

Guidelines for compiling Quarterly GDP in the CARICOM region

Foreword

The following guidelines are based on the Eurostat guide “Building the System of National Accounts – measuring quarterly GDP”. The Eurostat guide has been reduced to omit material which is not relevant to the economies in the CARICOM region, and the text has been edited to make it accessible to all members of national accounts production teams in the National Statistical Offices (NSOs) of CARICOM. The material has also been reduced where the technical issues require a treatment beyond the scope of a set of guidelines. The two areas most reduced are benchmarking of quarterly estimates to annual aggregates, and the seasonal adjustment of quarterly series. Both of these areas require significant mathematical skills to apply the methods successfully to national accounts time series. However, the guidelines below do give an insight into the purposes of the techniques and what they achieve. A more complete treatment of the subjects, can be found in the two main international publications:

Quarterly National Accounts Manual Concepts, data sources and compilation IMF (2001)

Handbook on quarterly national accounts Eurostat (2013)

There are also descriptions in English of country practice across the world available through NSO web-sites.

Quarterly GDP

The need for QGDP

Quarterly estimates of GDP show the development of the economy in a more timely manner than annual data, and more comprehensively than individual short-term indicators. Users who are required to take policy decisions about the economy on a short time-frame, value early measures of economic growth so that they can take actions to either stimulate the economy, or reduce inflation. Examples would be the Central Bank raising interest rates to try and reduce inflation, or lowering interest rates to encourage production and consumer spending. Similarly, the government could increase borrowing to stimulate economic activity.

Quoting from a paper submitted by the Australian Statistical Office to a workshop on QNA held in Bangkok 2002

“The year on year [growth] rates can be inadequate in identifying the current trend in economic activity, as they could indicate for example, that an economy was still in recession when it had actually been recovering for some time. In other words, a year-long span is too broad and insensitive to quarterly (or monthly) growth reversals e.g. a yearly growth can be negative due to the fact the current observation is below its counterpart one year ago, but monthly or quarterly trend movements may have been in growth for many months or quarters. In sum, year-to-year rates of change are not suitable for business cycle analysis, and analyzing the economy on the basis of these rates of change can have an adverse impact on the soundness of economic policy.”

Compilation of quarterly GDP is based on the 2008 SNA

The 2008 SNA does not specifically address quarterly national accounts issues, but the same principles, classifications, definitions and overall coverage as annual national accounts apply.

Early estimates

There are two important requirements for quarterly GDP. Estimates of the latest period must be: available as soon as possible; and as accurate as possible so as to require little subsequent revision. Accurate in this context implies that the quarterly estimates are based on the same population of businesses through the use of a business register for sampling purposes. If other populations are used, then it is important that these populations are the same in theory as the businesses stored on the statistical business register, or adjustments can be made to allow for the differing populations.

Early quarterly estimates will require greater revision than the normal annual estimates. A balance between timeliness and reliability must be struck, depending on the interests of users of the national accounts data in each country.

Main characteristics

The main characteristics of quarterly GDP are the following.

1. The purpose is to present the short-term movements of the economy. In contrast with annual estimates, quarterly data focuses on growth rates, and so volume measures are essential.
2. In quarterly GDP, the same standard classification as in annual accounts applies, but usually at a higher level of aggregation. Quarterly measures give a picture of short-term developments in the economy rather than structural details, which are given in the annual accounts.
3. Due to seasonal variations during the year, quarterly indicators are compiled in seasonally adjusted form as well as non-seasonally adjusted.
4. Quarterly measures of GDP must be consistent with annual estimates, and so when annual estimates of growth become available, the quarterly estimates must be benchmarked to the reference values.
5. Quarterly estimates of GDP are revised more often and with greater change in value, due to the early provisional nature of the data sources used.

Benefits

The benefits of measuring GDP on a quarterly rather than an annual basis are as follows:

1. The quarterly periods allow a more accurate determination of growth, recession, and peaks and troughs in economic growth.
2. GDPQ supplies useful information for monitoring the economy and supporting early policy decisions concerning economic growth.

Some conceptual issues

Some compilation considerations are particularly important for quarterly estimates; namely, the time of recording, their consistency and the meaningfulness of the estimates.

1. Time of recording

The 2008 SNA defines the time of recording of flows in national accounts and must take account of differences in the systems used to provide source data. Examples of such systems are:

1. cash accounting system: transactions are recorded when ‘cash’ (the payment) is received or tendered;
2. full accrual accounting system: transactions are recorded when the underlying economic events occur, regardless of the timing of the related payments; This is the appropriate recording for national accounts.
3. due for payment: transactions are recorded when a commitment—a liability to make a payment—occurs (e.g. pension liabilities in the public sector, tax payments due as income earned).

The choice of source system to provide data may affect results, especially when the recording period is shorter than one year, as is the case with quarterly estimates. To obtain a record of flows on an accrual basis, as required by the 2008 SNA, as opposed to the recording systems used by available timely sources, some data adjustments are necessary. The process starts with an in-depth analysis of the sources, to gain an understanding of the recording time of the transactions, and continues with adjustments for the current period. For example, if VAT declarations are used for the output estimation, adjustments should be made, taking into account that quarterly data from tax authorities do not refer to the production of the quarter; instead, this data usually has a one-month lag. This means that the value of turnover declared for VAT purposes in April represents the results of the activity carried out in March, thereby requiring adjustments to the data.

2. Consistency in recording and work-in-progress

The main issues, especially for quarterly production, are to ensure consistency in the records for the following special cases:

1. Production of goods produced over lengthy periods. Unfinished production from one quarter is recorded as inventory of a work-in-progress so as to ensure consistency with the compensation earned by the employees for this production.
2. Services produced under contracts covering lengthy periods. At present, there is growing evidence of producers with activity in the business and financial services industries producing services according to contracts which cover long periods. In this respect, quarterly business surveys need to capture service production for periods within the total contract period.

Data sources and methods used for QGDP compilation

Data sources

In many countries, the estimates of QGDP through the production approach are considered to have the highest reliability. Without a comprehensive set of short-term indicators for components of expenditure and income on a timely basis, the production approach is the only one to give reliable results and the remainder of this set of guidelines will assume that it is the production approach is followed.

In very few cases, a data source is available in a form that enables its direct use for QGDP estimation with little or no adjustment. In most cases, the indicators offered by the existing data sources require adjustments. These adjustments may typically be established for one or a small number of main benchmark years for which additional sources, such as the results of more comprehensive surveys are available. In these cases, the annual and quarterly time series are anchored to these main benchmark years and the regular source data are used as indicators to update the benchmark estimates. As the annual estimates provide the benchmarks for quarterly indicators, they should be the starting point in selecting and developing quarterly data sources.

Statistical and administrative data sources used for QGDP compilation differ from one country to another, due to:

1. the capacity of the country statistical system to provide short-term indicators that cover the main economic activities;
2. the availability of country administrative data, their coverage and the access of national accountants to this data;
3. the structure and size of the economy of each country.

The greater the degree of harmonization in classifications, prices, and so forth in a country's statistical systems, the more comparable the corresponding national accounts statistics (both annual and quarterly) between nations will be.

For QGDP compilation using the production approach, the most important statistical sources available within the national statistical system are the following:

1. Short term business surveys, which may provide some of the following:
 - a. General information on: sales/turnover; purchases from market, GFCF by principal assets type, inventories by types, foreign trade in services, compensation of employees and employment;

- b. Specific information on: monthly index of production and the monthly (or quarterly) index of retail sales, quantity indicators for hotels and restaurants (overnight stays), transport (ton km, passenger km), etc.
2. Price statistics, covering the consumer price indices (CPI), producer price indices (PPI) for goods (including agriculture), producer price indices for services, export and import price indices and the construction cost index.
3. Foreign trade statistics providing data on imports and exports of goods and services.

The **administrative sources** generally used for QGDP compilation provided by public authorities or institutions are the following:

1. government expenditures and revenues, available on a monthly basis;
2. financial statements of financial and non-financial enterprises, which may be available quarterly or twice a year;
3. tax declarations, which provide information concerning the turnover and the value of VAT paid, usually quarterly;
4. balance of payments (BoPs), available monthly;
5. building permit issued (data taken from an identifiable public authority);
6. registration of vehicles (data taken from an identifiable public authority);
7. employment data (e.g. employment register, social security system, etc.).

In the absence of statistical or administrative data, **other sources** can be sought and used for the compilation of quarterly national accounts indicators. Data from industry associations, industry experts, or leading enterprises in a particular industry may help with the calculation of quarterly indicators. These can be grouped as follows:

1. data from research institutes, news agencies, etc. (e.g. opinion surveys and other qualitative data);
2. data from professional unions and industry bodies (e.g. information relating to doctors, dentists, lawyers and pharmacists); and
3. quarterly company reports or special, tailored surveys of a few very large private and public corporations (e.g. utilities and transport usage).

However, given the ad hoc and fragmentary nature of much of this information, it is wiser to use it as a credibility check on statistical and administrative data from official sources, rather than a reliable source of data in their own right.

The following issues must be assessed in compiling quarterly series of GDP:

1. The relation to sources and methods used for the annual estimates of GDP
 - 1.1 Are the same sources available quarterly or more frequently?
 - 1.2 Are other sources of indicators available quarterly?

2 Compilation level

2.1 Are the quarterly data at the same level of detail as the annual data?

3 Coverage

3.1 Is the coverage of the quarterly sources the same in principle as the annual sources?

4 Sources and methods

4.1 Is the existing annual system providing good estimates of growth?

4.2 Is there a systematic bias in the quarterly sources used compared to the annual sources.

The quarterly estimates of GDP should use data as consistent as possible with the annual methodology and data. It is crucial that national accountants should have a good understanding of the indicators these sources provide, their definitions and coverage, how the data are derived, their accuracy, and possible biases. Establishing the ways in which the data sources are used is an on-going exercise. Basic data need continuous monitoring because new issues may emerge at any time. In this respect, national accounts compilers should have a good working relationship with their data suppliers to get the best possible support and to avoid complications in the compilation process. The data sources should be assessed for accuracy, reliability and timeliness in order to:

1. determine whether a specific data source is suitable for QGDP compilation;
2. where more than one data source is available for a particular indicator, select a source based on coverage, content, etc.;
3. when data from different sources are in conflict, this assessment will lead to a choice on where to make adjustments;
4. identify areas for data source improvement;
5. to allow national accountants to inform data users about the quality of the estimates and expected future revisions of the quarterly time series.

In practice, in many cases, there will be little or no choice about sources in the short term. Nonetheless, it is still necessary to assess the data sources and the indicators that may be used, based on information from the data providers.

The most important criterion for the assessment of the reliability of quarterly sources is the extent to which they are able to indicate annual movements. This follows the main requirement of keeping QGDP consistent with annual accounts. The accuracy of the short-term source statistics as indicators of the annual movements depends on a harmonized approach with the annual compilation system.

The timeliness of the quarterly source data also has considerable implications for how early QGDP estimates can be disseminated. Usually, the first estimates are based on an incomplete set of data; for some indicators, only two months of the last quarter may be available, while data for other series may be missing completely.

In this situation, provisional estimates of QGDP are made based on alternative indicators that are more timely but less accurate. It is not good practice to base early estimates solely on current trends, as this adds no real data to the estimate, and users are usually capable of making the same trend estimates.

It is important to underline that the assessment of the source data may also help identify areas for improvement, both for the quarterly and annual national accounts. In establishing priorities for improvements, the relative importance of an indicator in terms of value added weight is a key consideration. For many components, the basic data are so poor that refinement of methods would be of doubtful benefit.

The development of QGDP methods can also lead to improvements in annual accounts. The regular process of reviewing quarterly estimates can bring to light outdated or unrealistic methods and assumptions used for annual accounts.

Methods for QGDP compilation

As stressed above, QGDP must be closely linked to annual estimates to ensure consistency between short-term and long-term movements. Through the quarterly figures, national accounts seek to provide accurate estimates of unknown future annual GDP. Thus, because in quarterly accounts the emphasis is on relative movements rather than absolute levels, the selection of indicators for quarterly estimates is based on how well these reflect changes in annual national accounts.

Strategy for producing and publishing QGDP estimates.

The strategy consists of several parts:

1. Consultation with the data users in order to identify their needs – the level of detail in the industry classification which can be used with confidence as a stand-alone indicator, and the dissemination deadline;
2. Performing an inventory of data sources and methods in the statistical system, such as:

- a. Up-to-date description of annual and quarterly data sources;
 - b. Description of annual and quarterly compilation methods;
 - c. Identification of the links between quarterly and annual data sources and methods.
3. Description of indicators provided by quarterly data sources, covering:
- a. definition (coverage, units, classifications);
 - b. accuracy (reliability) in indicating quarterly movements;
 - c. revision history of quarterly indicators;
 - d. timeliness (available within at least one month after the end of the quarter).
4. Reviewing the quality of data sources and methods of compilation:
- a. analysing the correlation between annual and quarterly data;
 - b. analysing the revisions of quarterly national accounts aggregates, based on historical data;
 - c. revisions to the quarterly compilation methods based on new data sources or improvements in annual accounts estimation methods.

5. Generating time series of QGDP data for past years ('back series') and benchmarking them to the time series of annual data.

This should be done:

- a. for a sufficiently long time series;
 - b. at the most detailed compilation level possible
6. Revision of quarterly national accounts in line with annual results so as to keep data up to date and include new or improved information when available.
7. Compilation of the current quarterly GDP based on available data sources by:
 - a. linking monthly and quarterly source data for the current quarters with estimates for the back series;
 - b. extrapolating with indicators;
 - c. benchmarking the time series of quarterly source data to the time series of annual data;
 - d. filling the information gaps.
8. Dissemination of the results: first release and revised data.

Compilation methods

An important step of the implementation strategy is to decide on the compilation method (Part 4 of the strategy).

The QGDP compilation system may be separate from the annual accounts compilation system or integrated into it. Separate systems are commonly found in countries with a comprehensive, detailed annual system that includes annual SUTs, which involve a cross-sectional reconciliation of national accounts indicators.

Integrated annual and quarterly accounts compilation systems are typically found in countries not using the SUTs framework for their annual data, which makes it easier to use the same system for annual accounts and QGDP. In an integrated system, the data storage and calculation functions for both annual and quarterly data are carried out within the same processing system, although the level of detail differs (i.e. more details for annual accounts). In this situation, QGDP sources and compilation methods may be benchmarked to annual sources and methods.

The choice of the compilation method depends on the conditions in each country and the specifics of annual and quarterly national accounts, bearing in mind that:

1. annual data are subject to a detailed reconciliation process that cannot be applied each quarter;
2. quarterly data have a time series dimension; the annual system follows a year-by-year calculation method.

Ideally, the quarterly data sources and the methods should be the same as for annual accounts. In reality, however, this is usually not possible. Therefore, simpler methods that differ from those for annual NA compilation are developed to produce QGDP. In general, there are two main **approaches** for QGDP compilation:

1. the direct approach, which is based on the assumption that the basic quarterly data and the corresponding data from the annual accounts are consistent, at least in terms of growth rates;
2. the indirect approach, which employs statistical techniques to quantify the relationship between a time series of annual data (from the annual accounts) and the available quarterly indicators in order to generate quarterly estimates of the national accounts variables.

As the methods used for the estimation of national accounts are determined by the availability of data, the recommended approach for the compilation of quarterly national accounts aggregates is based on the best use of the existing data sources. This may be described as a

‘pragmatic’ approach. The vast majority of countries use a combination of direct and indirect methods, depending on the availability of source data. For example, when no quarterly indicator is available, national accountants fill gaps in the QGDP by looking at the available alternatives to ensure comprehensive estimates of the national accounts aggregates. After choosing a suitable alternative, compilers can use historical patterns in the annual data for the chosen variable as a guide. If a series is volatile and relates to the economic cycle, growth rates of the rest of the economy may be a suitable indicator. Extrapolation on the basis of past trends is undesirable, as this approach masks current trends. In the absence of a suitable indicator, a simple, transparent method may be more appropriate than one that is time-consuming and complicated without necessarily providing clear benefits.

Approach 1: The basic data are used directly with no amendments required for measurement or for coverage of indicators, although some classification changes for the level of disaggregation of indicators may be admissible. This is most commonly the case when the quarterly data sources meet the national accounts requirements.

Approach 2: If the data fails to meet the SNA requirements, some adjustments are necessary, such as conversion from cash to accruals or adjustments, or amendments regarding the coverage. These techniques are not mathematical nor use a statistical model, but instead are based on the basic data being close to the definition given by the 2008 SNA. The adjustments are relatively small and have a methodological foundation.

Approach 3: Data from sources fail to meet national accounts requirements, but serve a purpose as indicators in a statistical model to estimate the QGDP variables.

Approach 4: Applying some other (non-mathematical and non-statistical) approach, often qualitative, to estimate the path of the QGDP variable using knowledge of the series and of the principal influences upon its level and growth.

Approach 5: In some instances, data sources for quarterly estimates are unavailable, and the only information comes from annual national accounts. In this case, quarterly estimates are derived either by a weighted disaggregation of the available annual data according to some purely mathematical criterion or by using time series models. These methods are not recommended—they are a last resort—and national accountants should do their utmost to obtain and use quarterly sources for the estimates.

The general objective of quarterly national accounts implementation is to be able to apply an estimation method that follows the first or second approach.

Benchmarking

QGDG, should be consistent with annual national accounts data estimates, where the annual data provide the benchmarks. This consistency is obtained by a separate process of so-called 'benchmarking'. Generally, the annual indicators provide the most reliable information at the overall level and long-term movements in the series, while the quarterly estimates provide information about the short-term movements in the series. Benchmarking issues also arise in annual data (e.g. for the estimation of SUTs when a special survey is only conducted every few years).

The benchmarking process is seen as a way of improving the quality of the quarterly data and of the accounts overall, through what might be termed 'retrospective' alignment. In other words, a set of quarterly accounts has been established at a given moment in the past, with these estimates being consistent with the corresponding annual set of figures at the time of compilation. When the annual figures are improved by integrating more information from data sources that become available later, the quarterly accounts have to be aligned with the new annual data.

Discrepancies between quarterly and annual estimates should be corrected in order to ensure consistency. Such discrepancies are removed by benchmarking the quarterly data against the annual estimates, which, due to the accuracy of data sources and methodology, provide more reliable data. As a result, the time series of quarterly and annual data for the same phenomenon are consistent, while accuracy and quality of the quarterly estimates improve (so they may form the basis for forecasts of annual data).

The benchmarking procedure must simultaneously:

1. preserve, as much as possible, the short-term movements in the quarterly data source under the restrictions provided by the annual data;
2. ensure, for the forward series, that the sum of the four quarters of the current year is as close as possible to the unknown real future annual data.

It is important to preserve the short-term movements in the source data because the short-term movements in the series are the QGDG's key contribution, with the indicator providing the only available explicit information on these movements.

Benchmarking has two main uses for quarterly estimates:

1. To revise preliminary QGDG estimates to align them with new annual data when they become available;
2. extrapolation to update the series from movements in the indicator for the most current period ('forward series').

To understand the relationship between the corresponding annual and quarterly data, it is useful to analyse the ratio between the annual benchmark and the sum of the four quarters of the indicator (referred to as the annual benchmarking indicator ratio), which highlights any inconsistencies between the long-term movements of the indicator in the annual and quarterly data. These inconsistencies can help identify areas for improvement in the annual and quarterly data sources. The standard, basic method for benchmarking, is the uniform proportional adjustment (i.e. taking the difference and allocating it proportionally over the four quarters), a method that may sometimes be unsuitable. For this reason, various other approaches may be more appropriate for benchmarking.

1. Manual approach

The simplest approach is to adjust the quarterly data manually; that is, ‘by eye’. This procedure involves combining direct knowledge of the series with an ability to smooth the series manually. This may be appropriate when the differences between the annual and quarterly data are small, and when few series require adjusting.

2. Ratio approach

The pro rata distribution refers to the allocation of an annual total of a flow series to its four quarters. A pro rata distribution splits the annual total according to the proportions indicated by the four quarterly observations.

3. Mathematical and statistical techniques

A third approach refers strictly to mathematical and statistical techniques. The quarterly figures are like preliminary estimates that do not match annual estimates. The resulting discrepancies have to be distributed according to some criteria. As shown above, the ratio approach brings with it the step problem of the movements of the quarterly series between years showing a discontinuity. Various time series methods that avoid steps exist, and all have the same purpose: to keep the ratio of movements of the short-term benchmarked series to those in the original series as stable as possible over time.

Widely known and applied, the proportional Denton method uses a least squares technique to minimise the difference in relative adjustment to neighbouring quarters, subject to an annual total binding constraint, thus avoiding the step problem. In mathematical terms, according to the basic version of the proportional Denton technique, the benchmarked series X_t is the solution of the following minimisation problem:

$$\min_{(X_1, \dots, X_{4\beta}, \dots, X_T)} \sum_{t=2}^T \left[\frac{X_t}{I_t} - \frac{X_{t-1}}{I_{t-1}} \right]^2, t \in \{1, \dots, (4\beta), \dots, T\}$$

under the restriction that, for the flow series,

$$\sum_{t=4y-3}^{4y} X_t = A_y, y \in \{1, \dots, \beta\}$$

where:

t

is the time (e.g. $t = 4y - 3$ is the first quarter of year y , and $t = 4y$ is the fourth quarter of year y and may be T);

X_t

is the derived QGDP estimate for quarter t ;

I_t

is the level of the indicator for quarter t ;

A_y

is the annual data for quarter y ;

β

is the last year for which an annual benchmark is available; and

T

is the last quarter for which quarterly source data are available.

Using the proportional Denton method implies that the B–I ratio for the fourth quarter of the last benchmarked year is used to prepare the forward QGDP series. The B–I ratios for quarters with annual data are usually different and change smoothly, depending on the movements in the annual B–I ratios.

The benchmarking procedure is highly dependent on revisions. When annual national accounts data for previous years are revised, the QGDP data for those years are benchmarked to the revised annual data.

Seasonal adjustment methods

Seasonal adjustment provides an understanding of the evolution of the economy over time, and the direction and magnitude of changes that have taken place. To achieve this aim, it is necessary to compare the results of one period with those of the previous periods obtained in the same conditions. Seasonal adjustment (SA) “corrects” for seasonal or calendar effects, by smoothing out the extreme effects of seasons over the year. The presence of such effects in a time series makes comparability over time more difficult.

Mathematically, seasonal adjustment means using analytical techniques to break down a series into its components, with the main objective being to identify the components of the time series and thus provide a better understanding of their behaviour. The impact of the regular intra-annual seasonal pattern, the influences of moving holidays, the number of working/trading days, and the weekday composition in each period (the trading-day effect) are removed in the seasonally adjusted quarterly data. By removing the repeated impact of these effects, national accountants can produce seasonally adjusted data that highlight the underlying trends and short-run movements in the series.

The two main groups of methods for estimation of seasonal adjustments data are the following.

1. *Moving average-based methods*, which use different kinds of moving average filters. Moving average represents a weighted sum of a certain number of values of a time series comprising the observation under consideration and neighbouring observations. While the number of values in the average is kept constant, the time periods ‘move’ successively, hence the adjective ‘moving’. These methods do not rely on an underlying explicit model and were developed mainly on an empirical basis. The best known moving average-based method is the US Census Bureau’s X-11 (and its upgrades), which involves the repeated application of suitable moving average filters. This procedure leads to a decomposition of the unadjusted data into its trend-cycle, seasonal and irregular components. The latest update of the model is X-13 ARIMA, but the upgrade most commonly used is X-12-ARIMA.
1. *Model-based seasonal adjustment methods* estimate the trend-cycle, seasonal and irregular components with signal extraction techniques applied to an ARIMA model fitted to the unadjusted or transformed (e.g. logged) data. Each component is then represented by an ARIMA expression and some parameter restrictions are imposed to obtain orthogonal components. TRAMO/SEATS is one of the best known and most widely used methods of this type. In order to isolate a unique decomposition (i.e. the canonical decomposition), TRAMO/SEATS imposes further constraints. These constraints stipulate that the variance of the irregular component be maximised and, conversely, the other components be kept as stable as possible (compatible with the stochastic nature of the model used for their representations).

Both methods are divided into two stages. In the first stage, the model, the calendar effects, and the outliers are estimated (before adjustments and forecasts); in the second stage, the trend-cycle and the seasonal component are extracted.

In general, when applying the seasonal adjustment method based on X12-ARIMA/TRAMO-SEATS, NA compilers should follow **eight steps**:

Step 0: Number of observations It is a requirement for seasonal adjustment that the times series be *at least 3 years long* (36 observations) for monthly series and 4 years-long (16 observations) for quarterly series. Of course, these are minimum values; series should be longer for an adequate adjustment or for the computation of diagnostics on the basis of the fitted ARIMA model.

Step 1: Graph Compilers should first study the *data and graph* of the original time series before running a seasonal adjustment. Series with possible outlier values should be identified. It is important to check that the outliers are valid and free from sign problems (e.g. erroneous data capture). Missing observations in the time series should be identified and explained. Series with too many missing values will cause estimation problems. If series are part of an aggregate series, compilers should verify that the start and end dates for all component series are the same.

Step 2: Constant in variance *The type of transformation should be used automatically.* Confirm the results of the automatic choice by looking at graphs of the series. If the tests for choosing between additive and multiplicative decomposition models are inconclusive, then national accountants may choose to continue with the type of transformation used in the past for consistency between years, or should visually inspect the graph of the series. If the series has zero and negative values, then this series must be additively adjusted, as in

the equation: $Y_t = TC_t + S_t + I_t$

If the series is decreasing with positive values close to zero, then multiplicative adjustment must be used: $Y_t = TC_t * S_t * I_t$

Step 3: Calendar Effects Analysis should determine which regression effects, such as *trading/working day, leap year, moving holidays* (e.g. Easter) and national holidays, may be affecting the series. If the effects are implausible for the series or the coefficients for the effect are non-significant, then regressors (a kind of ‘independent variable’ representing the inputs or causes) should not be fitted for these effects. If the coefficients for the effects are marginally significant, then it should be determined if there is a reason to keep the effects in the model. If the automatic test of the model does not indicate the need to include a trading-day regressor but there is a peak at the first trading day frequency of the spectrum of the residuals, a trading-day regressor may be fitted manually. If the series is long enough and the coefficients for the effect are highly significant, then six regressors for the trading-day effect should be used instead of one. The regressors represent the elements of the common trading-day (TD) regression and are calculated as follows:

1t TD = (number of Mondays) – (number of Sundays)

2t TD = (number of Tuesdays) – (number of Sundays)

...

6t TD = (number of Saturdays) – (number of Sundays)

where t is the month or the quarter.

Step 4: Outliers There are two ways to identify outliers. *The first is when identifying series with possible outlier values, as in Step 1.* If some outliers are marginally significant, compilers should check if there is a reason to keep the outliers in the model. *The second possibility is when automatic outlier correction is used.* The results should be confirmed by studying graphs of the series, and any additional available information (economic, social, etc.) on the possible cause of the detected outlier should be used. A high number of outliers signifies that there is a problem related to weak stability of the process, or that the data are unreliable. Series with a high number of outliers relative to the series’ length should be identified. This can result in many interventions (over-specifications) in the regression model. The series should be remodelled by reducing the number of outliers. The outlier regressors that are revised should be considered carefully. Expert information about outliers is especially important at the end of the series because outlier type is unclear from a mathematical point of view, and changing outlier type (e.g. removing a level shift) leads to large revisions at a later date.

Step 5: ARIMA model *Automatic model identification should be used once a year,* but re-estimation of the parameters is recommendable upon adding new observations. If the results are implausible, then following the procedure described below is advisable. Non-significant high-order ARIMA model coefficients should be identified. It may be helpful to simplify the model by reducing the order of the model, taking care not to skip lags of AR (autoregressive) models. For moving average (MA) models, it is unnecessary to skip model lags whose coefficients are non-significant.

Step 6: Check the filter (optional) The critical X-11 options in X-12 ARIMA are the options that control the extreme value procedure in the X-11 module, and the trend and seasonal filters used for seasonal adjustment. National accountants should verify whether seasonal filters are in agreement with the overall moving seasonality ratio. After reviewing the seasonal filter choices, the seasonal filters in the input file should be set to the specific chosen

length, so they will not change during production. The SI-ratio graphs in the X-12 ARIMA output file should be studied. Any months with many extreme values relative to the length of the time series should be identified.

Step 7: Residuals *There should not be any residual seasonal and calendar effects in the published seasonally adjusted series or in the irregular component.* The spectral graph of the seasonally adjusted series and the irregular component may be looked at (*optional*). If there is residual seasonality or a calendar effect, as indicated by the spectral peaks, the model and regressor options should be checked in order to remove the residual peaks. If the series is a composite indirect adjustment of several component series, the checks mentioned above in the aggregation approach should be performed. Among others, the tests for normality and Ljung-Box Q-statistics should be studied in order to check the model's residuals.

Step 8: Diagnostic The stability diagnostics for seasonal adjustment are the sliding spans and revision history. Large revisions and instability indicated by the history and sliding spans diagnostics imply that the seasonal adjustment is not useful.

TRAMO/SEATS and X-12-ARIMA, together with well-documented and stable interfaces to use these tools, provide a sound basis for seasonal adjustment. The choice between these applications may be based on past experience, subjective preference and characteristics of the time series. These applications should be reviewed on a regular basis and, if necessary, updated after satisfactory testing. The methods and specifications currently used in seasonal adjustment should be clearly communicated to users.

Seasonal adjustment of QGDP is a **specific activity** that requires specific knowledge of econometrics. Both TRAMO/SEATS and X-12-ARIMA provide extensive aids for helping analysts achieve high quality seasonal adjustments, but the range of options and diagnostics may be difficult to understand for newcomers to the field. While both programs can be configured to work automatically, the automated choices made by the software should never be accepted blindly (see steps described above), hence the strong argument for having seasonal adjustment specialists performing the seasonal adjustment for QGDP. An arrangement that has proved to be successful in a number of countries is one whereby a small team of seasonal adjustment specialists meets the seasonal-adjustment needs of the whole NSI. The specialist statisticians, including the national accounts compilers, are responsible for the routine seasonal adjustment of the data each month or quarter. Whatever the arrangements within an NSI, it is imperative to have a pool of individuals responsible for the seasonal adjustment of QGDP with a high degree of seasonal adjustment expertise.

Production approach to QGDP

The production approach is the most common approach for compiling QGDP, predominantly because of the availability of data within the statistical systems. Following the national accounts methodological requirements, QGDP from the production side should be estimated based on the independent compilation of its main elements: output, intermediate consumption and net taxes on production. In standard practice, however, the quarterly data necessary for intermediate consumption estimates are usually unavailable or of significantly lower quality than sales/turnover data. In order to derive the volume estimates of output or GVA directly, the volume indicators related to output (output-related index) may be used. Such indicators include sales or turnover data, or product quantities. This process allows for extrapolation of

the output in the base period. Also, input-related indices such as employment may be used when output indices are unavailable.

Compiling the production account (output, intermediate consumption and GVA) at current prices and in volume terms requires detailed information on both output and current expenses, which may be unavailable at a quarterly frequency. Estimation of the missing data must rely on the use of other series as an indicator. Most commonly, output data is available, while data on intermediate consumption is missing. In other cases, data on total intermediate consumption, component(s) of intermediate consumption, labour inputs or capital inputs may be available as indicators. The quality of the estimate depends on the assumption of a stable relationship between the indicator and the target variable.

Relationships between inputs and outputs (input–output ratio or IO coefficients) may change as a result of technological changes, differences in seasonal patterns of outputs and inputs, or variations in capacity utilization caused by changes in the business cycle. The impact of technological changes is non-significant in the short term, and the benchmarking process is capable of handling such changes if they happen gradually over a long period. It is preferable to use benchmarking rather than fixed ratios.

An implicit ratio of GVA in output (GVA/output ratio) may be established and used in order to compile current and constant price estimates in the absence of other information. These ratios, derived from annual estimates, must be checked and updated continuously. The initial estimates of quarterly GVA by kind of activity for market sector activities may also be based on the assumption that output and intermediate consumption grow with the same rate in volume terms, either from the previous quarter or from the same quarter of the previous year.

In the process of performing the inventory and assessing the available data sources, an important activity is to separate the information by activities at the classification's chosen detail level to obtain the total GVA as the sum of corresponding values for all activities within the economy.

Output

A summary of the main methods used for the estimation of quarterly **output** by activities appears below.

Agriculture, forestry and fishing For these activities specific estimates should be made for the output produced and sold in the same quarter (e.g. milk and eggs) and the outputs that extend over a number of quarters, such as:

1. cases of '*one-off*' production, such as annual crops, trees for timber and livestock for consumption. Unfinished output, such as growing crops is classified as work-in-progress.
2. '*continuing*' production, covering, for example, fruit trees, vines, breeding, and dairy cattle. These are unfinished outputs classified as work-in-progress and converted to GFCF when completed.

For these cases, the 2008 SNA requirements recommend that the output of crops and similar production be considered in the same way as for other industries where production spans a number of quarters. Thus, the total value of the output of the crop over the whole period of

production is recorded in proportion to the costs incurred in each quarter. The costs considered for inclusion are: material inputs, compensation of employees, a return to the labour and capital of unincorporated enterprises (gross mixed income), and a return to capital of incorporated enterprises (gross operating surplus).

The application of the recommendations raises two major issues: the need to estimate a value for the crop before the harvest is sold; and the imputation of a value for activity (or income) at least two quarters before it actually takes place (or is received). The two main solutions to these problems are the following.

1. First solution:

- in quarters where preparatory work is being undertaken for the harvest and the crop is reaped, output is taken to be equal to the input costs;
- in the quarter(s) in which the crop is sold, output is taken as the difference between receipts in the quarter(s) and the costs incurred in the previous quarters.

2. Second solution:

- the output of crop products at both current and constant prices are compiled on the basis of an estimation of the annual production (harvest) and a distribution on quarterly values in proportion to inputs;
- the output of animal products at both current and constant prices is obtained by extrapolation using indicators based on surveys and agricultural statistics.

Mining and quarrying Taking into account the general data sources available for this industry, the methods applied are extrapolation by quantity indicator, and inflation with the output prices, unit value indices and import indices.

Manufacturing For the manufacturing industry, estimates should be made at the most detailed level possible (i.e. at least at the ISIC rev.4 two-digit level). The extrapolation method can be applied using volume indicators (IPI), deflation of current values with corresponding PPI, or direct estimation based on turnover obtained from VAT statistics.

Electricity, gas, steam and air conditioning supply The value of the turnover from specialised enterprises can be used for the estimation of the output. In the absence of reliable information about turnover and other elements necessary for the estimation of the output, volume indicators (number of kwh or m³ of water) and price index (PPI for electricity, CPI for water supply) can be used. Current prices could be extrapolated on the basis of data from the companies (volume indicators).

Construction

The estimation of construction output on a quarterly basis is a difficult task. Feasibility is limited by the availability of data, as construction enterprises are often small and production

may be hard to separate by quarters. Construction output can be measured in various ways, corresponding to different stages in the building process and the availability of source data.

1. The supply of building materials is often the most readily available construction volume indicator. While building companies tend to be small and dispersed, building materials are often produced by a relatively small number of large factories and quarries. Data on exports and imports of building materials are also generally available and may be important for some kinds of building materials in some countries.
2. Building permits provide information on the location, type of building (building or dwelling), kind of building activities, building costs, content, floor area and estimated building time. This information can be used to calculate, on a monthly basis, the different stages of the building process and to monitor its progress in order to identify the output.
3. Turnover reported by construction businesses to the tax authority or as a result of statistical surveys.
4. Households reports of their own consumption, collected by statistical surveys.

Wholesale and retail trade; repair of motor vehicles and motorcycles Sales data commonly serve as quarterly indicators for the output of wholesale and retail trade. Business surveys or administrative sources (VAT data) may yield sales data; shares of trade margins in the total sales from the previous year serve as indicators for the current price estimation. The constant prices can be obtained by extrapolating the sales based on the turnover volume index (in the absence of this information, the CPI provides an alternative), and deflation of goods bought for resale using PPI for the specific products.

Transport and storage The compilation of output should be made at a detailed level (at least at the two-digit level of ISIC rev. 4) by kind of transport services. Extrapolation of indicators based on the VAT statistics in combination with a deflator or inflator based on the relevant price index is recommendable. For some activities, volume indicators like tonne km and passenger km can be used.

Accommodation and food service activities Estimation of the output is based on turnover provided by VAT statistics or business surveys. Turnover value indices are used for deflation and estimation of the output in constant prices. For accommodation services, the extrapolation method is sometimes applied based on available volume indicators (number of beds in hotel, number of nights, etc.).

Financial and insurance services FISIM is the indirect payment to the financial institutions for intermediary services. The supply of FISIM is produced in resident financial institutions, and is imported by residents who pay interest for loans abroad and by residents who have deposits abroad. The demand for FISIM is used for intermediate consumption, final consumption expenditure and exports.

On a quarterly basis, it is possible to estimate FISIM directly based on data sources provided by the national central bank. The distribution of quarterly FISIM between users usually relies on some assumptions. For example, intermediate consumption of FISIM can be regarded as a service similar to other consumed services and is thus part of the fixed coefficient estimation of intermediate consumption (see Section 3.2). For imports and exports, the assumption is that FISIM has the same share of interests to and from abroad as in the final version of annual

national accounts. The output of insurance and pension funding at current prices can be compiled by extrapolating an indicator based on the number of employees in the industry. For activities auxiliary to financial intermediation, the value of output at current prices is compiled based on data from VAT statistics. The measure of the volume of these activities on a quarterly basis usually uses the relevant index of average earnings as a deflator.

Other services, including real estate activities; professional, scientific and technical activities, administrative and support services; education, human health and social work activities (market activity); arts, entertainment and recreation (market activity); other service activities Data from VAT statistics and short-term business surveys (usually monthly) contribute to the estimation of the output. One element of the real estate activity that requires specific estimation from national accountants is the imputed rent. Data concerning the quarterly own-dwelling services can be estimated by extrapolation on the basis of the number of dwellings. If construction data do not allow estimates of the net increase in the number of dwellings, population may be used as a proxy (preferably adjusted for any trends in the average number of persons per dwelling). Due to the differences in the average rent per dwelling, the quality of the estimation can be improved by doing separate calculations by location and by different dwelling types (e.g. house/apartment, number of bedrooms). Compilers should also consider employing an adjustment factor to account for any shortcomings in this method (e.g. for long-term changes in the size and quality of dwellings). These factors should be estimated for annual accounts, so that their effects are incorporated into the quarterly estimates by the benchmarking process. The extrapolation using the turnover value indices is advisable for the estimation at constant prices. If these indices are unavailable, the use of CPI represents one option, as long as the methodological requirements are followed. The estimation of the quarterly imputed rent represents one of the challenges of this process. Based on the availability of data sources, different methods have been developed and may be applied. For instance, the use of the annual data of the previous year and the growth rate of the construction of dwellings is an option for the output estimation.

Public administration and defence; compulsory social security; education, human health and social work activities; arts, entertainment and recreation (non-market activities) The direct estimation method is applied using data from the government budget. Consumption of fixed capital, as part of the output of non-market output, may be calculated using annual figures, divided by quarter.

Education, human health and social work activities, arts, entertainment and recreation, other service activities (market activities) For this kind of activity, extrapolation of the output based on the turnover is generally used. Data from the VAT system and from short-term statistics are used.

Intermediate consumption

For the compilation of [intermediate consumption](#) data, few sources are available on a quarterly basis. Some information may be available for purchases (usually for government and sometimes for businesses) or the change in inventory, based on special surveys carried out by the statistics office.

One method for the estimation of the intermediate consumption relies on the assumption that the output and the intermediate consumption growth follow the same trend in terms of volume. Thus, the first step is to estimate intermediate consumption at constant prices using

the constant price output as an indicator. This method assumes a stable ratio of the inputs in output (IO ratio), modified by annual trends in the ratio that are incorporated through the benchmarking process. Intermediate consumption at current prices can then be derived by reflating the constant price estimate by price indices that reflect the product composition of intermediate inputs. Because specific producer price indices (PPI) for inputs are non-existent, this should be constructed by weighting together relevant price indices for each component of the intermediate consumption. These indices include the CPI, PPI and foreign trade price indices—for inputs, data are supplied by imports.

The use of a fixed ratio between output and intermediate consumption is a way to make maximum use of the available information, and this method is often valid because the structure of the output and intermediate consumption in terms of volume is slow to change over time. However, this method has some weaknesses:

1. it does not take into account the improvement of the efficiency of the production process;
2. the change in volume of goods and services of the intermediate consumption can differ between quarters;
3. for some industries, particularly agriculture, the input–output ratio can fluctuate greatly in the short-term.

Taxes and subsidies on products

The estimation of taxes on products in current prices is based on revenues and expenditures recorded in government and customs administrative data (excise duties, VAT on imports). Compilers should pay special attention to the application of the accrual valuation principle. For constant prices estimation, the same methods of annual estimation are applied (for more information, see Chapter 9: *Volume measures*).

The subsidies on products are provided by the Ministry of Finance, but the payments are usually made and recorded in a different quarter from that of the production itself. This is the case for subsidies that may be regarded as essentially annual in nature, and for which the quarterly payments are insignificant. In these cases, estimates should be obtained by relating the subsidy to the economic activity for which it is due.

Exhaustiveness

The estimation of QGDP should follow the same methodological requirements as for annual data. Adhering to this principle ensures the exhaustiveness of quarterly estimates. Differences in the size of the non-registered economy normally owe to economic and social structures, and the stage of development of the statistical system. The main topics of exhaustiveness that appear in the annual accounts should be included in quarterly GDP, too. These refer, in general, to the following areas:

1. underreporting and non-registration of the activity in order to avoid the payment of taxes and fulfil the legislative requirements;
2. non-coverage of the national accounts indicators due to statistical under-recording;
3. estimation of the informal sector;
4. estimation of illegal activities.

Usually, the method for estimating the non-observed economy is based on projections because directly measured data are unavailable on a quarterly basis. Thus, the identification of suitable indicators related to the evolution of the non-recorded data represents one of national accountants' key tasks and requires a deep knowledge of this phenomenon, the methods used for annual estimates and the availability of data sources. The use of suitable proxy indicators based on the methodology for annual NOE estimation is common practice.

Revisions and dissemination

Revisions

Revisions are a common characteristic of both quarterly and annual national accounts, but they have particular significance for the quarterly indicators because they tend to be more substantial and occur more frequently. The balance between the statistics office's limited resources on the one hand and the user needs on the other raises a dilemma between timeliness of published QGDP, and the guarantee of reliability, accuracy and comprehensiveness. In order to meet user needs, preliminary quarterly data are compiled and are later revised when better source data are available. Good management of the process of revisions relies on a well-established and transparent revision policy.

It is important to emphasise that the revisions are carried out *for the benefit of users*, to provide them with data that are as timely and accurate as possible, while later incorporating new, more accurate information without introducing breaks in the time series. Sometimes, the revisions may seem to reflect negatively on the trustworthiness of official statistics, but the lack of revisions can have a much more detrimental effect. This may indicate that no better information is available to improve the poor first estimates. Finally, attempting to avoid revisions by producing accurate but highly untimely data, and thus of little use to users, is a wasteful use of the available information.

To avoid unnecessary criticism, a well-designed and carefully managed revision policy is crucial. Essential features of a well-designed revision policy are predictability and openness, advance notice of causes and effects along with explanations, and easy access to sufficiently long time series of revised data.

The main factors contributing to accurate quarterly national accounts revisions are:

1. preliminary data sources used for quarterly indicators are revised;
2. seasonally adjusted data are revised when more data allow better estimates to be made of the current seasonal pattern;
3. revisions occur when quarterly figures are benchmarked to more accurate and updated annual figures.

An awareness of two types of revisions is important: revisions applied **by reason** and revisions applied **by scheduling**.

1. Revisions by Reason Reasons that give rise to revisions to time series data can be broken down into four main categories.

(a) Incorporation of better data sources:

- incorporation of source data with more complete or otherwise better reporting;
- incorporation of source data that more closely match the concepts;
- replacement of judgment or values derived largely by statistical techniques with indicators from available data sources.

(b) Capturing the routine recalculation:

- incorporation of updated seasonal factors;
- updating of the base period.

(c) *Reflection of the improvements in methodology:*

- changes in statistical methods;
- changes in concepts, definitions and classifications.

(d) *Error corrections* that may occur in source data and computations.

2. **Revisions by Scheduling**, also called **expected revisions**, can be further subdivided, depending on their frequency, into the following groups.

(a) *Routine revisions*—characterised by their high periodicity and regularity—, which affect the current weekly, monthly or quarterly data. These revisions depend on the statistical characteristics of the estimation techniques adopted by the NSIs, the revisions of the basic statistics used to compile quarterly figures, or on errors made by national accountants. The reasons for routine revisions may include the following.

- Timeliness.
- Quarterly data are revised in line with the annual estimates. This introduces a new annual benchmark, not only for the intra-annual quarters, but also for any subsequent quarter.
- ‘Annual benchmark’ revision when the annual estimates are revised after data for all the months or quarters of a year become available, and whenever more detailed annual surveys become available.
- Seasonal and calendar adjustment.

(b) *Major revisions* are changes in the published data, often substantial, which happen when:

- a new structural source that is only collected at long intervals (5 to 10 years), such as a census or input-output tables, becomes available;
- a new methodology is developed, such as the 2008 SNA, which incorporates new concepts to be integrated in the current estimates;
- a new legal act is brought into force, such as a new classification by industry or products, or a new international national accounts methodology (e.g. the 2008 SNA).

(c) *Ad hoc revisions* are revisions that are non-scheduled and are unannounced in advance because they are a result of unforeseeable events, such as errors or accidents, or depend on the lack of a scheduling procedure. Non-scheduled revisions are not pre-announced or reflected in dissemination plans, and they can confuse users and undermine confidence in the quality of statistics. National accountants should strive to avoid ad hoc revisions at all costs.

Major revisions affect a large part of the time series, and sometimes even the complete time series. Usually, the data producers take the opportunity of a forthcoming major revision to introduce methodological improvements, which is good practice because it helps prevent revisions from occurring too often. Therefore, it is common for major revisions to be determined by a combination of factors, rather than one single cause. They are expected and planned well in advance, based on a detailed strategy. The policy for major revisions usually takes into account the following:

1. pre-announcing to users the implementation of a major revision, its calendar and the date of dissemination of the new estimates, and the reasons for doing it;
2. communicating and explaining the elements of the revision in advance, as well as the causes of the revisions;
3. informing the users about the expected magnitude, scope, length and impact.

When considering a revision, it is essential to distinguish between *revision analysis* and *revision policy*. The main purpose of revision analysis is to identify and adjust for any possible bias in the data. Revision analysis is therefore concerned with data quality. Revision policy, on the other hand, is concerned with establishing an approach, possibly a common approach, for introducing revisions.

The purpose of *revision analysis* is to reduce revisions in the future by identifying and remedying any possible bias in the initial figures. In addition, it helps with quantifying the scope and nature of revisions so that users are aware of the quality of the data when using them.

Three key aspects are important for the evaluation of the impact of revisions on the overall data quality.

1. *Accuracy* is the proximity of an estimate to its notional true value. An assessment of how accurate the estimates are may involve: analysis of data, analysis of methodology and analysis of the information gained from data confrontation within SUTs. After completing this process, analysts rank the accuracy of the estimates, disseminating this ranking to users. In practice, it is not usually possible to give a reliable estimate of confidence limits surrounding statistical estimates in national accounts.
2. *Reliability* is the extent to which estimates are revised. Consequently, the more the estimates are revised, the less reliable they are. Unlike accuracy, reliability is easily measured. This may be a measurement of the differences between the initial and final estimates of QGDP. Initial estimates that are substantially revised are clearly inaccurate, given that the final estimates are the most accurate. In any event, care must be taken with estimates that are highly reliable (e.g. they are subject to few revisions), because they are not necessarily accurate; it may be that initial estimates are highly inaccurate and remain so.
3. *Stability of the estimates* means frequency of revisions, or the number of revisions within a given unit of time. Users appreciate stability in the data, but at the same time, they want the most accurate statistics possible. This means that national accountants have to strike a balance between making meaningful revisions when new or better data become available, and avoiding minor revisions of little consequence.

Two aspects are important when looking at user needs. First, users appreciate stability in the data. Second, users want the most accurate statistics available. Following these two requirements, two approaches are suitable for adoption in the revision analysis.

1. *Producer-oriented*: this approach means considering the revision process from the viewpoint of data producers, by:

- (a) assessing the accuracy of preliminary estimates in relation to final estimates;
- (b) improving methods of estimation used to compile preliminary figures.

2. *User-oriented*: this approach means analysing the effects that the revision process may have on users' perceptions of the economic conditions. It concentrates on the nature of the revision in order to verify if preliminary releases satisfy certain desirable features of rational forecasts.

An essential *tool* for revision analysis is a database used to archive data releases, so the revisions between any two releases for any common variables for any common period can be easily identified.

Revision policy consists of establishing a standardised, coordinated and publicised approach for introducing revisions. A basic principle is that the most accurate estimates, using the most up-to-date data source, should be published in every release, but it is advisable to avoid making minor revisions of little consequence. Revisions linked to other data sources used for QGDP compilation should be coordinated across statistical domains (e.g. BoPs, Government Finance Statistics).

When considering the effects of revisions or when performing revision analysis, routine and annual revisions are often grouped together since it is somewhat difficult to quantify their effects separately. There are at least three ways in which the effects of routine and annual revisions may be considered from a policy point of view.

1. Each revision will cause data users to revise existing interpretations of the indicator, and hence possibly change economic forecasts and policy implications. When revision processes are appropriately and clearly documented in a standard form, and are widely disseminated (e.g. via websites), users will be able to qualify their interpretations according to the potential revisions of current and recent observations.
2. The statistical properties of the revision process can give users information about the expected reliability of existing and future values, and hence advise as to the degree of confidence that they may attribute to existing interpretations of the indicator.
3. The statistical properties of the revision process may be used by data producers to monitor the quality of the data production process. In particular, the existence of any revision may indicate some bias in the production of the first estimates. This could be a sign that the production process is in need of further improvement.

Major revisions have an extensive, sometimes even disruptive, effect, especially when they are associated with changes in statistical methods and in concepts, definitions or classifications.

Dissemination and publication

The dissemination of QGDP is similar to the dissemination of annual national accounts and other statistics, and general guidance is available from the IMF's SDDS and GDDS. These standards focus on integrity and other aspects such as avoiding non-statistical interference

with the data, simultaneous release to all users, general accessibility of the data and transparency.

Taking into account the nature of QGDP and their importance for decision-taking, the predominant condition is that the dissemination of the data should be swift. Rather than spending time on preparing and printing a glossy, comprehensive publication, the emphasis should be on releasing the quarterly data as soon as they are available, according to a release calendar available to users. The first release is usually rather limited, focusing on the most important data, which could be the growth rate of GDP and its value in current and constant prices, both seasonally adjusted and non-seasonally adjusted. As a further extension, a second release may include production and expenditure approach breakdowns.

The ways to disseminate quarterly data is through a press release and via the Internet (i.e. on the statistics office's website). The press release text should be concise (as a rule, no longer than one typed page) and ready for use without rewriting. It is advisable to support the press release with a small table containing the most important data, ideally consisting of content that has been discussed and agreed on with the users.

Later, when more data are available and the estimation of quarterly accounts improves, the QGDP can begin to appear in more comprehensive statistical publications. These publications will provide a more thorough analysis of the data, supported by charts depicting the economic developments in a range of ways.

Concluding remarks

The introduction of QGDP in statistical practice is part of the 2008 SNA implementation strategy. The need for the type of information provided through QGDP may be equally urgent in developing countries as in developed nations, although more efforts are necessary in developing countries to convince users of the importance of the data, and inform them about the limitations of QGDP.

The precise specification of desirable data depends on the economic structure in the country and the importance of various components in the accounts. For instance, if agriculture has a very small contribution to GDP, its compilation may be based on a smaller amount of quarterly information than for a country where the agriculture contribution is significant (i.e. 10–12%).

Statistical processing for quarterly data demands data gathering, benchmarking, deflating, seasonal adjustment, aggregation and other calculations. In designing a processing system, it is useful to anticipate the differences and links between the preparatory and operational phases of quarterly national accounts compilation so that the full range of user needs are satisfied. In the preparatory phase, the objective is to compile the data on past years (back series), whereas in the operational phase, the objectives are to update the time series with data for the current quarters and to revise the data for past years based on annual results.

The management of QGDP differs from that of annual accounts due to the greater intensity of work and tightness of deadlines. This means that the main problem for QGDP is timeliness:

their compilation is particularly vulnerable to problems like delays in major data inputs or bugs in computing systems. To deal with such problems, compilers should draw up and follow an efficient work schedule that includes the expected time of arrival of each of the data sources, the period required to carry out each process, and the flow of data from one stage to the next.

At the same time, the compilation of QGDP is more ‘creative’ than the compilation of annual NA, because more assumptions and indirect indicators are used. This implies a need for staff with a solid economic background and strong mathematical skills. A good work plan also covers staff organisation, and allocation of personnel between quarterly and annual activities. Obviously, a smaller number of staff may result in a much more basic quality of estimation, and a lower level of detail and timeliness.

Maintaining the time series of QGDP (based on IMF QNA manual)

1. Revise the quarterly estimates for the current year when new quarterly data become available
 - a. Link monthly and quarterly source data for the current quarters to the back series
 - b. Extrapolate with indicators; benchmark the time series of indicators to the existing quarterly time series
2. Revise the quarterly estimates when new annual data for year y become available:
 - a. Revise the quarterly estimates for year y and preceding years to incorporate the new benchmark data without introducing steps in the data across the year boundaries;
 - b. Benchmark the time series of quarterly source data to the new series of annual data;
 - c. Carry out the benchmarking at the most detailed level possible.

Update the quarterly time series with estimates for the next current year (y+1)

- a. Compile quarterly estimates for year y+1 by linking monthly and quarterly source data for the quarters of year y+1 with the revised and benchmarked QGDP estimates for year 1 to y
- b. Extrapolation with indicators – benchmark the time series of quarterly source data to the time series of annual data
- c. Both processes to be carried out at the most detailed level possible

Organization

An important organizational choice relates to whether there should be a unit specifically focused on QGDP or whether the same unit that works on annual national accounts should compile the QGDP. The cycle of peaks in workload is quite different, so peaks in the annual

compilation may not crowd out activities in QGDP (and vice versa). An advantage of combining both functions is that harmonization between quarterly and annual accounts is more likely if the same personnel is working on both. Nevertheless, the best choice when setting up the QGDP compilation system is to identify a separate team, even if this requires a high level of conceptual ability, and a staff with a good knowledge of national accounts methodology and the annual compilation system.

Another important aspect to organize following the implementation of quarterly accounts is the process of maintaining their compilation. The work plan should take into account the main steps of this process in order to ensure the sustained quality of the data over time.