

**UPDATE OF “QUARTERLY NATIONAL ACCOUNTS MANUAL:  
CONCEPTS, DATA SOURCES AND COMPILATION”<sup>1</sup>**

**CHAPTER 12. REVISIONS<sup>2</sup>**

**Table of Contents**

1. Introduction.....	2
2. User Requirements and Resource Constraints.....	3
3. Waves of Source Data and Related Revision Cycles.....	4
4. The Compilation and Release Schedule .....	6
5. Communications of Revisions .....	9
6. Revisions Analysis for Assessing QNA Reliability.....	11
Summary of Key Recommendations .....	15
Annex 1 Revisions Indicators .....	20
Bibliography .....	22

**Boxes**

Box 12.1 Compilation and Revision Schedule: An Example .....	16
Box 12.2 Presentation of Revisions: An Illustration based on Country Practices.....	17

**Examples**

Example 12.1 Real-Time Database.....	18
Example 12.2 Revisions Indicators.....	19

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<sup>1</sup> The QNA manual is being updated by the IMF Statistics Department. For more information on the update, please visit the website <http://www.imf.org/external/pubs/ft/qna/index.htm>.

<sup>2</sup> Draft posted for comments in October 2015.

## CHAPTER 12. REVISIONS

*Quarterly national accounts are subject to revisions. To satisfy timeliness requirements, the first estimate of a quarter generally relies on an incomplete and partial dataset. When more comprehensive source data are made available, previously published estimates must necessarily be revised. To avoid criticism from users, revisions should be explained and well communicated. This chapter describes how to design a sound, coordinated, and transparent revisions policy of the quarterly national accounts. Important ingredients for a sound revisions policy are a compilation and release schedule; an advance release calendar; and a communications strategy. Furthermore, a framework for conducting revisions analysis should be developed to measure and assess the reliability of quarterly estimates.*

### 1. INTRODUCTION

1. Revisions are an essential part of good quarterly national accounts (QNA) compilation practice. Revisions are necessary to incorporate improvements in source data, methods, international standards, and classifications that are continuously made available. They provide users with data that are as timely and accurate as possible. Resource constraints, in combination with user needs, cause tension between the timeliness of published data on the one hand and reliability, accuracy, and comprehensiveness on the other hand. To reduce this tension, typically, preliminary data are compiled on a timely basis; later, revised estimates are produced when more and better source data become available. Good management of the process of revisions requires the existence of a well-established and transparent revision policy.
2. It is important to emphasize that revisions are conducted for the benefit of users, namely, to provide users with data that are as timely and accurate as possible. Revisions provide the possibility to incorporate new and more accurate information, and thus to improve the accuracy of the estimates, without introducing breaks in the time series. Although repeated revisions may be perceived as reflecting negatively on the trustworthiness of official statistics, delaying the incorporation of new data in the published estimates may increase the magnitude of later revisions (in particular, if these go in the same direction). Furthermore, not passing on known revisions reduces the actual trustworthiness of data even more because the data do not reflect the best available information, and the public may know this or find this out (for instance, the public may wonder why a revision in the monthly production index is not reflected in the QNA).
3. It is essential to revise preliminary QNA data to take account of new and better information for the reasons stated above. Further, attempting to avoid revisions by producing accurate but very untimely, and thus less useful, data may not make the best use of the information available. If the official QNA compilers fail to serve users' needs, other

organizations may compile their own estimates, resulting in confusion from conflicting estimates to the point that many users may consider the official data irrelevant. Obviously, that will result in reduced prestige and respect for the official QNA compilers.

4. Revisions to past data are not without potential problems and may draw criticism if not properly handled. Revisions to past data are inconvenient to users because they entail revisions to their databases and applications. More important, frequent revisions — particularly to data for the most recent periods — may cause users to feel uncertain about the current economic situation and thus uncertain about what policy actions should be taken. Some of this uncertainty may be unavoidable and merely reveal the fact that the information base for the estimates for the most recent periods is limited and thus that the data should be used with care. Some of the uncertainty, however, may be caused unnecessarily by the way the revisions are carried out or presented. On the other hand, unjustified differences between national accounts estimates and their source data may cause users to doubt the competence of the national accounts compilers with serious—and justified—criticism of the national accounts data as a result.

5. To deal with the issues surrounding revisions and to avoid unnecessary criticism, a well-designed and carefully managed revision policy is needed. Essential features of a well-designed revision policy are predictability and openness, advance notice of causes and effects, and explanation, as well as easy access to sufficiently long time series of revised data. This chapter elaborates on the elements that make for a well-established revision policy.

## **2. USER REQUIREMENTS AND RESOURCE CONSTRAINTS**

6. The trade-off between timeliness on the one hand and accuracy and reliability on the other is caused by a conflict between different user requirements in combination with limitations in statistical resources. National accounts data are used for multiple purposes that have partly conflicting requirements. To allow corrective policy actions to be taken in time, policymakers and other users need a coherent, comprehensive, and reasonably accurate picture of the current economic situation that is as up-to-date as possible. For other purposes, such as time series and structural analysis of past events, users require long time series of very detailed annual, or quarterly, national accounts data. Finally, users are interested in both the period-to-period rates of change in the series and their levels. The resources available for statistical purposes, however, are limited. Collection of sufficiently accurate and detailed source statistics is time-consuming and expensive both for the statistical office and for the respondents, and compilation of comprehensive, accurate, and detailed national accounts is in itself time-consuming and expensive. Also, frequent collection of comprehensive and detailed data may impose an unwarranted burden on respondents, who themselves may not even have such data on a timely and short-term basis.

7. As a result, only a limited set of monthly or quarterly source data typically is available on a very timely basis. More detailed and more comprehensive monthly or

quarterly source statistics typically become available on a less timely basis, while the most detailed, comprehensive, and reliable source data may be annual or less frequent data that become available with varying delays long after the reference year. To provide sufficiently reliable benchmark data, many countries conduct periodic “benchmark censuses,” collecting very detailed and reliable annual data every five or ten years. These are often linked to periodic compilation of supply and use tables. The monthly and quarterly data commonly are based on smaller samples and less complete sample frames than the corresponding annual data. Finally, the annual data may be based on audited business accounts through comprehensive questionnaires that facilitate a thorough checking and editing of the reported data, while the quarterly data may be collected using simpler questionnaires that allow less extensive checking and editing.

### 3. WAVES OF SOURCE DATA AND RELATED REVISION CYCLES

8. Quarterly accounts are subject to three “waves” of statistical source data that become available. Each of these waves may lead to revisions of earlier estimates and the incorporation of more details in the published accounts. In accordance, three revision cycles may be distinguished:

- A *quarterly revision cycle* is determined by the evolution of the short-term statistics as used in the QNA;
- An *annual revision cycle* is caused by incorporation of annual source data or annual national accounts (ANA) estimates based on a separate ANA compilation system into the QNA through benchmarking.
- Finally, a *periodic major revision cycle* originates from incorporating data from periodic benchmark censuses, revised international guidelines, and other changes that cannot be incorporated on a continuous basis because of resource constraints.

Revisions may, of course, also be caused by compilation errors, which need to be corrected when found.

9. The evolution of short-term statistics used in the QNA may cause revisions for two reasons: (a) corrections or changes in specific short-term source data and (b) incorporation of additional, somewhat less timely, short-term data. Changes in short-term source data can be caused by late responses received after initial publication of source statistics and by the use of pre-published data that are still open to change. To increase the timeliness of the QNA, the first estimates may have to be based on an incomplete set of short-term source data. Monthly and quarterly source data commonly become available with varying delays. Thus, when preparing the first estimates, only data for two months of the last quarter may be available for some series, while data may be missing altogether for other series. To fill these source data gaps, provisional estimates are generally based on simple trend extrapolation or on

alternative indicators that are more timely but less reliable. During the course of the current year, these provisional estimates must be revised to incorporate more and better data as the less timely short-term source statistics become available.

10. An early (or “flash”) estimate of the quarterly GDP should always be revised during the same quarter to incorporate more complete and updated short-term indicators that become available after its publication. An early estimate serves a very crucial need for policymakers, who necessitates a prompt measurement of the current economic developments. However, timely but unreliable official estimates may lead to wrong decisions. Substantial changes to an early estimate should be introduced as soon as possible, because policy decisions may change in accord with the revised estimate. Countries producing early estimates should release at least one more release of the same quarter before the next quarter commences. The timing of the early and revised estimates should be decided on the basis of the timing of arrival of the short-term indicators.

11. Incorporation of more reliable annual data into the quarterly estimates implies several revisions to the QNA estimates over time for two reasons. First, the annual data themselves may be revised. Second, for technical reasons, the benchmarking procedure will result in revisions to quarterly data for earlier years in addition to the year(s) with new annual data. As explained in Chapter 6, these additional revisions to past estimates are needed to avoid introducing breaks (the “step problem”) in the QNA time series between successive pairs of years. Benchmarking of QNA on more reliable annual data has the advantage of conveying the accuracy and reliability of the annual data to the QNA and allows for a degree of comprehensiveness that the short-term source data by themselves do not admit. Annual source data may become available throughout the year or clustered around a few times of the year.

12. Periodic major revisions may be needed to the complete quarterly and annual time series or to a large part of the time series. Over time, periodic benchmark censuses may be conducted, new types of annual source data may become available, and improved compilation methods may be developed, all indicating a need for level adjustments. In addition, international guidelines are periodically revised. To introduce these improvements without creating breaks in the quarterly and annual time series, the complete time series—or a large part of the time series—must be revised at the same time. Ideally, this should be done on a continuous basis, series by series; however, resource constraints often do not permit such a frequent back-casting approach. Simplified ratio-based back-casting techniques may help in dealing with this problem. When such major revisions are released, it is desirable to provide to the user continuous time series of key QNA aggregates (such as the quarterly GDP) of at least five years of length.

#### 4. THE COMPILATION AND RELEASE SCHEDULE

13. A crucial part of a well-established and transparent revision policy is devising an appropriate compilation and release schedule. When establishing a compilation and release schedule, it is important to decide (a) how timely the initial quarterly estimates should be; (b) how frequent new quarterly source data should be incorporated; (c) how early and how frequent annual source data should be incorporated; (d) how frequent regular major revisions should be conducted; and (e) how long the revisions period should be extended.

14. Major elements in determining the compilation and release schedule are (a) timing of arrival of major data sources, and the source data revision policy; (b) timing of preparation of important economic political documents; (c) attitudes toward the trade-off between timeliness and accuracy, as well as toward size and frequency of revisions; (d) dissemination modes; and, finally, (e) workloads and the design of the national accounts compilation system.

15. To minimize the number of revisions needed without suppressing information, it is advisable to coordinate statistical activities. The revision schedule is, or should be, largely driven by the arrival of source data, and coordinating their arrival would substantially help reduce the number of revisions needed. Tying introduction of new concepts and methods, or new international guidelines, to the time of other planned revisions would also help reduce the number of revisions. Although the timing of censuses and new surveys may not be at the discretion of national accountants, they may have a strong say in this, and they are well advised to use their influence to achieve maximum consistency with their revision policy.

16. Account needs to be taken of the coordination of QNA with related economic policy documents, such as the general government budget and other important documents related to the parliament's or legislature's budget discussions. Release of new estimates shortly after the government budget has been presented or in the midst of a budget debate may cause problems (although this should not change the release schedule once it has been fixed).

17. As discussed in the previous section, care should be taken to prevent that initial estimates for a quarter are prepared and released too early. Improved timeliness could require use of a higher proportion of incomplete source data, resulting in an unacceptable reduction in the accuracy of the estimates and larger revisions. The information content of estimates based on very incomplete source data may be limited and, in some cases, more misleading than informative. In those cases, the users would be better served by less timely initial estimates for a quarter.

18. Finally, the design of the national accounts compilation system has important implications for how frequently it is possible and appropriate to incorporate new source data. Large and complicated compilation systems with detailed and extensive balancing and reconciliation procedures (e.g., based on quarterly or annual compilation of integrated supply

and use tables and a complete set of integrated sectoral accounts) make it costly to incorporate new source data very frequently.

19. Timeliness of release of the initial estimates for a quarter varies greatly from country to country, mainly reflecting different perspectives on the timeliness-accuracy-revision trade-off. Early releases of QNA data among statistically advanced countries come within 45 days after the reference quarter. In other countries, a more common release time for the initial estimates is around two to three months after the end of the quarter.<sup>3</sup> To provide very early annual estimates, some countries release their initial estimates earlier after the end of the fourth quarter than for other quarters. Correspondingly, there is typically a shift of focus in the presentation from the estimates of the quarters to the estimates for the full year. While the main focus may be on the estimates for the full year, the fourth-quarter data need to be published in their own right because failing to do so will cause users who need integrated annual and quarterly data to wrongly derive the fourth quarter as the difference between the annual total and the sum of the three previously published quarters. If the initial estimates for the fourth quarter are released earlier than for other quarters, it is preferable to highlight the lower quality of the fourth-quarter estimate, for example, by noting its revisions in previous years and the specific shortcomings in the data used.

20. How frequently new quarterly source data are incorporated varies. Countries that release their initial estimates within a month after the reference quarter typically release revised and more detailed estimates shortly thereafter. These early estimates are often revised once or twice in the first quarter after the reference quarter. The estimates may be open to quarterly revisions thereafter. A more common practice, followed by countries that are less timely in releasing their initial estimates, is to revise the estimates quarterly linked to the preparation and release of the initial estimates for the following quarters. To reduce the number of revisions, it may be tempting to allow the estimates to be revised only once during the ongoing year. However, temporarily suppressing information may result in larger revisions later. Suppression of information may also sometimes be technically difficult to implement and thus may result in compilation errors. The preferred practice is to let all estimates be open to revision during the ongoing year. This is particularly relevant for seasonally adjusted data, which may change substantially just with the addition of a new observation in the series (see Chapter 8 for technical details on revisions due to seasonal adjustment).

21. Annual source data can be incorporated into the QNA estimates either series by series, when the new annual source data for a series become available, or simultaneously for all series. The choice mainly depends on the design of the ANA and QNA compilation systems. The series-by-series approach has the advantage of allowing new annual

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<sup>3</sup> The Special Data Dissemination Standard (SDDS) specifies timeliness for the initial QNA estimates at three months after the end of the quarter.

information to be incorporated in as timely a manner as possible. Some countries compile their quarterly and annual estimates using basically the same time-series-oriented compilation system—typically without detailed and extensive balancing and reconciliation procedures—making this approach the natural choice. Most countries use a separate system for compiling their annual estimates, however, which makes it natural to filter the annual source data through the annual accounting system before incorporating the information into the QNA estimates. In those circumstances, to avoid inconsistencies between quarterly and annual accounts, the second approach may be the natural choice. Some countries use a combination of the two approaches. In any case, because the QNA system is an accounting system highly interconnected, compilers should make sure that changes due to new or updated annual source data be reflected consistently across QNA series.

22. Countries with an independent ANA compilation process typically revise their annual estimates from two to four times before the books are closed until a major revision is undertaken. These regular revisions to the annual estimates are normally undertaken once a year, although a few countries conduct them more frequently. The timing within the year of these annual revisions varies widely. The emphasis is typically on providing accurate and detailed data for structural analysis, with less emphasis on timeliness. They are nearly always more detailed than the QNA and may encompass a more complete set of the integrated economic accounts, including supply and use tables. All these features make back-casting a demanding task and thus restrict the frequency with which level adjustment originating from new data sources and new methods can be incorporated.

23. Box 12.1 gives an illustration of a possible compilation and release schedule followed by countries with independent ANA compilation systems. In this example, the annual accounts are revised only once, but in many countries the annual accounts are revised several times before they are declared final. These subsequent revisions of the ANA should also be put through in the QNA so that the number of revisions of QNA eventually depends on the number of revisions of the ANA. If a major overhaul of the ANA system is performed later, it should also be put through in the QNA time series. It should be noted that in the benchmarking procedures recommended in this manual, revisions of past years will also necessitate revisions in the quarters of later years, including the quarters of the current year.

24. An important element of the revisions policy is to establish a revisions period, namely the number of quarters that should be revised at each revision stage. The revisions period varies depending on the type of revisions. For revisions due to quarterly and annual sources, the revisions period of QNA estimates should cover at least the quarters and years with revisions to the source data. As mentioned earlier, the application of benchmarking and seasonal adjustment techniques may require extending the revisions period backward for avoiding steps between unrevised and revised periods. For benchmarked data, the QNA revisions period should comprise (at least) two years prior the first revised annual data; revisions to more distant years tend to be small and negligible and could be more difficult to explain to users. For seasonally adjusted data, the revisions period should be longer than the



revisions period of unadjusted data to accommodate changes in the estimated seasonal factors (see Chapter 8 for specific details on revisions policy of seasonally adjusted data). In the case of major revisions, the entire QNA series should be revised as far back as possible. The starting period of the new series should be communicated clearly, so that the user is aware that previously published series for earlier periods are not directly comparable with the new series.

25. Sometimes, a change in the revisions policy may be required to respond to unforeseen circumstances. For example, a major mistake in the treatment of source data should be fixed as soon as possible, possibly with an extraordinary QNA release not planned in the calendar. During periods of strong changes in the economy, it may be necessary to increase the frequency of revisions to incorporate new and updated quarterly source data as soon as they become available. Unexpected changes in the source data may also justify a change in the QNA estimates, or an extension of the revisions period. All of these changes are warranted to improve the accuracy of the current estimates for the benefit of users. However, users may misinterpret changes in the revisions policy and question the integrity of the statistics agency. To avoid such risk, it is extremely important to develop a communications strategy of QNA revisions. Elements of a clear and effective communications policy are detailed in the next section.

## **5. COMMUNICATIONS OF REVISIONS**

26. To inform users and avoid unmerited criticism, revisions should be communicated in a clear and transparent way. A number of important elements should be taken into account when communicating revisions to the users:

- Give advance notice of revisions to the national accounts data. Advance communication is critical when the revision is expected to produce significant changes to the levels and rates of change of the quarterly GDP and other macroeconomic aggregates. Compilers should proactively outreach to the users before, during, and after any benchmark revisions of the QNA. Users should be notified in advance about major revisions with significant impact on the current estimates. For planned revisions, an advance notice should be given in the QNA press release of the quarter preceding the revision;
- Provide sufficiently long, consistent time series. At least five years of continuous quarterly series for the most important QNA aggregates should always be available to the public. Five years of data is typically a minimum requirement for macroeconomic or forecasting models. Revised time series should be accessible with a sufficient level of detail, so that users can appreciate the differences in scope and coverage with the previously published estimates;

- Publish well known release dates through an advance release calendar, as prescribed by the IMF's Special Data Dissemination Standard (SDDS) and General Data Dissemination System (GDDS);
- Provide elements to appreciate the reliability of the estimates and the degree of potential future revisions, possibly through a revisions analysis as explained in section 6;
- Provide detailed data in an easily accessible format (e.g., structured query from a data warehouse, or pre-formatted spreadsheets);
- Publish tables showing the revisions to the data with accompanying text explaining their causes.

27. Users should be properly informed of the quality of the estimates and the degree of revisions to expect on predetermined dates in the future. Properly informing users of the quality of the estimates involves giving them candid and easily available documentation of sources and methods for the different versions of the quarterly estimates, clearly showing the main flows of source data leading to revisions. When releasing revised estimates, best practice is to simultaneously publish articles summarizing the main revisions and their causes since the previous release (see Box 12.2 for an illustration). Best practice also involves periodically conducting and publishing studies of long-term trends in the revision patterns. Summaries of these studies may accompany the regular quarterly release of data to remind users that data are subject to revisions. Specific details on how to produce revisions studies are given in the next section.

28. It is particularly important to inform users properly of the quality of the estimates when releasing QNA estimates for the first time. For a good indication of the degree of future revisions of the main aggregates to expect, the complete compilation process should be simulated based on historic data before releasing the new estimates. That is, the proposed QNA compilation system should be used to produce QNA estimates for the past years as if one were back in time and were producing the initial preliminary estimates for those years (see the discussion of the "tracking exercise" in Chapter 2). This exercise can provide a first assessment of reliability of the QNA system, which compilers may decide to communicate to users when the QNA data are officially launched.

29. Finally, providing easy access to the revised time series on a sufficiently detailed level should substantially ease the inconvenience for users of frequent revisions. This involves electronic release of the complete, detailed time series, not only the aggregated data for the most recent periods, which will make it easier for users to keep track of the revisions and update their databases. It should be emphasized that a release of complete time series for all revised periods is needed because users often use QNA data in a time-series format and need to be alerted to any changes in data for past periods. Not providing them with revised historic data will create breaks in the time series they use, which will seriously hamper the

serviceability of the data. As mentioned earlier, a minimum requirement for QNA users is at least five years of continuous series of the key macroeconomic aggregates.

## 6. REVISIONS ANALYSIS FOR ASSESSING QNA RELIABILITY

30. The analysis of revisions is an ideal framework for assessing the reliability of QNA estimates. The analysis of revision aims at measuring quantitatively the characteristics of the revisions process of QNA estimates. In the QNA, the first estimate of a quarter is always based on a partial set of information. For this reason, preliminary QNA estimates are rightly subject to a number of revisions in subsequent publications. These revisions can take different directions for each quarter, depending on the nature of the revision at each stage of publication. To understand the quantitative impact of revisions, the full revisions process is conveniently summarized by means of descriptive statistics of the quarterly revisions history. Such descriptive statistics – called *revisions indicators* – form the basis to conduct a revisions analysis of QNA variables.

31. Monitoring revisions indicators is relevant for both compilers and users of QNA data. For users, a set of revisions indicators offer a standardized framework to assess the reliability of preliminary estimates with respect to later, revised estimates. Evidence of bias (or lack thereof) from the revisions history can help users make better decisions. For example, modelers may decide to incorporate systematic elements from past revisions in an effort to improve their projections. Policy makers may decide to hold off on important decisions until more consolidated estimates are made available. At the same time, revisions indicators may help compilers identify failures in the QNA estimation process. A systematic bias in the early estimate of a specific QNA variable may indicate the necessity to improve the source data or revise the current estimation method.

32. A real-time database is essential to calculate revisions indicators. A real-time database is a tabular representation of the QNA series as originally published by the authorities. When the frequency of publication corresponds to the frequency of measurement (e.g., a quarterly series published once per quarter), the table assumes the characteristic form of a triangle. In such cases, a real-time database is also known as revisions triangle. Example 12.1 provides an illustration of a real-time database (or revisions triangle) using artificial data. The rows contain the quarterly rates of change as published at different release dates; the columns refer to the sequence of estimates related to the same quarter. A revisions triangle shows that a published QNA series comprises estimates that have reached a different revision stage: the latest quarter is published for the first time, while more distant quarters have already undergone several revisions and are likely to be more reliable than recent quarters.

33. Real-time databases can be prepared for any types of data (e.g., seasonally or not seasonally adjusted, current prices or in volumes) and forms of presentation (e.g., levels, changes, ratios). Each form may highlight interesting aspects of the revisions process.

However, developing and maintaining real-time database is costly and time-consuming. Priority should be given to those data and presentations that are more relevant to the users. Because QNA are mainly used for assessing short-term movements in the economy, a key variable for QNA real-time databases is the quarterly seasonally adjusted GDP growth. Real-time databases of unadjusted data may be relevant to single out revisions due to changes in the basic sources (net of seasonal adjustment effects). Revisions triangles of main expenditure and production components of the GDP can also be essential to understand the driving factors of the headline GDP revisions. Finally, revisions to the levels can be useful to assess the impact of benchmark revisions of national accounts to the QNA levels.<sup>4</sup>

34. Mathematically, a revision  $R_t$  for a generic quarter  $t$  is calculated as the difference between a later estimate  $L_t$  and a preliminary estimate  $P_t$ , that is<sup>5</sup>

$$R_t = L_t - P_t . \quad (1)$$

Suppose there are  $n$  quarterly revisions available. A revisions history  $\{R_t\}$  is the sequence of quarterly revisions for the  $n$  quarters, that is

$$\{R_t\} = (R_1, R_2, \dots, R_n) .$$

35. Revisions (1) can be calculated between any two stages of estimation. The first estimate of a quarter always receives the greatest level of attention from the users, and it is the one that is most likely assessed against later estimates. In a revisions triangle, the sequence of first estimates is contained in the main diagonal of the triangle. A comparison between the first estimate and the second estimate (usually released three months after the first estimate) provides the impact of new and updated source data received during this period. Longer revision horizons are useful the impact of annual source data on the quarterly estimates. When annual data are received after a considerable amount of time (more than one year), it is helpful to compare the estimate released after one year with the estimate release after two years. Finally, a comparison with the latest published series (i.e., last row of the revisions triangle) may be helpful to measure how the current quarterly information compares with previously published quarterly estimates. The latest series, however, includes estimates of different maturity.

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<sup>4</sup> The OECD has developed spreadsheet templates for creating real-time databases from monthly and quarterly data. The OECD also provides templates for calculating revisions indicators from real-time databases. Such templates are available for download on the OECD website. For further details, see McKenzie and Gamba (2009).

<sup>5</sup> Revisions are also calculated in relative terms. See Annex 1 for an explanation.

Example 12.2 presents three different revisions histories from the data shown in Example 12.1: second estimates vs. first estimates; estimates released after one year vs. first estimates; and latest series vs. first estimates.

36. Revisions indicators are calculated as descriptive statistics of a revisions history  $\{R_t\}$ . Each statistic aims at measuring a specific characteristic of the revision process. In general, direction, size, and dispersion of revisions are the most salient features of a QNA revisions process. The following is a list of the most common indicators used for the analysis of revisions of QNA estimates:

- *Mean Revision (MR)*. It is the simple average of  $\{R_t\}$ . It is a measure of *direction* of revisions. An *MR* value close to zero indicates that there are no directions in the revisions. In this case, the preliminary estimate shows no bias compared with later estimates. When the *MR* is positive, the preliminary estimate is on average below the later estimate (downward bias); when the *MR* is negative, the preliminary estimate is on average above the later estimate (upward bias).
- *Mean Absolute Revision (MAR)*. It is the simple average of  $\{R_t\}$  taken in absolute values. The *MAR* disregards the sign of revisions. It can be zero when positive and negative revisions perfectly offset each other. The *MAR* is a measure of the *size* of revisions. It is usually taken as a measure of reliability of QNA estimates. The larger the *MAR* value is, the less reliable the preliminary estimate is compared with later ones.
- *Standard Deviation of Revision (STDR)*. It is calculated as the standard deviation of  $\{R_t\}$ . It is a measure of *dispersion* of revisions around the mean value. The smaller the *STDR* value, the closer are the revisions to the *MR* value. A high *STDR* value indicates large fluctuations in the reliability of early estimates between quarters or across years.
- *Range of Revision (RR)*. It is the difference between the maximum revision and the minimum revision in  $\{R_t\}$ . Always non-negative, the *RR* value provides an immediate quantification of the spectrum of revisions occurred in the past.

Example 12.2 shows the calculations of these indicators using the artificial data of Example 12.1. Further, a mathematical formulation of the revisions indicators is provided in Annex 1.

37. A glimpse at revisions indicators can provide an immediate insight into the characteristics of the revisions process. In Example 12.2, for instance, the small values of the *MR* indicator (less than one percentage point) indicate that the preliminary estimate is

relatively unbiased compared to later estimates. However, the *MAR* values show that it is reasonable to expect revisions to the first estimate with a magnitude of 0.2-0.3 percentage points after three months and 0.4-0.5 percentage points after one year. The *STDR* indicator also signals an increase in the dispersion of revisions from the second estimate to the estimate published after one year (0.26 vs. 0.42 points).

38. Real-time databases and revisions indicators should be developed and regularly maintained as part of the QNA compilation process. Their availability makes it possible to monitor constantly the reliability of the published data and promptly identify shortcomings in the QNA estimates. When sufficient resources are available, real-time databases and revisions indicators for the GDP and its main components should also be made available to the public.<sup>6</sup> A summary of the GDP revisions indicators should be given in the QNA press release, so that the general user can immediately appreciate the level of reliability of the preliminary estimates and the characteristics of the quarterly GDP revision process. Occasionally, more in-depth revisions studies should be conducted to determine the underlying causes of the GDP revisions and discuss how to reduce systematic characteristics of the revisions process related to data sources and statistical methods.

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<sup>6</sup> Revisions triangles are provided by a number of countries with advanced QNA systems. The United Kingdom was the first country that disseminated revisions triangles of the GDP on a structured and regular basis.

## SUMMARY OF KEY RECOMMENDATIONS

- *Revisions are an essential part of good QNA compilation practice. Revisions provide the possibility to incorporate new and more accurate information in the QNA, and thus to improve the accuracy of the estimates, without introducing breaks in the time series.*
- *Series that are revised regularly to reflect new and better information are more accurate than those subject to little or no revision.*
- *To avoid unnecessary criticism, a well-designed and carefully managed revision policy is needed. Essential features of a well-designed revision policy are predictability and openness, advance notice of causes and effects, and explanation, as well as easy access to sufficiently long time series of revised data.*
- *Quarterly accounts are subject to three “waves” of statistical source data: (a) quarterly source data; (b) annual source data; and (c) periodic census data. Periodic benchmark revisions are also used to introduce revised international standards, major methodological updates, and changes in classifications.*
- *A crucial part of a well-established and transparent revision policy is devising an appropriate compilation and release schedule, which should specify timeliness, frequency of update, and revisions period of the preliminary estimates.*
- *Revisions should be communicated in a clear and transparent way. Users should be notified well in advance of any major revisions with significant impact on the current estimates. When a benchmark revision of national accounts is released, a minimum of five years of continuous series for the quarterly GDP and its main components should be made available to the public.*
- *Revisions analysis of QNA data is essential to monitor the reliability of the estimates and advise users on the range of uncertainty. Real-time databases (or revisions triangles) and revisions indicators should be developed and regularly maintained as part of the QNA compilation process. Best practices also involve periodically conducting and publishing revision studies of QNA data and disseminate real-time databases and revisions indicators of key QNA aggregates to the public.*

## Box 12.1 Compilation and Revision Schedule: An Example

### Revisions to Estimates for a Quarter of Year $y$

#### Quarterly Revisions

- Early GDP estimate: up to 1 month after the end of the quarter
- Initial estimate: 2 to 3 months after the end of the quarter
- Revised estimate: 5 to 6 months after the end of the quarter
- All estimates may be open to revisions during the current year

#### First Annual Round of Revisions:

	Annual Data for:	Quarterly Accounts
	year $y$ Preliminary annual estimates based on a separate annual accounting system	Revised quarterly estimates of year $y + 1$
3-12 months after the end of year $y$	year $y - 1$ “Final” annual estimates based on a separate annual accounting system	+Revised quarterly estimates for year $y$ , and $y - 1$ + Revised quarterly pattern through year $y - 2$ to $y - 4$ to avoid steps between year $y - 1$ and $y - 2$

#### Subsequent Annual Rounds of Revisions:

13-24 months after the end of year $y$	Incorporation of “final” annual estimates for year $y$ and preliminary estimates for year $y + 1$ based on a separate annual accounting system
25-36 months after the end of year $y$	Incorporation of “final” annual estimates for year $y + 1$ , and preliminary annual estimates for year $y + 2$
37-48 months after the end of year $y$	Incorporation of “final” annual estimates for year $y + 2$ , and preliminary annual estimates for year $y + 3$

The last two rounds of revisions are caused by technical properties of the recommended benchmarking methods (more rounds with minor revisions may in some cases be needed).

The “final” annual estimates may be revised later as needed, if new data become available or improved methods are developed.



**Box 12.2 Presentation of Revisions: An Illustration based on Country Practices****Changes in This Issue**

Data for the mining and manufacturing industries have been revised as a result of the incorporation of new annual census results for the previous year. As a result, value added for most industries has been revised upward in the previous and current years.

Retail output and household consumption have been revised for the most recent two quarters following the processing of late questionnaires. The most recent quarter has been revised down slightly as a result.

**Changes in the Next Issue**

Release date: xxxxx.

The methodology for estimating financial services will be revised in line with new international standards. The conceptual issues and quantitative effects are discussed in a research paper available on request.

**Summary Tables of Revisions**

Table 1: Revisions to Levels of GDP in Currency Units: Eight Most Recent Quarters

Table 2: Revisions to Percentage Changes in Volume GDP: Eight Most Recent Quarters

### Example 12.1 Real-Time Database

Reference quarter	2010q1	2010q2	2010q3	2010q4	2011q1	2011q2	2011q3	2011q4	2012q1	2012q2	2012q3	2012q4
<b>Release month</b>												
June 2010	1.2											
September 2010	1.4	0.8										
December 2010	1.4	1.2	0.2									
March 2011	1.5	1.3	0.3	1.4								
June 2011	1.4	1.3	0.1	1.1	0.5							
September 2011	1.3	1.4	0.2	1.1	0.7	0.2						
December 2011	1.3	1.3	0.5	1.0	0.8	0.4	0.5					
March 2012	0.8	0.8	0.7	0.4	0.7	0.3	0.1	1.2				
June 2012	0.8	0.9	0.7	0.3	0.8	0.3	0.1	1.2	0.6			
September 2012	0.8	0.9	0.7	0.4	0.6	0.4	0.1	1.3	0.8	0.1		
December 2012	0.7	1.0	0.7	0.4	0.6	0.5	0.0	1.3	0.7	-0.4	0.6	
March 2013	0.6	1.1	0.5	0.6	0.5	0.9	0.0	1.0	1.0	-0.4	0.3	0.9
June 2013	0.6	1.1	0.5	0.6	0.5	0.7	0.2	1.1	1.1	-0.6	0.3	0.6

Example 12.1 shows a real-time database (or revisions triangle). The example refers to (artificial) quarterly rates of change of a QNA aggregate expressed in seasonally adjusted form. It assumes a timeliness of 2-3 months from the reference quarter; one estimate per quarter; and an open revisions policy for previously published estimates.

The revisions triangle can be read in different ways. By row, the table shows the series of quarterly rates as published at each release month. For example, the June 2010 publication (first row) reports the first estimate of the quarterly rate of change for 2010q1; the September 2010 publication (second row) shows the estimates of 2010q1 and 2010q2 released at that time; and so forth. It can be noted that each row (e.g., each time series) comprises estimates with different maturity.

By column, the revisions triangle shows the revisions history of one specific quarter. For example, the fourth column shows that the initial estimate of 2010q4 (1.4 percent) has been revised downward several times until it stabilizes two years after the first release at a much reduced rate (0.6 percent).

Finally, the triangle can also be analyzed diagonally. The main diagonal includes all the first estimates of the quarters; the secondary column the second estimates; and so forth. The diagonal view is very important in the calculation of revisions indicators between two specific estimation points in time (e.g., first estimate vs. second estimate), as shown in Example 12.2.

### Example 12.2 Revisions Indicators

Revisions	First Estimate	Second Estimate	Second estimate vs. First estimate	Estimate after one year	Estimate after one year vs. First estimate	Latest Estimate	Latest estimate vs First estimate
	(1)	(2)	(3)=(2)-(1)	(4)	(5)=(4)-(1)	(6)	(7)=(6)-(1)
<b>Reference Quarter</b>							
2010q1	1.2	1.4	0.2	1.4	0.2	1.0	-0.2
2010q2	0.8	1.2	0.4	1.4	0.6	1.1	0.3
2010q3	0.2	0.3	0.1	0.5	0.3	0.5	0.3
2010q4	1.4	1.1	-0.3	0.4	-1.0	0.6	-0.8
2011q1	0.5	0.7	0.2	0.8	0.3	0.5	0.0
2011q2	0.2	0.4	0.2	0.4	0.2	0.7	0.5
2011q3	0.5	0.1	-0.4	0.0	-0.5	0.2	-0.3
2011q4	1.2	1.2	0.0	1.0	-0.2	1.1	-0.1
2012q1	0.6	0.8	0.2	1.1	0.5	1.1	0.5
2012q2	0.1	-0.4	-0.5			-0.6	-0.7
2012q3	0.6	0.3	-0.3			0.3	-0.3
2012q4	0.9	0.6	-0.3			0.6	-0.3
<b>Mean Revision (MR)</b>			-0.04		0.04		-0.09
<b>Mean Absolute Revision (MAR)</b>			0.26		0.42		0.36
<b>Standard Dev. of Revision (STDR)</b>			0.30		0.52		0.43
<b>Range of Revision (RR)</b>			0.90		1.60		1.30

Example 12.2 arranges the quarterly estimates from the real-time database in Example 12.1 conveniently for the calculation of revisions indicators. Column (1) shows the sequence of first estimates for the period 2010q1-2012q4. Column (2) shows the second estimates for the same quarters. The revisions are calculated in column (3) as the different between the second estimate (i.e., later estimate) and the first estimate (i.e., preliminary estimate). Columns (5) and (7) show the revisions to the first estimate made after one year and in the latest release (June 2013), respectively.

Revisions indicators are reported in the bottom part of the table. Taking the case of first vs. second estimate as illustration, the Mean Revision (*MR*) is obtained as the simple average of revisions:

$$MR \text{ (second estimate vs. first): } \frac{1}{12} [0.2 + 0.4 + 0.1 + (-0.3) + \dots + (-0.3)] = -0.04$$

The Mean Absolute Revision (*MAR*) is calculated as the simple average of the absolute value of revisions:

$$MAR \text{ (second estimate vs. first): } \frac{1}{12} [0.2 + |0.4| + |0.1| + |-0.3| + \dots + |-0.3|] = 0.26$$

The Standard Deviation of Revision (*STDR*) is calculated by taking the square root of the sum of squared revisions divided by the number of revisions minus one:

$$STDR \text{ (second estimate vs. first): } \sqrt{\frac{1}{11} [(0.2)^2 + (0.4)^2 + (0.1)^2 + (-0.3)^2 + \dots + (-0.3)^2]} = 0.30$$

Finally, the Range of Revision (*RR*) is the difference between the maximum revision and the minimum revision:

$$RR \text{ (second estimate vs. first): } 0.4 - (-0.5) = 0.90$$

## ANNEX 1 REVISIONS INDICATORS

1. A revisions history can be summarized using standard descriptive statistics. Section 6 of this chapter discussed and explained the most common indicators used in the revisions analysis of QNA variables (i.e., mean revision; mean absolute revision; standard deviation of revision; and range of revision). By offering a mathematical presentation of these indicators, this annex aims to facilitate their implementation in the QNA compilation system as routine diagnostics of QNA reliability.<sup>7</sup>

2. Given a generic quarter  $t$ , a revision  $R_t$  is defined as the difference between a later estimate  $L_t$  and a preliminary estimate  $P_t$ , namely

$$R_t = L_t - P_t . \quad (1)$$

The estimates  $L_t$  and  $P_t$  should be expressed in the same unit of measurement. Equation (1) is generally used for measuring revisions on rates of change (quarter-to-quarter, or year-on-year). Alternatively, a relative measure of revision  $\bar{R}_t$ ,

$$\bar{R}_t = \frac{(L_t - P_t)}{L_t} , \quad (2)$$

is used to calculate the revisions in terms of the later estimate (usually in percentage form). Equation (2) is suitable for measuring revisions in the levels of estimates. In the QNA, however, the main interest of compilers and users is on the measurement of quarterly (or annual) changes. For this reason, this annex will focus on the absolute measure of revisions (1) as the basis for the calculation of revisions indicators. However, all the formulae presented apply equally to (2).

3. Let us assume a sample of  $n$  revisions, that is  $\{R_1, R_2, \dots, R_n\}$ . The Mean Revision ( $MR$ ) is calculated as the simple average of the revisions:

$$MR = \frac{1}{n} \sum_{t=1}^n R_t . \quad (3)$$

The  $MR$  is an indicator of direction of revision. A positive  $MR$  indicates an average upward revision to the preliminary estimate (or alternatively, an average downward bias in the preliminary estimate); a negative  $MR$  indicates an average downward revision to the

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<sup>7</sup> For a comprehensive list of revision indicators, see Di Fonzo (2005) and McKenzie (2006).

preliminary estimate (i.e., average upward bias in the preliminary estimate). Ideally, the *MR* should be as close as possible to zero.

4. The Mean Absolute Revision (*MAR*) is the simple average of the absolute value of revisions:

$$MAR = \frac{1}{n} \sum_{t=1}^n |R_t|. \quad (4)$$

The *MAR* indicator measures the average size of revisions. It is a strictly positive number. It is equal to zero when negative and positive revisions perfectly offset each other.

5. The Relative *MAR* (*RMAR*) is calculated as the ratio between the *MAR* and the average value of the preliminary estimates:

$$RMAR = \frac{\sum_{t=1}^n |R_t|}{\sum_{t=1}^n |P_t|}. \quad (5)$$

The *RMAR* is very useful for comparing the size of revisions between variables with different magnitude (e.g., countries, sectors).

6. The Standard Deviation of Revisions (*STDR*) is the square root of the sum of squared revisions divided by  $(n-1)$ :

$$STDR = \sqrt{\frac{1}{n-1} \sum_{t=1}^n (R_t - MR)^2}. \quad (6)$$

The *STDR* indicator is a measure of dispersion of revisions. A small *STDR* indicates that revisions are close to the mean value.

7. Finally, the Range of Revisions (*RR*) is the difference between the maximum revisions and the minimum revision:

$$RR = \max \{R_t\} - \min \{R_t\}. \quad (7)$$

The *RR* indicator is also a measure of dispersion. It shows the widest range of revisions occurred in the sample. Because it could be affected by the presence of extreme revisions in the sample, it should always be presented along with the *STDR* measure.

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