III Sources for GDP and its Components

A. General Issues

1. Introduction

3.1. This chapter deals with the process of identification and assessment of quarterly data sources. Because circumstances differ, it is not possible to create a standard set of sources that can be applied in all countries. Rather, the approach taken in this chapter is to describe the alternatives that are used in quarterly national accounts (QNA) compilation in various countries and some of the considerations that need to be taken into account in choosing among them.

3.2. In general, the same principles for designing sources and methods apply to both annual national accounts (ANA) and QNA. Accordingly, this chapter does not seek to provide a general introduction to national accounts sources and methods. Rather, it deals with issues that are specific to or are of heightened importance in a QNA context.

3.3. This section deals with general issues that apply to more than one component of GDP compilation. The remaining sections of this chapter cover the components of each of the production, expenditure, and income splits of GDP. Even if expenditure or income data are incomplete, it may still be possible to derive a useful split of GDP by type of expenditure or income, as noted in Chapter II. For the production approach, the presentation in this chapter is by type of indicator, because there are common issues in data sources that cut across a wide range of industries. In contrast, a presentation arranged by output, intermediate consumption, and value added would not show the links between the compilation of these items, and a presentation by industry would be repetitive because some issues apply across many industries. The other approaches are discussed by component—expenditure by household consumption, government consumption, and so on; income by compensation of employees, operating surplus, and so on. Some indicators are used in more than one approach; for example, the same construction indicators are used for the construction industry in the production approach and for capital formation in the expenditure approach. In these cases, specific issues for such indicators are discussed under the heading of expenditure.

2. Data Sources

3.4. The basic principle in selecting and developing QNA sources is to obtain indicators that best reflect the items being measured. In some cases, source data are available in a form ready for use in the ANA or QNA with little or no adjustment. In other cases, the source data will differ from the ideal in some way, so that the source data will need to be adjusted. These adjustments may typically be established for one or a few *main benchmark years* for which additional sources such as the results of more comprehensive and detailed surveys or censuses may be 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 (extrapolation or, equivalently, forward carrying of the benchmark adjustments). As the ANA provide the benchmarks for QNA they should be the starting point in selecting and developing QNA sources. In some cases, the same sources that are used annually or for the main benchmark years may also be available on a quarterly basis, most commonly foreign trade, central government, and financial sector data. More commonly, QNA data sources are more limited in detail and coverage than those available for the ANA because of issues of data availability, collection cost, and timeliness. For each component, the available source that best captures the movements in the target variable both in the past and in the future constitutes the best indicator.

3.5. The use of an indicator implies an assumption that it is representative of the target variable. The best

strategy is to make such assumptions explicit and review them regularly. When assumptions are not made explicit, there is a greater risk that they are not being carefully evaluated. As well, the economic conditions that underlie an assumption may be initially realistic, but later change, so the assumptions need to be reviewed from time to time.

3.6. The suitability of an indicator can be assessed qualitatively by looking at the differences from the target variable in coverage, definitions, and so on. There are a range of possibilities for the closeness of the indicator and the target variable. After the ANA data sources themselves, the most desirable indicators differ only slightly from those used in the ANA, for example, by being based on a sound sample but with less detailed data. Less satisfactory are indicators that cover only a part of the total, such as the major products or largest establishments in an industry. Even less satisfactory as indicators are those that measure something related to the process or population of the target variable, but less directly, such as labor inputs as an indicator of service industry outputs. Least acceptable are indicators that apply past trends or measure something that is connected to the target variable only by a behavioral relationship or statistical correlation. Such indicators should be avoided because the underlying relationships can be expected to be less stable than is the case for an indicator with a direct intrinsic relationship to the target variable.

3.7. The indicator and the assumptions behind its use can also be assessed quantitatively by *comparing the growth rates* in the annual sum of the quarterly indicator with growth rates in the corresponding ANA estimate. Equivalently, the ratio of the ANA estimate to the sum of the quarterly indicator shows the relationship between the two series as a single figure, which in this manual is called the benchmark-indicator ratio. (The process of indicator assessment is described in depth in Chapter II.)

3.8. A stable benchmark-indicator ratio shows that the indicator represents the movements in the target variable well. Changes in the ratio may point to problems and help identify ways to improve the indicator in the future. The benchmark-indicator ratio does not have to equal one, as differences between the levels of the annual estimate and the quarterly indicator can easily be solved by multiplication. For example, a quarterly indicator in the form of an index can readily be converted to a money value. This lack of concern about levels is an important difference in focus between QNA and ANA compilation: while establishing correct **levels** is essential in ANA compilation, levels in QNA can be derived from the ANA. The essential task in QNA is to obtain the data sources that provide the best indication of quarterly **movements.**

3.9. Even with careful selection of the most suitable indicators and improvements to data sources, benchmark-indicator ratios will vary over time, because indicators are not fully representative of the target variable. Chapter VI deals with the mathematical processes used to make a QNA estimate that follows the movements of the indicator as closely as possible while being fully consistent with the levels and growth rates of the annual estimates. Use of fixed ratio adjustments is another way of using an indicator in conjunction with a benchmark. However, the adjustment of indicators to the levels of the annual data should be done through the benchmarking process, not using fixed ratios, because benchmarking takes into account changes in the ratios as smooth changes and so avoids step problems. (This issue is discussed in more detail in Section D.1 of Chapter VI.)

3.10. Two or more indicators may be available for the same item. In some cases, the indicators may represent different parts of the item. For example, clothing may have separate indicators for men's, women's, and children's clothing. In these cases, the best solution is to split the annual data into each component and benchmark each indicator and component separately. If that is not possible, the components should be added or weighted together to form a single indicator before benchmarking. Alternatively, if the various indicators do not represent different parts of an item but rather are alternative indicators, the one that is most representative in terms of concept and past annual movements should be adopted. If they are equally suitable, the indicators could be added or weighted together to produce a single indicator.

3. Issues with Surveys

3.11. A common problem for surveys is the delay in the inclusion of new businesses and deletion of nonoperating businesses in survey frames and estimation procedures. This problem is more serious for QNA than for ANA because of the more limited collection time for the quarterly source data and because the information needed to update the survey frames may be more limited on a quarterly basis. The continuing

process of births and deaths of establishments and enterprises occurs in all industries but particularly in those with a large number of small-scale, short-lived establishments, such as retailing and consumer services. Births and deaths of establishments and enterprises are an important factor in changes in the overall trends. In fact, growth often occurs largely through increases in the number of businesses rather than through growth in the output of existing businesses. Moreover, new businesses are particularly likely to have higher rates of growth and high levels of capital formation (particularly in the start-up quarter), as well as being more likely to be established during economic upturns. Closed businesses are included in the scope of surveys but may be misclassified as nonresponse. Because of these factors, quarterly business surveys should be designed to reflect changes in the population of businesses or they will tend to understate growth for a booming economy and understate declines for an economy in recession.

3.12. For the survey results to reflect changes in the population of businesses, the following considerations need to be taken into account when designing business surveys:

- The business register that provides the population frame[1] for the survey needs to be updated on a continuous basis to ensure complete coverage of the entire population of businesses in the frame.
- New businesses should be incorporated in the survey as soon as they start, either by drawing supplementary samples of new businesses or redrawing the sample for the whole population.
- Deceased businesses need to be separated from nonresponding businesses in the original sample. The contribution of deceased businesses to their industry should be recorded as nil; for nonresponding businesses, values should be estimated.
- For each industry, the original sample and the supplementary samples should be stratified by size, location, age, and other dimensions of businesses that may explain major variations in the level and growth rates of the target variable for each business for which corresponding population-wide information is available in the frame. Different stratification principles may have to be used for new and continuing businesses in cases where the available population-wide information differs for the two subgroups.
- The estimation procedure should be level oriented, not index oriented, because the introduction of new businesses and products is more difficult in an index framework. In contrast to an index formulation, a level formulation of the estimation procedure allows different grossing-up factors to be used for different parts of the sample. Levels can be easily converted to indices for presentation purposes.

3.13. If new businesses cannot be incorporated in the survey as soon as they start or there is a large informal economy, household labor force surveys may provide information that can be used to adjust incomplete coverage of business surveys. To be useful for this purpose, household surveys should include questions about the kind of work done and the number of hours worked by each resident of the household, as well as information that allows the place of employment to be identified from the business register, if possible. The survey should include each position held by those with more than one job. Business surveys would need corresponding questions about the number of employees and the number of hours worked. The comparison of labor force and business survey results would give adjustment factors for undercoverage in business surveys. The adjustments, or grossing-up procedures, should be conducted at a detailed industry level with stratification by dimensions that explain variations in the ratio between the target variable and the grossing-up factor. If used to derive measures of business survey undercoverage in this way, monthly or quarterly labor force surveys can be an important data source for QNA.

3.14. Infrequent changes in survey frames or other changes in survey methodology can lead to distortions in the time-series qualities of the QNA. Movements in the indicator will be misleading if caused by changes in survey methods or coverage, rather than actual changes. In these cases, it is essential to separate the causes of movements in the data. If an overlapping period is available for both the old and new survey bases, it would be possible to separate the effect of frame and method changes from the quarterly change. In the case of changes in the frame, the adjustment should be allocated over all the periods since the frame was last updated. For other changes in methods, the old and new series would be linked by a factor to take into account the effect of the change. If it were not possible to have an overlapping period, adjustments could be based on indicators not affected by the change, sometimes including the household labor surveys mentioned in the previous

[1]The sources of information available to update the business register depend on the legal and economic conditions in each country. Sources include business licenses, taxation registers, business bank accounts, and telephone directories.

paragraph, or derived from any other available information comparing the old and new survey bases.

4. Issues with Administrative Byproduct Data

3.15. Administrative byproduct data tend to be used more in QNA than in ANA. These data are derived from information gathered in the process of government taxation or regulation, rather than from a survey designed for statistical purposes. For example, taxation and control of foreign trade, taxation of payrolls and collection of social security contributions, and regulation of particular activities such as transport or land transfer all generate information that can be useful for QNA purposes. As these systems were designed with other objectives than obtaining statistics, there may be limitations from a national accounts perspective in matters such as coverage, units, data definitions, period covered, and level of detail. For these reasons, direct statistical collections may be preferred for annual data. On the other hand, if the administrative information has already been collected, the costs and response burden associated with a survey can be avoided. As well, governments often ensure high or even universal compliance on a timely basis. However, timing problems from differences in periods covered can become be a problem with administrative data and can be more severe in QNA, as any timing difference is relatively larger in a quarterly context. For example, a biweekly system could have six two-week periods in some quarters and seven two-week periods in others.

3.16. An important type of administrative data for QNA is from value added tax (VAT) systems (also called "goods and services tax" in some countries). VAT systems collect monthly or quarterly data on sales and purchases as part of the tax collection process. The data may also be suitable for statistical purposes and are being used in an increasing number of countries. VAT systems have the benefit of offering comprehensive or, at least, very wide coverage. Since the VAT system would collect information in any case, the extra cost and burdens of statistical collections can be avoided. However, VAT systems are not always designed with statistical objectives in mind, so there may be problems with regard to national accounts requirements on issues such as timeliness, timing, tax exemptions, industry classifications, units, the effects of rebates or backdated assessments, and limited product detail.[2] Because VAT is usually collected from legal entities rather than establishments, VAT data from multi-industry enterprises lacks industry detail. VAT data for the single industry enterprises could be supplemented by a survey of multi-industry enterprises. If such a survey is not possible, data by industry of enterprise could be used as an indicator of data by industry of establishment. There may also need to be extensive communication with the tax collection authorities to understand the data, to produce tabulations in a form suitable for national accounts compilation, and to make adjustments to tax forms and procedures to better meet statistical objectives. Other product tax systems may also provide data on the underlying flows of taxable products, such as alcohol and petroleum.

[2]Some product details may be available if different tax rates are applied.

5. Sources in the Absence of Surveys or Administrative Data

3.17. If no statistical collections or administrative data are available, industry associations, industry experts, or leading enterprises in a particular industry may be able to assist with finding or making quarterly indicators.

3.18. If no quarterly indicator is available, there is still a need to fill gaps to ensure a comprehensive total. Ideally, these gaps will be few in number, represent a small proportion of the total, and be closed later as other data sources become available. Among the alternatives for such items are use of:

- a somewhat related item as an indicator;
- totals of a wide range of other items as an indicator;
- the overall economy as an indicator; or
- mathematical methods based on distribution of annual data and extrapolation of past annual trends.

3.19. In choosing among alternatives, past patterns in the annual data for that variable can be used as a guide. If a series is volatile and related to the economic cycle, growth rates of the rest of the economy could be a suitable indicator. If the annual series does not relate to fluctuations in the rest of the economy, a growth rate based on past trends may be suitable. Extrapolation on the basis of past trends is generally not desirable, as it tends to hide the actual data on current trends. If there really is no suitable indicator, a simple method that is transparent may be more appropriate than something that is time-consuming and complicated but not necessarily any better. Mathematical techniques for generating synthetic data in the absence of indicators are discussed in Chapter VII.

B. GDP by Industry

1. General Issues

3.20. The production approach is the most common approach to measuring quarterly GDP. To some extent, this may reflect the availability of data before the introduction of QNA. In addition, the production approach shows the industry composition of growth, which provides a useful perspective on economic performance. The production approach is also particularly suitable for deriving productivity measures because industries for which output volumes are poorly measured can be excluded for this type of analytical use.

3.21. The general principles of deflation and choice of double and single indicator methods are the same for QNA and ANA. The production approach involves calculating output, intermediate consumption, and value added at current prices as well as in volume terms by industry. Because of definitional relationships, if two out of output, intermediate consumption, and value added are available, the third can be derived residually. Similarly, if two out of values, prices, and volumes are available, the third can be derived. (See Box 3.1.)

3.22. Observed data on both output and intermediate consumption at current prices may be available quarterly in some cases; in these cases, the double indicator method for value added can be used. For example, in some countries, government-owned enterprises in industries such as oil, transport, or telecommunications may be economically significant and able to supply data directly. Commodity flow methods may be used to generate information on some specialized inputs, for example, pesticides and fertilizers for agriculture. In a system of quarterly supply and use tables, the required data can be generated on the basis of available data, past tables, and national accounting identities.

3.23. However, the data required for the production approach are commonly incomplete on a quarterly basis. Because compiling the production accounts at current prices and in volume terms requires detailed accounting information on both output and current expenses, the required data may not be available quarterly or may not be collected with the speed needed for timely QNA compilation. Then the missing data must be estimated by using another series as an indicator. Most commonly, output data are available, while data on intermediate consumption are not. In other cases, data on total intermediate consumption, component(s) of intermediate consumption, labor 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.

3.24. Relationships between inputs and outputs (input-output or IO coefficients) may change as a result of technological changes, differences in the seasonal patterns of outputs and inputs, or variations in capacity utilization caused by changes in the business cycle. The impact of technological changes may not be significant in the short term and can be handled through the benchmarking process if they happen gradually over a longer period. As discussed in Section D of Chapter VI, it is preferable to use benchmarking rather than fixed ratios. The reliance on fixed coefficients is particularly unsatisfactory for calculations at current prices because of the additional factor of changes in relative prices.

3.25. It is recommended that output, intermediate consumption, and value added—at current prices, in volume terms, and the corresponding deflators—always be derived and published in a complete presentation. In some countries, value added is derived directly, without explicitly calculating output and intermediate consumption. This practice is undesirable for several reasons. It is not consistent with the *1993 SNA* presentation of the production account or with supply and use tables. It reduces the analytical usefulness of the data. Also, because value added is not able to be directly observed or deflated, it encourages the use of inappropriate calculation or deflation methods when better options are available. It does not facilitate comparison of quarterly estimates with subsequent annual output data or help in pinpointing weaknesses. As an example, compiling the full production account by industry makes explicit the assumptions about IO ratios that might otherwise be implicit or ignored. An assumption of fixed IO ratios at both current and constant prices might be highlighted in

Box 3.1. Data for the Production Approach

	Current price values	Prices/price index	Volumes/constant price values
Output	✓	✓	✓
Intermediate consumption	✓	✓	✓
Value added	(usually derived indirectly)	(usually derived indirectly)	(usually derived indirectly)

implausible implicit price deflator movements, or deflating value added by an output price index[3] might result in unacceptable changes in IO ratios.

3.26. If data on intermediate consumption are not available, the preferred method is first to obtain an estimate of intermediate consumption at constant prices using constant price output as an indicator. This method uses an assumption of a stable 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. In the likely event that there is not a specific producer price index (PPI) for inputs, industry-specific intermediate consumption price deflators can be constructed by weighting together relevant price index components from, for example, the consumer price index (CPI), PPI, and foreign trade price indices according to the composition of inputs. A use table[4] for a recent year would provide weights to derive industry-specific intermediate consumption deflators (or reflators). A more detailed level of reflation is preferable as it allows the effect of changes in the composition of output to be captured in the estimates.

3.27. Output and value added should be estimated at basic prices according to the *1993 SNA*, although producers' prices are an acceptable alternative. A number of countries that follow the *1953 SNA* or *1968 SNA* use factor cost valuation.[5] Measurement of value added at basic prices is preferred in the *1993 SNA* and is increasingly common in practice. To derive GDP from value added at basic prices, customs duties, VAT, and other taxes on products are added and subsidies on products are subtracted. This measure is consistent with the expenditure-based estimate of GDP, while separating the processes of production and taxation of products in the generation of GDP.[6]

2. Sources for Industries

3.28. Commonly used types of source data for the production approach on a quarterly basis include current price data from accounting and administrative systems, quantity indicators, labor and other input measures, and price indices. Most commonly, deflation will be used to derive a volume measure, that is, a current price value is divided by a corresponding price index. Due to problems that are discussed below, deflation is usually preferable to direct measures of volumes. In other cases, there may be volume and price indicators only or current price value and volume indicators only. Box 3.2 provides an overview of the value and volume indicators most commonly used for the production approach.[7]

a. Current price data on outputs and/or inputs

3.29. Current price data can be obtained from accounting systems through surveys or as administrative byproducts. Accounting data are particularly suited for the collection of aggregates. Compared with volume measures, these data have the advantages of being comprehensive and cutting the costs associated with collecting detailed data, which reduces respondent burden. In contrast, quantities of different products need to be collected separately for each product, and there are potential serious problems if new products are omitted.

3.30. The sources of accounting aggregates may be direct surveys, published accounts, or administrative systems for regulation or taxation.

3.31. For goods-producing industries, the values of sales together with opening and closing values of inventories of finished goods and work-in-progress[8] are required to derive an output indicator. The simplest indicators cover only total sales of goods manufactured by the enterprise. A more sophisticated system may collect separate data by product group and/or

[3]Unlike the other single indicator methods, deflation of value added by output price indices assumes that prices of inputs, outputs, and value added are all moving in the same proportions. Relative prices can often be quite volatile because of factors such as changes in exchange rates, wage rates, profitability, and commodity prices. It is almost always possible and better to

- deflate output at current prices by the output deflator; then
- estimate intermediate consumption at constant prices by using output as an indicator (assumes a stable input-output ratio, although this will be modified by annual trends by the benchmarking process); then
- derive value added as the difference between the estimates of output and intermediate consumption, all at constant prices.

This method requires no additional data; rather, it uses more realistic assumptions.

[4]A use table shows use by industry of each product. When a use table is not available, an industry-by-industry input-output table may be considered as a less satisfactory substitute. An industry-by-industry input-output table shows the use by industry of the output of each industry, and it is less useful in this context because it is more difficult to relate the price data (as they typically refer to products) and because product prices tend to be more homogeneous than industry prices.

[5]The factor price concept has virtually been dropped in the *1993 SNA* because factor cost does not correspond to observable prices in contrast to basic, producers', and purchasers' prices and is actually a measure of income, not production.

[6]Note that the effects of nonproduct taxes and subsidies on production are reflected in basic prices along with other production costs.

[7]The Organisation for Economic Co-Operation and Development (1996) provides information about sources in its member countries.

[8]Output = sales + changes in inventories of finished goods and work-in-progress (excluding any revaluation effects).

Box 3.2. Overview of Value and Volume Indicators Commonly Used for Quarterly GDP by Industry

	Current price data on outputs and/or inputs	Data on quantities of outputs and/or inputs	Labor input measures	Other indicators
Agriculture, forestry, fishing, hunting	X	X		Population (subsistence)
Mining	X	X	X	Industrial Production Index (may be derived from range including out put, quantities, and input)
Manufacturing, utilities	X	X	X	Industrial Production Index (may be derived from range including out put, quantities, and input)
Construction	X	X		Supply of building materials
Wholesale and retail trade	X			Supply of goods handled
Restaurants and hotels	X	X	X	
Transport, storage, and communications	X	X		Volume of goods transported
Financial intermediation	X	X		Value of loans/ deposits
Real estate, business services	X		X	
Ownership of dwellings		X		Stock of dwellings (capital input)
Public administration and defense	X	X	X	
Education, health, other services	X	X	X	
Net taxes on products (including import duties, VAT)	X			Constant price value of relevant products (equivalent to applying base year tax rates)

establishment. (In establishment-level data for multi-establishment enterprises, shipments of goods and provision of services to other establishments in the enterprise need to be recorded.) Other revenue, such as sales of goods not produced by the factory, repairs, or rental services, might also be collected in total or separately. Data on inventories used in calculations should have the effects of valuation changes excluded.

3.32. Value data for construction projects are collected in some countries. If only the total value of a project is available, it is necessary to allocate it over the life of the project and exclude holding gains (see Chapter X). Otherwise, data are collected on value of work done during the quarter. Collecting this kind of data avoids the difficulties of making assumptions about the allocation of a total value for a whole project to particular quarters. However, the feasibility is limited by the availability of data, as construction enterprises are often small scale and work done may be hard to separate into quarters. Progress payments for work done may be an acceptable approximation if interviews suggest that they approximate the value of work put in place. (Construction indicators are discussed further in Section C.2 of this chapter.)

3.33. Sales data are commonly used as quarterly indicators for the output of wholesale and retail trade. Sales data could be obtained from a business survey or as an administrative byproduct of a tax on sales. Output at current prices is defined as the trader's margin, that is, sales less the replacement cost of goods sold.

3.34. Output at current prices of other business and consumer services can be measured by turnover or sales. In some countries, there are surveys of sales of services such as restaurants, hotels, clubs, hairdressers, theaters, and repairers.

3.35. Government agencies are an important source of quarterly accounting data for activities that they operate, regulate, or tax. Publicly owned corporations are

important in some activities, for example, transport, post, and telecommunications. General government dominates the service industries of public administration, defense, and community services. Government regulation of activities such as banking, insurance, and health may give rise to quarterly value data. Sales information concerning products subject to a specific tax—gambling, for example—may be obtained from governments. In some of these cases, it may be possible to use the same methods used for the annual estimates; in others, a less detailed version may be acceptable.

3.36. VAT systems can supply helpful data that can be used for the production approach. In addition to the general issues discussed in Section A of this chapter, VAT systems have the problem that they do not take changes in inventories into account because the data cover sales (not output) and purchases (not intermediate consumption). Also, purchases of goods and services that are deductible for VAT usually include both capital formation and intermediate consumption. For national accounts indicators, it is highly desirable to separate these two components. Otherwise, the purchases data would not be usable as an indicator of intermediate consumption because fixed capital formation is usually large, lumpy, or both.

b. Data on quantities of output and/or inputs

3.37. Data on quantities of output are available for many products. Quantities are easy to define for the goods-producing industries, for example, metric tons of wheat and coal, kiloliters of beer, and numbers of cars. Less tangible quantities can be measured for other industries, for example, kilowatts of electricity, floor area of construction, and ton-kilometers of freight.

3.38. The concepts of quantity measures and volume measures should be distinguished. Quantity data are expressed in terms of physical units. Volume data are expressed in terms of constant price values or volume indices; these data differ from the quantity data because quality changes are accounted for and because the measures can be meaningfully aggregated. Quantity data can be converted to constant price values by multiplying them by base year prices and making adjustments (if any) for quality change.

3.39. In some cases, businesses can supply quantity data more readily than they can supply financial information on a quarterly basis. The businesses may not compile quarterly accounts, or they may take longer to complete than simply collecting numbers that do not require processing or valuation. Quantity indicators can be multiplied by price indices or average prices for the quarter to obtain current price indicators. Such estimates avoid the inventory valuation issues that arise for current price values that have been derived from data that include inventories measured at historic cost.

3.40. The limitations of quantity data are significant, and quantity data should be avoided if products are heterogeneous or subject to quality change. The range of products in an economy is enormous, so the list of products is limited to the major ones and is usually far from comprehensive. Products are not the same as industries, so secondary production should be included with the industry of actual production, not with the industry to which they are primary. The usefulness of quantity data is limited by the homogeneity of the products. For basic commodities, such as wheat and base metals, there is often relatively little variation in quality over time, particularly if data are broken down by grades of quality, so quantity indicators may be suitable. However, many products vary considerably in quality—that is, they are heterogeneous. For such goods, deflated current price data should be used. This situation applies to a large number of manufactured goods and to some agricultural and mining products. The more narrowly such products are defined, the more the estimates will be able to reflect the actual volume of output. For example, if cars are treated as a single product, changes in the mix of output toward larger cars or cars with more accessories or better quality will not affect the number of cars but should be treated as an increase in the volume of output. There are many products for which quantities are poor indicators or for which output is not readily quantifiable, such as clothing, medicines, and specialized equipment. One way of dealing with the problems of heterogeneity of products is to collect extra detail, although it may not be practical owing to greater collection costs, respondent burden, and delay in tabulation.

3.41. Quantity indicators are usually developed on a case-by-case approach for each industry, rather than as a unified system. The following are some examples of quantity indicators:

- Agriculture: quantities are usually closely monitored, heavily regulated, or subsidized by Ministries of Agriculture. Quantity data for agricultural products may be obtained from some point along the distribution chain if the number of farms is large and the distributors few. However, differences between quantity of products at the farm and quantity of products at the distribution site can be caused by

wastage, timing differences, double counting, grower-consumed products, informal sales, and other factors. Conceptual issues associated with the timing of agricultural production are dealt with in Chapter X.

- Construction: floor area built, preferably divided by type of building. (Indicators for construction are discussed further under gross fixed capital formation on construction in the expenditure approach in Section C of this chapter.)
- Hotels and restaurants: numbers of bed-nights; numbers of meals. Numbers of foreign tourists may be an acceptable indicator in countries where expenditures by foreign tourists are a high proportion of the total.
- Transport: numbers of passengers or passenger-kilometers; metric tons of freight or ton-kilometers; numbers of licensed taxis and hire cars. To the extent that prices, and therefore the volume of service, reflect distance, data with a kilometer dimension are better indicators. For example, metric ton-kilometers would be a better indicator of the volume of freight than a measure of metric tons that did not take into account differences in distances carried. (Ideally, if there were both fixed and distance-related elements to the price, the two would be weighted together.)
- Services to transport: numbers of ships handled in ports; numbers of aircraft and passengers handled at an airport; numbers of days for which cars are hired; weight or volume of goods stored or refrigerated; numbers of cars parked in pay parking; numbers of journeys on toll roads.
- Communications: numbers of letters, parcels, or local telephone calls; minutes of long-distance or international telephone calls; numbers of telephone lines. In view of technological change in the area of communications, it is important to include new products, such as electronic data lines, internet connections, and mobile phones.
- Ownership of dwellings: numbers of dwellings, preferably broken down by location, size, and type of dwelling and with adjustments for new dwellings and alterations and quality change. (Sources and methods are covered later in more detail in the discussion of indicators for household consumption of rent.)
- Other business services: numbers of wills, court cases, and divorces for lawyers; numbers of registered land transfers for real estate agents; numbers of deaths for undertakers; stock market turnover for stock market dealers.
- Public administration services: numbers of pensions processed, licenses issued, and court cases processed. Because these indicators are partial and do not reflect quality well, they are used to only a limited extent.
- Other services: numbers of tickets sold by theaters and other forms of entertainment; numbers of vehicle repairs.

3.42. The potential range of sources is very wide. Unlike industrial production indices, these indicators are not usually part of a comprehensive system of indicators. As a result, there are typically many gaps, and data often need to be obtained from different agencies. Some potential indicators may be unpublished but could be obtained by making a request to the relevant agency.

c. Labor input measures

3.43. Labor input measures are sometimes used as indicators of the volume of output of service industries. The assumption behind the use of this method is that employment is directly related to output and value added in volume terms. Labor is a major input to the service industries, and compensation of employees plus mixed income typically constitute very high proportions of value added. As well, comprehensive monthly or quarterly data on employment by industry are available in many countries, from specific surveys or as a byproduct of a payroll or social security tax system.

3.44. Number of hours worked is preferable to number of employees as an indicator of labor input. Output is affected by changes in standard weekly working hours, the proportions of part-time employees, and hours of overtime. Hours worked takes into account these effects, but numbers employed does not. However, hours worked is still an imperfect measure of labor input. Ideally, labor input measures would take into account different types of labor (e.g., disaggregating by occupation or skill level) weighted by their different rates of remuneration. The total value of wages and salaries divided by a fixed specifications wage and salary index would give an indicator that also takes into account such compositional effects, but it would need to be supplemented by a measure for self-employed labor. It is preferable that actual hours worked be covered, rather than paid hours which include sick leave, vacations, and public holidays but exclude unpaid work. The labor input measure should include working proprietors and the self-employed as well as employees.

3.45. Labor input would seldom be preferred as a volume measure because the relationship of labor to output is variable. Because of the delays and costs associated with hiring and firing, labor tends to be less responsive to output than some other inputs. The relationship between labor input and output also changes as a result of changes in capital intensity and total factor productivity.

3.46. In the case of the nonmarket activities of general government and nonprofit institutions serving households, current price output is measured on the basis of the cost of inputs. It is preferable that the output volume measure take into account the services provided by the government or nonprofit institution, if measurable. It is common, however, to use input indicators if suitable volume measures are not available.

3.47. As with other sources, calculations at a greater level of detail will usually improve the estimates. For example, cleaning and litigating may both be in the business services industry category, but the output per hour worked of a cleaning business is much less than that of a law firm. Accordingly, an indicator that separates the two activities will better reflect changes in output.

d. Indirect indicators

3.48. Where direct measures are not available, a diverse range of indirect indicators may be considered. It is sometimes possible to identify a downstream or upstream activity that can be used as a basis to generate indicators. For example, the supply of building materials can be used as an indicator of construction activity. Construction is often difficult to measure because of the large number of small-scale and ephemeral contractors, own-account work, and work done without permits. The supply of building materials, on the other hand, can often be obtained from a relatively small number of manufacturers and quarries (with adjustments for exports and imports, if applicable). To the extent that there is a stable relationship between building material inputs and output, this is a suitable indicator that can be obtained with relatively little cost or compilation time. The quality of the assumption deteriorates if there are changes in any of the mix of types of building, techniques of building, productivity, and inventories of building materials. If changes in these factors are known to be occurring, it may be desirable to explore more complex methods (e.g., a calculation that takes into account the different products used by different types of construction or collection of data on inventories).

3.49. An indicator for the wholesale and/or retail industries could be obtained from the supply of goods that are distributed by these industries. Although it would be conceptually preferable to obtain data on sales and purchases directly from the enterprises, data on the supply of goods handled are often better or easier to collect[9] because many wholesalers and retailers are small scale. (Data on sales of goods to consumers are discussed later in this chapter in the context of GDP by expenditure category.) Similarly, if the types of commodities handled by wholesalers are known, the value of supply of those commodities can be used as an indicator for wholesale output. The wholesaling activity of specialist importers can be measured by the volume of imports. As the estimation procedures rely on an assumption of fixed markups (i.e., the margin as a percentage of the price), the method will give better results if calculated at a greater level of product detail to take into account the combined effect of changes in the product mix with varying markups of different products.

3.50. If data on road freight transport activities are inadequate, it may be possible to derive an indicator based on the supply of goods that are usually transported, or at least the major components. Indicators for other supporting industries may also be derived from the output of the industries served, such as services to agriculture, mining, and transport.

3.51. Population is sometimes used as an indicator in areas where nothing more specific is available, such as subsistence agriculture, housing, and some consumer services. The indicators should be adjusted for long-term trends; for example, population could be used to represent dwelling services, but adjustments should be used to account for trends in quality of dwellings and persons per household. Adjustments for divergence in long-term trends between the population indicator and the annual estimates can be incorporated through the benchmarking process.

3.52. All of the methods discussed in this section assume ratios based on the benchmark data. Such

[9]The supply of goods is derived from output less exports plus imports (plus any other adjustments for any other known use in intermediate consumption, inventories, or capital formation, or tax or distribution margins).

ratios are more likely to be stable in constant price terms, so it is generally better to make the assumption in constant price terms and then reflate to current prices. Also, in all of these cases, if the benchmark data are more detailed, the quarterly estimates will tend to be better if the calculations are done at a detailed level.

e. Price indicators

3.53. If a current price value is available for an item, a volume measure can be obtained by deflating with a price index. Alternatively, if a volume measure is available, a current price measure can be obtained by reflating (or inflating) with a price index. Often appropriate deflators will already be available in the form of published price indices, but sometimes deflators will need to be derived by the national accounts compiler by recombining components of other indices or obtaining supplementary price information.

3.54. For manufacturing output, relevant detailed components of the producer price index (PPI) are usually available. PPI measures prices at the factory gate (usually at basic values, sometimes at producer's prices) and is, therefore, most suitable for deflating data at basic values, such as output. In an increasing number of countries, PPIs are extended to cover a wider range of industries beyond manufacturing, possibly including agriculture, mining, construction, and services. For consumer services, particular components of the consumer price index (CPI) could be used. A wholesale price index (WPI) measures prices including transport and distribution margins (and sometimes product taxes) and also covers imports. As a result, WPIs are less suitable for deflating output measures than is PPI, but WPI may be more suitable for deflating intermediate consumption that has passed through the distribution system and includes inputs.

3.55. In some cases, national accountants may be able to develop specific-purpose price indices to fill in gaps. For example, if there are a small number of airports or rail operators, it may be possible to obtain a selection of their charges directly (e.g., from their rate sheets if these show actual transaction prices). When a product is largely exported, average unit values may be used. Professional associations, such as those of lawyers or architects, may have information on fees. Ministries of agriculture and other government bodies that regulate or monitor agricultural activities are often sources of price data for agricultural products. The data are usually expressed in terms of average prices. It is necessary to exclude transport and distribution costs to derive "farm gate" prices.

3.56. Where no direct data are available, prices of one or more similar or closely related products or industries that have a tendency to move in the same way may be suitable. Suitable comparable products or industries should have somewhat related cost structures or demand. For example, CPIs for domestically produced components are more likely to be representative for unmeasured domestic products than the total CPI, which includes imports and so is more affected by exchange rate movements. Similarly, CPI service items are more likely to be representative of unmeasured services than the total CPI to the extent that services tend to have similar, labor-dominated cost structures.

3.57. It may be necessary to produce output deflators or reflators based on input costs, for example, weighting together wage indices or information on wage rates with the prices of major intermediate inputs. Because this technique does not account for operating surplus, it is unsatisfactory to the extent that profitability varies. However, to the extent that profitability and productivity are taken into account in annual data, the benchmarking process will incorporate the annual variations.

3.58. Wholesaling and retailing present special difficulties in identifying the price dimension. The difficulty arises because they are industries that predominantly produce margins; the service components are combined with the prices of the goods, and the quality aspects are difficult to measure. The preferred solution is to avoid deflating the margin directly by deriving independent volume and value measures. A volume indicator of the margin service can be made from the volume of goods bought or sold using an assumption of a stable volume of the distribution service per unit of goods, that is, no quality change in the service. The suitability of the assumption is improved by compiling at a greater level of detail, as markups differ among products and between outlet types. The price indices of the goods should not be used as a proxy deflator or reflator of margins because margins have different cost structures and can vary differently than goods prices.

3.59. Like output of wholesaling and retailing, the output of financial intermediation services indirectly measured (FISIM) is a margin and so is not readily

observable. The recommended approach for QNA estimation is to use the deflated values of loans and deposits as volume indicators for the service provided in conjunction with the annual benchmarks. The value of loans and deposits should be deflated by a price index measuring the general price level (e.g., the CPI). The method would ideally be applied at a disaggregated level, with a detailed breakdown of types of assets and types of liabilities, because the interest margin varies among different types of assets and liabilities, reflecting the fact that the value of service provided varies for different categories. Note that interest margins for financial services can be quite volatile. Interest margin changes are price effects and do not affect the volume of loans, so they will be correctly shown as a price effect with this method. A less satisfactory alternative would be direct deflation of the value of FISIM by a general price index or by financial service input prices. However, these deflators do not measure the price of FISIM and ignore interest margin changes. As a result, changes in financial institutions' profitability would be wrongly shown as a volume change.

3.60. In cases where independent current price and volume measures for output are obtained, the corresponding implicit price deflator should be checked for plausibility.

3.61. Intermediate consumption usually has no specific aggregated deflators, so it is necessary to build them from components of other price indices for the relevant products. Note that even when a fixed coefficient method has been used to derive volume measures for an industry, it is desirable to reflate intermediate consumption and output separately and undesirable to use the fixed coefficient method at current prices.

f. Industrial production indices

3.62. An industrial production index (IPI) is typically already available in countries that compile QNA. It is usually at least quarterly and sometimes monthly. IPIs can use any of the methods used for industry volume indicators, namely deflated values, quantity measures, or selected inputs. In some cases, the IPI may use a mix of methods, such as quantities for homogeneous goods and deflation for others.

3.63. It is preferable to compile QNA estimates from the IPI source data or from IPI components at a disaggregated level, rather than from the total IPI. The more detailed compilation allows differences in coverage and concepts between the IPI and QNA to be resolved. Benchmarking, structural assumptions, and reflation tend to be better when carried out at a greater level of detail. The national accounts measure of output requires weights to reflect output at basic prices or producers' prices, while the IPI may use other weights or valuations. The IPI may have gaps in coverage that may need supplementary sources, for example, particular industries, goods that are not easily quantified, repair service revenue, newspaper advertising revenue, hiring revenue, and secondary output. The base years may also differ. Published IPIs are sometimes adjusted for variations in the number of working days, rendering them unsuitable as QNA indicators. For compilation of non-seasonally adjusted QNA, the data should reflect the actual activity in each quarter, without adjustments for working days or other calendar and seasonal effects.

3.64. If different methods are used in the IPI and QNA, it will prevent confusion if the QNA sources and methods documentation clearly states the differences. These differences should be explained (e.g., weights, coverage, valuation) and quantified, if possible.

3. Adjustment Items

3.65. To derive GDP at market prices, total value added of industries at basic prices needs to have net taxes on products added and unallocated FISIM deducted.

3.66. Net taxes on products consists of import duties, value added taxes, and other taxes less subsidies on products. Data on net taxes on products at current prices are normally available from government finance statistics and present few problems. In a few countries, some components, such as state and local product taxes, may need to be estimated. Such estimates can be based on data on the supply of the taxed products.

3.67. Net taxes or subsidies in volume terms can be defined as the base year rate of tax (or subsidy) applied to the current volume of the good or service. Technically, this is equivalent to the base year value of taxes (or subsidies) extrapolated by the volume of the taxed (or subsidized) goods and services. To the extent that tax (or subsidy) rates differ, it is desirable to do the calculations at a more detailed level to take into account the differing rates.

3.68. The QNA treatment of FISIM should follow the ANA treatment. Under the preferred *1993 SNA* treat-

ment, FISIM should be allocated to users (viz., intermediate consumption by industries, final consumption expenditure, exports) and so would not be an adjustment item to total GDP. In the *1968 SNA*, FISIM was treated as the intermediate consumption of a nominal industry rather than allocated across users. With the *1968 SNA* treatment, it is necessary to deduct unallocated FISIM in aggregate from value added by industry in order to derive GDP. The same indicators that are used to derive and deflate output of financial services should be used for the adjustment. The *1993 SNA* also permits the use of the *1968 SNA* treatment.

C. GDP by Type of Expenditure

1. General Issues

3.69. GDP by type of expenditure shows the final demand for goods and services and so is particularly useful for economic analysis. One benefit for compilation of the expenditure approach is that prices are readily observable; also, this approach does not rely as much on fixed ratios as the quarterly production estimates. Nevertheless, the expenditure approach is less common than the production approach among QNA compiling countries because of problems of availability, timing, valuation, and coverage of expenditure source data, as detailed in the following:

- Government and international trade are typically well covered by quarterly data, but the timing of recording of data is often inconsistent with the national accounts requirements. Government data are usually recorded on a cash basis, although accrual adjustments are sometimes made for particular, identifiable items and accrual accounting is becoming more common in government accounts. Merchandise trade data are recorded when the merchandise passes through the customs frontier, although adjustments may already have been made for some timing problems in balance of payments statistics. Inconsistencies in the timing of transactions may lead to discrepancies and errors. Timing differences are a much more important issue in quarterly data than in annual data: with the same timing differences affecting the annual and quarterly series, the relative impact of an error is four times more significant.
- Expenditure estimates are more strongly influenced by coverage problems in the business register. This influence arises because of the high proportion of retailing and consumer services output that goes to household consumption and the high proportion of building output that goes to capital formation. These activities often have high proportions of smaller, shorter-lived, less formal businesses. The same activities are included in GDP by industry, but only to the extent of their value added.
- Changes in inventories have serious valuation problems. These problems also occur in production and income approach estimates, although they may be partly avoided by use of quantities of output in the production estimates.

3.70. If the available expenditure data have serious gaps, the expenditure approach cannot be used. However, it may still be possible to derive a useful split of GDP by type of expenditure. The sum of the available expenditure components can be derived so that the total of the missing components can then be derived as the residual from total GDP from the production approach. For example, many countries derive changes in inventories in this way. Although not an independent check on the production estimates, use of incomplete expenditure data in this way is helpful to data analysts.

2. Sources

a. Household final consumption expenditure

(i) Value indicators

3.71. Household final consumption is usually the largest component of GDP by expenditure. The main sources of data on household consumption are surveys of retailers and service providers, value added tax (VAT) systems, and household surveys. Also, data on the production and foreign trade in consumer products can be used to derive estimates by commodity flow methods.

3.72. Business surveys of retailers and providers of other consumer services are a common data source for household consumption at current prices. Many types of retailers and almost all services are fairly specialized, but supermarkets and department stores sell a wide range of goods, so that collecting product breakdowns for these stores is desirable. A detailed breakdown by product improves the quality of the deflation and provides extra information to users. If product mixes are stable, satisfactory quarterly data by product can be estimated by using total sales of a retail industry as an indicator for the benchmark values of sales by product.

3.73. A VAT or sales tax system may be able to provide data on sales by type of enterprise. Such a tax system may also divide sales into different product categories if different tax rates are applied. It is necessary to

identify which sales are indicators of household consumption, for example, sales by retailers and consumer services. The systems used to collect other taxes, such as taxes on alcohol or tobacco, may also be a potential source of information.

3.74. Some countries conduct continuous household expenditure surveys. If the results are processed on a timely basis by quarter, they could be useful indicators for QNA. Data collected from households have different benefits and shortcomings compared with business data. Reporting quality and omissions of small or sensitive items may be a problem in household surveys, depending on the behavior of respondents. For example, expenditure on socially sensitive items such as alcohol and tobacco is often understated, requiring adjustments to be made on the basis of other information.[10] As well, there are often problems with purchases of consumer durables as a result of recall and infrequency of purchases. On the other hand, household surveys ensure good coverage of purchases from informal, small-scale retailers and service providers. These are difficult to cover in business surveys, but the purchaser has no reason to understate this expenditure, which is no more difficult to report than any other expenditure. Household surveys may be favored in developing and transition economies because they cover purchases from the informal activities. In countries with small informal sectors, business surveys may be preferred because of issues such as collection cost, delay, and reporting quality of quarterly household expenditure data. For QNA estimation, a level bias in household surveys is not a problem as long as the bias is stable so that it gives a correct indication of movement. In general, a combination and reconciliation of data from several sources will give the best results.

3.75. In addition to broad sources such as retail sales, VAT systems, and household surveys, there are a range of specific indicators for components of household consumption. The sources of specific indicators include specialized statistical surveys, major supplying enterprises, and regulators. Where there are a small number of large suppliers of a particular item but no currently published data, the information can sometimes be collected specifically for QNA. Examples could include sales to residences of electricity and gas, as well as some components of transport, communication, and gambling.

[10]For example, from tax data if smuggling and tax evasion are not major problems.

3.76. Household consumption expenditure estimates that are based on indicators from the retailers and service providers will need adjustments for expenditure by residents when abroad and expenditure by nonresidents while in the country. Both of these can be obtained from balance of payments statistics, if available on a quarterly basis (and, if not, by using the methods discussed in the IMF's *Balance of Payments Compilation Guide*).

3.77. Commodity flow methods can be used in cases where there are good data on the supply of products. Total supply to the domestic market at purchasers' prices for a product can be derived as

- domestic output at basic prices,
- plus changes in inventories,
- less exports,
- plus imports,
- plus taxes on products,
- less subsidies on products, and
- plus trade and transport margins.

3.78. To obtain household consumption as a residual, other uses (i.e., intermediate consumption, government consumption, fixed capital formation, and changes in inventories) should be deducted from total domestic supply. This method often relies on ratios to fill in gaps, for example, taxes and margins may be calculated as a proportion of the underlying flows. As explained in Chapter VI, variation in the annual ratios is taken into account through the benchmarking process. In some cases, particular components are nil. The commodity flow method can be particularly useful for goods because goods are often supplied by a relatively small number of producers and importers, and data on the supply of the goods are easier to collect than data on sales at the retail level. Where a significant part of retailing is informal, surveys of retailers are likely to have incomplete coverage, so the commodity flow method could provide more suitable indicators than a survey of retailers.

(ii) Volume indicators

3.79. Data on consumption of 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 could be used as a proxy (preferably adjusted for any trends in the average number of persons per dwelling). Because of differences in the average rent per dwelling, the quality of the estimation would be improved by doing separate calculations by location and for different dwelling

types (e.g., house/apartment; number of bedrooms). It would also be desirable to put in 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 accounted for annually so that their effects can be incorporated in the QNA by the benchmarking process. Because the stock of dwellings is large and changes slowly, acceptable estimates can be derived for dwelling services, even in the absence of quarterly volume indicators. The methods used should be consistent with those used in the production estimates.

3.80. Indicators for some services, such as insurance, education, and health, may be obtained as a byproduct of government regulation. In addition, motor vehicle regulation may provide indicators for the volume of vehicle purchases. The components to be included are household purchases of cars and other light vehicles, both new and secondhand, from businesses and governments.

3.81. Administrative byproduct data may help fill other gaps. For example, taxis, financial intermediation, insurance, health, and gambling are often regulated. As a result, indicators may be published or potentially available on request to the regulatory authorities. Other administrative data can be used as indirect indicators. For example, numbers of divorces and wills in probate are a potential indicator for legal services; numbers of deaths for funeral services; total numbers of vehicles and numbers of road accidents for vehicle repairs. In each case, a direct survey would usually be better but may not be justifiable on a quarterly basis because of the data collection cost and the relative unimportance of the activity. (Value may also sometimes be available from these sources.)

3.82. Consumption from subsistence production of food can be quite important in expenditure estimates for developing countries. The methods should be consistent with those used in the production estimates. In some cases, estimates of agricultural output include subsistence agriculture, so that the consumption can be identified separately or derived by the commodity flow method. In the absence of quarterly surveys of subsistence production, population trends may be an acceptable indicator.

(iii) Price indicators

3.83. CPI components usually provide appropriate deflators for household consumption expenditure. The coverage of household consumption expenditure is typically fairly close to that of the CPI.

3.84. Deflation should be carried out at a detailed level to ensure that each component is deflated by the price index that most closely matches its actual composition and to minimize the impact of using deflators constructed using the Laspeyres formula and not the preferred Paasche formula. For example, it would be better to deflate each type of food separately to account for different price movements. It is seldom justifiable to use the total CPI in deflation. National accountants should work closely with price statisticians to have consistent classifications and coverage of all required components.

3.85. There may be gaps where a component of expenditure is not covered by a matching CPI item. An example is insurance, which is measured as a margin in the national accounts and which CPI compilers may exclude or measure as total premiums. A possible alternative as a deflator is a price indicator based on input costs (e.g., a weighted index of wages, taxes, and intermediate consumption components such as office-related items, together with an adjustment for profitability, if available). In other cases, it may be necessary to take the most closely related CPI item or group of items.

3.86. For expenditure by residents abroad, the CPIs of the main destination countries adjusted for exchange rate movements could be used as deflators. If available, it would be preferable to obtain specific indices for the most relevant components, for example, hotels, transport, meals, or any particularly important categories of goods, rather than the total CPI. Expenditure of nonresidents could be deflated by the domestic CPI items that relate to the major components of tourist expenditures, that is, hotels, transport, meals, and so on.

b. Government final consumption expenditure

(i) Value indicators

3.87. Government accounting data are often available on a monthly or quarterly basis. These could be prepared on the basis of the various international handbooks or country-specific accounting systems. The most important need for QNA is to have expenditures classified by economic type, in particular, consumption of goods and services, capital formation of goods and services, other expenditures, and

data on offsetting sales. Even if not published, the data may be available on request. Government accounts usually have the advantage of being reported on the same basis as the annual data so that the quarterly data are consistent.

3.88. Data for the central government are generally readily available. In some cases, lack of data or delays may require estimation for state, provincial, or local government. In the absence of comprehensive data, consideration can be given to alternative indicators that relate to the actual level of activity in the quarter, such as the following:

- a sample collection for local governments;
- wages paid by the governments concerned (preferably excluding those involved in own-account capital formation such as road building);
- expenditure data not classified by economic type;
- central government payments where these are the major source of funds; or,
- where actual data are not yet available, government budget estimates. Before forecasts are used, the track record should be checked to see whether they are reliable.

3.89. Government accounts are traditionally prepared on a cash basis. Government cash payments can be large and lumpy, and their timing can be determined by political or administrative concerns. Differences between the cash basis used and the accrual basis required by the *1993 SNA* could cause errors and discrepancies in the estimates. These timing errors are the same in both QNA and ANA, but the impact in QNA is relatively larger since they have a magnitude only about 25 percent of the corresponding ANA estimates. A particular instance of a distortion caused by cash recording is where government employees are paid every two weeks. While some quarters will have six paydays, others will have seven, causing fluctuations in the quarterly data that would not be a serious issue in annual data. To the extent that such timing problems can be identified, adjustments that are supported by evidence can be used to get closer to an accrual basis. Information may be available for some large individual transactions, such as the payday effect or large purchases of weapons.[11] Accrual accounting has already been introduced by some governments, and the 2001 IMF *Manual on Government Finance Statistics* recommends accrual accounting.

[11]These issues also occur for government gross fixed capital formation derived from cash-based sources.

3.90. The links to the production estimates for general government should be noted. If inconsistent methods or data are used, errors in the residual item or discrepancies will occur. The scope of government consumption and general government output differ in that government consumption is equal to:

(a) general government nonmarket output;
(b) less own-account capital formation included in output;
(c) less any sales and fees recovered, i.e., government output paid for by others;
(d) plus purchases that government provides free to households without processing.

Although the same indicators can often be used for both production and expenditure, the factors causing differences between them need to be taken into account, especially if they are changing proportions of the total.

(ii) Volume indicators

3.91. In a few cases, it may be possible to obtain quantity measures for output of government services. For example, numbers of students at government schools, numbers of operations or bed-nights for patients in public hospitals, and numbers of benefit recipients served by a government social assistance office may be available. However, these indicators fail to take into account important quality aspects. Further, there are many other activities of government where output is difficult to quantify, such as research and policymaking.

3.92. In the absence of suitable output volume indicators, an indicator based on labor inputs may be used, such as number of employees or hours worked. Because government consumption is a labor-intensive service, this is a more acceptable assumption than it would be for other expenditure components. In addition to the limitations of labor input measures for measuring production, measuring consumption is more difficult because of work contracted out to the private sector, capital work on own account, and the offsetting effect of charges for some services. Structural changes in the proportions of staff engaged in capital work, the proportions of output recovered through charges, or the proportion of work outsourced could be significant on a quarterly basis.

(iii) Price indicators

3.93. Although current price measures for government are clearly defined as being based on costs, the price and volume dimensions are less clearly defined and

have several alternatives. Prices are usually not directly observable. One option is to derive independent value and volume measures so that the price dimension is obtained indirectly. Alternatively, a deflator could be obtained as a weighted average of input costs. The usual input costs are wage indices or pay scales of civil servants and military staff, combined with relevant components of price indices reflecting typical input costs such as rents, electricity, stationery, and repairs.

3.94. Methods based on input costs have the shortcoming that they do not account for productivity changes. Of course, these measurement problems are the same for annual and quarterly estimates. For the quarterly national accounts compiler, the simplest solution is usually to adopt the annual method and allow the benchmarking techniques to incorporate any adjustment factors.

c. Final consumption expenditure by nonprofit institutions serving households

(i) Value indicators

3.95. Much of the discussion on measurement of government consumption also applies to nonprofit institutions serving households (NPISHs). Like general government, their output and consumption of nonmarket services at current prices is measured at cost. However, quarterly accounting data are less available than for general government. However, data for some larger institutions may be published or available on request. Governments may be a good source of statistical indicators if they monitor, regulate, or provide transfers to charities, private schools, and similar institutions. Otherwise, since they are mainly involved in services, wages and salaries paid may be an acceptable substitute. Balance of payments data on transfers to nongovernment institutions may be an important indicator in countries where foreign aid is a major source of funding for NPISHs.

(ii) Volume indicators

3.96. Labor input measures may be suitable indicators. If data are unavailable and the NPISH sector has been shown to be economically stable in annual data, past trends may be an acceptable volume indicator. The method for the expenditure estimates should be consistent with that for the equivalent production estimates.

(iii) Price indicators

3.97. The methods are analogous to those used for general government consumption, where output at current prices is also defined as the sum of costs. A weighted average of input costs may be used for consumption by nonprofit institutions serving households so that the deflator corresponds with the composition of the current price value measured from input costs. Items could include wages, rents, repairs, stationery, and electricity.

d. Gross fixed capital formation

(i) General value indicators

3.98. Annual and quarterly surveys of capital expenditure by businesses are the conceptually preferred sources of capital formation data. However, capital formation surveys are particularly expensive and difficult to conduct on a quarterly basis for the following reasons. First, such surveys are very sensitive to coverage problems in the business register because new enterprises, which may not yet even be in operation, are particularly likely to have higher rates of capital formation than established businesses. Second, the potential population is almost every enterprise in the economy, and there will be a large number of enterprises having little or no capital formation in any particular quarter. As a consequence, the sample frame needs frequent updating and the samples have to be relatively large. Product splits are also more difficult to obtain than from the supply side. Another problem is that the *1993 SNA* includes work done on contract as capital formation of the final purchaser at the time it is done, while only progress payments will be known to the purchaser. If possible, it would be desirable to compare data from the alternative indicators for construction and equipment noted in this section.

3.99. Where a VAT system requires capital and intermediate purchases to be split, a useful indicator of capital formation can be obtained. However, VAT lacks a product split and excludes capital work on own account. VAT returns in some countries do not separate capital and intermediate purchases. (The lumpiness of capital purchases may assist in identifying enterprises undertaking capital formation during the period and provide the basis for generating a split at the level of individual enterprise.)

3.100. The largest components of gross fixed capital formation are construction and equipment. In addition, capital formation includes cultivated assets (such as livestock and orchards) and intangible assets (such as mineral exploration; computer software; and entertainment, literary, and artistic originals; but not research and development). Costs

associated with the purchase of fixed and other assets are also included, such as transfer costs (including real estate agents' commissions, legal costs, and taxes on real estate purchases), architects' fees, and installation costs. In addition to purchases, own-account production of capital can be important in some cases, including construction, computer software, and legal work, and can be hard to include other than directly in surveys.

(ii) Specific value, volume, and price indicators

Construction

Value indicators

3.101. Gross fixed capital formation on construction assets includes the nonmaintenance parts of the output of the construction industry, own-account construction of other industries, and associated expenses such as architectural services and real estate agents' commissions.

3.102. Estimates of capital formation on construction raises a number of special measurement issues and problems, such as the following:

- Large numbers of small businesses. Construction is typically carried out by numerous enterprises that are often small and informal. Data collection and obtaining sufficient coverage from construction businesses can, therefore, be particularly difficult.
- Long projects. The length of construction projects gives rise to issues of holding gains and allocation of the output to quarters (as will be discussed in Chapter X).
- Subcontracting. Work is often arranged by a prime contractor with a number of specialized subcontractors which means that several enterprises may be involved in the same project, giving rise to the possibility of double counting or omissions.
- Speculative construction. Where the work is undertaken by a developer with no final buyer, the price is not known at the time after the work is done. In addition, land costs are included in the price, and holding gains and operating surplus are mixed together.

3.103. These problems apply to the corresponding estimates for construction industry by the production approach as well. They also apply to annual data, but quarterly data are more sensitive to the slowness or high cost of data collection and more subject to difficulty allocating the value of long-term projects to quarters.

3.104. Gross fixed capital formation of construction can be measured in various ways, corresponding to different stages in the building process, include the following:

- supply of building materials,
- issue of government permits for particular projects,
- data reported by construction businesses,
- data reported by construction-purchasing businesses, and
- data reported by households engaged in own-account construction.

3.105. In many countries, construction requires permits from local or regional governments, and the permit system can be used as a source for estimates of construction in the national accounts. The permit system may cover only larger projects or urban areas, while in other cases it may cover all except minor construction work. Permits usually show the type of construction, value, size, proposed starting and ending dates, and the name and address of the owner and/or builder. If the data are in volume terms only (e.g., numbers of dwellings, number of square meters) or the value data are of poor quality, then an average price per unit is also necessary to derive current price values for national accounts purposes. Data in this form need to be allocated to periods (see Example 10.2 in Chapter X), usually with information from builders, approval authorities, or engineers in order to obtain average construction times for each building type. It is also necessary to make adjustments, to the extent practical, for realization ratios (i.e., to account for projects that do not go ahead), biases in builders' estimation of their costs, the effect of holding gains included in prices, and the proportion of projects that are carried out without a permit. Government decisions and newspapers may be used to identify large-scale work that otherwise may be missed.

3.106. In some countries, the approval process is used to identify construction projects, and this process then provides the frame for a separate survey. Direct information about the project, such as the value of work done each quarter and changes from the original proposal in the cost or size or starting/ending dates, can be collected in such a survey. Using survey information prevents the need for making the kind of assumptions that have to be made when permit data are used directly. The survey method is conceptually much closer to statistical requirements, but it is more expensive and time-consuming to perform. The usefulness of the survey

is also limited by the degree of sophistication of builders' accounting records about the value of work done in the period. In practice, the value of work done may have to be represented by progress payments.

3.107. Architectural and approval costs are a part of capital formation on construction and need to be added to the values that represent construction output. These items are related to construction activity, so construction indicators could be used as indirect indicators if more direct data are not available. However, as some of these expenses precede construction work, their timing is different. As a consequence, the timing pattern built into construction estimates may have to be adjusted.

3.108. Real estate transfer costs consist of items such as lawyers' fees, real estate agents' commissions, land title transfer taxes, loan application fees and other set-up costs for finance, and inspection fees. These costs relate both to new construction and to purchases of land and existing dwellings. If these land dealings are registered with a government agency, it may be possible to obtain a quarterly indicator from this source. Data on financing of land and building purchases is a poorer indicator; an even worse indicator is the value of new construction. For real estate transfer expenses, numbers of transfers may be used as a volume indicator. To take into account compositional changes, it would be better to classify by type of property (e.g., houses, apartments, shops, complexes) and other variables that may affect the cost (e.g., by state or province if charges are different). In some cases, it may be necessary to derive a current price measure from the volume measure, which would require information about transfer tax rates, real estate commission rates, lawyers' fees, and so on.

3.109. Speculative construction raises special issues regarding valuation and timing. With speculative construction, the work is undertaken by the builder before a purchaser is identified. Under the *1993 SNA*, speculative construction is regarded as inventories of work-in-progress. (In contrast, the *1968 SNA* treated it as capital formation at the time the work was done.) Whatever the conceptual considerations, the availability of data tends to determine the treatment of speculative construction. For example, data based on supply of building materials only suit the *1968 SNA* treatment because they would not allow speculative construction to be identified separately. Surveys of builders or building permits could be designed to meet either treatment, although extra information would need to be collected to separate speculative construction. Surveys of construction purchasers are more suited to the *1993 SNA* treatment. Note that the net effect on GDP of the different treatments should be nil, since they cause offsetting differences in gross fixed capital formation and changes in inventories. If, contrary to the *1993 SNA* recommendations, it is decided to include unsold speculative construction work in gross fixed capital formation, there is a valuation issue in that the estimated price may differ from the realized price. If unsold speculative construction work is shown as changes in inventories, there needs to be a valuation adjustment to make the withdrawal from inventories consistent with the gross fixed capital formation. This topic is discussed further in Chapter X.

3.110. Construction in rural areas in developing countries is often carried out by households on their own account and made with their own labor, outside the scope of official permits. A household survey may provide information on the numbers of households involved and the cost of materials. These results would need to be adjusted to an estimated market price by taking the equivalent market prices (if such a market exists) or a shadow price based on costs (including labor). Usually, these indicators would only be available for a benchmark period and not on a quarterly basis. The building material approach captures some of this activity to the extent that a significant proportion of materials is produced by factories, although some materials may be made by the household. In the absence of other data, the size of the rural population could be used as a quarterly indicator for this type of construction.

3.111. It is desirable to obtain data on gross fixed capital formation of construction by type of asset, both for economic analysis and for improving deflation. Data by the industry and institutional sector of the purchaser are also useful for analysts. The estimates based on building materials give little or no breakdown, while other estimation methods can give more. In some cases, the general government sector data could be obtained from the government finance statistics, allowing the nongovernment component to be derived as a residual. Because residuals magnify the effects of errors, implausible values of the residuals may point to data problems.

3.112. Gross fixed capital formation of construction and construction industry output will often be

estimated from the same data sources. The estimates, however, will differ because of different treatment of the following:

- repair work (part of output, but not fixed capital formation);
- secondary activity (secondary capital construction by establishments outside the construction industry is part of capital formation, while construction establishments may have secondary activity in nonconstruction goods and services);
- speculative construction work (output of the industry when the work is put in place; in the 1993 SNA, it is included in inventories when produced and in fixed capital formation when sold); and
- associated expenses, such as nonconstruction goods included in a structure; architectural, legal, and approval fees (which are not part of construction output, but are fixed capital formation); or the effect of any product taxes and subsidies.

Volume indicators

3.113. Building permit systems may provide volume indicators such as floor area. To the extent that the composition of the variable is stable, quality changes per unit will not distort the estimates, so calculation in more detail is beneficial.

3.114. The supply of building materials is often the most readily available construction volume indicator. While builders are often 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. Therefore, measures of the total supply of building materials or selected major building materials to the domestic market can be obtained as output plus imports less exports. Preferably, trade, tax, and transport markups would be taken into account, to the extent that they have changed or that differential markups affected the weights of different components. A lag factor may be included to take into account the time it takes for materials to get from the factory (local production) and customs frontier (imports) until they are incorporated in construction work.

3.115. The advantages of the building materials method are the ready availability of data and the data's inclusion of informal and unapproved work. (Use of materials is one of the few ways that informal construction leaves a statistical trace.) The limitation of this indicator is that it assumes a stable relationship between building materials and output. The assumptions may not be stable because different kinds of construction work use different materials and have different materials-to-output ratios. Preferably, this method would only be used quarterly, so the benchmarking process would capture changes in these relationships as shown in the annual data. There may also be variations in the lags between production and use. As well, the building materials method does not provide details that may be of interest, for instance, by type of building, industry of purchase or use, or institutional sector.

Price indicators

3.116. Because each construction project differs, compiling a price of construction presents special difficulties. Three alternative methods that are used to derive construction price indices are

- model specifications,
- hedonic techniques, and
- input costs.

3.117. One method of obtaining output prices is to collect or derive hypothetical prices for construction output. House builders may have standard models of houses that are offered. Although options and individual circumstances mean that the model is not implemented in every case, it can still form the basis of the builder's pricing, and it would be relatively easy to obtain quotations from the builder for the standard model on a consistent basis. However, standard models are usually only found for dwellings, where a mass market exists, but not for other types of construction. Another approach to model specification is to divide construction into a number of particular tasks, for example, painting a certain area of wall, laying a certain height and type of brick, cost per hour of electrical work, and so on. A weighted total of each of these components could be used to represent overall prices for a particular type of construction. A possible shortcoming is that the most difficult jobs might be omitted, such as the prime contractor's organizational work and unique, large-scale engineering tasks. Construction is usually highly cyclical, with margins cut or increased in line with conditions. Because the prices are hypothetical, the statistician needs to be careful if list prices are being reduced by discounts or bargaining during a recession or if more is charged during a busy period to cover overtime costs.

3.118. In recent years, some countries have explored the use of hedonic techniques to measure prices of

one-off goods. In addition to collecting the prices of a range of buildings, these countries also collect data on characteristics of the building that affect the price (such as floor area, height, fittings, materials, and location). A regression model is then developed to identify the effect of each characteristic on the price. This allows the prices of the different kinds of buildings to be converted to a standard basis and, hence, allows a price index to be derived. This method requires a great deal of work in data collection and analysis of data. A limitation is that characteristics may be too numerous or abstract to be quantified, so the model would only explain a limited part of the price variation. Also, the coefficients of the model may not be stable over time.

3.119. Input cost measures are based on the prices of construction materials and labor. These should include building materials (from a producer or wholesale price index[12]) and wages (preferably specifically for occupations employed in construction). An adjustment could also be made for changes in markups to account for builders' operating surplus and mixed income, if indicators were available, because these represent a major part of the price and could be quite variable. Data on intermediate consumption by product supplied to the construction industry would be required for a benchmark period. Use tables could present these data or they could be obtained directly from surveys of construction enterprises. Otherwise, it would be necessary to seek expert advice or a sample of bills of quantities for building projects. Data on employment in construction by type of employee (occupation groups) would also be useful for weighting the labor cost part of the index. Because of different input structures, it would be desirable to compile separate indices for different types of building and construction (i.e., houses, apartments, offices, shops, etc.)

3.120. Generally, it is desirable to avoid using input costs to represent output prices, because input costs ignore changes in productivity and profitability. However, the input cost method avoids the difficulties of obtaining an output price index for heterogeneous products. Many types of construction are one-off, and even where the same model is used in different places, differences in soil type, slope, or options mean that it is not possible to find exactly comparable observations. Finding actual buildings that are representative and consistently priced is close to impossible.

3.121. In practice, countries may often use a mix of different pricing measures for the different types of construction.

3.122. In situations where independent volume and value indicators are available, it is beneficial to derive an implicit price per unit to check that the result is plausible. Erratic results may mean that one of the indicators is unsuitable (e.g., the implicit deflator may fluctuate because of quality changes that were not taken into account in floor area data used as a volume indicator).

Equipment

Value indicators

3.123. The four sources for measuring equipment, reflecting the stages along the distribution process, are the following:

- survey data on supply of capital goods,
- survey data reported by the purchasing businesses,
- VAT data on purchases of capital goods (if identified separately from intermediate goods), and
- registration data from governments.

3.124. Derivation of the supply of capital goods is an application of the commodity flow method. The supply of capital goods is measured, most simply, as the value of domestically produced capital goods plus imported capital goods, less exported capital goods. Changes in tax rates and margins should be taken into account, if possible, because they are subject to change. Deductions should also be made for capital goods that were used for intermediate consumption (e.g., parts for repairs), final consumption (e.g., computers, cars, and furniture that are used for nonbusiness purposes), or inventories, and for net sales of capital goods (e.g., company cars sold secondhand to households).

3.125. Data from the supply side provide totals and splits by asset type, but not estimates by industry or institutional sector of use, which are of analytical interest. Like construction, government finance data could be used to obtain government capital formation of equipment, and then a private total could be calculated as a residual.

3.126. Transactions in secondhand goods present some additional issues. Some sources may only

[12]Wholesale price indexes (WPIs) would generally be more suitable than producer price indexes (PPIs), because they include taxes, imports, and distribution costs. If a WPI is not available to deflate items that include margins, taxes, and imports, a PPI could be used as a substitute, preferably with adjustments for changes in import prices, tax rates, and other markups (if available).

provide data on new products. Data on some secondhand components—such as government asset sales, goods sold or purchased internationally, or vehicles—may be available. Data in some cases may not need to be collected if the transactions are small, stable, or occur within a single component.

Volume indicators

3.127. Capital goods tend to be heterogeneous, so quantities are unavailable or meaningless. A possible exception is transport equipment, where government registration systems sometimes provide numbers. These systems usually cover motor vehicles, aircraft, and seacraft. From these systems, it is often possible to obtain indicators of capital formation in these assets. Ideally, the registration authorities would be able to supply information on numbers and values and distinguish among types of owner (corporations, government, nonprofit institutions serving households—all capital; household purchases are more complicated in that they can be capital, consumption, or a mix), and between new and secondhand acquisitions.

Price indicators

3.128. Data derived from a survey of equipment purchases are at purchasers' prices. The most appropriate price indicators are the capital goods components of a WPI, because wholesale prices would take into account trade, transport, and tax margins and would generally include both imported and locally produced goods. If data on wholesale prices are not available, components of the PPI and import price index could be weighted and used as a proxy. However, PPIs are designed to deflate output rather than capital formation and, thus, exclude the margins. It would be desirable to make adjustments if trade, transport, and tax margins were known to be unstable. The most likely instance is taxes, where information on tax rates to adjust producer prices for taxes would generally be available. Similarly, import price indices are typically measured at the point of arrival in the country rather than the point of final purchase and, thus, exclude domestic trade, transport, and tax margins.

3.129. If the equipment data had been derived from the supply side, the current values for domestically-produced goods would have been reported at basic or producers' prices. If so, the best method would be to develop volume indicators by deflating the supply values of domestically-produced equipment by the relevant PPI component. As the value and price measures would be consistent, it would be expected to be a superior volume indicator to one derived from value and price measures that were based at inconsistent pricing points.

3.130. Imports are a major component of capital formation in many countries. Import unit values would be expected to be poor indicators of prices. If no import price index is available for some or all types of equipment, a solution may be to take advantage of the producer price or export price indices of the main equipment-supplying countries. These should be obtained at a detailed level so that the components can be weighted to reflect the composition of imported equipment in the importing country. The data should also be adjusted for exchange rate movements and lagged to account for shipping times, if the lag is substantial. It would also be desirable to take into account changes in shipping costs if an indicator were available. It is possible in practice that the effect of exchange rate changes is lagged or smoothed by forward exchange cover and by squeezing or expansion of margins. Because of changes in exchange rates and international specialization in types of equipment, prices of imported and domestically produced equipment may move in quite different ways.

Other fixed capital formation and acquisitions less disposals of valuables

3.131. Computer software was included separately in fixed capital formation for the first time in the *1993 SNA.* As with other capital items, the estimates could be made on the supply side (manufacture plus software developers plus imports less exports) or the demand side. Supply data may be easier to collect because of the relatively smaller number of businesses involved; demand data are complicated by the fact that almost all businesses are potentially involved in using software. However, the data on the supply side have the limitation—as do the data for motor vehicles—that a substantial proportion of computer software is for household consumption. Another issue is that some software can be developed in-house. If important, data on own-account software expenditure should be collected in surveys. A further issue is that some software is sold in conjunction with hardware, possibly raising questions of double counting. Price indices are also problematic; possible alternatives are cost-based measures, hedonic techniques, or the relevant indices of software-exporting countries.

3.132. Indicators for other components of gross fixed capital formation—such as mineral exploration, forests, orchards, livestock, and intangible

assets—are less commonly available. If significant, a survey could be considered. For example, in countries where mining or forestry is important, a specific survey on the topic would be justified. In some cases, administrative requirements for copyright registration or mining exploration permits may give rise to information that could be used as an indicator. Even in those cases, the timing of registration or permission could differ substantially from the time of economic activity.

3.133. In the *1993 SNA*, an additional category of capital formation is created for "valuables" such as paintings and jewelry. These were previously largely included in household consumption. They could be recorded from the point of production (e.g., factories) or import (customs data), from the point of sale (usually retailers), or from purchasers (household expenditure survey).

e. Changes in inventories

(i) Introduction

3.134. Inventories are defined as goods and some services that were produced or imported but have not yet been used for consumption, fixed capital formation, or export. This delay between supply and use brings about valuation issues. Inventories appear explicitly only in the expenditure estimates. They must, however, be taken into account in both the production estimates (both output and intermediate consumption) and income estimates (operating surplus and mixed income). The valuation issues also arise in the other approaches, except where output or input measures are expressed in quantity terms for production estimates.

3.135. Inventories consist of finished goods, work-in-progress, goods for resale, raw materials, and auxiliary materials.[13] These components of inventories differ according to their stage and role in the production process. Finished goods are part of output and are of the same form as their consumed equivalents. Work-in-progress is also part of output, but is harder to quantify than finished goods because the product is incomplete. Inventories of goods for resale, that is, goods held for the purpose of wholesaling and retailing are neither part of output nor future intermediate consumption of the holder. Net increases in inventories of goods for resale need to be deducted from purchases of goods for resale to derive cost of goods sold and, hence, wholesale and retail margins, which are defined as the value of goods sold less the cost of goods sold. Raw materials are goods intended for intermediate consumption by the holder. Auxiliary materials are also to be used for intermediate consumption but are not physically part of the final goods—office stationery, for example. Because auxiliary materials are typically minor, they are usually included as part of intermediate consumption at the time of purchase. The separation of different components is important because they include different products, and, therefore, the price indices to be used in deflation will also differ. In practice, attention can be confined to those components of inventories that are important; for instance, quarterly surveys could be limited to miners, manufacturers, wholesalers, and retailers.

3.136. Although changes in inventories are a small component of GDP, they can swing substantially from strongly positive to strongly negative. Consequently, this small component can be a major factor in GDP movements. In the quarterly data, the average absolute quarterly contribution to growth can be large, often being one of the major quarterly growth factors. Over the long term, the contribution of changes in inventories to GDP growth tends to be small because some of the quarterly volatility will cancel itself out over the year. The importance of inventories follows from its nature as a swing variable in the economy. It represents the difference between total demand (the sum of the other components of GDP expenditure) and total supply. An increase in inventories would represent supply that was not used during the period, while a reduction would show the amount of demand that was met from previous supply. Without these data, the expenditure estimates would show demand, not production. Data on changes in inventories are also important for analysis because the gap between demand and supply can be an indication of future trends. For example, a decrease in inventories suggests that demand exceeds supply, and output or imports will need to increase just to keep pace with the existing level of demand.

3.137. Changes in inventories present particular difficulties in terms of valuation. Businesses use several different varieties of historic cost, none of which match national accounting valuation concepts. Measurement practice also varies, from complete physical stock-takes to samples and estimates. The

[13]Called "stocks" in the *1968 SNA*. In the *1993 SNA*, the term "stocks" refers to balance sheet items in general and is used as a contrast to the term "flows."

valuation problems are sometimes ignored but are significant, as can be illustrated with some simple but conservative assumptions: if inventories are stable, the total holdings of inventories of inputs and outputs are equivalent to three months of output, and if value added is half of output, then 1 percent of price change in inventories will amount to a valuation effect of 2 percent of quarterly value added. Thus, even quite low rates of inflation can cause a significant overstatement of the level of value added, and this effect will be concentrated in the major inventory-holding industries. Similarly, a small increase in the rate of inflation will overstate the growth of GDP.

(ii) Value indicators

3.138. The *1993 SNA*[14] sets out the perpetual inventory method to produce estimates of changes in inventories. The method requires that data be reported transaction by transaction, with continuously updated replacement prices. While ensuring that valuation is consistent throughout the system, this method requires so much respondent and compilation time that it is not implemented in practice, and simplified methods have to be used. With advances in accounting software and sophisticated computing-based inventory monitoring, however, there is potential for improvements in the future through compiling perpetual inventory model data at the establishment level.

3.139. A number of issues arise concerning data on inventories. Some businesses may have computerized inventory controls; others have full physical stock-takes at less frequent intervals with sampling or indicator methods for more frequent measures; and some small enterprises may not measure inventories on a quarterly basis at all. The values of inventories may also be a particularly sensitive commercial issue. Valuation effects can generally be better calculated with higher frequency data. This is because higher frequency data reduce the possibility of uneven price and volume movements within the period. As a consequence, the annual sum of the quarterly valuation adjustments may be superior to annually calculated ones, unless there is some other compelling difference, such as differences in coverage or detail. Similarly, if monthly data are available, the calculation should generally be done on a monthly basis for use in quarterly estimates. These factors all need to be assessed in light of each country's conditions.

[14]See 1993 SNA, Chapter XII Annex.

3.140. Annex 3.1 shows how values of changes in inventories on a national accounts basis can be derived from business accounting data. The method involves conversion from historic cost prices to constant prices, then reflation to current prices. Because valuation changes can occur within the period and interact with changes in volume, better estimates can be obtained by making calculations for shorter periods. (Indeed, the perpetual inventory method involves the same calculations effectively made for every instant.) As a result, a quarterly estimate from the sum of monthly data will differ from and be better than one calculated from quarterly data. Similarly, the annual estimate would be better if made as a sum of the quarters than if made from annual data.

3.141. Some countries derive changes in inventories in GDP by expenditure as a residual. The residual method could be used quarterly even if the annual measures were obtained directly. This method is only possible if there is a complete measure of GDP from the production approach and estimates are available for all other expenditure categories. However, because inventories should also be included in estimates of output and intermediate consumption, the measurement problems still need to be dealt with, even though quantity data that sidestep these valuation issues can sometimes be used. Derived as a residual, changes in inventories would also include the net effect of errors and omissions. In that light, compilers should review it carefully for signs of any errors that could be dealt with directly. As well, users should be advised to use caution in interpreting the estimate of changes of inventories, which should be labeled as being "changes in inventories plus net errors and omissions" to emphasize the limitations.

3.142. One method that should not be used is to accept changes in inventories at book values as reported by enterprises without adjustment. Business accounting practices typically use historic costs, which result in the inclusion of holding gains in the value of changes in inventories.

(iii) Volume indicators

3.143. Inventory data may be available in quantity terms for some products held by some enterprises. Because inventories include almost every type of goods (as well as a few kinds of services) and firms typically use a range of products (especially their inputs), this solution cannot be implemented comprehensively. However, it may be available for some of the major components of inventories, such as

principal agricultural commodities, oil, or some minerals. (These goods have the most volatile prices, and inventory holdings are often large.) With quantity data, valuation problems can be sidestepped by directly revaluing the change in the quantity over the period by the base year average prices (constant price measures) and average prices of the period (current price measures).[15]

(iv) Price indicators

3.144. Price indicators can be chosen according to the composition of the inventories, making use of CPIs, PPIs, trade prices, and average prices for specific commodities. The opening and closing levels of inventories (never the change in inventories) should always be deflated. If inventories are usually valued at historic cost, prices of several preceding periods may be relevant.

f. Exports and imports of goods and services

(i) Value indicators

3.145. Countries that compile QNA data typically have a well-developed system of trade and balance of payments statistics that produce quarterly data on trade in merchandise and services. Merchandise data are derived from customs records, surveys of trading enterprises, or both. Services data are typically derived from specific surveys, administrative systems, and international transaction reporting (exchange record) systems.

(ii) Volume indicators

3.146. Quantity data on merchandise are usually obtained in a customs system. For homogeneous products, they may be used to derive volume estimates.

3.147. Quarterly balance of payments data on services may have been derived using volume indicators, for example, international arrivals and departures for travel and air and ship movements for passenger, freight, port, and airport services. Although the focus of balance of payments is toward value data, the derivation of volume measures for national accounts purposes may be of special interest to balance of payments analysts because they provide a perspective on whether price or volume forces are driving changes in values. Specific volume indicators may also be available. For example, for freight and passenger services it may be possible to obtain volume indicators, such as ton-kilometers or passenger-kilometers, from the carriers.

(iii) Price indicators

Merchandise

3.148. Customs and other trade data systems usually collect quantity information (e.g., metric tons, liters, numbers). These data are often processed to provide volume and unit value indices directly from the information already included on customs declarations. The unit values and volumes at the most detailed level of classification are combined to derive aggregate indices using weights from the value data.

3.149. Some countries have import and/or export price indices. These are collected from businesses in the same way as wholesale and producer price indices. Components of these indices can also be used to deflate the current price value data at the most detailed level to derive volume measures. If available, this will be the preferred method. The price indicators should be consistent with any adjustments for transfer pricing in the value data.

3.150. A price index is a better way of dealing with heterogeneous products than is a unit value index. The price index approach of identifying products with fixed specifications and transaction conditions for each product allows price effects to be isolated. However, a trade price index system has the disadvantages of high cost and respondent burden. Also, the actual transaction prices that make up trade may be affected by factors such as the mix of prices from contracts made at different times and the effects of foreign exchange hedging. These effects may not be easy to capture in a price index.

3.151. Unit values are derived by dividing the value of trade in a product by its quantity. Unit values have the advantage of being able to be derived from information collected by the customs system. However, the unit values, like the corresponding volume measures, often cover quite diverse products, even at the most detailed level of classification. For example, as discussed under capital formation, large-scale equipment, such as ships or heavy machinery, is often one-off in nature. Even for other products, changes in composition within the product group can be important, for example, a particular class of clothing can vary substantially in quality

[15]The result will be an estimate of the value of the physical change in inventories. At current prices, this is only an approximation of the *1993 SNA* concept, which also includes adjustments for all valuation changes that occur between the time of production and the time of final expenditure. The two concepts will be the same if price changes and transactions are spread evenly over the quarter.

of material, workmanship, and fashionableness. It is usually possible to identify the products affected by serious compositional changes by examining the variances in the average unit values of the product.

3.152. There are several ways of dealing with heterogeneous products in unit value indices. One possibility is to supplement the customs data with specific price surveys. Another possibility is to narrow the specifications by also taking into account the partner country. A further option is to use unit values and volumes only for those products with unit values not subject to high variance. In cases where unit values are too variable, the unit values of the most closely related homogeneous products could be used. The use of this price indicator assumes that prices for related products move in similar ways, which is often realistic—certainly more realistic than assuming that volumes of related products move in similar ways. This method works best for the "not elsewhere classified" products within a group, as there are usually readily identifiable related products with similar price behavior in the same group.

3.153. In some cases, both unit value and price indices may be unavailable or unsuitable. In these cases, a solution may be to use price indices from other countries. In the case of imports, the export price indices of the main supplying countries can be used. If export prices are not available for some supplying countries, a producer price index may be an acceptable substitute, although factory gate prices are less relevant than export prices. Preferably, the indices would be obtained at a fairly detailed level so that different imported products could be deflated separately to reflect the actual composition of trade, rather than the fixed composition used in the indices of the supplying country or countries. It would also be desirable to obtain price index data from several of the main supplying countries, to take into account different composition and price pressures. The price indices should be adjusted for exchange rate movements between the currencies of the supplying countries and the importing country. If the source of the trade is remote, it may be desirable to allow a lag to account for shipping times (e.g., if shipping takes two months, the January export price represents the March import price).

3.154. Similarly, for exports, the import price indices of the customer countries could be used. Alternatively, for major agricultural commodities, the world prices shown in the IMF's *International Financial Statistics* and other publications could be used.

3.155. Imports are deducted from total expenditure to derive GDP. In other words, the imported component of each type of final expenditure and intermediate consumption is excluded from total expenditure to derive the expenditure on domestic output. It is therefore highly desirable that the deflation of imports and the imported components in the corresponding other expenditure categories be as consistent as possible, so as not to create inconsistencies that lead to errors in total GDP. For example, different deflation methods for imported capital equipment in capital formation and imports could generate differences in data that would affect GDP.

Services

3.156. Overall price indices for international trade in services are not usually available. However, price or volume indicators are often available for many components of traded services. If the current price data have been derived by balance of payments compilers, it is essential to find out the methods they have used, because the data may sometimes have been compiled from volume and price indicators. In other cases, other price indices may be relevant. Hotels and transport components of the consumer price index may be relevant to travel service exports, while hotels and transport in the main destination countries may be relevant to travel service imports (adjusted for exchange rate movements). Price indices and implicit price deflators from particular industries in GDP by the production approach (exports) or from the supplying country (imports) may be useful. In the case of FISIM, the deflated value of loans and deposits may be used, as discussed under the production approach.

D. GDP by Income Category

1. General Issues

3.157. The income approach is built up from components of compensation of employees, operating surplus, mixed income, and taxes less subsidies on products, production, and imports. It is the least commonly used of the three approaches. Income estimates are particularly suitable for data by institutional sector, while industry data are more difficult to obtain. Income data provide a useful perspective on the distribution of income from GDP, for example, looking at compensation of employees and operating surplus as a proportion of value added

for the nonfinancial corporations sector. The income approach requires that businesses have quarterly data on, at least, profits, depreciation, and net interest paid, so the availability of data on business incomes determines whether independent quarterly income estimates are developed. The data could be particularly important in analyzing issues such as rates of return and profitability. The income approach is potentially useful as an alternative measure of GDP if the other approaches have serious data problems; for example, if IO ratios in production data are known to be changing rapidly with the business cycle.

3.158. The drawbacks of the income approach should also be noted. It does not support constant price and volume estimation because not all of the income components of GDP have a price dimension. In addition, the ability to produce data by industry of establishment on a quarterly basis is limited because some income components are only obtainable at the enterprise level.

3.159. Benchmark data for the income approach can be compiled in two ways. The income estimates can be compiled in the same way as value added in the production approach—that is, from goods and services produced less goods and services used—with the additional step of using expense data to split value added among compensation of employees, net taxes on production, and the residual, namely, operating surplus/mixed income. As for the production approach, getting this information is not usually feasible in a quarterly context. Alternatively, income estimates can be built up from the primary income components. This method is viable in some countries on a quarterly basis using profits, interest, and depreciation as indicators.

3.160. In the absence of an independent estimate of GDP from the income side, an income split can usually be derived with one category as a residual. Such data are as analytically useful as the full approach. Operating surplus/mixed income is always the residual in countries that use this method, because it is the most difficult component to measure.

2. Value Indicators

a. Compensation of employees

3.161. Data on compensation of employees are readily available in many countries. The major indicators are

- administrative byproducts from the collection of social security or payroll taxes,
- business surveys of employment and wages and salaries, and
- business or household surveys of numbers of employees in conjunction with business surveys of average wages.

Where government regulates employment, clear definitions of employment and data are usually readily available. The data may refer to total compensation of employees paid or received, but an industry or institutional sector split may also be available.

3.162. Often only wages and salaries are available quarterly. Pension fund contributions and other social contributions paid by employers are also included in the definition of compensation of employees. Data may be available for programs run or highly regulated by government, but data are less likely to be available for private programs, where they would need to be collected by survey or derived using wages and salaries as an indicator. There is also a wide variety of supplements and fringe benefits that vary from country to country, such as annual bonuses, thirteenth month of salary, profit sharing, stock plans, concessional loans, discounts on purchases, commissions, redundancy payments, and remuneration in kind. Ideally, quarterly source data would also cover these items. If some items are not available, and especially if these items are small and/or stable, use of the available items to indicate the unavailable ones will be quite acceptable (i.e., an implicit ratio adjustment through benchmarking the quarterly data to annual data that include these items). However, the larger or more volatile they are, the stronger the case for collecting additional data to record them separately.

3.163. In quarterly estimates, there are potentially important questions of allocation over time that are more significant than in annual data. The usual national accounting concept requires that compensation of employees be recorded on an accruals basis. For payments that are paid once a year but earned during the year, it would be desirable that they be allocated over the time they accrued, not just the quarter in which they are paid.

b. Operating surplus/mixed income

3.164. An indicator that approximates gross operating surplus or mixed income can be derived by adding operating profits, net interest paid, and depreciation. These kinds of business accounting data can

potentially be collected directly from businesses by surveys.

3.165. Profits data should be collected with definitions as close as practical to national accounts concepts. "Operating profit" is closer to the national accounts concept than some bottom-line profit measures, to the extent that it excludes one-off items such as capital gains, foreign exchange gains and losses, and insurance claims. It also excludes income from the operation of other enterprises, that is, profits received as dividends from subsidiaries and other share holdings. The *1993 SNA* definitions of production and, therefore, operating surplus also exclude the effect of provisions for bad debts, so these should be added back. In a quarterly context, some adjustments may need to be made implicitly through benchmarking an incomplete quarterly indicator to the more comprehensive annual data. Business accounting measures of profits include the effect of price changes from inventories, which should be excluded in national accounts measures. (The adjustment would be the same as the corresponding adjustments made to the production and expenditure estimates, that is, the inventory valuation adjustment discussed in Annex 3.1.)

3.166. Net interest paid and depreciation also need to be added back to profits to get closer to gross operating surplus and mixed income. It would, therefore, be worth collecting data on these items at the same time as profits, because the relationship of operating surplus to profits is likely to be much less stable than the relationship of operating surplus to profits plus net interest and depreciation. Expense data from detailed annual or benchmark surveys would allow the identification of other expenses that are not intermediate consumption, compensation of employees, or taxes on production. Similarly, detailed income data would allow the exclusion of any items that were not from production. If these factors are small and stable, an implicit ratio adjustment through the benchmarking process may be suitable. Otherwise, consideration may need to be given to collecting the data quarterly.

3.167. Large enterprises often calculate their incomes on a quarterly or even monthly basis, and publicly listed companies are often required to release quarterly or half-yearly information. Similarly, data may be available for government enterprises and market producers within general government. Privately held corporations and unincorporated enterprises are typically less inclined to have sophisticated monthly or quarterly accounting systems. This is changing, however, with computerization of business accounts. Standard accounting software packages can make quarterly and even monthly data available to even the smallest of businesses. Once the basic transactions are recorded, these packages can generate data for any required period or level of detail at little extra cost. Many small enterprises do not have quarterly accounts, particularly in developing countries. In these cases, their operating surplus cannot be collected, but it may be derived by estimating their output, intermediate consumption, and compensation of employees. The same indicators used for estimating value added under the production approach could be used and estimates of their wages and net taxes on production deducted. In the case of ownership of dwellings, the sources for estimating output and value added can be used with the addition of data on property taxes paid and compensation of employees. To the extent that the same indicators are used in the income and production approaches, they become less independent and more integrated.

c. Taxes and subsidies on products, production, and imports

3.168. Data on total taxes on imports, value added taxes, other taxes and subsidies on products, and other taxes and subsidies on production are usually available from a government finance statistics (GFS) system. Although GFS systems are generally among the most accurate and timely data sources, the data can suffer from problems of time of recording and may not provide any industry/institutional sector split.[16] Typically, GFS data have been compiled on a cash basis, not on an accrual basis as required in the national accounts. However, an accrual basis is becoming more common and will be recommended in the forthcoming *Manual on Government Finance Statistics*. Knowledge of the tax payment regulations may provide a basis for adjusting cash-based data to an approximately accrual basis. In some cases, state, provincial, or local government data may not be available for the most recent quarters. If this is the case, it would be necessary to make estimates. For large components, the estimate should be based on actual data on trends in the tax base and changes in tax rates, while simpler methods could be used on small items.

[16]An industry and/or sector split may sometimes be possible from the underlying administrative data.

3. Volume and Price Indicators

3.169. The income approach is oriented to current price data only because prices of some income components are not observable. It is possible to measure labor inputs in volume terms and make estimates of net taxes on products at base year rates, but there is no meaningful price or volume dimension to operating surplus/mixed income and other taxes on production.

3.170. A few countries derive GDP by the income approach at constant prices by deflating by the implicit price deflator for GDP from the production or expenditure-based estimates. Only if the income-based GDP figure differs from the other approach will this give a different GDP, and it will differ from the other approach by the same percentage as at current prices. This treatment is valid only for total GDP and is not valid for splits by type of income. Deflating income components by a generalized price index, such as the CPI, is a measure of purchasing power (called "real" income in the *1993 SNA*) that should not be confused with volume measures of product.

Annex 3.1. Estimation of Changes in Inventories

3.A1.1. This annex discusses the calculation of changes in inventories from business accounting data and gives a simple example. In most countries, accounting practice is to value withdrawals from inventories at historic cost, that is, the prices at the time of acquisition or some notional approximation, rather than the prices at the time of withdrawal as required by the *1993 SNA* and economic concepts. In a few countries, most of which have had high inflation, accounting principles use a current replacement price concept approximating the one used by the *1993 SNA.* If prices are changing, the change in the book value of inventories between the beginning and end of the period will be affected by valuation changes. Changes due to price movements do not contribute to GDP and should be excluded from production, income, and expenditure data. The valuation effects are usually removed by an inventory valuation adjustment (IVA). The IVA should be deducted/added to the book value of changes in inventories, operating surplus, and value added.[17]

3.A1.2. The inventory valuation practices of businesses need to be understood before making calculations. In historic cost measures, inventories as of the end of each quarter are valued at a mix of prices paid over several earlier periods. If data are at historic cost, the periods that prices relate to need to be known in order to adjust from those prices to current prices. Historic cost has several variations, of which the most common are FIFO (first in, first out), LIFO (last in, first out), WAC (weighted average cost), and "specific cost." Note that, other than specific cost, the valuation methods do not necessarily reflect actual ages of products in the inventory—they are simply valuation conventions.

3.A1.3. FIFO means that withdrawals are valued at the earliest prices, and hence the stock of inventories is valued at relatively recent prices. In contrast, under LIFO, the withdrawals are at recent prices, but the stock of inventories is valued at old prices. Thus, FIFO usually results in lower values of withdrawals and higher values of inventories, and it usually requires larger valuation adjustments to withdrawals than does LIFO. However, under FIFO, the valuation of stocks of inventories is more stable and recent, so inventory valuation calculations are more straightforward. The specific cost valuation is the least abstract and is now feasible as a result of computer-based inventory recording. Rather than using a hypothetical valuation rule, with specific cost valuation, each item is valued individually at its actual price at the time of its purchase or production. In many businesses, this will approximate FIFO to the extent that inventory management practice is to turn goods over quickly.

3.A1.4. Sometimes, the historic cost principle is modified to allow for declines in value (COMWIL valuation, i.e., "cost or market, whichever is less"). If price declines are major, this may need to be taken into account.

3.A1.5. The *data required* to derive value of physical change in inventories are the following:

- Values of opening (beginning of period) and closing (end of period) stocks of inventories. Preferably, these would be classified by product groups and/or industries and/or stages of processing (raw materials/work-in-progress and finished goods/goods for resale). If available, product data would be preferable to industry data because the price behavior would be more homogeneous.
- Price indices for relevant products.
- Information on the product composition of inventories.
- Information on the valuation methods used by enterprises.
- Information on the age structure of inventories.

3.A.1.6. The steps involved in the calculation are the following:

- Create an inventory-specific book value deflator. The deflator should reflect both the product composition and the valuations used for the items included in the book values.

[17]Note that "holding gains" in the 1993 SNA sense arise from changes in prices during the period. If the source data are at historic cost, the inventory valuation adjustment (IVA) will cover holding gains from changes in prices between the time of initial valuation and the current period.

- Deflate the opening and closing book values to obtain constant price values.
- Obtain changes in inventories at constant prices as the difference.
- Create reflators to convert from constant price to current price values.
- Reflate constant price values of levels and changes in inventories to obtain current price values.

3.A1.7. The price indices would also need to reflect the products included in inventories. These would not necessarily be in the same proportions as in sales, production, or intermediate consumption. Data on inventories should be collected in detail, if possible. For a quarterly collection, this may not be viable, so more aggregated data may have to be collected.

3.A1.8. The appropriate price index for raw materials would be input prices; for work-in-progress and finished goods, it would be output prices. Goods for resale are the typical holdings of retailers and wholesalers, but manufacturers and others may also act as wholesalers. The appropriate price index would reflect these goods and could be different from the equivalent finished goods indices because goods for resale could include imports and different types of goods. More detailed information on the product composition of inventories could be obtained in annual or less frequent business surveys or in a survey or interview program for a subsample of firms. In a quarterly system, a range of producer, wholesale, import, and consumer prices may be combined in fixed proportions. It would be desirable to assess the stability of the composition of inventories to see whether the fixed proportions need to be changed.

3.A1.9. Note that two price indices usually need to be derived for each period and component: first, a price index to deflate historic cost data to constant prices, and second, a price index to reflate constant price data to current prices. The two indices are different because the historic cost prices of goods in inventories differ from current replacement prices. For the first price index—the historic cost deflator—a mix of historic prices is obtained. For instance, if the producer price index relates to average prices of the month and if investigations have shown that the inventory is valued by FIFO principles at prices of the previous three months—each month with an equal quantity and none from earlier months—the deflator for the book value on December 31 would be an equally weighted average of the October, November, and December price indices. (This treatment assumes that the prices and transactions were spread evenly over the period.) The most sophisticated inventory valuation adjustment calculations have proportions for weighting previous months' prices that take into account fluctuations in the level of inventories (e.g., when inventory levels fall, the proportions of newer inventories rise).

3.A1.10. The second price index is for converting from base period prices to current replacement prices. For example, for flow data for the fourth quarter, the index would be an average of October, November, and December prices. The required current price measure should reflect the average prices of the whole quarter. Note that prices used for the end of the period would not be comparable to prices used for other transactions during the quarter.

3.A1.11. Even when balance sheets are not calculated, it is necessary to obtain both the opening and closing values in order to make valuation adjustments to inventory data in value terms. Direct data on the changes in inventories are almost useless because valuation effects occur on the whole value and so cannot be calculated without data on the inventory levels.

3.A1.12. The quality of all these calculations would usually be improved by working at a more detailed level of product or industry dissection. This is because price movements are more likely to be homogeneous at a more detailed level. To the extent that price movements are similar across different types of goods, the results will not be affected so much by aggregation or choice of index. Primary commodity prices that are particularly volatile and differ from product to product are a higher priority for disaggregation.

Example 3.A.1. Calculation of Changes in Inventories

Information

The book values of inventories of coal for use as a raw material are as follows:

December 31, 2000	1,000.0
March 31, 2001	1,500.0

Both are valued at historic cost on a first-in, first-out valuation basis.

The inventory holdings at both points represent three months of purchases. The coal was acquired evenly over the previous three months.

Price indices and constant price data use a reference base of 2000.

The price index for coal is as follows:

	2000	2001
January	94.5	106.5
February	95.5	107.5
March	96.5	108.5
April	97.5	109.5
May	98.5	110.5
June	99.5	111.5
July	100.5	112.5
August	101.5	113.5
September	102.5	114.5
October	103.5	115.5
November	104.5	116.5
December	105.5	117.5
Average	100.0	112.0

The price indices are based on average prices for the month.

Calculations

(1) Derive an inventory-specific price index to deflate the book value of inventories.

	Weight	Dec. 31, 2000	Mar. 31, 2001
2-3 months	0.3333333	103.5	106.5
1-2 months	0.3333333	104.5	107.5
< 1 month	0.3333333	105.5	108.5
Total index	1.0000	104.5	107.5

The resulting index reflects the book valuation of the inventories, based on equal proportions of coal from each of the three previous months.

A more complex example would involve several price indices and differing proportions being assigned to each month (typically showing a tapering off for earlier months). If the weights for each month are based on quantities or volumes, the indices can be combined in this way; but if the weights are based on values, the total value should be split into component months of purchase according to the proportions and each month deflated by its price index.

(2) Deflate the opening and closing book values of inventories to obtain constant price values.

	Dec. 31, 2000	Mar. 31, 2001
Book value of inventories	1,000.0	1,500.0
Deflators	104.5	107.5
Value of inventories at average 2000 prices	956.9	1,395.3
(Derived by dividing the book value by the book value deflator.)		

(3) Derive the change in inventories at constant prices.

The change in inventories from January through March 2001 at average prices of the year 2000 is 438.4 (=1,395.3 – 956.9)

(continued on next page)

Example 3.A.1. *(continued)*

(4) Derive price indices to reflate from constant price to current price values.

Index for flows, q1 2001	107.5	(average January 2001 through March 2001)
Index for stocks, Dec. 31, 2000	106.0	(average December 2000 through January 2001)
Index for stocks, Mar. 31, 2001	109.0	(average March 2001 through April 2001)

As the original price index data relate to the average for the month, an end-of-month value (required for balance sheet items) can be approximated, in the absence of better information, as the (geometric) mean of the two surrounding months.

(5) Reflate constant price values to obtain current price values.

Estimated change in inventories at average prices of January through March 2001	471.3	=	438.4 /1.075
Inventory valuation adjustment	28.7	=	500.0 – 471.3

(book value of inventory changes less estimated change in inventories at average prices of January through March 2001 where book value of inventory changes are equal to 500.0 = 1500.0 – 1000.0)

Stock data at current prices			
Inventory value at current prices on December 31, 2000	1014.4	=	956.9 · 1.060
Inventory value at current prices on March 31, 2001	1,520.9	=	1,395.3 · 1.090
Total change in inventory current price values January through March 2001	506.6	=	1,520.9 – 1,014.4
"Holding gains" in the 1993 SNA sense	35.3	=	506.6 – 471.3