have to be forecasted. This is done by means of time series models, econometric techniques as well as combinations thereof (Reg-ARIMA models).

When employing time series models, a multivariate approach is used. In the deterministic part calender effects (like holidays and Easter effects) are considered and special effects (like certain developments in gross salaries due to fiscal measures, changes in recording methods, and faulty reporting) are included by way of an outlier detection method. The applied outlier detection techniques *Chen – Liu – Hudak* (1990), *Thury – Wüger* (1992), *Brandner – Schubert* (2000) in an iterativ approach simultaneously estimate the parameters of the model as well as the outlier effects. In every step every observation of the time series is tested for an additive outlier (an event that affects a time series at a single date), a level shift (a permanent change in the data generating process), an outlier in the error term (an innovation in the process) or a transitory effect (which dies away as time proceeds). After identifying the outlier, it will be corrected appropriately. These three steps, i.e., identifying the outliers, adjusting for them, and estimating the model parameters, are repeated until no more outlier is found[7].

After removing the deterministic part, the rest of the series is specified as an ARIMA model including a regular and seasonal part. The regular part includes the trend and the cycle, whereas the seasonal part accounts for the regular effects occurring during the year. Hence, this multivariate time series model uses calender and special effects as well as cyclical, trend, and seasonal factors for the explanation and the forecasts of sales developments.

When econometric causality models are used to forecast sales figures for certain branches of the retail sector, the figures are explained with the total sales statistics for the retail sector . The differences in the seasonal pattern of a given branch and of the retail sector as a whole are taken into account. Apart from that, appropriate business cycle indicators (for retail sales) and already available sales figures from KMU-Forschung[8] are included. If diagnostic checks of

[7] The outlier detection approach offers an advantage compared to so called 'interventions models'; the date of the special effects does not have to be known.

[8] This private institute conducts business surveys especially in small and medium-sized Austrian enterprises.

the residuals are not satisfactory, they are modelled with an appropriate ARIMA model (thus a Reg-ARIMA model is constructed).

At the end all the respective results (from time series models, econometric and/or Reg-ARIMA approaches) are pooled, resulting in a general outcome which now includes information obtained by different procedures.

To ensure consistency between quarterly and annual figures, the benchmarking method proposed by *Chow – Lin* (1971) is used. In this 'optimal' solution framework, quarters are derived by estimating a systematic component and an adjustment term, obeying some time series specification.

The quarterly estimation of private consumption expenditure of households is based on the development of the most contributing items of each group. The development at current prices of these items is taken as an indicator for the overall development of the group.

The indices of turnover of retail trade is the only source for the groups 'Food and non-alcoholic beverages', 'Clothing and footwear', and 'Recreation and culture'.

'Furnishings, household equipment and routine maintenance of the house' and 'Health' are based on this source as well as appropriate data of value added as derived in the production approach for the specific industry.

Information on 'Transport' comes from the retail trade statistic and the number of registrations of new passenger cars, the number of passengers in city transportation and transport in the air, and consumption of fuels and lubricants for personal transport.

'Education' and 'Restaurants and hotels' are based on a value added data set as derived in the production approach for the specific industry, only.

For 'Alcoholic beverages, tobacco' information on production of beer in Austria (Verband der Brauereien) and turnover of tobacco (Austria Tabak GmbH) is used.

'Housing, water, electricity, gas, and other fuels' are based on appropriate indices (water supply, electricity, etc.).

Information for 'Communications' is based on the operating revenues of Telekom Austria.

For 'Miscellaneous goods and services' the same percentage changes are assumed as shown in the sum of the other groups.

The development of international tourism expenditures is the basis to estimate the expenditures abroad by Austrian residents and non-residents in Austria.

In general, annual chain-linked volume measures are disaggregated with the *Chow – Lin* (1971) approach according to the above mentioned indicators. For inflating those figures in order to get values at previous and current year's average prices, annual inflators are disaggregated by using the official statistic of turnover of retail trade and items covered by the HCPI.

5.2 Government final consumption (P.3, S.13), split-up in individual (P.31) / collective consumption (P.32)

Government final consumption consists primarily of non-market goods and services produced by the government. Therefore government final consumption expenditures are closely linked to output estimations. As for that, quarterly figures can be derived using values from the production side as indicators. One time factors causing differences between government output and government consumption are accounted for by implementing dummy variables. Individual and collective consumption are derived independently from each other.

Individual consumption of the government (P.31, S.13) absorbs large parts of the output produced by the industries 'Education' (NACE 80) and 'Health and social Wor'k (NACE 85). Therefore a strong relation for annual data to this supply side aggregates is found. The *Chow – Lin* (1971) procedure is used to break down annual totals at current prices to quarters. As public sector output is mainly determined by costs, wage deflators play a significant role to determine public consumption deflators. Therefore, wage indexes of the public sector are used to disaggregate annual chain-linked deflators. By means of this, values at current and previous year's average prices are calculated.

Regarding the collective consumption (P.32, S.13) – theoretically as well as empirically – there exists a strong relationship to the output produced by the industry 'Public administration and defence' (NACE 75). The procedure is the same as presented for the calculation of 'individual consumption of the government' (P.31, S.13). Again information about wages and salaries are used as indicators in order to benchmark annual deflators.

5.3 NPISH's final consumption (P.31, S.15)

As there is no specific information available concerning this area, the output activity producing this type of consumption services is a natural candidate for disaggregating annual NPISH's final consumption. By means of the *Chow – Lin* (1971) benchmarking procedure annual totals at current prices are broken down to quarters using the quarterly output of NACE 91 'Activities of membership' as an indicator.

As output of this activity is mainly determined by costs, wage deflators play a significant role to determine NPISH's consumption deflators. Therefore, wage indexes of this activity are used to disaggregate annual chain-linked deflators, which is done with the *Chow – Lin* (1971) approach. By means of this, values at current and previous year's average prices are calculated.

5.4 Gross capital formation

5.4.1 Gross fixed capital formation (P.51, TPI6)

5.4.1.1 Agriculture capital formation (P.51, PI61)

For this component no subannual information is available which would allow a distribution accordingly. Therefore an approach where annual chain-linked volumes are directly broken down to quarters is employed. This is done with the purely mathematical *BFL (1967)* distribution procedure, as described in section 3.2.2. It constructs the quarterly pattern based on past trends in the annual data. Following the assessment of the *IMF* (2001), this process avoids any unexplained steps in the time series.

As an indicator capable to explain variations of the annual chain linked deflator, whole sale prices of agricultural products are used in a *Chow – Lin* (1971) benchmarking framework in order to derive quarterly deflators.

5.4.1.2 Machinery and equipment capital formation (P.51, PI62)

In order to break down annual totals of machinery and equipment capital formation (P.51, PI62) *Chow – Lin* (1971) method is used. Several indicators, representing a commodity flow approach are used. One index represents the quarterly domestic supply of equipment in metal products and machinery is the gross production value NACE D and two further indicators cover imports and exports of machinery and transport items (according to SITC classification). Several dummy variables are included to adjust for structural breaks. The quarters derived with this regression approach are deflated by prices, which are itself the output of a *Chow – Lin* (1971) benchmarking model. Here weighted wholesale prices of machinery are used as an indicator to break down annual chain-linked deflators.

5.4.1.3 Transport equipment capital formation (P.51, PI63)

The procedure used for deriving quarterly investment in transport equipment is similar to section 5.4.1.2. Again a commodity flow method is used which considers the production value of automobile industries (NACE 34 + 35) plus imported transport items minus exported transport items (according to SITC classification) minus final consumption of transport equipment. These subannual series are used in a *Chow – Lin* (1971) regression model in order to benchmark investment in transport equipment at current prices.

For breaking down annual chain-linked deflators, wholesale prices for transport equipment (like trucks) are used for setting up a *Chow – Lin* (1971) regression model.

5.4.1.4 Construction capital formation (P.51, PI64 + PI65)

In the estimation procedure, capital formation in construction is split into 'Housing' (P.51, PI64) and 'Other construction' (P.51, PI65). For the component 'Housing', there exists better subannual information than for the subgroup 'Other construction'. Sources used in the estimation process of quarterly figures for housing comprise production values of construction of residential building and restoration work on building, as collected and compiled by the short-term business survey. The *Chow – Lin* (1971) method is used to relate indicators to capital formation at current prices and to ensure consistency between quarterly and annual figures. Volume estimates are calculated by benchmarking annual chain-linked deflators by the official residential construction price index.

The indicator to estimate non-housing construction capital formation is obtained as residuum from estimating total construction investment (related to total construction output) and housing capital formation. Information for the division into housing and non-housing capital formation is additionally drawn from the results of the WIFO monthly business survey conducted on behalf of the European Commission. It relates to the indicator of order stocks in both residential construction and other construction industries. For deriving the quarterly deflator the total construction index is taken as the indicator in a benchmark framework.

5.4.1.5 Others (P.51, PI66)

Other capital formation mainly relates to intangible capital assets. Quarterly distribution is measured with a commodity flow method considering three indicators: production of the industries 'Computer and related industries' (NACE 72), imported computer services and exported computer services. Using these three indicators, a *Chow – Lin* (1971) benchmarking model is set up in order to brake down annual investment at current prices.

As no indicator for disaggregating annually chained deflators in this category is available, the mathematical *BFL* (1967) technique is used in order to break down figures. These are used in order to calculate other investment at average current and previous year's prices.

5.4.2 'Changes in inventories' and 'Acquisition less disposals of valuables' (P.52, P.53):

5.4.2.1 Changes in inventories (P.52)

In Austrian ANA there is a residual component representing the difference between production and expenditure side of GDP, called statistical discrepancy. As there is no indicator available to calculate quarterly changes in inventories, the difference between production and expenditure side is derived together with the statistical discrepancy. In order to separate this quarterly series of changes of inventories at current prices from the statistical discrepancy, the seasonal component is extracted from the aggregate and assigned to the changes in inventory part. The idea behind is that only changes in inventories should show a seasonal variation but not the remaining statistical discrepancy.

The difference from summing up this seasonal pattern to annual totals of inventories is distributed according the mathematical *BFL* (1967) benchmarking method. Quarterly final statistical discrepancy is again calculated as the residual between both sides of GDP.

As no price information concerning the quarterly development of changes in inventories is available, annually chained deflators are broken down by the mathematical *BFL* (1967) method. From this quarterly series, inventories at current and previous year's average prices are calculated. Changes in inventories are only published in levels at current prices.

5.4.2.2 Acquisition less disposals of valuables (P.53)

Annual series of acquisition less disposals of valuables at current prices are disaggregated with the *Chow – Lin* (1971) regression model, using sales statistics of *Münze Österreich* as an indicator.

The same type of model is used for benchmarking the annually chained deflator taking quarterly averages of the gold price as indicator.

5.5 Exports and imports of goods and services (P.6, P.7)

Due to its specific nature and their importance for the Austrian economy, services and tourism are estimated separately.

5.5.1 Exports and imports of goods (P.61, P.71)

Information on exports and imports of goods are well available on a monthly basis from the foreign trade statistic of Statistics *Austria.* They are used as a benchmarking indicator because their definition does not exactly match with the one used in National Accounts (cif/fob corrections; duties collected by countries located at the EU border but which are implicitly paid by Austrian importing units; including maintenance services in the NA framework but not according to the trade statistics definition). Benchmarking is done according the *Chow – Lin* (1971) approach considering structural breaks caused by recent changes in the classification by dummy variables.

A problem is that foreign trade statistics are revised every month. As revisions are often substantial, information obtained from univariate time series must be additionally taken into account to find a more robust estimation for QNA.

As at the moment there is no obligation to split goods geographically, it is not implemented yet. But as this information is available in the foreign trade statistics, this can be implemented easily in quarterly national accounts, in the future.

In order to derive estimates in current and previous year's average prices, annually chained deflators are benchmarked using the *Chow – Lin* (1971) regression approach. As up to now no foreign trade price statistic is available in Austria, German international trade price indices adjusted for our country-specific import/export basket of goods are used instead.

5.5.2 Exports and imports of services (P.62, P.72)

Information for quarterly figures of exports and imports of services and tourism is taken from the balance of payments statistics. Generally, this serves as a reliable source, but because of some readjustment process in the past, additional information, such as the number of overnight stays in hotels of tourists coming from abroad, is used. To derive the quarterly pattern in order to fulfil the constraint of the annual figures, the *Chow – Lin* (1971) method is used.

For tourism exports current values are deflated by a special index consisting of several HCPI components covering tourism related services. For tourism imports an index partly determined by CPI positions covering the cost of living abroad and partly by weighing together the CPIs of holiday destination countries of Austrian tourists. These weights are taken from the European Travel Monitor.

For services other than tourism, the CPI sub-category covering services is taken for exports and imports as well. In all cases indicator series are used within a *Chow – Lin* (1971) benchmarking framework in order to derive quarterly series from annually chained deflators, which can be used for calculating current and previous year's average prices.

Chapter 6 GDP components: the income approach

6.1 Compensation of employees (D.1)

In order to derive indicators suitable for benchmarking annual totals of compensations, the quarterly number of employees broken down by A6 aggregates (see chapter 7) is multiplied by respective wage indices.

These wage indexes do not reflect the effective wage increase but those agreed on in the collective bargaining process. Nevertheless, they should be closely related to effective as long as the relative wage drift shows no long-term trend.

Following indexes are used

NACE A+B	Wage index for employees in agriculture
NACE C+D+E	Industrial wage index
NACE F	Wage index for construction workers
NACE G+H+I	Wage index for trade, for tourism, for transport
NACE J+K	Wage index for employees in banking and insurance
NACE L to P	Wage index for employees in public services

These indicators are used together with the *Chow – Lin* (1971) regression method in order to get quarterly compensations at the A6 breakdown, consistent to annual figures.

Wages and salaries are calculated from these compensation figures by holding constant the annual relation between compensations and wages (employer's contribution rate) over the year. For extrapolation it is assumed, that the relation of the previous year is maintained.

As a control, the sum over all industries is compared to social security pension contributions per quarter.

6.2 Taxes less subsidies on production (D.2–D.3)

6.2.1 Taxes on production (D.2)

Taxes on production are defined as the sum of taxes on products (D.21), which have been described in section 4.3, and other taxes on production (D.29). The latter are estimated by benchmarking annual totals by an indicator which is derived from the official tax revenue statistic. This indicator covers 60 percent at least of other total taxes on production (D.29). Again, the *Chow – Lin* (1971) approach is used as the regression framework for benchmarking.

6.2.2 Subsidies on production (D.3)

Subsidies on production are defined as the sum of subsidies on products (D.31), which have been described in section 4.3, and other subsidies on production (D.39). As outlined in section 4.3 even for subsidies on products, which are somewhat related to production, theory is a poor guide for breaking down annual to quarterly figures. The more this is true for the position 'Other subsidies on production' (D.39). As for that, no benchmarking is done but quarters are derived through division of the annual figures by four. The idea behind this is the assumption that the donor giving this kind of subsidies at an annual frequency would mentally distribute them equally over the year, at least on an accrual basis.

6.3 Gross operating surplus and gross mixed income (B.2*g + B.3*g)

Like in ANA the sum of 'Gross operating surplus' and 'Gross mixed income' is derived as a residual. In fact, this position is formed by the difference between GDP as determined by the production approach and the sum of compensation of employees (D.1) and taxes less subsidies on production (D.2 – D.3).

Chapter 7 Population and employment

7.1 Population (POP)

As there are no statistics or indicators which would give information about the sub-annual development of the population, the mathematical procedure (*BFL*) as proposed by *Boot – Feibes – Lisman (1967)* is used for distributing annual to quarterly figures. For extrapolation the official annual population forecast is used.

7.2 Employment (ETO)

The regular quarterly employment dissemination covers both employees and self-employed broken down by industry A6, measured by thenumber of jobs. In some cases, where it is necessary and possible, estimation takes place at a more detailed breakdown, with a final aggregation to the A6 level. Corresponding to the annual national accounts, figures for both employees and self-employees contain resident employed by resident and non-resident producer units. All indicator series used are tested for plausibility by benchmark quotas (for example productivity).

7.2.1 Employees (EEM)

Consistent with all GDP approaches, for most industries an optimal solution benchmarking model on the basis of a linear regression involving quarterly explanatory variables is used. The industry breakdown for the estimation process is the same as for the GDP production approach. As indicators, quarterly employment data by the *Federation of Austrian Social Security Institutions* (measured in jobs) were able to explain the annual variations in most cases. In some industries there exists a certain mismatch regarding both, the classification and the terms of measurement of employees between the definition in the national accounts framework and the *Federation of Austrian Social Security Institutions*. This mismatch is considered in the compilation of the QNA. Further, if structural breaks (for example shifts in the indicator series) are identified, dummy variables are used.

For those industries, which show only minor differences between the employment classification of the *Federation of Austrian Social Security Institutions* and national accounts, the *Chow – Lin* (1971) specification is used. For the industries '*Agriculture, hunting and forestry' and 'Fishing' (NACE A+B)* and *Wholesale and retail trade, repair of motor vehicles, motorcycles and personal and household goods (NACE G)* according to the test statistics, a random walk structure for the error term was specified.

For industries where the recorded employees of the benchmark statistics differ too much from the national accounts concept (incorporating decisively more or less employees), certain adjustments are applied in the estimating process. This is mainly the case for the industries in the public sector domain. One way to adjust is to calibrate the regression parameter. This forces the estimated series to follow a more/or less pronounced seasonal pattern compared to the indicator series. Another applied method is to use the regression pattern of the indicator series only for a part of the series, while allocating the rest proportionally. If for example, the national accounts framework uses a wider classification than the indicator series, only a fraction of the new quarterly series follow the pattern of the indicator, for the rest a proportional distribution is assumed. This could result in a minor step problem at the beginning of each year.

The following table gives an overview:

NACE A+B:	Optimal methods, Error structure: random walk
NACE C–F:	Optimal methods, Error structure: AR(1)
NACE G:	Optimal methods, Error structure: random walk
NACE H–L:	Optimal methods, Error structure: AR(1)
NACE M:	Adjustments
NACE N:	Optimal methods, Error structure: random walk with drift
NACE O+P:	Adjustments

At the end, summing up these industries enables to explore a cross-check with the aggregate employees published by the *Federation of Austrian Social Security Institutions*, adjusted for persons in the military service, maternity leave and marginally employed persons *(Geringfügig Beschäftigte)*.

7.2.2 Self-employed (ESE)

In order to derive quarters of the self-employed persons, no sub-annual indicators of a quality similar to employees are available. The main source used is the quarterly *Labour Force Survey* which is derived from a micro-census. The survey focuses on persons whereas QNA figures are related to the number of jobs. Regarding the volatility of the series, adjustments have to be made concerning multiple job holders. Further, the *Labour Force Survey* is not available at the recent time margin. In order to complete missing data, a univariate time series forecast of one quarter is necessary. As to the limited sample size of the survey the output shows large variations, in order to reduce them to a plausible size, cross-checks with industry-specific output are important. For quarterly disaggregation the following methods are applied at the industry level A6:

NACE A+B:	Pro rata distribution added on a fixed base
NACE C–E:	Optimal methods, Error structure: ARIMA (0, 1, And 1)
NACE F:	Optimal methods, Error structure: AR(1)
NACE G–I:	Optimal methods, Error structure: AR(1)
NACE J–K:	Pro rata distribution
NACE L–P:	Optimal methods, Error structure: ARIMA (0,1,1)

7.3 Total hours worked: Employment

Total hours worked are often considered as the preferred indicator concerning the measurement of productivity. Despite this fact, information available for the compilation of the quarterly series often falls short and must be chosen with caution. The annuals are derived by Statistics *Austria.*

In the regular quarterly employment dissemination the component is broken down into employees and self-employed on industry level A6. The series are derived on the lowest possible level and aggregated at the end.

7.3.1 Total hours worked: Employees

Total hours worked of employees are benchmarked using various sources. For industries *NACE C-F* the relevant short-term business survey gives appropriate monthly information of hours worked. Concerning the definition of hours worked the statistics matches closely to the definition to be used in the national accounts framework. Due to the good fit for annuals, it is used as a quarterly indicator in a benchmarking framework. For the other industries such data are not available. To derive the quarterly pattern, information about employees as well as about the output of relevant sectors is incorporated. A calculated ratio between part-time and full-time jobs (from the *Labour Force Survey*) serves as cross-check.

7.3.2 Total hours worked: Self-employed

Concerning hours worked by self-employed, data from the *Labour Force Survey* (and its univariate forecast for the recent time margin) serve as the background. Again extern information is taken into account additionally. For the industries *NACE C– F* results of the monthly business survey conducted by *WIFO* on behalf of the *European Commission* are used to find a plausible distribution of annuals on quarters.

Chapter 8 From GDP to net lending/borrowing

8.1 Primary income from/to the ROW (D.1 to D.4), gross national income (B.5*g)

The positions primary income from and to the rest of the world (ROW) are estimated by their several components: factor income from labour (compensation of employees) from/to the ROW, factor income from property (property income) from/to the ROW, taxes on production and imports to the ROW and subsidies from the ROW. Gross national income is derived by adjusting GDP at current prices by the net flows of the before mentioned positions.

8.1.1 Compensation of employees (D.1) from/to the ROW

In the Austrian Balance of Payments (compiled by the Austrian National Bank) quarterly information concerning labour income from and to the rest of the world is available. This position forms part of the respective component of the national accounts external balance which makes this position suitable for breaking down annual national account's figures. For benchmarking, both series are used in the framework proposed by *Chow – Lin* (1971).

8.1.2 Property income (D.4) from/to the ROW

In the Austrian balance of payments (compiled by the Austrian National Bank) quarterly information concerning property income from and to the rest of the world is available. This position forms part of the respective component of the national accounts external balance which makes this position suitable for breaking down annual national account's figures. For benchmarking, both series are used in the framework proposed by *Chow – Lin* (1971).

8.1.3 Taxes on production and imports (D.2) to the ROW

Taxes on production and imports to the rest of the world are derived by summing up the two balance of payments positions 'Production and import related taxes and the 'UK correction payments to the EU budget'. Furthermore, the import taxes implicitly paid by Austrian importing units (Rotterdam effect) as imputed for calculating domestic taxes on imports are added. This aggregate summed over the quarters comes very close to the respective annual national accounts position. Therefore, the quarterly aggregate is used and the difference to annual totals is spread according the *BFL* (1967) method.

8.1.4 Subsidies (D.3) from the ROW

By concept, this position consists mainly of two kind of subsidies related to agriculture paid by the EU budget to Austria. These payments are recorded in the balance of payments and their sum corresponds closely to the respective position in annual national accounts. Therefore, it is used in a *Chow – Lin* (1971) benchmarking framework using it as a regressing variable.

8.2 Consumption of fixed capital (K.1), net national income (B.5*n), acquisition less disposals of non-financial non produced assets (K.2)

According to definition, net national income is calculated by subtraction of consumption of fixed capital (K.1) from gross national income (B.5*g) as derived in section 8.1.

8.2.1 Consumption of fixed capital (K.1)

As capital stock is not calculated on a quarterly basis, subannual nominal consumption of fixed capital is derived by distributing annual totals according to the mathematical *BFL* (1967) method. For quarters to be extrapolated, a forecast of annual figures is made considering the dynamic of investment at current prices in the recent past.

8.2.2 Acquisition less disposals of non-financial non produced assets (K.2)

In the Austrian balance of payments quarterly acquisition less disposal of non-financial non produced assets (K.2) sum perfectly up to annual totals of the national accounts foreign account. As for that, quarterly values are overtaken without any changes in quarterly national accounts.

8.3 Current transfers from/to the ROW (D.5 to D.7), net national disposable income (B.6*n)

According to definition, net national disposable income is calculated by subtraction of net current transfers from/to the rest of the world (D.5 to D.7) from net national (B.5*n) income as derived in section 8.2.

8.3.1 Current transfers (D.5 to D.7) from the ROW

In the Austrian balance of payments (compiled by the Austrian National Bank) quarterly information concerning current transfers from the rest of the world is available. This position correlates strongly with the respective component of the national accounts external balance. As for that, this position seems suitable for breaking down annual national account's figures with a benchmarking method. The approach proposed by *Chow – Lin* (1971) is used.

8.3.2 Current transfers (D.5 to D.7) to the ROW

In the Austrian balance of payments (compiled by the Austrian National Bank) quarterly information concerning current transfers from the rest of the world is available. As this aggregate also includes production and import related taxes and the UK correction, which already recorded in the external balance under D.2 (see section 8.1.3), they have to be subtracted from it. The residual correlates strongly with the respective component of the national accounts external balance. As for that, this position is taken for breaking down annual national account's figures with the *Chow – Lin* (1971) benchmarking method.

8.4 Adjustment for the change in net equity (D.8), net savings (B.8*n)

Net saving (B.8*n) is derived by adjusting net disposable income (B.6*n) as deduced in section 8.3 by adjusting it for consumption expenditures (P.3) at current prices and changes in net equity (D.8). The latter position is taken over from the Austrian quarterly balance of payments (compiled by the Austrian National Bank), as it is fully consistent with annual national accounts.

8.5 Capital transfers (D.9), net lending/borrowing (B.9)

Capital transfers (D.9) from/to the rest of the world are derived by summing up capital transfers of the private and the public sector as published in the Austrian balance of payments. This sum matches perfectly to the figures published in annual national accounts respective position, so no further benchmarking is required.

Net lending or borrowing (B.9) is calculated by correcting net saving (B.8*n) by net capital transfers (D.9), net acquisition less disposals of non-financial non produced assets (K.2) and net investment. The latter position is derived by subtracting consumption of fixed capital (K.1) from gross fixed capital formation (P.5).

Chapter 9 Flash estimates

The calculation of flash estimates is embedded in the framework of the regular quarterly national accounts and follows the data generation process of the regular estimates. As for that, the methodical description for flash estimates is the same as for regular disseminations, and only methods for circumventing the lack of data at the recent time margin remain to be explained.

The advantage of compiling flash estimates within the same framework as regular releases, explained also in *Savio (2002),* is that it is possible to revise the results of the previous quarter during the process of the flash estimates. Such an update of past observation is of great benefit for compiling flash estimates, as the lack of data at the recent time margin is usually bridged by time series methods, relying heavily on the quality of observations of the most recent past.

The following data are published in accordance with the release calendar proposed by Eurostat not later than 45 days after the end of the reference period:

	nominal		real[1]	
	unadjusted	adjusted[2]	unadjusted	adjusted[2]
GDP-production side	✓	✓	✓	✓
Gross value added NACE A+B	✓	✓	✓	✓
Gross value added NACE C+D+E	✓	✓	✓	✓
Gross value added NACE F	✓	✓	✓	✓
Gross value added NACE G+H+I	✓	✓	✓	✓
Gross value added NACE J+K	✓	✓	✓	✓
Gross value added NACE L	✓	✓	✓	✓
Gross value added NACE M+N+O+P	✓	✓	✓	✓
Taxes less subsidies on goods production	✓	✓	✓	✓
GDP-expenditure side	✓	✓	✓	✓
Consumption of private households	✓	✓	✓	✓
Consumption of public households	✓	✓	✓	✓
Gross capital formation	✓	✓	✓	✓
Export	✓	✓	✓	✓
Import	✓	✓	✓	✓
GDP-income side	✓	✓		
Compensation of employees	✓	✓		
Consumption of Capital	✓	✓		
Taxes on production less subsidies	✓	✓		
Labour market				
Number of employees in NACE A+B			✓	✓
Number of employees in NACE C+D+E			✓	✓
Number of employees in NACE F			✓	✓
Number of employees in NACE G+H+I			✓	✓
Number of employees in NACE J+K			✓	✓
Number of employees in NACE L			✓	✓
Number of employees in NACE M+N+O+P			✓	✓

[1] For monetary aggregates absolute values are chained 2000 euros. – [2] Adjusted for seasonal and working day effects.

9.1 Flash GDP estimate

In Austria, flash estimates are derived in the same manner as regular releases. As used indicator series are too short for reaching the required time margin, they have to be extended by econometric means. This is done by multivariate time series models. Unlike univariate time series models, they allow new external information to be considered in estimates for the missing months. This improves the possibility of detecting cyclical turning points at an early stage, which univariate time series models do not offer[9].

For Austria, the most important external database to be considered for extending the indicators used in regular QNA estimation stems from the business survey conducted by the WIFO on behalf of the EU Commission. These data can be assumed to carry not only information about changing production activities in several sectors but also about turning points of the business cycle.

This refers especially to the survey in the goods producing sector (NACE D) and construction industry (NACE F). Test statistics calculated confirm the significant better performance of forecasts including these data compared to univariate ARIMA forecasts. This makes overall flash estimates quite promising, as both sectors not only account for around 40 percent of Austrian GDP, but are suspected to carry large part of the business cycle volatility.

For some of the components to be compiled, no special forecast of indicators was necessary. Either they are already available in the required length at the time of setting up flash estimates or they are even not available at the time of calculation of regular estimates. The first goes for example for employment data emitted by the Federation of Austrian Social Security Institutions, which are available only few days after the end of a quarter and therefore no forecast is necessary. This data builds the backbone of calculating quarterly national accounts employment figures, so this component is of the same quality in flash estimates as in the regular QNA. A similar example are wage deflation indexes by sectors underlying QNA gross salaries and other price statistics, necessary for deflating certain components.

In the regular QNA the indicator variable for quarterization of taxes on products comprises tax revenues of the central state. This monthly data covers already the end of the quarter, which is sufficient for most types of taxes on products. The principle of accrual concerning VAT requires instead of assigning only the last month of a specific quarter to the quarter of subject plus the first two months of the following. For estimating the missing two months, a simple univariate seasonal ARIMA model is used. Furthermore, this type of estimation is used for all aggregates at the production side of national accounts, for which neither employment data nor a regression on business survey data turned out to be appropriate.

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[9] Surely this advantage has not to be overstressed, as turning points based on monthly observations can only be recognized as such after some further observations are available. So there is a time lag between the registration and the recognition of them.

Generally, results coming from the production approach of national accounts are statistically more reliable compared to the expenditure approach. This feature refers to the annual and quarterly NA and to flash estimates as well. As for household final consumption (P.31, S.14) the required database covers nearly the same periods as available for regular estimates, the method described in section 5.1 applies here as well. The same goes for government final consumption (P.3, S.13) and NPISH final consumption (P.31, S.15) expenditures, which are explained in section 5.2 and 5.3, respectively.

Construction capital formation (P.51, PI64 + PI65) is estimated using information gathered from the output of the construction industry (NACE F). The remaining components of fixed capital formation go along with developments in the output of the industries producing them plus net imports. In all cases the extension of indicator series has already been explained above for estimating supply side flash aggregates.

For the exports and imports of goods (P.61, P.71) the trade statistics published by Statistics Austria are extended with univariate time series models. Further, qualitative information coming from the goods producing sector and the wholesale and retail trade sector are additionally considered in the series. Generally, these results are not very reliable because the trade statistics from Statistics Austria and the Austrian National Bank are usually subject to substantial revisions, which show up in QNA as well. The indicator for estimating flash estimates for tourism exports is the number of over-night stays of foreign guests. The remaining exports of services are forecasted with simple time series models. The estimates of other services imported and exported are done analogically.

9.2 Flash employment estimate

Employment data released by the *Federation of Austrian Social Security Institutions*, are available already a few days after the end of the reference quarter. As explained in section 7.2 above, these data constitute the backbone of the calculation of QNA employment figures. No forecast is necessary and flash employment estimates are the same as disseminated in the regular QNA. This refers only to the employees, self-employed are not calculated for flash estimates. Equally, employment in total hours worked is not computed on a flash basis.

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