Eurostat-OECD compilation guide on inventories

2017 edition

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2017 edition

Printed by Consorzio Euredit in Italy

Manuscript completed in June 2017

Luxembourg: Publications Office of the European Union, 2017

Print	ISBN 978-92-79-67733-5	ISSN2 2363-197X	KS-GQ-17-005-EN-C
PDF	ISBN 978-92-79-67734-2	ISSN2 2315-0815	KS-GQ-17-005-EN-N

Foreword

The Eurostat-OECD compilation guide on inventories represents the first comprehensive overview of conceptual and practical issues related to the compilation of the balance-sheet item 'inventories' in the national accounts.

The aim of the compilation guide is to provide conceptual and practical guidance to statisticians on the estimation and valuation of inventories in mutual coherence with the transaction changes in inventories, and by doing so, to increase international comparability for these items. The guide clarifies theoretical concepts and possible data sources. It elaborates several estimation methods for both the asset inventories and the transaction changes in inventories, including their breakdowns into products, industries and institutional sectors. The compilation guide also addresses several special estimation cases and provides the results of a questionnaire — completed by 34 countries — on country practices regarding the estimation of inventories.

The guide presents the information that is available on this topic in the System of National Accounts 2008 (SNA 2008) and in the European system of accounts 2010 (ESA 2010) in a systematic and accessible way. It draws on a wide range of experience and expertise by reviewing the methods used in estimating (changes in) inventories in an attempt to describe practical and suitable measurement methods.

The primary purpose of the compilation guide is to help producers of national accounts data on (changes in) inventories. As such, the guide is designed to help them prepare reliable estimates that are comparable across countries. This particularly applies to countries that are in the process of developing estimates for inventories. The guide therefore includes country examples that illustrate the practical application of the guidelines.

However, the compilation guide is also useful to users of the data. For them the guide not only provides background information about how data on inventories can be compiled, but also about the limitations of the data.

Since balance-sheet data for inventories are often not available it is hoped that this compilation guide will help countries fill in this information gap. Compiling estimates of inventories will move countries one step closer to providing a complete set of information on a nation's balance sheet.

The electronic version of the compilation guide on inventories is available on the websites of Eurostat and the OECD.

We trust that this guide will be a useful resource to both compilers and users of data on inventories, and wish to express our sincere thanks to all those involved in its production.

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OECD Chief Statistician and Director of Statistics

Mariana Kotzeva
Acting Director-General of Eurostat

Preface and acknowledgements

Both the statistical office of the European Union (Eurostat) and the Organisation for Economic Co-operation and Development (OECD) consider the compilation of non-financial assets as a high priority and therefore in June 2012 they decided to join efforts and create a joint Eurostat-OECD Task Force. Eurostat and OECD mandated the Task Force to start the work on non-financial assets by looking at land as the first balance-sheet item. This study was concluded in May 2015 with the publication of the 'Eurostat-OECD compilation guide on land estimation'. Considering the need of national accounts compilers to have more guidance on other non-financial assets, Eurostat and the OECD decided to extend the mandate of the Task Force and to continue the work with the study of inventories. As there is a close link between stocks and flows the present study not only covers the asset inventories, but also takes on board the transaction changes in inventories.

Representatives from various European Union (EU) and non-EU OECD countries were represented in the above-mentioned Task Force and the European Central Bank (ECB) participated as well. The Task Force was chaired by Hans Wouters (Eurostat) and Jennifer Ribarsky (OECD). Other members of the Task Force were, in alphabetical order: Walther Adler (Germany), Brenda Bugge (Canada), Joy Sie Cheung/Hugo de Bondt (the Netherlands), Irmina Cerling (Poland), Taehyoung Cho (Korea), Dan Frankkila/Henrik Romanov (Sweden), Christian Gysting (Denmark), Wesley Harris/Kate Davies/Joe Murphy (United Kingdom), Elisa Huber (Austria), Bob Kornfeld (United States), Elodie Martial/ Alice Tchang (France), Antonio Matas Mir (ECB), Petr Musil (Czech Republic), Paola Santoro (Italy), Nina Strazisar (Slovenia), Martha Tovar (Mexico). Bettina Wistrom (OECD) also contributed to the drafting.

Regarding the topic inventories the Task Force on Land and other non-financial assets met five times:

- 8–9 December 2014 Czech statistical office, Prague
- 2–3 July 2015 Statistical office of Slovenia, Ljubljana
- 3–4 December 2015 Office for National Statistics, Newport
- 7–8 July 2016 Statistics Denmark, Copenhagen
- 1–2 December 2016 Statistics Sweden, Stockholm

All Task Force members actively contributed to the work and drafted chapters or sections of the compilation guide. The work on the compilation guide was coordinated by Hans Wouters (Eurostat). The editing was performed by Jennifer Ribarsky (OECD). The draft chapters and preliminary versions of the compilation guide were available for comments on Eurostat's website.

The compilation guide on inventories benefited from contributions of many countries that replied to the questionnaire on inventories. The guide also benefited from comments received from the Eurostat's National Accounts Working Group, the OECD's Working Party on National Accounts and a global consultation conducted on behalf of the Inter-Secretariat Working Group on National Accounts (ISWGNA).

Eurostat and the OECD would like to thank all those who contributed to the Eurostat-OECD compilation guide on inventories.

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1 Why do we need this compilation guide?

1.1 Introduction

1.1. At its thirty-ninth and fortieth sessions in February 2008 and February 2009, the United Nations Statistical Commission (UNSC) adopted the System of National Accounts 2008 (SNA 2008) as the international statistical standard for national accounts and encouraged Member States, regional and sub-regional organisations to implement the standard and support all aspects of the implementation of the updated SNA 2008. The SNA 2008 guidelines were produced under the joint responsibility of the United Nations (UN), the International Monetary Fund (IMF), the statistical office of the European Union (Eurostat), the Organisation for Economic Cooperation and Development (OECD) and the World Bank (WB). Countries are encouraged to use the SNA 2008 as the framework for compiling and integrating economic and related statistics, as well as for national and international reporting of national accounts statistics.

1.2. To achieve the objectives set by the Treaty on the Functioning of the European Union (EU), and more specifically on economic and monetary union, high quality statistical instruments are needed which provide the EU institutions, governments, economic and social operators, and analysts with a set of harmonised and reliable statistics on which to base their decisions and policy advice. The European system of national and regional accounts in the EU (ESA 2010) is an internationally compatible accounting framework — broadly consistent with SNA 2008, but adapted to the circumstances and needs of the EU — for a systematic and detailed statistical description of an economy. To ensure that the concepts, methodologies and accounting rules set out in ESA 2010 are strictly applied, it has been decided, following a proposal from the Commission, to give it a solid legal basis. ESA 2010 was thus adopted in the form of a regulation of the European Parliament and of the Council dated 21 May 2013. This regulation comprises binding methodological rules to secure comparability of national accounts aggregates, and a compulsory data transmission programme.

1.3. The fortieth session of the UNSC also requested a coordinated effort by the Inter-Secretariat Working Group on National Accounts (ISWGNA) on the development of manuals, implementation guides, data collection tools and standardised training material, and in use of modern and innovative tools, such as distance learning and knowledge bases, to provide easy access on a range of information, including best practices, to facilitate the implementation of the SNA 2008. The ISWGNA subsequently also formulated a global strategy for the implementation of the SNA 2008 and supporting statistics, taking into account the different levels of implementation of existing international standards and the statistical capacity in the various countries.

1.4. The Eurostat-OECD compilation guide on inventories is one of a number of manuals, handbooks and guidance notes under the umbrella of the ISWGNA to strengthen the statistical capacity for compiling national accounts, according to the implementation programme for the SNA 2008 and the ESA 2010 in the European Union. The concepts are described and defined in line with the SNA 2008 as well as the ESA 2010.

1.5. The impetus for this compilation guide is the recognition that non-financial assets are important for understanding a nation's (or sector's) wealth, yet data, in total and by institutional sector are often not available. Recognising the need for more practical guidance on the estimation of non-financial assets the mandate of the joint Eurostat-OECD Task Force on land and other non-financial assets was extended to provide guidance on the estimation of inventories on the balance sheet.

1.6. The G-20 Data Gaps Initiative is a case in point for the demand for more complete data on the balance sheet. Data for inventories by institutional sector are considered a minimum information requirement ([1]). In response to interest on balance sheet data, the revised transmission programme for ESA 2010 requires additional mandatory items for Table 26 'balance sheets for non-financial assets' ([2]). Data on inventories by institutional sector are now compulsory in the new ESA transmission programme.

1.2 Importance of inventories

1.7. Inventories, in the broadest sense covering both stocks and transactions, play several roles in the national accounts. From the perspective of economic flows, changes in inventories are a component of demand and, as one of the more volatile components of gross domestic product (GDP), an important determinant of short-term variations in GDP growth. In addition, changes in inventories of materials and supplies are needed to move purchases to intermediate consumption and changes in inventories of work-in-progress and finished goods not sold are needed to move from sales to output. Therefore, changes in inventories affect national accounts aggregates on production, incomes, and uses (and hence, the estimates of GDP by production, income and expenditure approaches). These issues are briefly explained below for all three approaches to derive GDP estimates.

1.8. From the perspective of the balance sheet, stocks of inventories are an important component and is to be included to get a full accounting of a nation's or sector's wealth. In addition, historical movements in the stock of inventories (as well as inventory to turnover (sales) ratios) provide additional analysis for monitoring trends in transportation and communication systems. For example, the advancement in communication and transportation systems allowed for some firms to adopt 'just-in-time' inventory strategies causing a declining trend in inventory to turnover ratios ([3]). More recently, inventories have also been recognised as assets that provide capital services ([4]).

1.9. The following paragraphs describe the component changes in inventories from the perspective of the three GDP approaches and well as linking the changes in inventories to the stock of inventories on the balance sheet.

Changes in inventories — production approach

1.10. GDP measures the total production occurring within the territory and one way to derive this measure is by summing up the value added at each stage of production. Production is an activity in which a unit uses inputs (labour, capital, intermediate consumption) to produce outputs of goods and services. Nominal holding gains and losses ('holding gains') are not part of production because they are derived from changes in prices of products that have already been produced and are being held in inventory. To remove the effects of holding gains, output and intermediate consumption must be valued at the prices at the time the production and the use of input take place.

([1]) This concerns recommendation 15 of the Data Gaps Initiative 1 and Recommendation 8 of the Data Gaps Initiative 2. See International Monetary Fund website, 'Templates for Minimum and Encouraged Set of Internationally Comparable Sectoral Accounts and Balance Sheets', 11 July 2012. Available at http://www.imf.org/external/np/sta/templates/sectacct/index.htm

([2]) European Commission/Eurostat, *European system of accounts — Transmission programme of data*, European Union, 2014, p.107. Available at http://ec.europa.eu/eurostat/web/products-manuals-and-guidelines/-/KS-01-13-429-3A-C

([3]) Just-in-time inventory strategies is the process of ordering and receiving inventory for production and customer sales only as it is needed and not before.

([4]) While the role of inventories as an asset that provides a flow of capital services is an important topic it is not addressed in this compilation guide. For more information on capital measurement see Organisation for Economic Co-operation and Development, *Measuring Capital: OECD Manual, Second edition*, Paris, 2009. Available at www.oecd.org/dataoecd/16/16/43734711.pdf

1.11. As discussed in the Shrestha and Fassler ([5]) the issue of holding gains on inventories arises when output and/or intermediate consumption are measured using financial data of businesses. This is the case when output is measured as sales (and other uses) plus changes in finished goods/work-in-progress and intermediate consumption is measured as purchases less changes in inventories of materials and supplies. Chapter 2 of this guide provides much more detail regarding valuation and time of recording, but in brief, a product entering into inventory is counted as output when it is produced, at the same time it is added to inventory. When the product is withdrawn from inventory and sold, no output should be recorded. Thus, the value of the sale is offset by the corresponding negative change in inventories, i.e. the withdrawals of finished goods from inventories should be valued at the prices at which the goods are sold. Similarly, a product is recorded as intermediate consumption when it is used in the production process and not at the time that it was purchased. As a result, the use of materials is valued at the prices current at the time of use, i.e. the prices at the time of withdrawal. Box 1.1 from the IMF Working Paper illustrates the relationship between value added and changes in inventories.

Box 1.1: Gross value added and changes in inventories, production approach

Inventory of materials	Production		Inventory of finished goods	
Purchases (import): Quantity: 5 units Price per unit: 10	Use of materials: Quantity: 5 units Prices at the time of use: 12	Production: Quantity: 10 units Prices at the time of production: 15	Entries: Quantity: 10 units Prices: 15	Sales to households: Quantity: 8 units Prices: 16

Calculation of gross value added (GVA)	
Direct calculation:	Calculation based on sales/purchases and inventories:
Output = Quantity produced * current prices 10 * 15 = 150	Output = Sales + Changes in inventory of finished goods (8*16) + [(10*15) - (8*16)] = 128 + 22 = 150
IC = Quantity used * current prices 5 * 12 = 60	IC = Purchases - Changes in inventory of materials (5*10) - [(5*10) - (5*12)] = 50 - (-10) = 60
GVA = Output - IC 150 - 60 = 90	GVA = Output - IC 150 - 60 = 90
(IC = Intermediate consumption)	

Note: It is assumed there were no opening inventories. Changes in inventories are measured by the sum of additions less withdrawals.
Source: IMF Working Paper Changes in Inventories in National Accounts; fictitious data

1.12. As can be derived from the example in Box 1.1, if withdrawals from inventories are not valued at current prices, gross value added will include holding gains. Assuming that withdrawals are valued at prices at the time of entry (15) instead of the prices at the time of withdrawal (16) as shown above under 'calculation based on sales/purchases and inventories', the effect will be as follows: (i) output will be overstated ((8 * 16) + [(10 * 15) – (8 * 15)] = 128 + 30 = 158; instead of 150), (ii) intermediate consumption will be understated ((5 * 10) – [(5 * 10) – (5 * 10)] = 50; instead of 60), and (iii) gross value added will be overstated (158 – 50 = 108; instead of 90) as it includes valuation effects on both output and intermediate consumption.

([5]) Shrestha, Manik and Segismundo Fassler, 'Changes in Inventories in the National Accounts', IMF Working Paper, 2003.Available at https://www.imf.org/external/pubs/ft/wp/2003/wp03120.pdf.

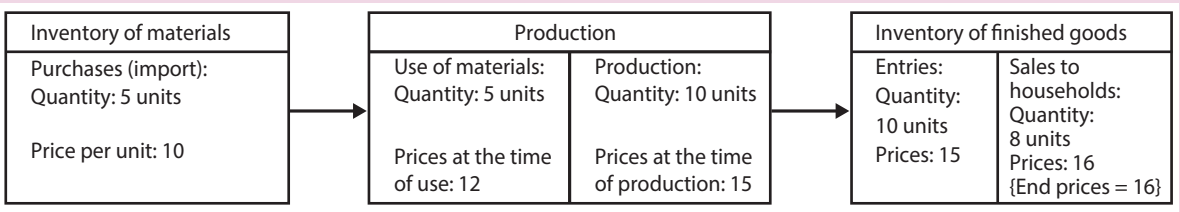
1.13. The issue of holding gains does not arise when output is measured directly by using data on quantity produced and current prices as illustrated in Box 1.1 under 'direct calculation'. The same can be said when measuring intermediate consumption directly from the quantity of materials used and their current prices at the time of use.

Changes in inventories — expenditure approach

1.14. The value of changes in inventories is a component of final uses (demand) and is therefore important in estimating GDP by the expenditure approach. The final uses are recorded on an accrual basis (at the time the ownership of goods is transferred) and valued at the prices at which transactions take place, i.e. purchasers' prices. The value of the product at the time it is acquired for uses may include holding gains ([6]). In order to offset the holding gains that the purchaser's price of a product may include, the withdrawals of that product from inventories must be valued at the prices at the time of withdrawal.

1.15. If the measure of the changes in inventories does not reflect the actual prices at which withdrawals take place, but historic prices are used to value the withdrawals (as in most business accounts), the resulting estimates of changes in inventories will include holding gains that will be reflected in the value of GDP. Box 1.2 provides a numerical example illustrating the relationship between final uses and holding gains on inventories.

Box 1.2: Gross domestic product by expenditure, changes in inventories, and holding gains and losses



GDP by expediture:

Final consumption = Quantity purchased * prices
8 * 16 = 128

Changes in inventories = Finished goods + materials
22 + (-10) = 12

Imports GDP = 50
128 + 12 - 50 = 90

(GDP equals GVA in the absence of taxes/subsidies)

Changes in inventories:

Finished goods = Additions less withdrawals
(10*15) - (8*16) = 22

Materials = (5*10) - (5*12) = -10

Holding gains:

Finished goods = Realised + unrealised
[8 * (16-15)] + [2 * (16-15)]
8 + 2 = 10

Materials = Realised
[5 * (12-10)] = 10

Note: It is assumed there were no opening inventories. Changes in inventories are measured by the sum of additions less withdrawals.
Source: IMF Working Paper Changes in Inventories in National Accounts; fictitious data

([6]) The other components that may contribute to the difference between the value of a product at the time of production and at the time when it is acquired for uses may include taxes/subsidies on products, and trade and transport margins.

1.16. As illustrated in Box 1.2, changes in inventories can be negative even when the physical change in inventories is zero or positive. For example, the physical change in material inventories is zero, but the value of change in material inventories is negative. The prices at the time of use (or sale in other cases) of the materials include holding gains, which are realised gains as these products are used or sold. The uses or sales are recorded at their prices. The realised holding gains included in the purchasers' prices of materials are exactly offset in the changes in inventories by valuating withdrawals at the same prices (the prices at the time of use or sale). The example shows that the value of changes in material inventories is –10, which is equal to the realised holding gains. The changes in inventories, therefore, reflect not only the movement in inventories but also adjustment for difference in valuation between production and use due to holding gains, specifically the realised holding gains. As a result, the sum of total final uses less imports yields GDP exclusive of holding gains, a measure of production.

1.17. Total holding gains on inventories include both realised and unrealised gains (see 'holding gains' subsection in Box 1.2 and Box 1.3). The adjustment included in the changes in inventories comprises only realised holding gains on inventories (e.g. if withdrawals of finished goods were valued at the same price in which they entered the change in finished goods inventories would be 30 instead of 22, thus the realised holding gains included is 8).

Changes in inventories — income approach

1.18. The holding gains on inventories affect operating surplus/mixed incomes. When these estimates are derived residually (by deducting compensation of employees and relevant taxes less subsidies from value added), the output and intermediate consumption should be adjusted, where necessary, for holding gains on inventories (see discussion under production approach above). If the estimates of operating surplus are calculated using information from business accounting, they should be adjusted to eliminate holding gains on inventories included in business profits.

Recording flows and stocks of inventories

1.19. Stocks of inventories, changes in inventories, and the corresponding holding gains are registered across the system of national accounts in the accumulation accounts and balance sheets. Changes in inventories are part of gross capital formation and are registered on the asset side of the capital account. Holding gains on inventories are recorded in the revaluation account, a sub-account of the other changes in assets accounts. Chapter 2 provides an extensive discussion on these concepts and definitions.

1.20. Accumulation accounts and balance sheets are closely linked. Continuing with the numerical example presented in the previous boxes, Box 1.3 illustrates the link between stocks and flows of inventories on the balance sheet.

Box 1.3: Inventories balance sheet

	Opening balance sheet	Transactions	Other changes in volume	Holding gains and losses	Closing balance sheet
Inventories	0	12	0	20	32
Materials and supplies	0	-10	0	10	0
Finished goods	0	22	0	10	32

Source: Eurostat-OECD Task Force (TF) on land and other non-financial assets adapted from IMF Working Paper Changes in Inventories in National Accounts; fictitious data.

1.3 Structure of the guide

1.21. Inventories pose one of the most difficult measurement problems in the compilation of national accounts and are usually among the weakest components. Thus, the purpose of this compilation guide is to provide a better understanding of the methods countries employ to estimate the annual stock of inventories on the balance sheet, identify best practices, and promote international discussions on a number of issues. Since the guidance on measuring the stocks of inventories, as illustrated above, cannot be isolated from the issues that arise when estimating the changes in inventories this compilation guide also discusses how changes in inventories are estimated.

1.22. The following paragraphs briefly outline the contents of this compilation guide. Chapter 2 presents the SNA 2008 and the ESA 2010 concepts and definitions that are relevant for the balance sheet item inventories as well as the changes in inventories for the capital account.

1.23. Chapter 3 describes the types of source data that may be available to national statistical institutes when compiling data on both the stocks of inventories and the changes in inventories. Because much of the source data (whether business surveys or administrative records) are based on business accounting standards Chapter 4 provides a brief discussion on the International Accounting Standards, a description of how businesses value inventories, and the valuation differences between business accounting methods and national accounts.

1.24. The next two chapters provide practical and operational guidelines on how to estimate changes in inventories (Chapter 5) and the stocks of inventories on the balance sheet (Chapter 6). Chapter 5 describes the general methods used in estimating the changes in inventories. The first by using book value data based on business accounting methods (from sources such as business surveys, tax records, or business financial reports) to obtain inventory levels followed by a process of deflation, differencing and revaluing to the average prices of the period. The second estimation method describes estimating the physical flows multiplied by the average prices of the period. The third estimation method describes a supply-demand model for estimating changes in inventories. The annex to Chapter 5 provides a discussion of why the changes in inventories should not be used to balance the three GDP approaches, in other words, the changes in inventories should not include the statistical discrepancy between the three approaches.

1.25. Chapter 6 presents three possible estimation methods for calculating the annual inventory stock on the balance sheet. The first estimation method makes direct use of the business book value data with some adjustments if any. The second estimation method uses something akin to a perpetual inventory method by relying on year-to-year changes in the value of stocks. The third method for computing the annual inventory stock is application of a direct approach, in other words the price times quantity approach.

1.26. In practice, countries will most likely integrate stocks and flows into one estimation method. The organisation of the estimation methods of stocks and flows into two chapters is simply for ease of presentation and discussion. Chapter 6A provides a simplified and integrated overview of the estimation process for the stocks and changes in inventories.

1.27. Since data on inventories are primarily collected by industry, Chapter 7 begins by addressing the issues of further disaggregating inventories by industry into a more detailed industry classification (needed if data are not collected at the establishment or kind-of-activity level) and by type of product. This is often done for use in producing supply and use tables. Chapter 7 also addresses the breakdown of inventories by institutional sector and the cross-classifications. In addition, since changes in inventories should be validated within a supply and use framework the last section in the chapter, Section 7.3, discusses the changes in inventories within the supply and use tables.

1.28. Chapter 8 begins by discussing topics for specific sectors or industries (agricultural and timber inventories, inventories and the asset boundary with gross fixed capital formation, and government and military inventories) and ends by focusing on selected issues (inventories of finished services, the treatment of exceptional and recurrent losses, inventories held under global production, differences between closing and next period opening stocks in source data, and inventories under high inflation). The last chapter, Chapter 9, presents a summary of the responses to a 2015 Eurostat-OECD survey of National Practices in Estimating Inventories.

2 Concepts and definitions

2.1 Introduction

2.1. The concepts and definitions that are of importance for the item inventories are scattered over many chapters and paragraphs in the SNA 2008 and ESA 2010. They are combined in this chapter and presented in a systematic way. Where necessary, this chapter describes how the SNA 2008 and ESA 2010 concepts should be applied to and interpreted for inventories. However, the chapter will not discuss the details of the practical application, measurement and way of compilation and estimation. This is done in the following chapters.

2.2. The chapter begins by addressing some general aspects of inventories as a balance sheet item (AN.12). It presents the position of inventories and its breakdowns on the balance sheet as defined in the SNA 2008 and ESA 2010. It discusses the definition of the asset inventories, its aggregates and its breakdowns. Clarifications of definitions are provided as well. Subsequently the same issues are addressed for the changes in inventories (P.52).

2.3. The remaining parts of the chapter deal with several conceptual issues that are relevant for inventories. Attention is successively paid to the topics of inventories in the system of national accounts (stocks and flows), valuation of inventories, time of recording, netting and consolidation.

2.2 Position of inventories on the balance sheet and definitions

Position of inventories on the balance sheet

2.4. Inventories is an asset on the balance sheet of a country and its institutional (sub)sectors. Inventories is a component of the produced non-financial assets. Table 2.1 below illustrates the position of inventories on the balance sheet.

Table 2.1: Balance sheet according to the SNA 2008 and ESA 2010

Assets			Liabilities and net worth		
AN	Non-financial assets	4 621	AF	Liabilities	7 762
AN.1	Produced non-financial assets	2 818	AF.1	Monetary gold and SDRs	0
AN.11	Fixed assets	2 579	Etc.	Etc.	
AN.12	Inventories	114			
AN.121	Materials and supplies	35			
AN.122	Work-in-progress	33			
AN.1221	Work-in-progress on cultivated biological assets	15			
AN.1222	Other work-in-progress	18			
AN.123	Finished goods	28			
AN.124	Military inventories	8			
AN.125	Goods for resale	10			
AN.13	Valuables	125			
AN.2	Non-produced non-financial assets	1 803			
AF	Financial assets	8 231			
AF.1	Monetary gold and SDRs	770			
Etc.	Etc.				
			B.90	Net worth	5 090

Source: Eurostat-OECD Task Force on Land and other non-financial assets, based on ESA2010; fictitious data

Definitions and elaborations of inventory stocks and its aggregates

2.5. The SNA 2008 defines a balance sheet as 'a statement, drawn up in respect of a particular point in time, of the values of assets owned and of the liabilities owed by an institutional unit or group of units' (SNA 2008 paragraph 13.2). Similarly, according to the ESA 2010 a balance sheet is 'a statement, drawn up for a particular point in time, of the values of assets economically owned and of liabilities owed by an institutional unit or group of units' (ESA 2010 paragraph 7.01).

2.6. An asset is a store of value representing a benefit or series of benefits accruing to the economic owner by holding or using the entity over a period of time. It is a means of carrying forward value from one accounting period to another (SNA 2008 paragraph 3.30, ESA 2010 paragraph 7.15).

2.7. Non-financial assets (AN) are non-financial items over which ownership rights are enforced by institutional units, individually or collectively, and from which economic benefits may be derived by their owners by holding, using or allowing others to use them over a period of time (ESA 2010 Annex 7.1). Non-financial assets are divided into produced (non-financial) assets (AN.1) and non-produced (non-financial) assets (AN.2).

2.8. Produced assets (AN.1) are non-financial assets that have come into existence as outputs from production processes that fall within the production boundary of the SNA 2008 (SNA 2008 paragraph 10.9a). According to the ESA 2010 produced non-financial assets are outputs from the production processes (ESA 2010 paragraph 7.22).

2.9. The classification of produced non-financial assets is designed to distinguish among assets on the basis of their role in production. It consists of: fixed assets which are used repeatedly or continuously in production for more than one year; inventories which are used up in production as intermediate consumption, sold or otherwise disposed of; and valuables. Valuables are not used primarily for production or consumption, but are instead acquired and held primarily as stores of value.

2.10. The definitions of inventories in ESA 2010 (Annex 7.1) and SNA 2008 (paragraph 10.12) are almost identical: inventories are produced assets that consist of goods and services that came into existence in the current period or in an earlier period held for sale, use in production or other use at a later date.

2.11. Inventories consist of stocks of outputs that are still held by the units that produced them prior to their being further processed, sold, delivered to other units or used in other ways and stocks of products acquired from other units that are intended to be used for intermediate consumption or for resale without further processing. Inventories of services consist of work-in-progress or finished products, for example architectural drawings, which are in the process of completion or are completed and waiting for the building to which they relate to be started. Inventories held by government include, but are not limited to, inventories of strategic materials, and grain and other commodities of special importance to the nation.

Definitions and elaborations of the components of inventory stocks

2.12. The asset inventories (AN.12) consists of five components: materials and supplies (AN.121), work-in-progress (AN.122), finished goods (AN.123), military inventories (AN.124) and goods for resale (AN.125). Work-in-progress is broken down again into two sub-components: work-in-progress on cultivated biological assets (AN.1221) and other work-in-progress (AN.1222).

2.13. SNA 2008 and ESA 2010 define the components of inventories slightly different. However, the substance of the definitions in both manuals is identical. The definitions are presented and elaborated below. Regarding the definitions: the first mentioned definition for each component comes from SNA 2008 and the second one is derived from ESA 2010.

2.14. Materials and supplies (AN.121) consist of all products that an enterprise holds in inventory with the intention of using them as intermediate inputs into production (SNA 2008 paragraph 10.131). Materials and supplies are goods that their owners intend to use as intermediate inputs to their own production processes, not to resell (ESA 2010 Annex 7.1).

2.15. Not all materials and supplies necessarily get used in this way, however, as some may be lost as a result of physical deterioration, or recurrent accidental damage or pilfering. Such losses of materials and supplies are recorded and valued in the same way as materials and supplies actually withdrawn to be used up in production.

2.16. Enterprises may hold a variety of different kinds of goods under the heading of materials and supplies, the most common types being fuels, industrial raw materials, agricultural materials, semi-processed goods, components for assembly, packaging materials, foodstuffs, office supplies, etc. Every enterprise, including non-market producers owned by government units, may be expected to hold some inventories of materials and supplies, if only inventories of office supplies.

2.17. Materials and supplies do not include works of art or stocks of precious metals or stones acquired by enterprises as valuables. However, there are some producers that do use gold, diamonds, etc. as intermediate inputs into the production of other goods or services, for example, manufacturers of jewellery or dentists. Stocks of gold, diamonds, etc., intended for use in production are recorded under materials and supplies.

2.18. Work-in-progress (AN.122) consists of output produced by an enterprise that is not yet sufficiently processed to be in a state in which it is normally supplied to other institutional units (SNA 2008 paragraph 10.134). Work-in-progress are goods and services that are partially complete but that are not usually turned over to other units without further processing or that are not mature, and whose production process will be continued in a subsequent period by the same producer. Excluded are partially complete structures for which the ultimate owner is deemed to have taken ownership, either because the production is for own use or as evidenced by the existence of a contract of sale/purchase (ESA 2010 Annex 7.1).

2.19. Work-in-progress occurs in all industries, but is especially important in those in which a long time is needed to produce a unit of finished output, for example, in agriculture, or in industries producing complex fixed assets such as ships, dwellings and other types of construction such as public infrastructure, software or films. However, other products for which the production process starts close to the end of the reference period can very well still be work-in-progress at the end of the accounting period. Work-in-progress can therefore take a wide variety of different forms ranging from growing crops to partially completed film productions or computer programs. Although work-in-progress is output that has not reached the state in which it is normally supplied to others, its ownership is nevertheless transferable, if necessary. For example, it may be sold under exceptional circumstances such as the liquidation of the enterprise.

2.20. Work-in-progress must be recorded for any output that is not complete at the end of the accounting period. The shorter the accounting period, the more important work-in-progress is likely to be relative to finished output. In particular, it is likely to be more significant for quarterly accounts than annual accounts, if only because the production of, for example, many agricultural crops is completed within a year but not necessarily within a quarter. The only exceptions to recording incomplete work as work-in-progress are for partially completed projects where the ultimate owner is deemed to have taken ownership, either because the production is for own use or as evidenced by the existence of a contract of sale or purchase.

2.21. Work-in-progress is subdivided between work-in-progress on cultivated assets and other work-in-progress, as defined below.

2.22. Work-in-progress on cultivated biological resources (AN.1221) consists of output that is not yet sufficiently mature to be in a state in which it is normally supplied to other institutional units (SNA 2008 paragraph 10.140). ESA 2010 defines work-in-progress on cultivated biological assets as livestock raised for products yielded only on slaughter, such as fowl and fish raised commercially, trees and other vegetation yielding once-only products on destruction and immature cultivated assets yielding repeat products (ESA 2010 Annex 7.1).

2.23. It is necessary to distinguish single-use plants, trees and livestock that produce an output once-only (when the plants or trees are cut down or uprooted or the livestock slaughtered) from trees (including vines and shrubs) and livestock that are used repeatedly or continuously for more than one year to produce outputs such as fruit, nuts, rubber, milk, wool, power, transportation and entertainment. Work-in-progress should be recorded for single-use resources. Repeat yield products should in principle be registered as gross fixed capital formation.

2.24. Other work-in-progress (AN.1222) consists of output (other than on cultivated biological resources) that is not yet sufficiently processed to be in a state in which it is normally supplied to other institutional units (SNA 2008 paragraph10.141). Other work-in-progress are goods other than cultivated assets and services that have been partially processed, fabricated or assembled by the producer but that are not usually sold, shipped or turned over to others without further processing (ESA 2010 Annex 7.1).

2.25. Finished goods (AN.123) consist of goods produced as outputs that their producer does not intend to process further before supplying them to other institutional units (SNA 2008 paragraph 10.142). Finished goods are defined as goods that are ready for sale or shipment by the producer (ESA 2010 Annex 7.1).

2.26. A good is finished when its producer has completed the intended production process, even though it may subsequently be used as an intermediate input into other processes of production. Thus, inventories of coal produced by a mining enterprise are classified as finished products, although inventories of coal held by a power station are classified under materials and supplies. Inventories of batteries produced by a manufacturer of batteries are finished goods, although inventories of the same batteries held by manufacturers of vehicles and aircraft are classified under materials and supplies.

2.27. Military inventories (AN.124) consist of single-use items, such as ammunition, missiles, rockets, bombs, etc., delivered by weapons or weapons systems (SNA 2008 paragraph 10.144). Military inventories includes ammunition, missiles, rockets, bombs and other single-use military items delivered by weapons or weapons systems; it excludes some types of missiles with highly destructive capability (ESA 2010 Annex 7.1).

2.28. Most single-use items are treated as inventories but some types of missiles with highly destructive capability are treated as fixed capital because of their ability to provide an ongoing deterrence service against aggressors.

2.29. Goods for resale (AN.125) are goods acquired by enterprises, such as wholesalers or retailers, for reselling them to their customers (SNA 2008 paragraph 10.145). Goods for resale concerns goods acquired by enterprises, such as wholesalers and retailers, for reselling them without further processing (that is, not transformed other than by presenting them in ways that are attractive to the customer) (ESA 2010 Annex 7.1).

2.30. Goods for resale are not processed further by the enterprises that purchase them, except for presenting them for resale in ways that are attractive to their customers. Thus, goods for resale may be transported, stored, graded, sorted, washed, packaged, etc. by their owners but are not otherwise transformed.

2.31. By convention, goods acquired by government for distribution as social transfers in kind but that have not yet been so delivered are also included in goods for resale (SNA 2008 paragraph 10.148).

2.3 Position of changes in inventories on the capital account and its definition

Position of changes in inventories on the capital account

2.32. Where the previous sections (paragraphs 2.4 to 2.31) discussed the definition of inventories as stocks, the sections below address inventories as transactions. Transactions in inventories are registered under changes in inventories (P.52) on the capital account.

2.33. Changes in inventories are registered on the use side of the capital account of a country and its institutional (sub)sectors. Changes in inventories is a component of gross capital formation (P.5). Table 2.2 below illustrates the position of changes in inventories on the capital account.

Table 2.2: Capital account according to the SNA 2008 and ESA 2010

Code	Changes in assets		Code	Changes in liabilities and net worth	
			B.8n	Net saving	205
P.5	Gross capital formation	414	D.9r	Capital transfers, receivable (+)	62
P.51g	Gross fixed capital formation	376	D.9p	Capital transfers payable (-)	-64
P.51c	Consumption of fixed capital (-)	-222			
P.52	**Changes in inventories**	**28**			
P.53	Acquisitions less disposals of valuables	10			
NP	Acquisitions less disposals of non-produced assets	4			
B.9	Net lending (+)/net borrowing (-)	7			
	Total	203		Total	203

Source: Eurostat-OECD Task Force on Land and other non-financial assets, based on ESA2010; fictitious numbers

Definitions of changes in inventories, its aggregate and components

2.34. A transaction is an economic flow that is an interaction between institutional units by mutual agreement or an action within an institutional unit that it is useful to treat as a transaction, because the unit is operating in two different capacities (ESA 2010 paragraph 1.66).

2.35. Changes in inventories is a transaction in products. Transactions in products describe the origin (domestic output or imports) and use (intermediate consumption, final consumption, gross capital formation or exports) of products.

2.36. The capital account records acquisitions less disposals of non-financial assets by resident units and measures the change in net worth due to saving (final balancing item in the current accounts) and capital transfers. It includes the various types of investments in non-financial assets of which changes in inventories is one.

2.37. Both SNA 2008 (paragraph 10.31) and ESA 2010 (paragraph 3.122) describe gross capital formation as the total value of gross fixed capital formation, changes in inventories and acquisitions less disposals of valuables.

2.38. According to both SNA 2008 (paragraph 10.118) and ESA 2010 (paragraph 3.146) changes in inventories are measured by the value of the entries into inventories less the value of withdrawals and less the value of any recurrent losses of goods held in inventories during the accounting period.

2.39. Some of the acquisitions and disposals are attributable to actual purchases or sales, but others reflect transactions that are internal to the enterprise.

2.40. From the definition in paragraph 2.38 it can be concluded that recurrent losses of goods from inventories are treated in the same way as deliberate withdrawals. Regular wastage, pilfering, physical deterioration or recurrent accidental damage are examples of recurrent losses.

2.41. It is useful to distinguish between two functions performed by an enterprise: its function as a producer of goods and services and its function as an owner of assets. When a good is entered into inventories it is acquired as an asset by the enterprise in its capacity as owner either by purchase (or barter) or by an internal transaction with itself as the producer. Conversely, a good leaving inventories represents the disposal of an asset by the owner either by sale or other use, by an internal transfer to the producer or possibly as a result of recurrent losses (recurrent wastage, accidental damage or pilfering).

2.42. Most goods going into inventories simply remain there until they are withdrawn in the same state as when they entered. Not infrequently, the price of the goods will have increased (or decreased) while they are in inventories, but these increases (decreases) are not due to production but are simply nominal holding gains and losses ('holding gains'). There are some goods, though, where the passage of time in store changes the character of the goods. In such cases, the increase in value due to storage is to be treated as production and not as holding gains, though holding gains may occur as well. In these cases the increase has to be registered as a transaction in changes in inventories as well: the goods in storage are classified as work-in-progress (and not finished goods). The indication that storage is being undertaken as a production activity is that the price of the good stored, relative to the general level of prices, is expected to increase by a certain amount over a predetermined time. For example, winter wheat may be expected, on the basis of past experience, to fetch a given multiple of its price at harvest. Similarly, wine that is several years old is more valuable than the current year's vintage by a predictable factor. This issue is elaborated in detail in Annex 2A.

2.43. The increase in value during the accounting period up to the expected level at that time is treated as production of storage and changes in inventories/work-in-progress. In order to estimate the increase in the value of goods stored over and above the storage costs, use may be made of the expected increase in value over and above the general rate of inflation over a predetermined period. Any gain that occurs outside the predetermined period continues to be recorded as a holding gain.

2.44. Neither SNA 2008 nor ESA 2010 have provided for separate codes for the breakdown of changes in inventories into components. However, in principle the breakdown as discussed above for the balance sheet item inventories can also be applied to changes in inventories.

2.45. Changes in inventories can therefore be decomposed into changes in materials and supplies, work-in-progress, finished goods, military inventories, and goods for resale. The definitions of these components are similar to the definitions of the corresponding balance sheet items as presented in paragraphs 2.12 to 2.31, of course taking into account that it concerns transactions in these components instead of outstanding values.

2.4 Conceptual issues

Inventories in the system of national accounts

2.46. In the sections above the position of inventories on the balance sheet (stocks) as well as their place in the capital account (transactions) were discussed. In this section a more complete picture is given regarding the relationship between the inventory stocks (AN.12) and the changes in the stocks. Where balance sheets express the value of inventory stocks at a certain point in time, the flow accounts — the capital account and the other changes in assets account — show the changes in the balance sheet values: either as transactions or as other changes (in assets). The mutual coherence between balance sheets, transactions and other changes is elaborated in the paragraphs below.

2.47. The overview below presents a picture of the relationships between stocks and flows in general (ESA 2010 paragraph 7.12).

Figure 2.1: Relationship stocks and flows

The value of the stock of a specific type of asset in the opening balance sheet		
Plus	Transactions	The total value of that asset acquired in transactions that take place during the accounting period
Minus		The total value of that asset disposed of in transactions that take place during the accounting period
Minus		Consumption of fixed capital (if applicable)
Plus	Other changes in the volume of assets	Other positive changes in volume affecting that asset
Minus		Other negative changes in volume affecting that asset
Plus	Revaluations	The value of nominal holding gains accruing during the period resulting from changes in the price of that asset
Minus		The value of nominal holding losses accruing during the period resulting from changes in the price of that asset
Equals the value of the stock of that asset in the closing balance sheet.		

Source: European system of accounts 2010

2.48. The accounting links for the asset inventories between the opening balance sheet and the closing balance sheet via transactions, other changes in (the) volume (of assets), and (nominal) holding gains and losses are shown below (ESA 2010 Annex 7.2).

Figure 2.2: Accounting links inventories between opening and closing balance sheet

Classification of assets, liabilities and net worth	IV.1	III.1 and III.2	III.3.1	III.3.2		IV.3
	Opening balance sheet	Transactions	Other changes in volume	Holding gains and losses		Closing balance sheet
				III.3.2.1	III.3.2.2	
				Neutral holding gains and losses	Real holding gains and losses	
Inventories	AN.12	P.52	K.3, K.4, K.5, K.61, K.62	K.71	K.72	AN.12

Source: European system of accounts 2010

STOCKS

2.49. The balance sheet completes the sequence of accounts. It shows the ultimate effect of the entries in the production, distribution and use of income, and accumulation accounts (SNA 2008 paragraph 13.5, ESA 2010 paragraph 7.03).

2.50. The item inventories (AN.12) on the opening balance sheet (IV.1) and closing balance sheet (IV.3) relates to the value of this asset at a particular moment of time: the beginning and end of an accounting period. The accounting period can be any period, but usually is a year or a quarter. The closing balance sheet at the end of the period should be equal to the opening balance sheet at the beginning of the next period.

2.51. The inventory stock can be determined for the total national economy and the resident institutional sectors. The institutional sectors are non-financial corporations, financial corporations, general government, households and non-profit institutions serving households (SNA 2008 paragraph 4.24); most of them can be broken down into subsectors. The asset inventories does not appear on the balance sheet of the rest of the world towards the national economy.

2.52. Inventories are also often broken down by industry. In ISIC Rev. 4 ([7]) and its European equivalent NACE Rev. 2 ([8]) a standardised breakdown into industries can be found.

TRANSACTIONS

2.53. Transactions in inventories must be registered on the capital account under changes in inventories (P.52). More detailed information on changes in inventories, like the position on the capital account and definitions, is available in the paragraphs 2.32 to 2.45 above.

OTHER FLOWS

2.54. Other flows are changes in the value of assets and liabilities that do not result from transactions (SNA 2008 paragraph 3.99). In ESA 2010 the concept of other changes (in assets) is used, which is defined as economic flows, other than those that occur through transactions recorded in the capital and financial accounts, that change the value of assets and liabilities (ESA 2010 paragraph 6.02).

2.55. Two types of other flows (other changes) are distinguished. The first consists of other changes in (the) volume (of assets). The second is through (nominal) holding gains and losses (K.7, ESA 2010 paragraph 6.02).

2.56. On the first one: other changes in the volume of assets include flows that allow assets to enter or leave the accounts other than by transactions — for example, the destruction of inventories as a result of a major fire. Other changes in the volume of assets also include the effect of exceptional, unanticipated external events that are not economic in nature, and changes resulting from reclassification or restructuring of institutional units or assets and liabilities.

2.57. On the second one, nominal holding gains and losses: the nominal holding gains and losses that relate to an asset are the increases or decreases in the asset's value accruing to its economic owner as a result of increases or decreases in its price.

OTHER CHANGES IN THE VOLUME OF ASSETS AND LIABILITIES

2.58. As can be concluded from Figure 2.2, there are five types of other changes in volume that are relevant for the asset inventories. They are catastrophic losses (K.3), uncompensated seizures (K.4), other changes in volume n.e.c. (K.5), changes in sector classification and structure (K.61) and changes in classification of assets and liabilities (K.62).

([7]) United Nations, *International Standard Industrial Classification of All Economic Activities (ISIC), Rev. 4*, United Nation Publications, New York, 2008. Available at: http://unstats.un.org/unsd/cr/registry/isic-4.asp

([8]) European Commission/Eurostat, *NACE Rev. 2 — Statistical classification of economic activities in the European Community, Rev. 2*, Office for Official Publications of the European Communities, 2008. Available at: http://ec.europa.eu/eurostat/documents/3859598/5902521/KS-RA-07-015-EN.PDF

2.59. Catastrophic losses (K.3) recorded as other changes in volume result from large-scale, discrete and recognisable events that destroy economic assets (SNA 2008 paragraphs 12.46–12.47, ESA 2010 paragraphs 6.08–6.09). Such events include major earthquakes, volcanic eruptions, tidal waves, exceptionally severe hurricanes, drought and other natural disasters; acts of war, riots and other political events; and technological accidents such as major toxic spills or release of radioactive particles into the air. Examples of such events for inventories could be the destruction of (part of) the stock of inventories because of a flood or earthquake.

2.60. Uncompensated seizures (K.4) occur when governments or other institutional units take possession of the assets of other institutional units, including non-resident units, without full compensation, for reasons other than the payment of taxes, fines or similar levies. The seizure of property related to criminal activity is considered to be a fine. The uncompensated part of such unilateral seizures is recorded as other changes in volume (SNA 2008 paragraphs 12.48–12.49, ESA 2010 paragraphs 6.10–6.11). An example applying to inventories could be the seizure of inventories by the government that previously belonged to an enterprise without providing compensation for this to the enterprise.

2.61. Other changes in volume not elsewhere classified (K.5) are the effects of unexpected events on the economic value of assets (SNA 2008 paragraphs 12.50–12.62, ESA 2010 paragraphs 6.12–6.15). Exceptional losses of inventories from fire damage, from robberies, from insect infestation of grain stores, from an unusually high level of disease in livestock, etc., should be recorded here. In this context, exceptional losses indicate that the losses are not only large in value but also irregular in occurrence. Even very large losses, if they occur regularly, should be taken into account when calculating the changes in inventories for the capital account.

2.62. Reclassifying an institutional unit from one sector to another (K.61) transfers its entire balance sheet, e.g. if an institutional unit classified in the households sector becomes financially distinct from its owner, it may qualify as a quasi-corporation and be reclassified in the non-financial corporations sector (SNA 2008 paragraphs 12.64–12.67, ESA 2010 paragraphs 6.17–6.20). For instance, if an unincorporated owner of a large farm changes into an incorporated unit, the inventories of the farm (and all other assets and liabilities) should be transferred from the households sector to the sector of the non-financial corporations. This transfer should be registered as K.61 on the other changes in the volume of assets account.

2.63. Changes in classification of assets and liabilities (K.62) occur where assets and liabilities appear under one classification, such as work-in-progress, in the opening balance sheet and under another classification, such as finished goods, in the closing balance sheet (SNA 2008 paragraphs 12.68–12.71, ESA 2010 paragraphs 6.21–6.25). Reductions in work-in-progress take place when the production process is completed. At that point, all work-in-progress is reclassified as a finished product. In all instances, work-in-progress needs to be reclassified to finished goods prior to sale.

2.64. As it might be difficult in practice to register changes between work-in-progress and finished goods as changes in classification of assets and liabilities, SNA 2008 and ESA 2010 seem to leave open the possibility of registering these changes as transactions. SNA paragraph 3.7 and ESA 2010 paragraph 1.66 mention that a transaction usually takes place between institutional units, but that it can also be useful to register transactions within an institutional unit. In addition, SNA paragraph 10.118 states, after having mentioned the definition of changes in inventories, that acquisitions and disposals are attributable to actual purchases or sales, but may also reflect transactions internal to the enterprise.

2.65. Some animals treated as fixed capital because they are kept as dairy stock or for their fleece may be slaughtered for meat at the end of their productive lives. In this case, they should in principle be reclassified from fixed capital to inventories when they cease to yield repeat products. If this is not practicable, or deemed too fastidious, then some of the source of meat should be accounted for by a reduction in fixed capital rather than a withdrawal from inventories. In principle, reclassification from one type of inventory to another or from fixed capital to inventories, should not involve a change in value. If at the time of conversion the previous valuation is different from the appropriate new valuation, an entry in the other changes in the volume of assets account is recorded under economic appearance or disappearance as appropriate. If this is found to be happening systematically, the valuation techniques for inventories should be re-examined.

NOMINAL HOLDING GAINS AND LOSSES

2.66. Nominal holding gains and losses form part of the profits in business accounts. However, they are not part of the national accounts production definition as they result from price changes that occur after production has taken place and the products are already in the inventory.

2.67. The nominal holding gains and losses that relate to an asset are the increases or decreases in the asset's value accruing to its economic owner as a result of increases or decreases in its price (ESA 2010 paragraph 6.27). In the SNA 2008 the nominal holding gain on a non-financial asset is the value of the benefit accruing to the owner of that asset as a result of a change in its price over a period of time (SNA 2008 paragraph 12.74). As the prices of inventories often change over time, this type of other changes will occur frequently and could be an important explanation for the changes between opening and closing balance positions of inventories. The holding gains and losses in the value of inventories will be unrealised as long as the inventories remain on the balance sheet of the same entity. The holding gains and losses in the value of inventories will be realised when the goods leave the inventories.

2.68. Nominal holding gains and losses (K.7) comprise neutral holding gains and losses (K.71) and real holding gains and losses (K.72).

2.69. The neutral holding gains and losses (K.71) relate to assets and liabilities and are the value of the holding gains and losses that accrue if the price of the asset or liability changes over time in the same proportion as the general price level (ESA 2010 paragraph 6.37). The SNA 2008 defines a neutral holding gain (loss) over a period as the increase (decrease) in the value of an asset that would be required, in the absence of transactions and other changes in the volume of assets, to maintain command over the same amount of goods and services as at the beginning of the period (SNA 2008 paragraph 12.75). Neutral holding gains and losses are identified to facilitate the derivation of real holding gains and losses, which redistribute real purchasing power between sectors. The general price index to be applied for the calculation of neutral holding gains and losses is a price index for final expenditure.

2.70. The real holding gains and losses (K.72) relate to an asset or liability and are the difference between the nominal and the neutral holding gains and losses on that asset (ESA 2010 paragraph 6.42). According to the SNA 2008 a real holding gain (loss) is the amount by which the value of an asset increases (decreases) over the neutral holding gain for the period, in the absence of transactions and other changes in the volume of assets (SNA 2008 paragraph 12.76).

2.71. The estimation of nominal holding gains and losses ('holding gains') on inventories may be difficult because of lack of data on transactions or other changes in the volume of inventories. Transactions in inventories of work-in-progress and finished goods may not be adequately recorded because they are internal transactions. Goods entering inventories can be regarded as being acquired by the owner of an enterprise from itself as producer, while goods leaving inventories can be regarded as being disposed of by the owner to the producer for use in production or for sale. These internal transactions should be valued at the prices prevailing at the times they take place. The value of withdrawals thus includes any holding gains on the inventories when stored and this ensures that the value of the holding gain is not included in output. However, as explained in paragraphs 2.42 and 2.43, when the storage of goods is essentially an extension of the process of production, the increase in the value of the goods that is due to this production is not to be counted as a holding gain. In the case of goods for resale, the value of the goods when withdrawn from inventory should include the value of any holding gain that has occurred while they were in store but not the value of any margin to be realised by the wholesaler or retailer. That is to say, goods withdrawn from inventories are valued at the prices prevailing at the time of withdrawal for goods in the same state as when the goods entered inventories (except for the storage case).

2.72. As explained in paragraph 2.40 recurrent losses of goods from inventories, such as losses due to regular wastage or pilfering, must not be treated as nominal holding gains, but should be considered as deliberate withdrawals from the inventories. In addition, as discussed in paragraph 2.59, exceptional losses have to be registered as catastrophic losses. Nominal holding gains on inventories thus relate only to the level of inventories once both exceptional and recurrent losses on inventories have been taken into account. The treatment of exceptional and recurrent losses is discussed in more detail in Section 8.6.

2.73. Estimating holding gains based only on period end data involves two problematical assumptions. The first is that prices increase linearly throughout the period; the second is that the changes in volume of inventories increase or decrease linearly between opening and closing balance sheets. Both assumptions

are improbable, especially in the case of seasonal products. It should also be noted that this is not only a problem for the accumulation accounts as the values of changes in inventories of inputs and outputs are needed in order to measure intermediate consumption, output and value added and hence all the balancing items of the SNA. In general, if these sorts of assumptions need to be made in order to derive holding gains, they should be made over as short a period as possible. In particular, the aggregation of quarterly estimates of this type will be preferable to an annual estimate of the same type.

Valuation

STOCKS

2.74. On the balance sheet inventories should be valued at their current market price (SNA 2008 paragraph 13.16, ESA 2010 paragraph 7.33), which is the value of the inventories as if they were being acquired on the date to which the balance sheet relates.

2.75. When market prices for transactions are not observable, valuation according to market-price-equivalents provides an approximation to market prices. However, for inventories market prices are usually available.

2.76. From paragraph 2.74 it follows that inventories should also be valued at prices prevailing on the date to which the balance sheet relates, and not at the prices at which the products were valued when they entered inventory.

2.77. Inventories of materials and supplies are valued at purchasers' prices, and inventories of finished goods and work-in-progress are valued at basic prices. Inventories of goods intended for resale without further processing by distributors are valued at the prices prevailing on the date to which the balance sheet relates, excluding any transportation costs incurred by the wholesalers or retailers. For inventories of work-in-progress, the value of the closing balance sheet is estimated by applying the fraction of the total production cost incurred by the end of the period to the basic price of a similar finished product on the date to which the balance sheet relates. If the basic price of the finished products is unavailable, it is estimated by the value of the production cost with a mark-up for expected net operating surplus or estimated net mixed income.

2.78. Single-use crops (except timber) under cultivation and livestock raised for slaughter can be valued by reference to the prices of such products on the markets. Standing timber is valued by discounting the future proceeds of selling the timber at current prices after deducting the expenses of bringing the timber to maturity, felling, etc.

TRANSACTIONS

2.79. The SNA 2008 and ESA 2010 prescribe to value transactions at market prices (SNA 2008 paragraph 3.119, ESA 2010 paragraph 1.94). Market prices for transactions are defined as amounts of money that willing buyers pay to acquire something from willing sellers; the exchanges are made between independent parties and on the basis of commercial considerations only, sometimes called 'at arm's length'.

2.80. The valuation of changes in inventories must be consistent with the valuation of other transactions in products. This applies in particular to intermediate consumption (e.g. for materials and supplies) and output (e.g. work-in-progress and output from storage of agricultural products, and finished goods). If goods are processed abroad with a change in economic ownership, the goods are to be included in exports (and later in imports if the economic ownership is transferred back). The export is reflected in a concomitant reduction in inventories, and the corresponding later import is recorded as an increase in inventories, provided it is not sold or used at once. Goods that leave the domestic economy without change in economic ownership do not appear as exports and imports. They remain in the inventories of the domestic unit. Section 8.7 discusses more details regarding inventories held abroad.

2.81. Unless records are kept of the quantities of goods entering and leaving the stock of inventories and their prices at those times, it is not possible to measure the value of changes in inventories directly. As such records may not be available, it becomes necessary to try to deduce the value of changes in inventories from the value and quantities of the opening and closing inventories using methods that attempt to

partition the difference between the values of the opening and closing stocks of assets into transactions and holding gains. Such methods are only as good as the assumptions on which they are based. More details about the estimation of changes in inventories can be found in Chapter 5.

2.82. In measuring changes in inventories, goods entering inventories are valued at the time of entry, and goods being withdrawn are valued at the time of withdrawal.

2.83. The enterprise in its capacity as a producer may obtain goods or services for intermediate consumption either by purchasing them on the market for immediate use or by internal transfers out of inventories. In order to ensure that all the goods and services used for intermediate consumption are consistently valued at current prices, the goods transferred out of inventories are valued at purchasers' prices current at the time of the withdrawal from inventories.

2.84. Similarly, the output produced by the producer may either be sold or otherwise disposed of or be transferred to inventories as finished products or work-in-progress. In order to ensure that output is consistently valued, finished goods transferred into inventories are valued as if they were sold at that time, while additions to work-in-progress are given the value they have at the time they are added to inventories.

2.85. More specifically, the prices used to value goods in changes in inventories are as follows (ESA 2010 paragraph 3.151):

(a) output of finished goods transferred into the producer's inventories is valued as if they were sold at that time, at current basic prices;

(b) additions to work-in-progress are valued in proportion to the estimated current basic price of the finished product;

(c) reductions in work-in-progress due to work withdrawn from inventories when production is finished are valued at current basic prices of the unfinished product;

(d) goods transferred out of inventories for sale are valued at basic prices;

(e) goods for resale entering the inventories of wholesalers and retailers, etc. are valued at the actual or estimated purchasers' prices of the trader; they include any additional transportation charges paid to enterprises other than the suppliers of the goods, but not the costs of any transport services produced on own account by the enterprise taking delivery;

(f) goods for resale withdrawn from inventories are valued at the purchasers' prices at which they can be replaced at the time they are withdrawn, and not at the price when they were acquired.

2.86. Losses as a result of physical deterioration, insurable accidental damage or pilfering are recorded and valued as follows:

(a) for materials and supplies: as materials and supplies actually withdrawn to be used up in production (intermediate consumption);

(b) for work-in-progress: valued as deduction from the additions accruing to production carried out in the same period;

(c) for finished goods and goods for resale: treated as withdrawals at the current price of undeteriorated goods.

2.87. ESA 2010 paragraph 3.153 states that where information is lacking, the approximate methods for the estimation of changes in inventories can be used.

(a) When changes in the volume of inventories are regular, an acceptable approximate method is to multiply the changes in the volume of the inventories by the average prices for the period. Purchasers' prices are used for inventories held by users or by wholesalers or retailers; basic prices are used for inventories held by their producers.

(b) When prices of the goods involved remain constant, fluctuations in the volume of inventories do not invalidate the approximation of estimating the changes in inventories by multiplying the changes in volume by the average price.

(c) If both the volume and the prices of the inventories change substantially within the accounting period, more sophisticated approximation methods are required. For example, quarterly valuation of the changes in inventories or the use of information about the distribution of the fluctuations within the accounting period (fluctuations may be largest at the end of the calendar year, during harvest time, etc.).

(d) If information about the values at the beginning and end of the period is available (e.g. in case of wholesale or retail trade in which inventories often exist of many different products), but no separate information is available about prices and volumes, the changes in volume between the beginning and end of the period are estimated. One way of estimating the change in volumes is to estimate stable turnover rates by type of product.

Seasonal changes in prices may reflect a change in quality, e.g. clearance prices or off-season prices for fruit and vegetables. These changes in quality are treated as changes in the volume.

Chapter 5 provides further guidance of what estimation methods countries use in practice when estimating changes in inventories.

OTHER FLOWS

2.88. In order to determine the valuation of the other changes in the volume of assets, SNA 2008 paragraph 3.151 recommends to value the asset before and after the change in volume and take the difference that is not explained by any transaction as the value of the other changes in the volume of assets. If stock data are directly derived from business reports, this approach might not be feasible. However, the business report might also contain some information on the event that gave rise to the other changes in volume.

2.89. For valuing nominal holding gains for inventories, it is useful to distinguish four different situations. For clarity of exposition it is assumed that there are neither transactions nor other changes in volume intervening between the two dates mentioned.

(a) An asset held throughout the accounting period: the nominal holding gain accruing during the accounting period is equal to the closing balance sheet value minus the opening balance sheet value. These values are the estimated values of the assets if they were acquired at the times the balance sheets are drawn up. The nominal gain is unrealised.

(b) An asset held at the beginning of the period that is sold during the period: the nominal holding gain accruing is equal to the actual or estimated disposal value minus the opening balance sheet value. The nominal gain is realised.

(c) An asset acquired during the period and still held at the end of the period: the nominal holding gain accruing is equal to the closing balance sheet value minus the actual, or estimated, acquisition value of the asset. The nominal gain is unrealised.

(d) An asset acquired and disposed of during the accounting period: the nominal holding gain accruing is equal to the actual, or estimated, disposal value minus the actual, or estimated, acquisition value. The nominal gain is realised.

2.90. The estimation and valuation of the components of the stocks and flows (opening balance sheet, transactions, other changes in the volume of assets, holding gains, closing balance sheet) heavily depends on the available sources. The identity discussed in paragraph 2.48 and shown in Figure 2.2 can be used to estimate one of the components as a residual.

Box 2.1: Valuation in detail — relationship basic, producers', purchasers' and market prices

The overview below presents the relationship of basic, producers', purchasers' and market prices (SNA 2008 paragraphs 6.54–6.69, ESA 2010 paragraph 3.06).

	Intermediate consumption
+	Compensation of employees
+	Consumption of fixed capital
+	Operating surplus (or mixed income)
+	Taxes on production
–	Subsidies on production
=	Basic prices
+	Taxes on products excluding invoiced value added tax (VAT)
–	Subsidies on products
=	Producers' prices
+	VAT not deductible by the purchaser
+	Separately invoiced transport charges
+	Wholesalers' and retailers' margins
–	Deductions for discounts from standard prices or charges
=	Purchasers' prices
±	Any further situational adjustments (incl. dumping, calculation errors etc.)
=	Market prices

As discussed in paragraph 2.85 (a)–(d) stocks of finished goods or work-in-progress as well as the additions and withdrawals from the inventories should be valued at current basic prices.

The basic price is the price receivable by the producer from the purchaser for a unit of a good or service produced as output minus any tax (i.e. taxes on products) payable on that unit as a consequence of its production or sale, plus any subsidy (i.e. subsidies on products) receivable on that unit as a consequence of its production or sale ([9]). It excludes any transport charges invoiced separately by the producer. It also excludes nominal holding gains and losses on financial and non-financial assets. (SNA 2008 paragraph 6.51a, ESA 2010 paragraph 3.44). The equivalent for imported products is the c.i.f. (cost, insurance and freight) value, that is, the value at the border of the importing country ([10]). The basic price measures the amount retained by the producer and is, therefore, the price most relevant for the producer's decision-taking (SNA 2008 paragraph 6.52).

The inventory book value of finished goods or work-in-progress as recorded in business accounting at historical costs does not include a mark-up for operating surplus (or mixed income) but only the firm's production costs. Accordingly, if business accounting book value data for finished goods or work-in-progress are directly used in estimating the inventory stock level (AN.12) for national accounting the expected net operating surplus (or mixed income) should be added to the business's book value (see Section 6.2 for estimation techniques). In addition, in many cases a surcharge for marketing (except advertising) or management may be operated and recorded at the enterprise level while production costs are recorded at the establishment level. If so, production related marketing or management costs for e.g. processing and transportation should also be added in order to value inventory stock at basic prices as recommended in SNA 2008 and ESA 2010.

([9]) The basic price may be measured from bottom-up of the production cost. The problem is that businesses usually do not record net operating surplus on their production cost accounts or inventories. In the case of finished goods and work-in-progress, when capital income (i.e. operating surplus or mixed income) is added in their inventory accounts, the market price valuation principle of the SNA 2008 may be obtained.

([10]) World Bank web site, 'What is the difference between purchaser prices, producer prices (VAP), and basic prices (VAB)?' 16 November 2015. Available at https://datahelpdesk.worldbank.org/knowledgebase/articles/114947-what-is-the-difference-between-purchaser-prices-p

Unlike the basic price, the producer's price includes taxes on products (taxes payable per unit of output) and excludes subsidies on products (subsidies receivable per unit of output): The producer's price is the amount receivable by the producer from the purchaser for a unit of a good or service produced as output minus any VAT, or similar deductible tax, invoiced to the purchaser. It excludes any transport charges invoiced separately by the producer (SNA 2008 paragraphs 6.51b–6.52).

For valuing inventories, the SNA 2008 and ESA 2010 do not recommend producers' prices. However, firstly, they are statistically close to basic prices: Both producers' and basic prices are actual transaction prices that can be directly observed and recorded. Basic prices are often reported in statistical inquiries and some official 'producer's price' indices actually refer to basic prices (SNA 2008 paragraph 6.54). It may be noted that usually only their average amounts are statistically within reach. And secondly, they form the logical link between basic and purchasers' prices that are necessary to value stocks of inventories and changes in inventories of materials, supplies and goods for resale (see for the latter paragraph 2.85 (e)–(f)).

The purchaser's price is the amount paid by the purchaser, excluding any VAT or similar tax deductible by the purchaser, in order to take delivery of a unit of a good or service at the time and place required by the purchaser. The purchaser's price of a good includes any transport charges paid separately by the purchaser to take delivery at the required time and place (SNA 2008 paragraph 6.64) as well as deductions for any discounts for bulk or off-peak-purchases from standard prices or charges. It should be noted that the purchaser's price excludes interest or services charges added under credit arrangements and extra charges incurred as a result of late payment, where late payment means failing to pay within the period stated at the time the purchases were made (ESA 2010 paragraph 3.06).

In practice, when a purchaser buys directly from the producer, the purchaser's price may exceed the producer's price by the value of any non-deductible VAT, payable by the purchaser; and the value of any transport charges on a good paid separately by the purchaser and not included in the producer's price. It follows that the purchaser's price may exceed the basic price by the amount of the two items just listed plus the value of any taxes less subsidies on the product (other than VAT) ([11]). If purchasers buy output not from the producer directly but from a wholesaler or retailer, it is necessary to include their margins in the difference between basic and purchasers' prices also (SNA 2008 paragraphs 6.65–6.66).

In general, the reference for valuation in SNA 2008 and ESA 2010 alike are current market prices (SNA 2008 paragraphs 3.119– 3.121, ESA 2010 paragraph 1.94). Hence, stocks as well as changes in inventories (P.52) should always be estimated at their exchange values embodied in the market prices effective at the date of recording and not at the date when the goods entered inventory. Therefore, it is necessary to consider i) the point in time of measuring market prices and ii) their relationship to the price concepts presented so far.

- The valuation at current prices may be in conflict with commercial and tax law regulations as in many countries inventories should be valued at historical cost. Things get further complicated by the additional principle of the lower of cost and market which is legal in many countries for reasons of caution. It states that enterprises should value their inventories by the lower of historical cost and replacement cost or an even lower value stated to prevent the risk of random price fluctuations. From the national accounting point of view these commercial law instructions have to be considered in case of business statistics following commercial instead of SNA valuation principles.
- Irrespective of the above, current market prices also have to be examined more closely. A market price is the price payable by the buyer after taking into account not only appropriate taxes and subsidies but any rebates, refunds, adjustments, etc. from the seller (SNA 2008 paragraph 3.121). This explicitly includes dumping and discounting actions. Even computing or transmission errors could influence market prices of this kind as long as both transaction partners agree upon the resulting accounts.

Hence and following the strict definition of SNA 2008 paragraph 3.119, a market price refers only to the price for one specific and maybe unique exchange. A second exchange of an identical unit, even under very similar circumstances could result in a different market price.

([11]) Tax legislation may be quite different among countries. Some products (e.g. tobacco products) are extremely taxed and they can be stored either with tax (label) or without.

A market price defined that way corresponds to the term price paid, that means the actual amount of money a specific purchaser pays for a single unit in the specific situation — it is a situational variable coined in a maybe unique setting.

From this it follows that especially for the valuation of inventories current market prices must not be defined that strictly because only the factual initial expenses for stocked goods comply with the narrow definition of SNA 2008 paragraph 3.119, be they historical production cost for domestic produced finished goods and work-in-progress or prices paid for materials and other supplies provided by third parties. Current market prices instead refer to other transactions of other goods and therefore their application leads to hypothetical valuations of the considered inventories.

For this reason it may be sensible to rely on a broader definition of market prices that refers to more standardised, average transactions. The treatment of price reductions in the Harmonised Index of Consumer Prices (HICP), set out in the Commission Regulation (EC) No 2602/2000 may provide some guidelines ([12]). According to Article 2 purchasers' prices used in the HICP shall in general take account of reductions in prices of individual goods and services if — *inter alia* — such reductions can be attributed to the purchase of an individual good or service and are available to all potential consumers with no special conditions attached (non-discriminatory). In particular, reductions in the prices of individual goods and services which are likely or expected to be available again at standard prices or are available elsewhere at standard prices shall be taken into account in the HICP. Standard price means the price without any conditions or qualifications and not described as a special price.

This concept of standard prices or cost might be adopted in a taxonomy on price or cost measures used to value inventories.

([12]) Commission Regulation (EC) No 2602/2000 of 17 November 2000 laying down detailed rules for the implementation of Council Regulation (EC) No 2494/95 as regards minimum standards for the treatment of price reductions in the Harmonised Index of Consumer Prices.

Time of recording

2.91. When discussing timing in the SNA 2008 and ESA 2010, an essential distinction should be made between stock data as recorded in balance sheets, on the one hand, and flow data as recorded in the accounts, on the other. Balance sheets, by definition, refer to specific points in time. In contrast, flows are aggregations, over some chosen accounting period, of individual transactions or other flows, which are themselves scattered over the accounting period.

2.92. With the implementation of SNA 2008 and ESA 2010 there are no longer any exceptions to the recording basis of the change of economic ownership and the principles are the same as in the international accounts based on Balance of Payments and International Investment Position Manual (BPM6) ([13]). In practice, the change of economic ownership of goods is often taken to be when goods are recorded in customs data. To the extent that there are differences between customs data and actual changes in ownership adjustments are made (SNA 2008 paragraph 26.20, ESA 2010 paragraph 18.33). This issue is further elaborated in Section 8.7 of this guide.

STOCKS

2.93. Balance sheets can be drawn up for any point in time, but are usually compiled at the beginning and end of a quarter or year. The SNA 2008 and ESA 2010 define balance sheets for all sectors at the moment when one accounting period ends and a new accounting period begins. The closing balance sheet of one period is identical to the opening balance sheet of the next one, so there remain no price changes, reclassifications or other economic flows that are not duly recognised by the SNA 2008 and ESA 2010 (SNA 2008 paragraph 3.189, ESA 2010 paragraph 7.11).

([13]) International Monetary Fund, *Balance of Payments and International Investment Position Manual, Sixth Edition*, Washington D.C., 2009. Available at http://www.imf.org/external/pubs/ft/bop/2007/pdf/bpm6.pdf

TRANSACTIONS

2.94. Cash accounting only records cash payments and records them at the times these payments occur. Cash accounting cannot be used generally for economic and national accounting as the times at which payments take place may diverge significantly from the economic activities and transactions to which they relate and it is these underlying activities and transactions that the SNA 2008 and ESA 2010 seek to portray. Therefore the general principle regarding the time of recording of transactions is accrual accounting (SNA 2008 paragraph 3.166, ESA 2010 paragraph 1.101).

2.95. Accrual accounting records flows at the time economic value is created, transformed, exchanged, transferred or extinguished. This means that flows that imply a change of ownership are entered when the change occurs, services are recorded when provided, output at the time products are created and intermediate consumption when materials and supplies are being used.

2.96. The general principle for the time of recording of acquisitions less disposals of fixed assets is when the ownership of the fixed assets is transferred to the institutional unit that intends to use them in production. Except in two special cases, this time is not generally the same as the time at which the fixed assets are produced. Nor is it necessarily the time at which they are put to use in the production of other goods or services.

2.97. The two exceptions cover assets that take some time to produce such as construction projects and some cultivated biological resources. In general, incomplete construction projects and immature animals and plantations are treated as work-in-progress. They are reclassified from inventories to fixed capital when complete and delivered to the unit intending to use them as fixed assets. However, when the assets are being produced on own account, the partially complete products are recorded as fixed capital formation as work takes place.

2.98. When assets are developed under a contract of sale, the producer records work-in-progress as normal but when stage payments are made, these are regarded as purchases of (part of) a fixed asset or as a trade advance if the value of the stage payment exceeds the value of the work put in place. In the latter case, work is recorded as fixed capital delivered to the final owner as work proceeds until the trade credit is exhausted. When there is no contract of sale agreed in advance, the output produced by the enterprise must be recorded as work-in-progress or as additions to the producer's inventories of finished goods, depending on whether the product is completed. For example, finished dwellings built speculatively remain as additions to the producer's inventories of finished goods until they are sold or otherwise acquired by users. Section 8.3 discusses this issue in further detail.

OTHER FLOWS

2.99. Other changes in the volume of assets are usually discrete events that accrue at precise moments or within fairly short periods of time (SNA 2008 paragraph 3.182).

2.100. Changes in structure and classification should be entered at the moment when a unit or an asset is moved to a different category than that to which it was classified previously. An integrated stock-flow system requires that all reclassifications are recorded and all entries for the reclassification are recorded at the same time (SNA 2008 paragraph 3.185).

2.101. Changes in prices often have a more continuous character, particularly in respect of assets for which active markets exist. In practice, holding gains will be computed between the beginning of the accounting period or the point in time when goods enter the inventory, and the end of the accounting period or the point in time that the goods leave the inventory (SNA 2008 paragraph 3.183).

Netting and consolidation

2.102. Net recording concerns a registration whereby the values of some elementary items are offset against items on the other side of the account (for example asset against corresponding liability) or which have an opposite sign (SNA 2008 paragraph 3.193, ESA 2010 paragraph 1.110). With respect to inventory stocks: as inventories can only appear on the asset side of the balance sheet and as the value is always positive, stocks of inventories cannot be netted. With respect to changes in inventories: these are netted by definition as the transactions are defined as the value of goods that enter the inventories minus the value of goods that leave the inventories.

2.103. Consolidation is a method of presenting the accounts for a set of units as if they constituted one single entity (unit, sector, or subsector). It involves eliminating transactions and reciprocal stock positions and associated other economic flows among the units being consolidated (SNA 2008 paragraph 3.197, ESA 2010 paragraph 1.106). In general, SNA 2008 and ESA 2010 recommend not to consolidate. More specifically, as stocks of inventories are non-financial assets without counterpart liabilities, consolidation is not applicable to inventory stocks. Changes in inventories (transaction) also only appear as changes in assets (and not as changes in liabilities), so they cannot be consolidated either.

Annex 2A: Separating output due to storage from nominal holding gains and losses

2A.1 Introduction

2A.1. Sometimes it is not clear whether the increase in value of goods held in inventories should be regarded as output due to storage or as nominal holding gains and losses ('holding gains'). This annex, that is largely derived from the annex to Chapter 6 of the SNA 2008, explores the topic further and gives examples of when it is appropriate to treat any of the increase in value of a product as due to production and how this may be separated from any remaining holding gains.

2A.2. This annex distinguishes between goods whose real value does not change over time and goods whose real value does change. The former category of goods are the so called 'type I' products and the latter category concerns the 'type II' products. First the type I products are briefly described. Subsequently three categories of type II products are elaborated more extensively. The next section of this annex discusses the question who benefits from the increase in value of goods in storage, and the chapter concludes with presenting some numerical examples that show when output due to storage must be recorded.

2A.2 Type I products

2A.3. Holding products in inventories always involves costs whether they are being held by the original producer or a subsequent wholesaler or retailer. These costs include those associated with providing the physical storage capacity, maintaining information on levels and types of inventories, costs of supplying withdrawals to customers and costs associated with renewing the level of inventories by acquiring replacement goods (other than the cost of the goods themselves). These costs form part of the basic price charged by a manufacturer or are recovered in the margins charged by wholesalers and retailers. The costs incurred are included in intermediate consumption, compensation of employees and the cost of capital. It may also be the case that specialist storage producers provide a service to other producers and again their costs are included in intermediate consumption.

2A.4. For most products, called 'type I' products, this is the only aspect of storage that is relevant. All the costs associated with storage are included in production costs. The value of the goods as they are withdrawn from inventories is valued at the costs of producing or acquiring replacement items at that time. As a consequence, output is measured excluding any change in the value of products held in inventories; this change in value is treated as a holding gain, as illustrated in the following example.

2A.5. Suppose a wholesaler buys and sells 100 packets of washing powder every period and in order to allow for marginal variations in demand keeps an inventory of 10 packets. At the beginning of a period the price paid per packet is 2, so the value of his inventories is 20. During the period the acquisition cost per packet increases to 2.1. The value of the 10 packets in inventories rises to 21 but the increase in value of 1 reflects that if the 10 packets were withdrawn from inventories for sale and replaced by identical products, the new products would cost 21 to acquire. Because output is measured with all units, whether newly produced or withdrawn from inventories, valued at the new price of 2.1, the 1 increase in the value of inventories does not enter the measures of production but appears only in the revaluation account explaining how the value of a stock of 10 packets at the beginning of the period, valued at 20, is replaced by a similar stock of 10 packets at the end of the period now valued at 21.

2A.3 Type II products

2A.6. There are three specific cases where the treatment described above is unsatisfactory because other factors intervene over time while the goods are held in storage. Goods where this is the case are described as 'type II' products. The three specific circumstances are the following:

(a) goods that have a very long production process;

(b) goods that change their physical characteristics while in inventories;

(c) goods that have seasonal patterns of supply or demand but not both.

Each of these is discussed in turn below.

Goods with a long production period

2A.7. When a product is held in inventories for an extended period of time because of the length of the production process, in principle, discount factors should be used when calculating the value of work put in place each period before the delivery date. For example, if a construction project ultimately worth 200 is put in place steadily over four years, it is unrealistic to count 50 as the contribution to production in the first year. Any purchaser would take into account the fact that he would not be able to realise the value of this production for another three years and discount the value accordingly. As time passes, there is income arising to the unit holding the products as the discount factor unwinds.

2A.8. It is suggested that in practice it is necessary to make an allowance for the discount factor only for goods of a significantly high value and significantly long production process, where goods are recorded as work-in-progress or capital formation on own account for many periods before completion.

Goods whose physical characteristics change

2A.9. The second set of circumstances relates to goods whose physical characteristics change during storage because maturing is part of the production process. The goods concerned are those that in the absence of any general or relative change in prices still increase in value because they improve in quality over the time held in storage. Examples are fermentation affecting food products and the ageing of wine and spirits. When the product is withdrawn from storage, it is physically different from a new item entering the maturing phase and so it is not appropriate to use the acquisition cost of the new entry into inventories as the value of the product being withdrawn. The question is how to separate the increase in value due to maturing from the overall price increases of the goods concerned.

2A.10. Suppose a product takes three years to reach a sufficient maturity to be sold and there is final demand for the product until it reaches this state. If the good is traded, even in its immature state, then prices will exist for the immature, newly manufactured product, for the one year old product, the two year old product and the mature product. Supposing the product is well-established, at any point in time there will be a mix of newly manufactured items and those of maturities of one, two and three years. If prices exist for these different maturities, separating the value of storage is not difficult. In the first year the new product is transformed into a product of one year's maturity. If the price when the product is brand new is P_0 and when it is one year old is P_1, and t is the first year and $t+1$ the second, the change in value of a quantity Q of the product is $Q(P_{1,t+1} - P_{0,t})$. The increase in value is due to two factors, the increase in the price of the new product made last year to the price of a similar new product made this year $(Q(P_{0,t+1} - P_{0,t}))$ and the difference between the price of a similar new product made this year and the price of the one year mature product this year $(Q(P_{1,t+1} - P_{0,t+1}))$. By applying the price differences to the volumes involved, the first difference gives rise to a holding gain; the second to the value of output due to storage.

2A.11. The identity that:

the increase in value from period t to period t+1,

is equal to the change in value between products of the same maturity (or vintage) from period t to period t+1 (treated as a holding gain),

plus the change in value between products of successive maturities (or vintages) in period t+1 treated as the output due to storage,

is true for any two successive time periods. Thus, in the second year the increase in price between the one year mature product at the beginning of the year and the price of a one year mature product at the end of the year gives rise to a holding gain and the difference in price between a one year mature product at the end of the year and the two year mature product at the same time gives the value of output due to storage, and so on.

2A.12. The identity in paragraph 2A.11 holds in current values, when each term contains (or consists of) nominal holding gains and losses or when each term is deflated by the general level of inflation so that each term contains or consists of real holding gains and losses. In volume terms, as when there are no price increases, the increase in value is identified with the output due to storage.

2A.13. In practice it is very likely that robust time series of prices at different points in the maturing process do not exist. It is possible that some close equivalent might be available but even this is not very likely. How can storage be separated from holding gains in the absence of these prices?

2A.14. From past experience the producer may be able to make a reasonable prediction about the increase in value due to storage. Suppose in a particular case he expects the value in volume terms after three years to be two and a half times the cost of producing the new product. If the new product is worth 100, the three year old, mature, product is worth 250. This suggests that the volume of output due to storage is 50 in each of the next three years. (Like the long construction product discussed above, in principle, a discount factor should be applied to the initial 100 and the first two tranches of 50 because the product is not ready for sale until the end of the third year.) In the absence of information about the increase in the price of the product relative to the general increase in prices, it may be necessary to assume there are no real holding gains in the product and the actual increase in value must be taken as the value of the output due to storage in current values. Once the price of the fully mature product is known, some adjustment could be made or, pragmatically, the difference between the original prediction and the outcome, adjusted for general inflation, may be taken as a real holding gain.

2A.15. It is not ideal that the output due to storage is assumed to be invariant to fluctuations in relative prices, but in circumstances where most of the price increase will be due to storage and better basic data are not available, this approach gives a pragmatic estimate of output due to storage that is superior to the assumption that the whole of the increase in value is simply a holding gain.

Goods with seasonal patterns of supply and demand

2A.16. The third case where there is a change in value that is not attributable solely to holding gains is when goods are placed in storage to take advantage of changes in the pattern of supply and demand over a year. The most common case is storage of a staple crop, such as maize, where there is a relatively short harvest period but demand is fairly constant throughout the year. As a result, the price rises as inventories decrease until the next harvest when an increase in supply causes the price to fall again. It is possible to envisage the opposite case where demand is seasonal but it is cost effective for producers to produce the good for the whole, or most, of the year, even though for much of that time the production goes straight into inventories and stays there until demand peaks.

2A.17. The reason that this type of product is different from a type I product is that, as with the goods that change characteristics due to maturing, the price increases, relative to the general level of inflation, in a more or less predictable way because of the effect of transporting the goods through time, from a period of abundance to one of relative scarcity. This is quite a different motivation than holding items in store for purely speculative reasons when there is no pattern established for the probable increase in prices and no predetermined time over which the goods might be held.

2A.18. The ideal situation is one where there is a well-established and robust seasonal pattern for the expected price increases in the crop. In such a case, the seasonal pattern of the prices can be used to establish the output due to storage and the remaining increase in value represents holding gains that can be separated into real and neutral elements as normal.

2A.19. However, given that the total level of a harvest can be quite different from year to year and the actual time of harvest may also vary slightly depending on climatic conditions, establishing a robust seasonal pattern of prices may not be easy. In such a case, the pragmatic suggestion is similar to that for maturing goods when there is imperfect information. The premise is that the increase in price will be attributable to two factors; the first is an increase matching the general increase in prices. The element of increase in the value of inventories corresponding to this should be treated as nominal holding gains. The second factor leading to the increase in prices is a seasonal scarcity value and this element should be treated as giving rise to output due to storage. Assuming that all the increase other than that matching average price increases is due to storage implies that there are no real holding gains.

2A.4 Who benefits from the increase in value of goods in storage?

2A.20. The fact that type II products give rise to production of storage depends only on the type of product, not on the producer. If a farmer produces a seasonal crop and then stores most of it to sell bit by bit throughout the year, he records the benefits of the increase in value due to storage in his output. However, if he sells all of his crop at harvest time to another unit (for example, a wholesaler) and that unit puts it in inventories and sells it continuously throughout the year, then that unit derives the benefits from holding the crop in storage and records in his output these benefits that would otherwise have been recorded by the farmer as output. However often a type II good changes hands between its production and sale, the value of output due to storage will be the same. It is likely that every time it changes hands, the associated intermediate consumption will increase so that value added will decrease but the level of output will not be affected. Thus an increase in value accrues to the unit holding the goods, if they are type II goods and the holder is a wholesaler or retailer, he may have output just as the original producer may.

2A.5 When is output due to storage recorded?

2A.21. Output due to storage is produced on a continuous basis. In order to have an articulated set of information on production and inventories, output from storage must be calculated period by period. If the goods that are changing value remain in inventories, the owner of the goods has output that is treated as an addition to inventories. Even though the quantity of the inventories may not change, the quality-adjusted measures do change to reflect the increase in price that is treated as a quality change and not as a holding gain.

Some examples

2A.22. These simple examples show how the approximate approach to calculating storage works under different assumptions.

EXAMPLE 1

2A.23. Unit A purchases goods with a value of 100 and they rise in value to 110 by the middle of year 2 when they are sold. At the end of year 1 the value of the goods is 108. There is no general inflation in the period.

2A.24. In year 1, A records output of 8 and additions to inventories of 108 in total. In year 2, A records output of 2, additions to inventories of 2 and sales of the withdrawals from inventories of 110. See Table 2A.1 below.

Table 2A.1: Elaboration example 1

Unit A, year 1						
Variable	**Opening balance sheet**	**Transactions in assets/ uses**	**Transactions in liabilities/ resources**	**Other changes in volume**	**Holding gains and losses**	**Closing balance sheet**
AN.12 Inventories	0	100 (P.52, purchase) 8 (P.52, quality change)				108
P.1 Output			8 (quality change)			
Unit A, year 2						
Variable	**Opening balance sheet**	**Transactions in assets/ uses**	**Transactions in liabilities/ resources**	**Other changes in volume**	**Holding gains and losses**	**Closing balance sheet**
AN.12 Inventories	108	-110 (P.52, sales) 2 (P.52, quality change)				0
P.1 Output			2 (quality change)			

Source: Eurostat-OECD Task Force on Land and other non-financial assets, based on ESA 2010; fictitious data

EXAMPLE 2

2A.25. The goods bought in example 1 also increase in line with inflation so that they are worth 115 by the end of year 1 and 120 on disposal.

2A.26. The recordings in year 1 are complemented by holding gains of 7 in year 1. At the end of year 1, it is necessary to re-estimate the expected price level on disposal. If this is estimated to be 117, showing the same absolute increase as previously expected, for example, then a holding gain of 3 will be recorded in year 2. See Table 2A.2 below.

Table 2A.2: Elaboration example 2

Unit A, year 1						
Variable	**Opening balance sheet**	**Transactions in assets/ uses**	**Transactions in liabilities/ resources**	**Other changes in volume**	**Holding gains and losses**	**Closing balance sheet**
AN.12 Inventories	0	100 (P.52, purchase) 8 (P.52, quality change)			7	115
P.1 Output			8 (quality change)			
Unit A, year 2						
Variable	**Opening balance sheet**	**Transactions in assets/ uses**	**Transactions in liabilities/ resources**	**Other changes in volume**	**Holding gains and losses**	**Closing balance sheet**
AN.12 Inventories	115	-120 (P.52, sales) 2 (P.52, quality change)			3	0
P.1 Output			2 (quality change)			

Source: Eurostat-OECD Task Force on Land and other non-financial assets, based on ESA 2010

EXAMPLE 3

2A.27. The goods in example 1 are sold to unit B for 105 part way through the year. B then holds the goods until selling them at the same point in time in year 2 for 110.

2A.28. In year 1, A has output of 5 and acquisition of inventories of 100. A withdraws inventories of 105 and sells them to B. B has output in year 1 of 3, which is recorded as an addition to inventories. The value of B's total additions to inventories in year 1 is thus 108. In year 2, B has output of 2, additions to inventories of 2 and sales that represent withdrawals from inventories of 110. See Table 2A.3 below.

Table 2A.3: Elaboration example 3

Unit A, year 1						
Variable	**Opening balance sheet**	**Transactions in assets/ uses**	**Transactions in liabilites/ resources**	**Other changes in volume**	**Holding gains and losses**	**Closing balance sheet**
AN.12 Inventories	0	100 (P.52, purchase) -105 (P.52, sale to B) 5 (P.52, quality change)				0
P.1 Output			5 (quality change)			
Unit A, year 2						
Variable	**Opening balance sheet**	**Transactions in assets/ uses**	**Transactions in liabilites/ resources**	**Other changes in volume**	**Holding gains and losses**	**Closing balance sheet**
AN.12 Inventories						
P.1 Output						
Unit B, year 1						
Variable	**Opening balance sheet**	**Transactions in assets/ uses**	**Transactions in liabilites/ resources**	**Other changes in volume**	**Holding gains and losses**	**Closing balance sheet**
AN.12 Inventories	0	105 (P.52, purch. from A) 3 (P.52, quality change)				108
P.1 Output			3 (quality change)			
Unit B, year 2						
Variable	**Opening balance sheet**	**Transactions in assets/ uses**	**Transactions in liabilities/ resources**	**Other changes in volume**	**Holding gains and losses**	**Closing balance sheet**
AN.12 Inventories	108	-110 (P.52, sales) 2 (P.52, quality change)				0
P.1 Output			2 (quality change)			

Source: Eurostat-OECD Task Force on Land and other non-financial assets, based on ESA 2010

3 Data sources

3.1 Introduction

3.1. This chapter will outline various data sources employable when estimating the balance sheet item inventories. As the quality of that estimation method is dependent on the quality of the source data, the chapter tries to highlight possible strengths and weaknesses of each data source.

3.2. It is important to note that some data sources are more suited to estimation of the changes in inventories (P.52), rather than the level of inventory stock (AN.12) or vice versa. If estimation is performed based on the changes in inventories, a starting stock of inventories is required to commence the accumulation of those changes. Countries can utilise a variety of these sources, in combination, in order to achieve full economy-wide coverage.

3.3. In cases where combinations of multiple data sources are available for the same industries, this can serve as a confrontation mechanism between those data sources. An example of such an exercise, undertaken by Canada, is provided within the administrative data section. It is recommended to conduct a quality evaluation of available data sources to determine which source may be more appropriate.

3.4. This chapter also contains a brief overview of price data sources to be used in the deflation and revaluation of inventories. To end this chapter on data sources, there are illustrative examples of survey forms used by Poland, Germany and the United States as well as a country case study by the United Kingdom (Box 3.2) describing the business surveys used to obtain book values, and a case study from the Netherlands (Box 3.3) regarding business tendency surveys.

3.2 Types of data available

3.5. As noted in Chapter 9, most countries use enterprise surveys as their main data source when compiling annual estimates of inventories. Additionally, tax data from administrative sources or financial reports are frequently used as a supplementary source of data.

3.6. The following outlines possible types of source data that can be used and, for most of the data sources outlined, there are common issues that will need to be addressed before using the estimates directly for the balance sheet item inventories.

3.7. Most companies report inventories on a book value basis, which is their cost paid or historical cost. For each data source, the price basis will need to be ascertained and if they are reported at book values, a process of deflation, to remove the book values prices, then revaluation, to obtain a value at the prices needed, will be required (Section 5.2 discusses this process for changes in inventories).

3.8. According to SNA 2008 and ESA 2010, 'Inventories should be valued at the prices prevailing on the date to which the balance sheet relates, and not at the prices at which the products were valued when they entered inventory' (SNA 2008 paragraph 13.38).

Table 3.1: SNA 2008 recommended prices

Type of inventory	Prices
Materials and supplies	Purchasers' prices
Finished goods and work-in-progress	Basic prices
Goods intended for resale without further processing	Prices paid for the goods
Military inventories	Basic prices

Source: System of National Accounts 2008

3.9. If the data source provides estimates of opening and closing inventories, care should be exercised to ensure that the opening of one reference period matches the closing balance of the previous reference period. If that is not the case, an explanation behind the variance should be obtained to ensure consistent entries for the accumulation of stock. Closing and opening stock balances may differ for a variety of reasons, including mergers/acquisitions or different valuation methods. This issue is discussed in more detail in Section 8.8.

3.10. Furthermore, verification should be obtained on how enterprises report their gains or losses on that inventory (including possible profit mark-ups), as a separate adjustment may be needed to reflect these gains or losses from the sale of goods.

Enterprise surveys

3.11. The most widely used data sources for inventories are the enterprise surveys. Although the primary purpose of an enterprise survey is usually not to obtain inventory information, such as retail trade surveys, many surveys also request data on inventories as they are important components to the operation of a business.

3.12. Enterprise surveys may request a stock estimate of inventories, such as the opening and closing balance, or they may ask for the change in inventory level, which would represent the flow of inventories. Monthly or quarterly enterprise surveys will probably provide good estimates for sub-annual balance sheets, and are timelier than other data sources as their main purpose may be to supply data for the compilation of GDP.

3.13. There could be variances between the target populations of the survey versus the target of the balance sheet, which is generally the entire economy, by sector. It is recommended that the survey coverage, as well as edit and imputation methods, be reviewed to determine if there is sufficient coverage.

3.14. Response rates, low or skewed, for enterprise surveys could introduce significant bias to the estimate, a mandatory survey would provide better responses. The goal and other uses of the survey should be taken into account when validating its fitness for use in inventory estimation.

Financial reports

3.15. Company financial reports may be readily available for medium to large enterprises, however, they may be close to non-existent for small enterprises. Medium and large enterprises will usually release audited financial statements, especially those listed on stock exchanges. The financial statements would include the value of inventories held, with the intention to keep investors informed.

3.16. Often, these financial reports are annual, fiscal year based rather than calendar year; therefore, a calendarisation procedure will be needed. Annual financial reports are suitable for annual balance sheets; however, it would be difficult to use these for sub-annual balance sheets.

3.17. For companies with global operations, it might be difficult to isolate country specific inventories from company-wide financial reports. Moreover, subsidiaries of multinationals may release financial reports in the country of operations, thereby adding to the complexity of identifying country specific inventories.

Government finance statistics

3.18. EU and EFTA countries use the ESA 2010 manual as the basis for the compilation of government finance statistics. The EU government finance statistics present the general government sector according to the

sequence of accounts in combination with an overview of total revenue and total expenditure. Other countries may primarily use the IMF's framework for compiling government finance statistics (GFS). The IMF presentation includes the statement of government operations, statement of other economic flows, balance sheet and statement of sources and uses of cash.

3.19. Inventory data, either stocks from the balance sheet, or flows from the statements, are available for each government (sub)sector. Where available, GFS data would be a comprehensive data source for the government (sub)sector(s).

3.20. In the absence of detailed data, or to augment that source, countries may be able to obtain inventory data directly from administrative sources.

Administrative data

3.21. Administrative data include data that are typically captured for a regulatory or taxation purpose, such as state run marketing boards, trade associations or income tax returns. Government run monitoring agencies for natural resources, such as energy or agriculture, may also have inventory data as these would monitor performance for these industries.

3.22. Corporate income tax returns often have end-of-year inventory data with the opening and closing inventories. While inventory values are often reported, in some countries a 'physical stocktaking' is also required. Tax returns would provide a source with census-like coverage.

3.23. There may be a substantial time lag compared to the reference period for administrative data. In addition, rather than explicitly reporting stocks of inventories, some companies may treat inventories as a component of cost of goods sold ([14]). In other words, only the flow is recorded, rather than the stock level. The user should be aware of this problem and should make the appropriate adjustments, if needed.

Box 3.1: Confrontation of survey data with tax data — Canada

In countries with access to both administrative data on inventories and survey data, it is possible to use administrative data as a confrontational tool to validate or verify the corporate survey data. Canada has conducted this review, confronting survey data with tax data, for several reference years.

As most of the tax data used to estimate inventories are at the enterprise level, the tax data were re-allocated from enterprises to establishments so that the estimates were comparable with the establishment based survey data.

Then, the top 100 establishments within the three-digit North American Industrial Classification System were selected. These responses were linked to survey responses to verify the inventory book value levels and the changes in book values.

Although there is a time lag with administrative data, on an annual basis the change in book value reported on the administrative records was very similar to that reported on surveys.

However, several issues became apparent with the use of administrative data:

- It was difficult establishing coherence between the enterprise based tax data and the establishment based survey data. Corporations may report for the entire company, under one industrial code, whereas there may be various activities within that company covered under different surveys (and different industrial codes).
- Corporations could have submitted multiple tax returns as they received more up to date information or to remedy previous errors.
- Takeovers or other disruptions in the operation of corporations could have affected their reporting arrangements.

([14]) Cost of goods sold represents the cost associated with bringing that product to sellable condition, which reflects the opening inventory stocks plus purchases minus closing inventory stocks. See Chapter 4 for further discussion.

Economic census

3.24. An economic census is a mandatory questionnaire for all enterprises and includes a range of operational and performance components. In countries where an economic census is conducted, inventory data from the census can be used to validate the estimates obtained by using other sources.

3.25. If a country calculates the stock of inventories using the period-to-period flow (called the perpetual inventory method or PIM in this guide), a starting stock is required to commence the accumulation. An economic census could be used as the data source for the starting stock.

Business tendency surveys

3.26. Business tendency surveys are usually conducted to determine the current status of a business which will help in the identification of business cycles and for economic analyses. These surveys ask for the current situation related to important aspects of a business operation, such as production levels and capacity utilisation rates, and oftentimes, the operations' intentions for the immediate future. As these types of surveys are generally more concerned with the 'health status' of a business, the targeted responses may be more qualitative, such as 'at normal levels', rather than quantitative (values).

3.27. Depending on a countries' survey undertaking, there can be a significant time lag associated with enterprise surveys, so a business tendency survey may be a timelier indicator if information is collected on inventory holdings or movements. However, as these surveys are concerned with an operations' strength, the inventory estimate may lack some precision. Therefore, wherever possible, those estimates should be used only as a general indicator and in conjunction with additional, more precise data sources, to develop the estimate of stock.

Price data sources

3.28. Prices are used both in the deflation of inventories and the revaluation. In order to obtain a high level of precision, prices should be asset specific where feasible. In addition, as commodities held by different industries could have different prices, an industrial dimension is important. For example, inventories held by wholesalers of the same commodity as that eventually sold by retail merchants will have a different price at the wholesale level versus the retail level.

3.29. Possible prices for inventories could be those used elsewhere for deflation purposes, including producer price indices, consumer price indices, machinery and equipment price indices, raw materials price indices, import price indices and market prices. The price chosen should align closely with what would be the observed price.

3.30. As a general note of caution, when gathering data from outside sources, or combining a variety of sources, it is important to verify the concepts and methods used to derive that information as much as possible. Especially any source that the national statistical institute does not control will require verification of what is included. This will allow for more standardisation of concepts and for adjustments to be made within the estimation process in cases where concepts vary.

3.3 Illustrative examples of data sources

3.31. As data sources and data collection methods vary across countries, it may be useful to have examples of such methods. For those countries that do not have any information and are considering designing survey collections it may be useful to review Eurostat's Essential SNA: Building the basics ([15]) for references. The following are illustrative examples of data collection methods used by Poland, Germany, and the United States to obtain the necessary details in order to permit the compilation of estimates of inventories.

([15]) European Union/Eurostat, *Essential SNA: Building the basics*, Publications Office of the European Union, Luxembourg, 2014. Available at http://ec.europa.eu/eurostat/web/products-manuals-and-guidelines/-/KS-GQ-14-008

3.32. Poland uses the following enterprise survey.

Figure 3.1: Enterprise survey of Poland

Central Statistical Office, al. Niepodległości 208, 00-925 Warszawa www.stat.gov.pl		
Name and address of a entity reporting	**F-01/I-01** **Report on income, costs, financial results and investment outlays on fixed assets**	Portal sprawozdawczy GUS www.stat.gov.pl Urząd Statystyczny ul. 1 Sierpnia 21 02-134 Warszawa
National Official Business Register	for the period from the beginning of the year to the end of the X quarter of t year	Przekazać w terminie do 20. dnia po kwartale z danymi za okres od początku roku do końca I, II, II kwartału i do 10 lutego 2017 r. z danymi za rok 2016

Part 2. Fixed and current assets (in thousand PLN)

Specification				at 01.01.2016	The end of reporting period
0				1	2
A. Fixed asset			01		
in which	long-term dues total		02		
	long-term investments total		03		
B. Current assets (rows 05+10+13+16)			04		
Of which	I. Stocks total		05		
	In which	materials	06		
		work in progress and semi-finished goods	07		
		finished products	08		
		goods	09		

Part 2. Fixed and current assets (in thousand PLN) cont.

Specification				at 01.01.2016	The end of reporting period
0				1	2
Of which	**II. Short-term dues**		10		
	In which	From deliveries and services (regardless of the maturity data)	11		
		From taxes, subsidies, duties, social and health insurance and other public law titles	12		
	III. short-term investments		13		
	In which short-term financial assets		14		
	In which cash and other pecuniary assets		15		
	IV. Short-term inter-period settlements		16		

Source: Central Statistical Office of Poland

3.33. Germany employs the cost structure survey as shown below.

Figure 3.2: Cost structure survey of Germany

Federal Statistical Office

DESTATIS wissen.nutzen.

Cost Structure Survey for 2014
of enterprises in manufacturing, mining and quarrying

Federal Statistical Office, Section E 205, 65180 Wiesbaden

If the enterprise name or address has changed, please update on page 4.

Please return by

SBS

Contact person in the event of queries (optional)

Name:

Phone or e-mail:

Federal Statistical Office
Section E 205
65180 Wiesbaden

You can contact us by

Phone: +49 611 75-2304
+49 611 75-2301
+49 611 75-2988

Fax: +49 611 75-3940

E-mail: KSE-Industrie@destatis.de

Thank you for your cooperation.

For the legal basis and further legal information, please refer to pages 1 and 2 of the attached document which is an integral part of this questionnaire.

Identifier
(please quote in the event of queries)

NACE Code

2 **Stocks of unfinished and finished products from own production,** including contract work performed but not yet invoiced, repairs, maintenance, installation, assembly and the like (excl. raw materials and consumables, excl. goods sold as purchased) 10

2.1 **at the beginning of** the business year 2014 41

2.2 **at the end** of the business year 2014 42

Change in stocks = *Field 42 minus field 41* 43

D Raw materials and other supplies, consumables

Materials, intermediate products, energy and water, office and advertising materials as well as non-capitalised low-value assets, however excluding goods sold as purchased and excluding costs for contract work performed by other enterprises at original cost, excluding turnover tax deductible as input tax, in the business year 2014. 12

1 **Stocks** 13

1.1 **at the beginning** of the business year 2014 50

1.2 **at the end** of the business year 2014 51

E Goods sold as purchased

at original cost, excluding turnover tax deductible as input tax, in the business year 2014 15

1 **Stocks**

1.1 **at the beginning** of the business year 2014 56

1.2 **at the end** of the business year 2014 57

Source: Federal Statistical Office of Germany

3.34. The United States makes use of the retail trade report as shown below.

Figure 3.3: Retail trade report of the United States

U.S. DEPARTMENT OF COMMERCE
Economics and Statistics Administration
U.S. CENSUS BUREAU

FORM
SM-4412B-A (09-14-2012)

OMB No. 0607-0717: Approval Expires 07/31/2017

MONTHLY RETAIL TRADE REPORT

4 VALUE OF INVENTORIES

INCLUDE
- The cost value of all merchandise for the end of the month
- Merchandise owned by this firm but held by others for consignment
- Merchandise under contract for sale
- Merchandise if title has passed to you, including merchandise in transit
- Inventory held in Foreign Trade Zones or in bond warehouses in the U.S.

EXCLUDE
- Items such as fixtures, equipment, and supplies not held for resale
- Merchandise owned by others such as those held on consignment
- Merchandise of leased departments and concessions operated by other firms in this retail establishment

A. What was the value of merchandise inventories, regardless of where held, owned as of the end of the month?

	Dollars
1. Merchandise inventories in retail stores *Include leased departments and concessions operated by this firm in other establishments.*	
2. Merchandise inventories in warehouses, offices, or in transit for distribution to retail stores	
3. Total inventories (if applicable, before Last-in, First-out (LIFO) adjustment)	

	Month	Day
B. Inventories were reported as of what date?		

Source: US Department of Commerce, US Census Bureau

3.35. The country study below presents the data sources that are used by the United Kingdom in order to prepare the national accounts estimates for inventories.

Box 3.2: Data sources of inventories — United Kingdom

Stocks and inventories are reported by firms in terms of book values. These are obtained through two surveys in the UK; the Quarterly Stocks Inquiry (QSI) and the Annual Business Survey (ABS). These surveys request values of stocks at the beginning and the end of the period.

Quarterly Stocks Inquiry (QSI)

The QSI collects data on the level of stocks at the beginning and end of each quarter, with an asset breakdown of these totals requested for certain industries.

Like other UK business surveys, the QSI uses the Inter Departmental Business Register (IDBR) as its sampling frame. The IDBR assigns a Permanent Random Number (PRN) to each business, and contains information about the industry, legal status, employment, and turnover of the vast majority of businesses in the UK. The PRN allows different surveys from the same business to be linked, for example, to analyse the congruence between the QSI and the ABS for a particular question and a particular business.

The IDBR contains information about the legal status of each business recorded on it. These describe whether the business is a company, sole proprietor, partnership, public corporation/ nationalised body, local authority or non-profit body. Legal status does not necessarily match institutional sector under national accounts definitions, but nonetheless this information is useful in order to inform the additional sources required to make estimates exhaustive in terms of their coverage by institutional sector. The QSI samples private sector activity, where data for public corporations and general government are furnished by alternative sources.

Questionnaires are sent to approximately 5 500 businesses each quarter. All businesses with employment of 300 or more are permanently included in the sample; smaller businesses are included based on a stratified random sample. No companies with fewer than 20 employees are selected except for Standard Industrial Classifications (SICs) 36–47, where those companies with fewer than 10 employees are not sampled. This helps to reduce the burden on businesses. Once selected, a respondent can expect to be sampled for a period of five quarters, before usually taking a break. There is no specified period that a respondent will be omitted from the survey.

Not all sampled businesses return data. Imputations are made for non-response, based on quarter-on-quarter ratios in the current and previous year. Newly selected non-responders are given a constructed or estimated value based on the average stock for their employment level. Occasionally, manual estimates are used if more information is known about the business.

Every response to the survey goes through a selective editing process. A form will either pass on 'clean' or fail, given certain criteria (for example a large value change or differences between the opening/closing data). Not all forms which show inconsistencies or large value changes will fail. Selective editing allows those forms which have discrepancies but which have only a minimal impact on the total for that industry and employment size band to pass; while those that have a significant impact for that industry and employment size band fail.

Around 60 % of returned forms pass first time. For comparison, around 75–80 % of returned forms for the monthly business survey pass selective editing first time. Forms that fail selective editing may be manually 'passed' if there is reason for the figures to be trusted — for example a company shows strong seasonal trends or has given prior warning of an expected increase or decrease in their data. If not, the respondent will be contacted to query the data.

Of the 40 % forms that fail selective editing, around 70 % are because of the mismatch between the previous period's closing stock and the current period's opening stock. This issue is described in more detail in the case study in Section 8.8.

Figure 3.4: Quarterly Stocks Inquiry for construction industry firms

1. Value of stocks held (net of progress payments on long-term contracts) (excluding VAT)

	31 March 2016				30 June 2016			
	Day	Month	Year		Day	Month	Year	
or at				11				12

The figures for the beginning and the end of the period should be on the same basis (see note iii)
If the value of stocks is zero, you still need to complete and return this questionnaire.

		Value at start of period to nearest £ thousand		Value at end of period to nearest £ thousand	
1.1	Raw materials and consumable stores	319	000	320	000
1.2	All other stocks	329	000	330	000
1.3	**Total**	65	000	66	000

2. Please put a cross in the box if closing figure is estimated 15

Source: UK Office for National Statistics

The change in book value for each quarter is calculated as the current quarters closing stock level (in book values as reported on the QSI) minus the previous periods closing stock level. The change in book value is used during processing to help calculate the national accounts changes in inventories (P.52) which is a component of the expenditure measure of GDP.

Annual Business Survey (ABS)

The ABS, the UK's main structural business survey, asks for the same data supplied on the QSI but on an annual basis. The large sample size of the ABS (approximately 73 000 businesses) provides a higher quality estimation of the value of stocks held, and as a result is used as a benchmark for the quarterly survey. Being an annual survey, there is a time lag between the QSI and ABS data, for example ABS 2014 data are supplied while QSI is processing 2015Q4 data.

The results of the QSI are benchmarked to the ABS using the Denton method. Recent research has focused on using the Cholette-Dagum method as this is seen to better preserve the quarterly path of the source data after benchmarking. As with any benchmarking method, this process assumes that the un-benchmarked quarterly estimates are reflective of the annual benchmarks and thus should only be used to eradicate small differences resulting from sampling error. The method can, under certain circumstances, result in negative values for the quarterly path even when the source data contain no such negatives. As the value of stock level of assets cannot, by definition, be negative, a multiplicative model is normally used to ensure that the benchmarking process does not result in negative values.

The ABS sample is stratified by employment. Those businesses with employment of less than 250 are randomly sampled, whereas businesses with employment equal to or greater than 250 are fully enumerated. However, there are cases where businesses with employment of less than 250 but large registered turnover are also fully enumerated.

The processing and validation of the ABS data is carried out in the same way as the QSI. Selective editing requires investigation of those errors which have significant impact on the results. Differences between previous period closing and current period opening stock levels are still seen in the ABS, thus, to derive a consistent change in book value, the difference between the closing stock levels is used instead of the closing less opening stock book values.

Figure 3.5: Annual Business Survey for construction industry firms

Section D - Value of Stocks Held ***(see note D)***

Value of stocks held **including** Work in Progress but **excluding** VAT and progress payments on long-term contracts

The figures for the beginning and end of the period should be on the same basis in terms of valuation and business units covered.

7.	**Total value of all stocks at the beginning of the period**	£	000	500
(a)	**Of which:** stocks of goods/energy bought for resale without further processing (merchanted or factored goods)	£	000	503
8.	**Total value of all stocks at the end of the period**	£	000	599
(a)	**Of which:** stocks of goods/energy bought for resale without further processing (merchanted or factored goods)	£	000	504

Source: UK Office for National Statistics

3.36. Box 3.3 below discusses how business tendency surveys look like and how they are used in the Netherlands.

Box 3.3: Business tendency surveys — The Netherlands

Besides the quantitative surveys or other data sources mentioned in this chapter, business tendency indicators can also provide information on inventories. The information in these surveys is of a qualitative nature. They can be used to get an indication of the direction of the changes in inventories (up or down), however when using this information some caveats are in order. First the survey design might not be exhaustive, e.g. some industries and/or size classes are excluded from the sample, so a bias might occur. Second the questions are directed at the subjective opinion of an enterprise or entrepreneur about their economic and financial state, which might not be close to its factual state.

At Statistics Netherlands both quarterly and monthly business tendency indicators are compiled, which are partly financed by Directorate-General on Economic and Financial Affairs (DG ECFIN) of the European Commission (EC). It provides these indicators for the EC, but also for domestic employers' organisations, economic research institutions and chambers of commerce.

As mentioned before, the questions are of a qualitative nature, so businesses are asked to reflect upon their past or current and future situation. The answers available are (almost) always: increase, remain equal or decrease or a variation of these three, but there are always three options to answer the question, and a fourth one 'don't know, not applicable'.

The surveys are sent to so called local enterprises, which is a level of economic activity between an enterprise and an establishment. The sample size for the monthly survey is 6 000 and for the quarterly survey 7 500. There is a maximum of 37 different questions on the economic and financial state of the local enterprise. One of those 37 questions concerns the inventories. The question is (translated from Dutch): 'We judge our current inventory of finished product, given the expected sales, as (too) [<answer one of three options or not applicable>]'.

Every answer is then weighted according to the size of the local enterprise, which then leads to a weighted share per answer and also a balance (netting) of positive and negative answers. In the case of a positive balance the conclusion is that there are more enterprises who think their inventory stock (AN.12) is too high instead of too low and vice versa.

The industries that get the survey question on inventories are restricted to manufacturing, retail trade (including motor vehicles) and wholesale trade. Given the industries, it will be very likely that the question not only relates to finished goods, but also to goods for resale.

4 Business accounting methods

4.1 Introduction

4.1. As the data for calculating inventories are largely obtained from business surveys, valuation differences between business and national accounting standards have to be taken into account. Generally all enterprises use historic cost methods for the valuation of their inventories. This is a fundamental difference to national accounting standards, where all transactions have to be recorded at current prices at the time of transaction (see SNA 2008 paragraph 3.178, ESA 2010 paragraph 3.150).

4.2. Whereas all historic cost methods record entries into the inventory stock at current prices at the time of transaction, this is not the case with respect to withdrawals. According to business accounting standards, withdrawals are valued at the prices at the time of acquisition (historic cost method) and not at the time of withdrawal (as required by SNA 2008 and ESA 2010). As a consequence the prices at which the stocks of inventories on the enterprises' balance sheet are valued depend on the inventory valuation method used by the enterprise.

4.3. This chapter begins with a general introduction of the International Accounting Standards (IAS) in Section 4.2. Subsequently Section 4.3 describes the various historic cost accounting methods most commonly used by enterprises in detail. Finally other issues related to business accounting and national accounts accounting are discussed in Section 4.4.

4.2 International Accounting Standards

4.4. The relevant standard to provide guidance for businesses on the valuation and classification of inventories is the International Accounting Standard 2 (IAS 2). In the past IAS 2 has been revised several times. The latest revision was in 2003 which has to be applied for all accounting periods after 1 January 2005. IAS 2 applies to all inventories except work-in-progress arising under construction contracts (including directly related service contracts), financial instruments and biological assets related to agricultural activity and agricultural production at the time of harvest (see IAS 2 paragraph 2).

4.5. In general, IAS 2 requires that those assets considered as inventory should be recorded at the lower of cost or net realisable value (often referred to as lower of cost or market). Net realisable value is defined as 'the estimated selling price in the ordinary course of business less the estimated costs of completion and the estimated costs necessary to make the sale' (IAS 2 paragraph 6). The cost of inventories 'shall comprise all costs of purchase, costs of conversion and other costs incurred in bringing the inventories to their present location and condition' (IAS 2 paragraph 10).

4.6. The cost of goods for resale include the purchase price as well as all other costs of acquisition (import duties and other taxes, transport and handling costs, etc.), excluding any discounts. The cost of goods produced in the business (work-in-progress or finished good inventory) include all direct costs of production, like raw materials and supplies, labour and allocated fixed and variable production overheads. The latter include for example depreciation and maintenance costs (fixed overheads) as well as indirect materials and

indirect labour (variable overheads). Not included in the cost of goods are abnormal amounts of wasted costs, storage costs (if not necessary for further production stages), administrative overheads (that do not contribute in bringing inventories to their present location and condition) as well as selling costs (see IAS paragraphs 10 to 18).

4.7. The rules on cost formulas are identified in paragraphs 23 to 27 of IAS 2. In particular, IAS 2 requires specific identification of cost for items that are not ordinarily interchangeable or produced and segregated for specific projects. In these cases specific costs have to be attributed to the identified items of inventory. However, if a specific identification is inappropriate in the case of ordinarily interchangeable items, two other cost methods are proposed: the first-in-first-out (FIFO) or the weighted-average cost formula.

4.8. In general the same cost formula should be applied to inventories having a similar nature or use. In the case of a different nature or use (apart from a different geographical location by itself) different formulas may be applied to different inventory items. Since the revision of IAS 2 in 2003, the application of the last-in-first-out cost formula (LIFO) is no longer permitted. However, country specific accounting rules may allow the LIFO valuation method, for example the United States generally accepted accounting principles (GAAP) allow this method.

4.3 Description of historic cost accounting methods

4.9. There are several variants of historic cost accounting methods used in business accounting. This chapter provides descriptions of the most common cost flow methods (specific identification method, FIFO method, average-cost and LIFO method). Other types of historic cost methods may be used according to bookkeeping practices and tax regulations in different countries. However, these are not described in detail because of their limited relevance in practice.

4.10. The choice of the valuation method does affect the cost of goods sold (COGS) and so the profit of a company (which is defined as revenue minus COGS) as well as the closing inventories. As already mentioned, COGS include all costs of purchase, costs of conversion and other costs incurred in bringing the inventories to their present location and condition. The profit of a year is calculated by charging appropriate costs against revenue. Therefore it is directly affected by the assigned COGS and so by the choice of inventory valuation methods.

Specific identification method

4.11. According to IAS 2 the specific identification method is recommended when inventory items are not ordinarily interchangeable and/or identified for a specific project. The specific identification means that specific costs have to be attributed to identified items of inventory, regardless of whether they have been bought or produced.

4.12. The specific identification method is the most accurate method as each item is identified and priced separately. However, because of the limited applicability of the specific identification method other assumptions may be used.

First-in-first-out method

4.13. By applying the FIFO method it is assumed that the first items that enter the inventories are also withdrawn first. Therefore, withdrawals from inventories are recorded at the prices of acquisition of the oldest items held in the inventories. As a consequence the items remaining in the inventory stock are recorded at the prices of the latest acquisitions. The following numerical example illustrates the method:

Table 4.1: Illustration of the first-in-first-out method

FIFO	Quantity	Price per unit	Value
Opening stock	100	100	10 000
Purchases	60	120	7 200
Sales	50	125	6 250
Cost of goods sold	50	100	5 000
Closing stock	110	50 à 100 60 à 120	12 200
Change in book value			2 200
Recorded profit			1 250

Source: Eurostat-OECD Task Force on Land and other non-financial assets; fictitious data

4.14. The accounting period starts with an opening stock of 10 000. The company then buys 60 units at a price of 120 per unit. Later in the accounting period the company sells 50 units at a price of 125 (sales of 6 250). These withdrawals from inventory are valued at the price of the first items that entered the inventories (FIFO) — in this case 100. The COGS therefore amount to 5 000 and recorded profits amount to 1 250 (sales of 6 250 minus COGS of 5 000). The closing stock is comprised of 110 units (100 + 60 – 50 = 110) valued at 100 for the 50 units that remain from the opening stock and 120 for the 60 units that were bought during the period. The value of the closing stock therefore amounts to 12 200 (50 * 100 + 60 * 120 = 12 200).

Weighted-average cost method

4.15. The weighted-average cost method requires the calculation of the per unit average price based on the quantity and value of similar inventory items in the stock. The calculations may be done on a periodic basis or when additional items enter the stock, depending on the circumstances of the company. Withdrawals or inventory stocks are therefore valued by using constantly updated weighted-average prices. Under inflationary conditions, the value of the closing stock of inventories is lower than by applying the FIFO method. The following numerical example illustrates the method:

Table 4.2: Illustration of the weighted-average method

Weighted-average	Quantity	Price per unit	Value
Opening stock	100	100	10 000
Purchases	60	120	7 200
Sales	50	125	6 250
Cost of goods sold	50	107.5	5 375
Closing stock	110	107.5	11 825
Change in book value			1 825
Recorded profit			875

Source: Eurostat-OECD Task Force on Land and other non-financial assets; fictitious data

4.16. The setting is the same as in the previous example — the opening stock amounts to 10 000, 60 units are bought at a price of 120 and 50 units are sold at a price of 125. However, according to the weighted-average cost method withdrawals are valued at the average price of all inventory items in the stock — in this example 107.5 (100 * 100 + 60 * 120)/(100 + 60)). The COGS therefore amount to 5 375 which results in a recorded profit of 875 (sales of 6 250 minus 5 375). The value of the closing stock is calculated as the quantity remaining in stock (110) times the average price (107.5) which results in a value of 11 825 (alternatively this number can be derived by calculating opening stock + purchases – COGS = closing stock).

Last-in-first-out method

4.17. By applying the LIFO method it is assumed that the last items that enter the inventories are withdrawn first. This means that withdrawals are valued at the prices of the most recent acquisitions and therefore are closer to current market prices than under FIFO or weighted-average cost methods (as long as inventory levels are increasing; if withdrawals exceed acquisitions then there is a destocking and older prices enter). However, the prices implicit in the closing stock represent the prices of the earliest acquisitions and are therefore under inflationary conditions lower than under FIFO or weighted-average cost. The following numerical example illustrates the method:

Table 4.3: Illustration of the last-in-first-out method

LIFO	Quantity	Price per unit	Value
Opening stock	100	100	10 000
Purchases	60	120	7 200
Sales	50	125	6 250
Cost of goods sold	50	120	6 000
Closing stock	110	10 à 120 100 à 100	11 200
Change in book value			1 200
Recorded profit			250

Source: Eurostat-OECD Task Force on Land and other non-financial assets; fictitious data

4.18. Again the example starts with an opening stock of 10 000 and entries of 60 units at a price of 120 and sales of 50 units at a price of 125. With the LIFO method these withdrawals are however valued at the price of the latest items that entered the inventories — therefore the 50 units are valued with a price of 120 which leads to COGS of 6 000 and a corresponding profit of 250 (sales of 6 250 minus COGS). The closing stock of 110 units is then valued at 100 for the 100 units that remain from the opening stock and 120 for the 10 units that were bought during the period and amounts to 11 200.

Comparison of inventory valuation concepts in business and national accounts

4.19. The following numerical example shows the potential outcome under inflationary conditions according to national accounting standards:

Table 4.4: Illustration of valuation concept in national accounts

National accounts	Quantity	Price per unit	Value
Opening stock	100	100	10 000
Purchases	60	120	7 200
Sales	50	125	6 250
Cost of goods sold	50	122	6 100
Closing stock	110	130	14 300
Change in balance sheet			4 300
Recorded profit			150

Source: Eurostat-OECD Task Force on Land and other non-financial assets; fictitious data

4.20. Under national accounting standards withdrawals are valued at the prices prevailing at the time of withdrawal — in this example 122. This leads to COGS of 6 100 (50 * 122) and the corresponding profit amounts to 150 (sales of 6 250 minus COGS of 6 100). Under the assumption of a unit price at the end of the period of 130, the value of the closing stock amounts to 14 300 (110 * 130) under national accounting standards.

4.21. By comparing the inventory valuation concepts in business and national accounting one can see that purchases/entries are recorded at current prices at the time of acquisition in all four cases. However, the valuation of withdrawals differs from case to case. So, COGS and profits as well as closing inventories differ between the methods.

4.22. Under LIFO assumptions, when prices are rising, withdrawals are valued the highest when comparing with the other business accounting methods (COGS of 6 000 compared to 5 375 and 5 000 under weighted-average and FIFO respectively) and the value of the closing stock is the lowest (11 200 compared to 11 825 and 12 200 under weighted-average and FIFO respectively). The opposite applies using the FIFO method. Comparing these results with the calculations according to national accounting concepts reveals that LIFO is the best estimation for the value of the withdrawals and FIFO is nearest to national accounting standards with respect to the closing stock. This is quite clear, as with the LIFO method, withdrawals are valued at the prices of the most recent acquisitions, and therefore they are recorded closer to current market prices than with the FIFO or the weighted-average method. However, the closing stock is closest to current market prices by applying the FIFO method, as the value of the closing stock reflects the prices of the latest acquisitions.

4.23. From the company's perspective, in times of rising prices, FIFO tends to overstate profits as earlier and lower unit costs are matched with current prices in the statement of comprehensive income. The opposite applies to LIFO where COGS represent the more up-to-date-values and therefore profits tend to be lower than under FIFO. As can be seen from the numerical examples inventory valuation has a significant impact on profits and may therefore be subject to creative accounting.

4.24. This analysis is based on the assumption of period-exceeding storage durations and inflationary conditions. However, the implications are the same in the opposite direction when falling prices are assumed. If prices remained stable, there would be no differences between any of the valuation methods.

4.4 Issues related to business accounting and national accounts accounting

Write-down of inventories

4.25. In prescribing the accounting treatment for inventories, IAS 2) also provides guidance for recognising any write-downs of inventories. A write-down occurs if current market prices for the goods held in inventory are lower than the costs. According to IAS 2, any write-down to net realisable value should be recognised as an expense in the period in which the write-down occurs. Similarly, any reversal should be recognised in the income statement in the period in which the reversal occurs (IAS 2 paragraph 34). Write-downs should also be disclosed (IAS 2 paragraph 36). Inventory costs should not include 'abnormal waste' (IAS 2 paragraph 16 and 18).

4.26. The treatment of write-downs of inventories in SNA 2008 is in many ways consistent with IAS 2. SNA 2008 recommends recognising reductions in the stock of inventories in the period in which they occur.

Recurrent losses and exceptional losses

4.27. SNA 2008 also makes an important distinction between 'recurrent' losses of inventories and 'exceptional' losses of inventories. Recurrent losses to the stock of inventories arise from 'normal' or 'typical' physical deterioration, accidental damage, or pilfering. Recurrent losses are included in withdrawals and are valued in the same way as withdrawals. Changes in inventories are therefore defined as the difference between entries into and withdrawals from inventories and recurrent losses. Recurrent losses thus reduce the value of output. Even high rates of inventory losses are treated this way as long as they are recurrent (SNA 2008 paragraph 6.109 and ESA 2010 paragraphs 3.146 and 3.147).

4.28. More specifically, recurrent losses to the stock of inventories are recorded and valued as follows (ESA 2010 paragraph 3.152):

- losses to materials and supplies are recorded as materials and supplies withdrawn for production purposes (as intermediate consumption) (SNA 2008 paragraphs 10.131 and 6.216);
- losses to work-in-progress inventories are recorded as a subtraction from the additions that result from production in the same period (SNA paragraph 10.138);
- losses to finished goods and goods for resale are treated as withdrawals at the current price (SNA paragraph 10.143).

4.29. In calculating the value of output of a retailer that suffers recurrent inventory losses due to theft, part of the margin on the goods sold must cover the cost of the stolen goods. Thus the margin is estimated as the value received for the goods sold less the cost of both the goods sold and the goods stolen (SNA paragraph 6.46).

4.30. Exceptional losses, on the other hand, arise from natural disasters, fire damage, exceptional insect infestation of grains, and other irregular, non-recurring events. Exceptional losses are classified as other changes in the volume of assets, valued using relevant prices in the current period. In other words, exceptional losses lead to 'write-downs' to the stock of inventories rather than to reductions in current output (SNA paragraph 12.58 and ESA 2010 paragraph 3.126).

Work-in-progress and finished goods inventories

4.31. In the national accounts, work-in-progress and finished goods are to be valued at basic prices. As paragraph 4.6 states business book value data include all direct production related costs and therefore would not include a mark-up for operating surplus or marketing and management expenses at the enterprise level. It should also be noted that the business book value data would include an estimate of depreciation at historic values.

Nominal holding gains and losses on inventories, relationship between nominal gains and inventory valuation adjustment

4.32. According to SNA 2008 and ESA 2010 all transactions need to be recorded at current prices at the time the transaction is made (see SNA 2008 paragraph 3.178 and ESA 2010 paragraph 3.150). However, in most countries business accounting practice (as discussed in Sections 4.2 and 4.3) is to value withdrawals from inventories at historic cost, that is, the prices at the time of acquisition or some notional approximation. Only 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 SNA 2008 ([16]). If prices are changing, the change in the book value of inventories between the beginning and the end of the period will be affected by valuation changes. Even if an inventory remains constant in physical units, its value increases with rising prices (holding gains) and decreases with falling prices (holding losses). As illustrated in Chapter 1, changes due to price movements do not contribute to GDP and should be excluded from production, income, and expenditure data. The concept of nominal holding gains and losses ('holding gains') in national accounts is not the same as the inventory valuation adjustment (IVA). Holding gains in the SNA 2008 and ESA 2010 arise from changes in prices during the period. The IVA is a measure of holding gains included in the change in reported company book values. Thus, when book values of inventories are used or if profits/mixed income is estimated from business accounting an IVA is needed to remove the valuation effects arising from the use of historic cost flow methods.

([16]) Bloem, Adriaan M., Robert J. Dippelsman, Nils O. Maehle, *Quarterly National Accounts Manual — Concepts, Data Sources, and Compilation*, International Monetary Fund, 2001, p.60–63. Available at http://www.imf.org/external/pubs/ft/qna/2000/textbook/ch3.pdf

4.33. As discussed in detail in Section 4.3, the historic cost measures of inventories at the end of a period reflect a mix of prices paid over several earlier periods. Therefore, the valuation methods need to be known as well as the corresponding historical prices in order to adjust those prices to current prices. Of the valuation methods discussed in Section 4.3, only the specific identification method reflect actual ages of products in the inventory, the other methods — FIFO, LIFO, and weighted-average costs — are based on conventions. It should be noted that in many countries only book values and no explicit data on age structures of the stocked goods are available. In this case additional assumptions of the age structures (such as approximations based on turnover rates as discussed in Chapter 5.2) are necessary to estimate IVAs for changes in book values.

4.34. To calculate holding gains, stocks of assets must be valued in the same way they are recorded in the balance sheet. The nominal holding gain (G) accruing on a given quantity q of some stocked material, supply, unfinished or finished product between times o and t can be expressed as follows: $G = (p_t - p_o) * q$, where p_o and p_t are the prices of the stocked good at times o and t respectively (ESA 2010 paragraphs 6.32–6.33).

4.35. In practice, the continuous valuation of all individual entries and withdrawals within a production process, i.e. a perpetual inventory, is not feasible. This is also recognised in ESA 2010 which proposes in paragraph 3.153 various alternative methods for use (these methods are discussed in paragraph 2.87 of this guide).

4.36. When changes in the volume of inventories are regular, i.e. without seasonal or random fluctuations, a recognised method is to multiply the changes in volume of the inventories by the average prices for the period. Purchasers' prices are used for inventories held by users or by wholesalers or retailers, basic prices are used for inventories held by their producers. A more or less stable development of volumes of inventories can be assumed as normal in certain industries. However, on raw materials, petroleum products or agricultural products the assumption of rather steadily changing inventories may not be valid and other solutions should be found.

4.37. The concept of SNA 2008/ESA 2010 regarding holding gains can be approximated sufficiently well with the difference between the change in inventory stocks at current prices and the same change in physical stocks expressed at average prices of the period. This can be demonstrated with a simple mathematical conversion.

4.38. For a single product the following variables are defined:

q_a = Quantity of stock at the beginning of a period

q_e = Quantity of stock at the end of a period

p_a = Price of stock valuation at the beginning of a period

p_e = Price of stock valuation at the end of a period

$\bar{q} = (q_a + q_e)/2$ = Average annual quantity (assuming continuous developments)

$\bar{p} = (p_a + p_e)/2$ = Average annual price (assuming continuous developments)

The difference between the change in inventory stocks at current prices and changes in inventories at average prices can be expressed as:

$$(q_e p_e - q_a p_a) - \bar{p}\,(q_e - q_a)$$

$$= q_e p_e - q_a p_a - \left(\frac{q_e p_a + q_e p_e - q_a p_a - q_a p_e}{2} \right) = \frac{q_e p_e - q_e p_a + q_a p_e - q_a p_a}{2}$$

$$= \frac{q_e(p_e - p_a) + q_a(p_e - p_a)}{2}$$

$$= (p_e - p_a)\,\frac{q_a + q_e}{2}$$

$$= (p_e - p_a)\,\bar{q}$$

= holding gain according to SNA 2008/ESA 2010

4.39. The idealised SNA 2008/ESA 2010 formula for holding gains defined in physical quantities and unit prices $(p_e - p_a)\bar{q}$ can be approximately transformed for statistical purposes by using the expression $(Pl_e/Pl_a - 1)\overline{BV}$, where Pl_e, Pl_a denotes the price indices and $\overline{BV}$ the annual average of the book values.

4.40. It is important to distinguish between holding gains and the IVA. Both concepts arise from the use of business accounting data in the compilation of changes in inventories, but while holding gains represent the difference between the book value and the stocked assets measured at current prices in a period, i.e. a difference between stocks, the IVA is an implicit difference between the changes in inventories in national accounting and the changes in book values obtained from business accounting, i.e. a difference between flows.

4.41. Different historic cost flow methods lead to different IVAs as they generate different book values of inventories ([17]). When book values of inventories are used in compiling national accounts, valuation effects arising from historic cost flow methods should be removed from inventories and incomes through an IVA, which depends on the type of historic cost flow method. The calculation of holding gains on inventories and the IVA is illustrated by considering the same numerical example used to explain the different cost flow methods.

Table 4.5: Inventory valuation adjustment by method of inventories

	National accounts	FIFO	Weighted-average	LIFO
Closing stock	14 300	12 200	11 825	11 200
Opening stock	10 000	10 000	10 000	10 000
Changes in balance sheets/changes in book value	4 300	2 200	1 825	1 200
Changes in inventories	1 100			
Holding gains	3 200			
Inventory valuation adjustment		1 100	725	100

Source: Eurostat-OECD Task Force on Land and other non-financial assets; fictitious data

Changes in inventories = 7 200 – 6 100 = 1 100 (see Table 4.4)

Holding gains = 4 300 – 1 100 = 3 200

IVA FIFO = 2 200 – 1 100 = 1 100

IVA Weighted-average = 1 825 – 1 100 = 725

IVA LIFO = 1 200 – 1 100 = 100

4.42. The IVA is derived by deducting the national accounts changes in inventories from the company reported changes in book value ([18]); the latter differ in every case depending on the prices and the cost flow method used. For the FIFO method, the IVA amounts to 1 100 (changes in book value 2 200 minus changes in inventories 1 100), for the case of weighted-average the IVA amounts to 725 (changes in book value 1 825 minus changes in inventories 1 100), and for LIFO method the IVA amounts to 100 (changes in book value 1 200 minus changes in inventories 1 100). Because the FIFO method values withdrawals from inventory at older prices the holding gain included in the change in book value, as shown by the IVA, is larger than the IVA included in the change in book value under the LIFO and weighted-average methods.

([17]) Shrestha, Manik and Segismundo Fassler, 'Changes in Inventories in the National Accounts', IMF Working Paper, 2003, p.15–17. Available at https://www.imf.org/external/pubs/ft/wp/2003/wp03120.pdf.

([18]) In some countries, for example the US, the IVA is calculated as the difference between the current price change in inventories and the business change in book values. In this case the IVA moves counter to the direction of price movements, so as prices increase the IVA is negative.

5 Estimation methods changes in inventories

5.1 Introduction

5.1. Estimating changes in inventories (P.52) is one of the more difficult measurement challenges in national accounts. The main difficulty arises from the lack of data sources for estimating the value of changes in inventories according to the national accounts definition and valuation principles. As discussed in the concepts and definitions chapter (Chapter 2) and in the business accounting methods chapter (Chapter 4), changes in inventories in the national accounts are not merely the difference between the closing and opening values of inventories either from the balance sheets in the national accounts themselves or from the balance sheets in the business accounts.

5.2. As previously mentioned, in the SNA 2008 and ESA 2010 the value of changes in inventories in a certain accounting period is given by the sum of all entries and withdrawals from inventories when each transaction is valued at the prices prevailing at the time they take place. As discussed in paragraph 2.87 of this compilation guide, where information is lacking approximation methods for changes in inventories are used. In general, national statistical institutes may only obtain information on book value of inventories at certain dates from the businesses' accounts, usually at the beginning or end of each quarter or year, or quantities and prices of goods held in inventories. Therefore, national statistical institutes have to resort to specific techniques and assumptions to derive approximate measures of changes in inventories from the available data sources.

5.3. In this chapter, possible estimation methods for calculating the value of changes in inventories are discussed. The first two estimation methods begin with calculating a change in the volume of inventories during the accounting period. The change in the volume of inventories can be derived as a change in the deflated values of inventories (when book values of inventories are available) or as a change in quantities (when quantities of inventories are available). Then, the change in volume is multiplied by the average price for the accounting period. These estimation methods are discussed in Section 5.2 and 5.3 respectively. An additional estimation method is discussed in Section 5.4 when direct information on inventories (be it book values or quantities) is lacking. In such cases, a commodity supply-demand method may be used.

5.2 Transforming business accounts data on changes in inventories into national accounts — general method

Introduction

5.4. This estimation method begins with book value data based on business accounting methods (from sources such as business surveys, tax records, or business financial reports). However, depending on the accounting

method, the changes in the book value data are generally not in line with the national accounts concepts; therefore, techniques are used to revalue the book values.

5.5. As illustrated in Chapter 4, when prices are changing, the book values of the stock of inventories will reflect different prices (or prices at different times) under the FIFO, weighted-average cost, and LIFO methods. While the techniques used for book values based on the FIFO and weighted-average cost methods are similar, a different approach is needed in the case of LIFO-based book values.

5.6. The estimation method begins with knowledge of the different historic cost accounting methods that underlie the book value data. If the book value data are not available by the different accounting methods then assumptions about the different valuation methods used need to be made. The information on the different historic cost accounting methods can be sourced from legal views and policies related to income tax and accounting rules, from ad hoc questions in surveys, from financial statements or economic censuses ([19]).

5.7. The method for estimating the value of the changes in inventories (P.52) using book value data is:

Step 1: Segregate the book values of inventories at the opening and closing dates of the period by accounting method used. In most cases, the book value data are available by industry and not by type of product. Apply any adjustments needed to reported business book value data such as including a mark-up for operating surplus in the case of work-in-progress and finished goods inventories or a coverage multiplier if the data do not include the entire population (for example if data do not include unincorporated enterprises).

Step 2: Techniques for FIFO and weighted-average cost accounting methods.

(a) Construct an appropriate price deflator to convert book values of inventories into volumes. For this one needs:

i. An assumption of how long goods are held in inventory (or stock holding period).

ii. Appropriate prices for the goods held in inventory.

(b) Calculate constant price values by dividing the book values of inventories by the appropriate price deflator.

(c) Take the difference between the constant price values of the book values of inventories at the beginning and end of the period. This provides an estimate of the volume change in the stock of inventories at base period prices. In principle, this notion is equivalent to the change in quantities of inventories between the beginning and end of the accounting period.

(d) The volume change in the stock of inventories is multiplied by an average price index for the current accounting period (this price index should have the same reference period as that used to deflate the book values of inventories) to obtain an estimate of the changes in inventories at current prices. In principle, this method is equivalent to the quantity revaluation method where the change in quantities of inventories during a period is multiplied by the average prices of the current period.

The general procedure for FIFO and weighted-average accounting methods can be expressed as follows:

$$(1)\ \Delta S_{i,t} = \left(\frac{BV_{i,tE} * b_{i,t} * c_{i,t}}{CI_{i,tE}} - \frac{BV_{i,tE-1} * b_{i,t-1} * c_{i,t-1}}{CI_{i,tE-1}} \right) * \overline{PI_{i,t}}$$

Where $\Delta S_{i,t}$ is the value change in inventories for inventory item i at average prices of the current period t. $BV_{i,tE}$ is the book value of inventories for inventory item i at time t, $b_{i,t}$ indicates a mark-up for operating surplus and other relevant costs that are not included in work-in-progress and finished goods inventories in business accounting, $c_{i,t}$ is a coverage multiplier. $CI_{i,tE}$ is the deflator (sometimes called the (acquisition) cost index) used to convert book value of inventories for item i into constant price volumes, and $\overline{PI_{i,t}}$ is the average price of item i in period t.

([19]) According to the inventories questionnaire presented in Chapter 9, many countries make assumptions based on experience, or through consultation with accountants. It appears that most countries assume that the FIFO is the most used valuation method.

Step 3: Techniques for LIFO accounting methods.

Step 4: Calculate totals by adding together the changes in inventories from each accounting method.

Step 1: Segregate by accounting methods

5.8. The method begins with book values of inventories as reported by businesses. The following illustration assumes that the data are representative and that inventories of unincorporated enterprises are included in the data, thus the coverage multiplier, $c_{i,t}$, is not needed. In addition, it is assumed that no mark-up for operating surplus, $b_{i,t}$,is needed (see Box 5.4 for a discussion of work-in-progress and finished goods inventory). Thus, $b_{i,t}$ and $c_{i,t}$ are set equal to 1 in the example. Therefore, Table 5.1 directly uses the book value data as reported by businesses and assumptions about the proportion of book values by valuation method to disaggregate the total book value. The assumptions on valuation methods could be based on source data but not every country will necessarily have the valuation methods assumed below. In many cases countries assume only the FIFO valuation method is used.

Table 5.1: Book value of inventories, by valuation method

Year	Book value of inventories	FIFO inventories	Weighted-average inventories	LIFO inventories
2014	2 000	1 500	333	167
2015	3 000	2 160	600	240
		Proportions		
2014	1.00	0.75	0.17	0.08
2015	1.00	0.72	0.20	0.08

Source: Eurostat-OECD Task Force on Land and other non-financial assets; fictitious data

Step 2: Techniques for first-in-first-out and weighted-average cost accounting methods

5.9. Techniques used to revalue FIFO and weighted-average cost book values can be described as a process of deflation, differencing, and revaluing. The valuation of the changes in the volume of inventories at the average prices of the product in inventories is sometimes called the value of the physical change in inventories. As discussed at the end of this section, under strengths and weaknesses, it is an approximation of the national accounts concept and only under specific conditions will these techniques provide an accurate estimate of changes in inventories according to the SNA 2008 and ESA 2010.

5.10. The most difficult challenge when utilising this method is the creation of appropriate deflators for the book values of inventories. The choice of deflator should be representative of the type of accounting method used and of the price movements during that period.

A) CONSTRUCTING DEFLATORS FOR BOOK VALUES: FIRST-IN-FIRST-OUT AND WEIGHTED-AVERAGE CASES

5.11. Constructing deflators for book values of inventories implies taking into account that the values are implicitly based on a weighting of the prices of the product at the time the goods entered into inventory. Essentially these values can be seen as the sum of the values of the remaining quantities held from different vintage groups of entries. Thus, under historic cost accounting methods, to derive deflators for the book values of inventories weights and price data of the component products are needed for each vintage.

5.12. Usually no data are available for the 'true' weights of the various vintage groups because, except for maybe in cases in which maturing of products is part of the production process, businesses do not keep records of such information. However, assumptions can be used to approximate this. Because the vintage structure of inventories is different under FIFO and weighted-average cost methods, a different procedure for deriving

the deflators under each business inventory accounting method should be used. The next subsections describe how stock holding periods (or inventory turnover rates) can be calculated, and how they can be used to construct deflators.

(i) Stock holding period

5.13. As just discussed, the prices underlying the book value of inventories are weighted-averages of prices of goods in inventories which were acquired at different times. Ideally, it is necessary to know the holding time for each unit held in inventory because holding periods provide weights for combining prices of goods held in inventories. As such information is rarely available many countries approximate an average holding period for the goods in inventories.

5.14. The average holding period of the inventory for a specific good can be defined as the average number of months during which items remain in inventories before they are withdrawn (e.g. before the items are sold, completed, or used). It can be calculated by counting the number of months of sales (withdrawals) required to sell all the goods currently held in inventory. Alternatively it can be calculated as the number of months worth of entries (production in the case of output and purchases in the case of goods for resale and raw materials) required to make-up the inventory.

5.15. Calculations can be performed using monthly, quarterly, or annual data. For instance, if quarterly data are used monthly averages of inventory additions over the quarters are calculated, and the holding period is estimated as the number of months worth of these average monthly additions required to make-up the inventories.

5.16. Many businesses report and many national statistical institutes (NSIs) assume that the goods held in inventory are valued using the FIFO cost method ([20]). Under this method, it is a common practice to calculate and apply the inventory turnover rate when making assumptions about the lag structure of the underlying prices used in constructing the deflator.

5.17. A turnover rate can be calculated from business surveys where both the inventories and sales (turnover) are reported. Sometimes called the stock-to-sales ratio, the monthly turnover rate is simply the inventories divided by the sales and this rate reflects the average time the good remains in inventory.

Turnover rate (monthly)

(2) Turnover rate =monthly inventories / monthly sales ([21])

5.18. This turnover rate can be applied to the monthly prices in order to obtain a weighted-average of the prices during the turnover period. This weighted-average price will then mirror the price movements during that period and the importance of each monthly price to the overall change in value. The estimate of an accurate holding period is further complicated if the product composition of the inventories is not known. An average holding period for the total of inventories may imply different holding periods for individual goods. Even under the assumption of a uniform path of stock building for each individual good, the proportion of total inventories acquired in more recent periods will be higher than that acquired in earlier periods. This is because under FIFO goods acquired shortly before the closing date are more likely to be still in stock than goods acquired earlier. The calculation of average holding periods using aggregated stocks of inventories would therefore underestimate the proportion of inventories acquired in the most recent months, overestimate the proportion of inventories acquired in earlier months, and discard some inventories acquired in the earliest periods. In order to deal with this problem, some arbitrary weighting patterns giving higher importance to the most recent periods are sometimes assumed by compilers. Therefore, the highest level of precision will result when this calculation is conducted at the detailed commodity level.

([20]) See Chapter 9 of this compilation guide on country practices in estimating inventories.

([21]) Alternatively it may also be calculated as monthly inventories/cost of goods sold. Cost of goods sold may be substituted (in particular for goods for resale) because sales are recorded at market value, while inventories are usually recorded at cost. There are several ways to calculate cost of goods sold but one of the more basic ways is to start with the opening inventory stock for the period and add the total amount of purchases made during the period, and then deduct the closing inventory stock.

Box 5.1: Calculating stock holding period

Consider commodity, XYZ, which is a commodity reported within manufacturing industries and experiences significant monthly price fluctuations. Using monthly survey reports, it has been determined that the turnover rate for inventories of commodity XYZ for the past 7 months hoovers around 4.1 months.

Table 5.2: Turnover rate calculation commodity XYZ

	December	January	February	March	April	May	June
Inventories	150 472	147 574	138 659	139 080	149 974	153 211	152 160
Sales	36 346	35 819	33 902	34 005	36 490	37 644	36 932
Turnover rate	4.14	4.12	4.09	4.09	4.11	4.07	4.12

Source: Eurostat-OECD Task Force on Land and other non-financial assets; fictitious data

To calculate a cost index (i.e. the book value deflator) using this turnover rate for month *t*, the calculation would be the sum of the price index for the four months including month *t* $(PI_t + PI_{t-1} + PI_{t-2} + PI_{t-3})$ plus the percentage remaining that would apply to the price from the fourth preceding month (PI_{t-4}), together divided by the turnover rate to arrive at an average price which reflects a weighted price based on turnover rates.

For example, the turnover rate for the month of June is 4.12 (152 160/36 932). Then the equation for the deflator for June would be:

CI_{FIFO_June} = *(June price index + May price index + April price index + March price index + (0.12 * February price index))/4.12*

Or written another way:

CI_{FIFO_June} = *(June price index * (1/4.12 = 0.243) + May price index * (1/4.12 = 0.243) + April price index * (1/4.12 = 0.243) + March price index * (1/4.12 = 0.243) + February price index * (0.12/4.12 = 0.029)*

This example shows that the inventories remaining in each month are uniform over the holding period. However, there may be different paths for stock building that match a given average holding period of inventories. Sometimes countries assume different weighting patterns.

For ease of computation for the examples in the text the weights are rounded to 2 decimals places and adjusted to sum to 1, thus the weights are 0.24, 0.24, 0.24, 0.24, 0.04.

(ii) Appropriate price indices

5.19. Price indices used to construct the deflators for book values of inventories should have the same price concept as that used to value the flows of inventories. It is preferable to construct the deflators for book values of inventories at disaggregated levels to take into account differences in holding periods and price movements among various groups of products. Therefore, deflators at each group level should be built up as weighted-average of price indices for products covered in that group.

5.20. Since current information on product composition will not usually be available, the product weights might have to be taken from detailed (benchmark) data on the product composition of the inventories. An alternative would be to assume that the commodity composition of the inventories of finished goods is the same as the commodity composition of output. Likewise, the commodity composition of the inventories of materials and supplies is usually assumed to be the same as that of the purchases or consumption of these goods. For inventories of goods for resale, mainly held by wholesale and retail trade enterprises, are available by industry classification rather than by type of product, then it is common to assume that the type of goods sold are the same as those held in inventory. Section 7.2 provides a more detailed description of how inventories by industry can be broken down into products.

5.21. In constructing appropriate price indices one should also take into account the share of the products that are produced domestically versus imported and use the appropriate price indices, e.g. producer price indices for domestically produce goods and import prices for imported goods. Information on the share of imported products can be estimated from information obtain from the supply and use tables.

First-in-first-out cost index

5.22. The FIFO valuation of inventories implies that the prices used for the valuation of the inventories at any given point of time are the prices of the latest acquisitions. Considering a single item held in inventories, the prices relevant for this item are the prices at which the units held in inventories were acquired. Assuming that inventories are held for (k) months, the deflator for the book value of inventories at the end of a certain month would be:

(3) $$CI_{FIFO,t} = \sum_{n=0}^{k} PI_{t-n} * W_{t-n}$$

Where, $PCI_{FIFO,t}$ is the cost index used to deflate the FIFO book value, PI_t are the monthly price indices for the item held in inventories, n refers to the months during which the inventories are built up, and W_t represents the proportions of the quantity of inventories acquired in each month which remain in the stock.

5.23. When deflators are derived for a group of products in inventories, the PI_t should be a weighted monthly average of price indices representing the composition of goods held in inventory. The weights, W_t, are usually calculated using data reported by businesses as illustrated in Box 5.1.

5.24. Assuming the inventory composition for this group of products (sometimes data are only available by industry then an assumption needs to be made about the types of products held in inventory for that industry) is 40 % commodity A and 60 % commodity B. In addition, assume, as calculated in Box 5.1, the turnover rate is 4.12 months for the entire time period (and the distribution is uniform over the months thus the weights are [0.24, 0.24,0.24, 0.24, 0.04]). Then the following calculations can be done:

Monthly price index (PI_t): Calculated as the weighted-average of the commodity prices. For December 2015: (119.8 * 0.4) + (130.2 * 0.6) = 126.0

Monthly cost index ($CI_{FIFO,t}$): Calculated as the monthly price indices for the stock holding period weighted by the turnover pattern.

For December 2015: (126.0 * 0.24) + (124.2 * 0.24) + (122.3 *0.24) + (119.5 * 0.24) + (116.8 * 0.04) = 122.8

Table 5.3: Price indices for first-in-first-out valuation method

Year	Month	Price commodity A	Price commodity B	Monthly price index	Average annual price index	Monthly cost index
2014	January	101.5	101.4	101.4	103.7	
	February	102.7	102.1	102.3		
	March	103.1	103.0	103.0		
	April	103.8	103.4	103.6		
	May	104.5	104.5	104.5		103.3
	June	105.0	103.5	104.1		103.8
	July	105.9	102.0	103.6		103.9
	August	106.4	101.4	103.4		103.9
	September	106.6	102.0	103.8		103.7
	October	106.8	102.5	104.2		103.8
	November	107.0	103.7	105.0		104.1
	December	107.2	104.4	105.5		104.6
2015	January	107.4	112.7	110.6	118.3	106.3
	February	107.6	119.9	115.0		108.9
	March	107.8	116.1	112.8		110.8
	April	108.0	127.3	119.6		114.2
	May	108.2	132.0	122.5		117.3
	June	108.4	118.8	114.6		117.3
	July	108.6	120.2	115.6		117.9
	August	110.0	121.4	116.8		117.4
	September	112.6	124.1	119.5		116.8
	October	114.6	127.4	122.3		118.4
	November	116.0	129.7	124.2		120.6
	December	119.8	130.2	126.0		122.8

Source: Eurostat-OECD Task Force on Land and other non-financial assets; fictitious data

Weighted-average cost index

5.25. The prices underlying the book value of inventories based on a moving weighted-average cost method at any point of time are an average of the price of the last acquisition and the average prices of the stock prior to the last acquisition. The latter is calculated as the average of the price of the acquisition prior to the last acquisition and the average prices of the stock before the second to last acquisition. Thus, under the moving weighted-average cost method an average price of the inventory is calculated every time an item is added to the inventory. To approximate the prices underlying the book values of inventories implicit in this method of enterprise valuation, the following algorithm provided by Shrestha and Fassler (IMF Working Paper Changes in Inventories in National Accounts) can be used.

(4) $$CI_{WAC,t} = W_s^n PI_{t-n} + W_A W_s^{n-1} PI_{t-(n-1)} + W_A W_s^{n-2} PI_{t-(n-2)} + \ldots + W_A W_s PI_t$$

Where, $CI_{WAC,t}$ is the cost index used to deflate the weighted-average cost book value, PI_t is the monthly price indices for the item held in inventories, n refers to the months during which the inventories are built up, and W_A represents the proportions of the quantity of inventories acquired during period t and W_S represents the proportions of inventories held in inventory at the end-of-period t.

5.26. As $0 < W_S < 1$, W_S^n tends to zero when n becomes large. That is, prices of previous periods have a decreasing weight in the formation of the average bookkeeping price of inventories. Therefore, for practical purposes the first terms of equation (4) may be discarded when n is sufficiently large.

5.27. The values of W_S and W_A depend on the holding period of the inventories. The holding period k in terms of months may be estimated using the inventory turnover rate method described in Box 5.1. The weights of the stock of inventories and additions are:

(5) $$W_s = \frac{Q_s}{Q_s + Q_A} = \frac{k * Q_A}{k * Q_A + Q_A} = \frac{k}{k+1}$$

and

$$W_A = \frac{Q_A}{Q_s + Q_A} = \frac{Q_A}{k * Q_A + Q_A} = \frac{1}{k+1}$$

Where, $W_s + W_A = 1$; Q_s is the quantity held at the end of the period and Q_A is the quantity added (acquisitions) during the period.

5.28. The bookkeeping prices of the inventories can be calculated by replacing in equation (4) the values of and from equation (5). The numerical example shown in Box 5.2 illustrates the weights for aggregating prices of different periods using an assumed holding period of two months. Thus, using equation (5), $W_s = \frac{2}{2+1} = 0.67$ and $W_A = \frac{1}{2+1} = 0.33$.

Box 5.2: Moving weighted-average cost method of inventory valuation - calculation of weights

Figure 5.1: Moving weighted-average cost method of inventory valuation, calculation of weights

Period	Weights	Adjusted weights
t	$w_A = 1/3 = 0.33$	0.3300
t-1	$w_A * w_S = 0.33 * 0.67 = 0.2211$	0.2210
t-2	$w_A * w_S^2 = 0.33 * (0.67)^2 = 0.148137$	0.1481
t-3	$w_A * w_S^3 = 0.33 * (0.67)^3 = 0.099252$	0.0993
t-4	$w_A * w_S^4 = 0.33 * (0.67)^4 = 0.066498$	0.0665
t-5	$w_A * w_S^5 = 0.33 * (0.67)^5 = 0.044554$	0.0446
t-6	$w_A * w_S^6 = 0.33 * (0.67)^6 = 0.029851$	0.0299
t-7	$w_A * w_S^7 = 0.33 * (0.67)^7 = 0.020000$	0.0200
t-8	$w_A * w_S^8 = 0.33 * (0.67)^8 = 0.013400$	0.0160
t-9	$w_A * w_S^9 = 0.33 * (0.67)^9 = 0.008978$	0.0140
t-10	$w_A * w_S^{10} = 0.33 * (0.67)^{10} = 0.006015$	0.0115
SUM		1.000

Note that the adjusted weight column has been normalised so that it sums to 1.0.
Source: IMF Working Paper Changes in Inventories in National Accounts

5.29. Using the same inventory composition of 40 % commodity A and 60 % commodity B the monthly price indices from Table 5.4 can be used as the starting point of the calculation. Taking the weights derived in Box 5.2 and applying equation (4) the following calculations can be done:

Monthly cost index ($CI_{WAC,t}$): Calculated as the monthly price indices weighted by the weighted-average cost weights.

For December 2015: (128.9 * 0.3300) + (126.7 * 0.2210) + (125.4 * 0.1481) + (124.3 * 0.0993) + (122.1 * 0.0665) + (122.4 * 0.0446) + (121.0 * 0.0299) + (119.4 * 0.0200) + (116.6 * 0.0160) + (114.4 * 0.0140) + (112.4 * 0.0115) = 125.8

Table 5.4: Price indices for weighted-average cost method

Year	Month	Monthly price index	Average annual price index	Monthly cost index
2014	January	105.1	107.4	
	February	106.6		
	March	106.8		
	April	107.0		
	May	107.2		
	June	107.4		
	July	107.6		
	August	107.8		
	September	108.0		
	October	108.2		
	November	108.4		108.1
	December	108.9		108.4
2015	January	110.3	120.3	109.1
	February	112.4		110.2
	March	114.4		111.6
	April	116.6		113.3
	May	119.4		115.3
	June	121.0		117.2
	July	122.4		119.0
	August	122.1		120.0
	September	124.3		121.5
	October	125.4		122.8
	November	126.7		124.2
	December	128.9		125.8

Source: Eurostat-OECD Task Force on Land and other non-financial assets; fictitious data

B) CALCULATE CONSTANT PRICE BOOK VALUES: FIRST-IN-FIRST-OUT AND WEIGHTED-AVERAGE CASES

5.30. The following example illustrates the method utilising annual data, however, the same calculation can be used for monthly or quarterly data. Using the book value data for FIFO and weighted-average cost methods from Table 5.1 and the cost indices from Tables 5.3 and 5.4 the procedure is (see Table 5.5):

The constant price book value inventory for 2015 for the FIFO method is

BVQ_{FIFO} = (2 160/(122.8/100)) = 1 759

The constant price book value inventory for 2015 for the weighted-average cost method is

BVQ_{WAC} = (600/(125.8/100)) = 477

Keep in mind that inventories are stocks so that the December value is equal to the annual value. This means that the December cost index is used when deflating the annual book value.

Table 5.5: Constant price inventories

Year	FIFO inventories	Weighted-average inventories
2014	1 434	307
2015	1 759	477

Source: Eurostat-OECD Task Force on Land and other non-financial assets; fictitious data

C) CALCULATE DIFFERENCE IN CONSTANT PRICE BOOK VALUES: FIRST-IN-FIRST-OUT AND WEIGHTED-AVERAGE CASES

5.31. Using the data provided in Table 5.5 simply take the difference in constant price book value inventories for the FIFO and weighted-average cost methods (see Table 5.6).

The constant price changes in inventories for 2015 for the FIFO method is

$\Delta SQ_{FIFO} = \Delta BVQ_{FIFO} = 1\,759 - 1\,434 = 325$

The constant price changes in inventories for 2015 for the weighted-average cost method is

$\Delta SQ_{WAC} = \Delta BVQ_{WAC} = 477 - 307 = 170$

Table 5.6: Constant price changes in inventories

Year	FIFO inventories	Weighted-average inventories
2015	325	170

Source: Eurostat-OECD Task Force on Land and other non-financial assets; fictitious data

D) REVALUE THE VOLUME CHANGE: FIRST-IN-FIRST-OUT AND WEIGHTED-AVERAGE CASES

5.32. Using the data provided in Table 5.6 and the annual average price from Tables 5.3 and 5.4 the volume change in the stock of inventories can be revalued by multiplying by the average prices of the period (see Table 5.7).

The current price changes in inventories for 2015 for the FIFO method is

$\Delta S_{FIFO} = 325 * (118.3/100) = 384$

The current price changes in inventories for 2015 for the weighted-average cost method is

$\Delta S_{WAC} = 170 * (120.3/100) = 204$

Table 5.7: Current price changes in inventories

Year	FIFO inventories	Weighted-average inventories
2015	384	204

Source: Eurostat-OECD Task Force on Land and other non-financial assets; fictitious data

Box 5.3: Constant price changes in inventories using different price assumptions

Book values can be deflated using other methods, such as monthly prices or price averages, however, these deflators are not representative of the price movements during the time that the good was held in inventory. For a product with stable prices, this would not be pertinent, however, with volatile prices, there could be significant differences. To illustrate this, the table below uses three different deflator methods and illustrates the differences that can occur.

Table 5.8: Constant price changes in inventories using different price assumptions

Year	FIFO inventories	December value of monthly price index	Average annual price index	December value of monthly cost index
2014	1 500	105.5	103.7	104.6
2015	2 160	126.0	118.3	122.8
		Constant price inventories		
2014		1 422	1 446	1 434
2015		1 714	1 826	1 759
		Constant price changes in inventories		
2015		292	380	325

Source: Eurostat-OECD Task Force on Land and other non-financial assets; fictitious data

Step 3: Techniques for last-in-first-out accounting method

5.33. As discussed in Chapter 4, under the LIFO cost method businesses record withdrawals from inventories at the prices of the latest acquisitions. When quantities of inventories are stable or rising during the accounting period, the prices of the items withdrawn are likely to represent (close to) current prices because none of the older items in inventory are withdrawn. In such instances, the business accounting changes in book values (entries and withdrawals) would match (or closely match) the valuation concepts of the national accounts, and hence, no inventory valuation adjustment is needed to convert business reported change in book values to national accounts changes in inventories.

5.34. Therefore, in countries where the LIFO method is an accepted accounting standard, the NSI makes a simplifying assumption that when LIFO inventories are stable or rising then the national accounts current price changes in inventories are simply the difference in the LIFO reported book values as shown in equation (6).

(6) $\Delta S_{LIFO,t} = BV_{LIFO,tE} - BV_{LIFO,tE\text{-}1}$

Thus, using data from Table 5.1 the current price changes in inventories for 2015 for inventories valued using the LIFO method is 73 (240 – 167).

5.35. If prices are fairly stable equation (6) will not introduce any biases. However, the prices of the items last acquired may not exactly represent the current prices depending on how long goods are held in inventory even if the inventory is not decreasing. This will cause a problem, particularly, in a high inflation situation, thus if the NSI does not take this into account, then utilising this simplified assumption for the LIFO method may introduce nominal holding gains and losses ('holding gains') in value added.

5.36. A different situation occurs with the LIFO valuation when quantities in inventories are decreasing since part of the withdrawals will be valued at historic prices of items acquired in earlier periods. As a result, book value data reported by businesses may include substantial holding gains and equation (6) cannot be used.

5.37. Estimating the holding period from the bookkeeping data is not possible under the LIFO method because of the long time lag of the historic prices implicit in the book value with respect to the prices of the current period. Thus, independent information of the holding period is needed in order to estimate the holding gains. In addition, information on the periods during which inventories are accumulating and de-cumulating is needed to determine whether holding gains occur.

5.38. If holding gains are occurring then information on what prices (from which periods) are needed to make the appropriate inventory valuation adjustment. Two approaches may be used to estimate the changes in inventories when inventories are de-cumulating:

(a) by requesting enterprises to supply data on quantities of inventories together with prices of the main products held in inventories, which would allow the use of the quantity revaluation method (i.e. the price times quantity method); or

(b) by estimating the time periods in which the withdrawn goods were acquired, and then revaluing these withdrawals to current replacement prices using appropriate price indices.

5.39. Since under International Accounting Standards the LIFO method is not a valid inventory valuation method this LIFO depletion will not be illustrated.

Step 4: Calculate total changes in inventories

5.40. To calculate the national accounts total for changes in inventories simply add together the changes in inventories derived from each accounting method.

(7) $\Delta S_{TOTAL,t} = \Delta S_{FIFO,t} + \Delta S_{WAC,t} + \Delta S_{LIFO,t}$

The total current price change in inventories for 2015 is the FIFO and weighted-average current price changes in inventories as shown in Table 5.7 and the LIFO change in inventories as described in paragraph 5.34. Thus, Table 5.9 shows 384 + 204 + 73 = 661.

Table 5.9: Current price changes in inventories

Year	Total	FIFO inventories	Weighted-average inventories	LIFO inventories
2015	661	384	204	73

Source: Eurostat-OECD Task Force on Land and other non-financial assets; fictitious data

Strengths and weaknesses

5.41. One strength of this method is that business book value data on inventories are generally available but the weakness is that the data refer to values of inventories held by businesses based on historical costs valuations and therefore should not generally be used directly when estimating the changes in inventories. The method described in this section is a way to revalue business book value data to national accounts valuation concepts; however, it is not without its weaknesses. Any statistical technique for estimating the changes in inventories that uses data on the opening and closing book values can only produce the correct measure of these transactions at current prices if inventories are changing at a constant rate or by a constant amount. In practice, inventory fluctuations could be volatile reflecting seasonal and technical factors as well as economic decisions.

5.42. Applying the statistical techniques described in this section with higher frequency data will increase the accuracy of the estimates of the changes in inventories at current prices. 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. If changes in inventories at a quarterly (or monthly frequency) are of high enough quality then NSIs can estimate the annual changes in inventories as a simple sum of the quarterly estimates (or monthly estimates).

5.43. The technique described in this section is highly data intensive and is based on various assumptions regarding how the deflators are constructed. Some countries may use simplifying assumptions on how to weight the corresponding prices in constructing deflators for the book values. One key weakness is the lack of strong data on turnover rates: according to the survey, almost all countries can only provide rough approximations of turnover rates and weights for estimating prices for valuing stocks. When prices are highly volatile over short periods, even smaller errors in assumed turnover patterns can lead to large errors in estimated changes in inventories.

5.44. In addition, if the source data contain erroneous volatility, estimates of changes in inventories may be volatile and may lead to excessive volatility in estimates of GDP. Notable revisions can occur whenever original source data are revised significantly. Because changes in inventories can be a major component of quarterly fluctuations in GDP, these revisions can lead to major revisions to GDP growth rates.

5.45. According to Shrestha and Fassler (IMF Working Paper Changes in Inventories in National Accounts) a better way to estimate the changes in inventories that meet the SNA 2008 principles for the valuation and recording of transactions in inventories is to separately measure the flows of entries into inventories and the flows of withdrawals from inventories. According to the Eurostat-OECD survey discussed in Chapter 9 no country responding to the survey currently uses this estimation method as the main way to estimate changes in inventories. Therefore, since this is a compilation guide meant to illustrate current practice this method will not be discussed.

Box 5.4: Work-in-progress and finished goods inventory

Section 6.2, paragraphs 6.20–6.23, provides a discussion of what is included in the value of work-progress and finished goods inventories as reported by businesses. For instance, manufacturer's work-in-progress and finished goods normally include direct material costs and direct labour costs and overhead costs (such as rent, utility expenses, depreciation of plant and equipment) but not a mark-up for operating surplus. As is discussed in Chapter 2, work-in-progress and finished goods should be valued at basic prices, thus including a mark-up for operating surplus. Paragraph 6.21 provides an explanation on how this mark-up can be calculated. Alternatively, some countries ask respondents to their business surveys to value work-in-progress and finished goods (from own production) as the net sales value as of the measurement day or, if businesses are not able to do this, they can use manufacturing cost plus a mark-up.

In practice, countries may not make an adjustment to work-in-progress and finished goods business reported book value data. This omission may be acceptable for changes in inventories if the timing between production and the sale (when the operating surplus is recognised by businesses) is not long. It is probably more important to ensure that a mark-up is added if book value data are used directly as the stock level in national accounts. See Section 6.2 for additional details.

Once the appropriate book value level is obtained the steps outlined above, i.e. the method of deflation, differencing, and revaluing can be followed. It should be noted that price deflators/revaluers used are normally output deflators based on producer price indices but some countries compute a composite deflator of producer price indices and labour indices (see Chapter 9, Table 9.5, for an overview of the type of price index used for deflating inventories of the major inventory holding industries).

5.3 Direct estimation of changes in inventories

Introduction

5.46. When the quantities of inventories are available a direct estimate of the changes in inventories (P.52) can be calculated using a price times (change in) quantity method. For some products, such as agriculture (cereals and livestock) or fuel-related products, price and quantity can be directly available to national accountants and then this method can lead to an accurate and timely estimate of changes in inventories.

Description of the method

5.47. When calculating changes in inventories (i.e. the transaction), in a theoretically correct way according to national accounts concepts and definitions, as discussed in Chapter 2, information on all entries into and withdrawals from inventories are required. These entries and withdrawals should also be valued at the actual prices when the transactions are made. According to this, changes in inventories can be derived with following equation:

$$(8) \quad \Delta S = \sum_{i=1}^{n} P_e * Q_e - \sum_{j=1}^{m} P_w * Q_w$$

where ΔS are the value of changes in inventories and P_e and Q_e are the market prices and quantities of entries into inventories and P_w and Q_w are the corresponding withdrawals from inventories, respectively.

5.48. However, these flows and the corresponding valuation are difficult to measure in practice and the statistical data are often missing. As discussed in paragraph 2.87 the SNA 2008/ESA 2010 state that when information is lacking approximate methods for the estimation of changes in inventories are used. This chapter presents one of those estimation methods, specifically, how changes in inventories can be estimated if the statistical information available is quantities of a specific product at the beginning and at the end of an accounting period and an average price for the same product. When the price times quantities method is used, changes in quantities are multiplied by the average unit price of the products held in inventories during the accounting period as shown in equation (9) ([22]).

$$(9) \quad \Delta S_{i,t} = (Q_{i,tE} - Q_{i,tE-1}) * \overline{P_{i,t}}$$

Where $\Delta S_{i,t}$ is the value change in inventories for inventory item i at average unit prices ($\overline{P_{i,t}}$) of the current period t and $Q_{i,tE}$, $Q_{i,tE-1}$ is the quantity of inventory item i in period t and $t\text{-}1$. The method is rather simple and can be illustrated with a numerical example (Shrestha and Fassler, 2003).

Table 5.10: Calculation of changes in inventories using data on quantities and prices

Year/quarter		Information available			Calculations		
		Quantities		Average price of the period	Change in quantity	Changes in inventories	
		Opening	Closing			At current prices	At base year (t) prices
Year (t)	Annual	20	32	7.00			
Year (t+1)	Q1	32	35	10.00	3	30.00	21.00
	Q2	35	30	10.50	-5	-52.50	-35.00
	Q3	30	28	11.00	-2	-22.00	-14.00
	Q4	28	32	12.00	4	48.00	28.00
	Annual	32	32	10.88	0	3.50	0.00

Source: Shrestha and Fassler (2003); fictitious data

5.49. Table 5.10 shows the available information and the calculation results. Using equation (9), changes in inventories in current prices are calculated by multiplying the change in quantity between the opening and closing stock with the corresponding average prices for the accounting period. In the example the quantity change is 3 for Q1 of year t and the average unit price of the product is 10, thus the value of physical change is 3 * 10 = 30. The annual value is calculated as the sum of the four quarters (30.0 – 52.5 – 22.0 + 48.0 = 3.5). Note that this is different than if the method was applied to the annual values (0 * 10.88 = 0). Because the prices and quantities fluctuate over the time period a more accurate annual result is obtained by applying this method on a quarterly basis.

([22]) The method is sometimes referred to as the quantity revaluation method, see Shrestha, Manik and Segismundo Fassler, 'Changes in Inventories in the National Accounts', IMF Working Paper, 2003. Available at https://www.imf.org/external/pubs/ft/wp/2003/wp03120.pdf

5.50. The change in inventories in constant prices is calculated by multiplying the change in quantity with the previous year's average price or a base year price. As for Q1 year t+1 the estimated changes in inventories in constant prices is 3 * 7 = 21.

5.51. As mentioned, the estimated value of changes in inventories when using equation (9) differs from the value according to SNA 2008/ESA 2010. Because of the fact that entries and withdrawals from inventories fluctuate within the accounting period and prices generally also can fluctuate, the method only gives an approximate estimate. The estimate will be less accurate the more the inventories and prices fluctuate within the accounting period. The shortcoming of fluctuating quantities within the accounting period can be illustrated with the following numerical example ([23]).

Table 5.11: Example of inventory stocks and flows of a specific product

	1	2	3	4	5	6	
Price	4	5	5	7	9	6	**Average**
							6.00
Quantities							
Opening stock	100	104	98	91	88	87	
Additions	5	1	0	12	2	7	
Withdrawals	1	7	7	15	3	1	
Closing stock	104	98	91	88	87	93	
Values							**Sum**
Value of additions	20	5	0	84	18	42	169
Value of withdrawals	4	35	35	105	27	6	212

Source: Eurostat-OECD Task Force on land and other non-financial assets, based on Lequiller and Blades (2006), Understanding National Accounts; fictitious data

5.52. In Table 5.11 information on inventories of a specific product is shown; prices, quantities, additions and withdrawals for six sub-periods. In this example the theoretically correct way to calculate the annual changes in inventories, according to SNA 2008/ESA 2010, would be to sum the value of additions and subtract it from the sum of the value of withdrawals, 169 – 212 = –43. But this detailed information is usually not known to national accountants. Normally just the opening stock in the first sub-period (100) and closing stock in the last sub-period (93) are known variables. When using the average price over the sub-periods for the product, the calculation gives an approximation of the changes in inventories equal to (93 – 100) * 6.00 = –42. As the additions and withdrawals within the accounting period have prices that differ from the simple average price used in the price times (change in) quantities estimate the result differs from the theoretically correct estimate. However, this estimate can function as a rather good approximation under certain circumstances.

5.53. In some cases only prices at the beginning and end of the accounting period are available. In such cases an average price can be calculated with the available information, but this is less satisfactory than the average of all prices during the accounting period.

5.54. To obtain more accurate estimates with the price times quantity method, data could be collected for shorter time periods, i.e. on a monthly or a quarterly basis. The annual changes in inventories are then the derived by the sum of the months or quarters.

([23]) The example is similar to Lequiller, F. and D. Blades, *Understanding National Accounts: Second Edition*, OECD Publishing, 2014, Chapter 5. Available at https://www.oecd.org/std/UNA-2014.pdf

Box 5.5: Direct estimation inventories — Sweden

Introduction

In the Swedish national accounts, the main sources that are used to calculate changes in inventories are two quarterly business surveys. One of the surveys covers inventories in manufacturing industries and the other covers wholesale and retail trade industries. Both surveys are carried out by Statistics Sweden. The method in these surveys is based on the bookkeeping values of opening and closing stocks of inventories from business accounts, followed by a process of deflation, differencing and revaluation to the average price of the period (the general method described in Section 5.2). But these sources do not cover all sectors and industries in the economy and is therefore complemented with a number of other sources for the industries in agriculture, forestry, electricity, fuel and gas, construction and services industries. The price times quantity method is mainly applied for fuel-related products, and this case study will focus on the calculation of motor gasoline in the wholesale trade industry. The same calculation procedure is applied on a number of other fuel products.

Data source

Even though all companies in trade industries are covered in the above-mentioned quarterly survey, the companies trading with fuel and crude oil are excluded. The reason for this to avoid double data collection from these companies, because data are also collected in Statistics Sweden's fuel, gas and inventory statistics. The fuel, gas and inventory statistics collects quantities of a series of fuel products held by the companies at the end of the period. The statistics are on a monthly or quarterly basis, but the national accounts use only quarterly. Quarterly producer price indices and prices per unit are used in the calculations. These price statistics are produced at Statistics Sweden's price statistics unit.

Description of the method

The quantities collected in the energy statistics is usually expressed in cubic metres, but in some cases in tonnes. To be able to match the price measurements of the same product it sometimes requires a transformation from tonne to cubic metre. In the case of motor gasoline, data are collected in cubic metre, so no transformation is needed.

Basically the same method described in Section 5.3 is applied, and this is illustrated in Table 5.12.

Table 5.12: Calculation of changes in inventories for motor gasoline in the wholesale trade industry

	Quantity (1000 m^3)	Change in quantity (1000 m^3)	Motor gasoline price in 2014 per 1000 m^3 (million SEK)	Price index (t-1=100)	Change in inventories	
					Constant prices (million SEK)	Current prices (million SEK)
2014Q4	321					
2015Q1	306	-15	5.99	76.4	-90	-69
2015Q2	301	-5		93.7	-30	-28
2015Q3	255	-46		85.1	-276	-235
2015Q4	296	41		70.5	246	173
2015					-150	-158

Source: Statistics Sweden

The calculation starts with the information on price per 1 000 cubic metre in 2014, which was SEK 5.99 million. Since it is producer price, taxes are excluded. From the opening and closing stock quantity, the change in stock volume between 2014Q4 and 2015Q1 is calculated (–15). The volume change is then multiplied with the unit price of motor gasoline to get the value change in inventories in constant prices (5.99 * –15 = –90).

To get the value of change in inventories in current prices, the value change in constant prices is simply multiplied with the price change (–90 * 76.4/100 = –69). The year value is the sum of the four respective quarters.

Box 5.6: Direct estimation inventories — Canada

Inventory estimation using the direct method, price times quantity, is especially important in the estimation of farm inventories due to differences in the unit of measure. Volumes of live animals may be reported as 'number of heads', whereas grains may be reported as 'metric tonnes'. The use of price times quantity within farm inventory estimation generates a value that can then be aggregated for the farm sector.

Canada has several agriculture surveys and a census of agriculture that asks respondents inventory details, by commodity, as well as prices. With this detailed information, estimation can be computed on a quarterly basis, by province, for three main types of farm inventories: on-farm inventories of grains, on-farm inventories of livestock, and grains in commercial channels ([24]).

Taking the difference between the closing and opening inventory volumes, combined with the average price during the quarter, will provide an estimate of the investment in farm inventories or changes in farm inventories (ΔS),called value of physical change in Canada. The annual provincial changes in inventories is the sum of the provincial quarterly estimates, and the total changes in farm inventories for Canada is calculated as the sum of the provincial changes in inventories. Then, the stock level is calculated using a perpetual inventory type methodology where the annual changes in inventories is accumulated over time, on a starting stock level, to arrive at a timeline of stocks, with the starting stock being a level established using the census of agriculture.

Thanks to the details gathered from the agriculture surveys and census, the source data allow for estimation at a specific commodity level, with commodity specific quarterly prices. This results in more precise estimates once aggregated. Quarterly ΔS of inventories are estimated for the following commodities:

Table 5.13: Commodities for which inventories are estimated

Crops (on-farm)	
Grains	Other crops
Barley	Special crops
Canola	Dry peas
Wheat	Mustard seed
Oats	Sunflower
Flaxseed	Lentils
Soybean	Canary seed
Com	Chick peas
Rye	Other
	Tobacco
	Potatoes
Livestock	
Calves	Poultry
Cattle	Sheep
Hogs	
Grains in commercial channels	
Barley	Oats
Canola	Flaxseed
Wheat	Rye

Source: Statistics Canada

([24]) Grains in commercial channels are grains already sold by farmers and are held off farm.

Method

Estimation of crops

In order to obtain a value of physical change of crops held on farms, the value of production and the value of inventory depletion are calculated, on a commodity basis, using the price times quantity approach. Value of production (*VPROD*) is the production (metric tonnes) in the reference period multiplied by the average quarterly price ($\overline{p}$), whereas the value of depletion (*VDI*) is the depletion estimate (*DI*), which is the difference between the estimates for the end and the beginning of a period minus production (*PROD*), in (metric tonnes), multiplied by the average price ($\overline{p}$).

Equation 10: VPC of crops

(10a) $VPROD_t = PROD_t * \overline{p}_t$

(10b) $DI_t = Q_e - Q_b - PROD_t$

(10c) $VDI_t = DI_t * \overline{p}_t$

(10d) $\Delta S_t = VPROD_t + VDI_t$

Table 5.14: Value of stocks and physical changes of stocks for grain ABC, Ontario, 2014

Variable		Unit of measure	Q1	Q2	Q3	Q4
Opening stock	Q_b	*Tons*	11 309	6 287	2 854	17 420
Production	*PROD*	*Tons*	0	0	39 658	0
Closing stock	Q_e	*Tons*	6 287	2 854	17 420	9 802
Quarterly price	$\overline{p}$	*CAD / ton*	136	135	119	104
Value of production	*VPROD*	$PROD * \overline{p}$	0	0	47 034	0
Depletion	*DI*	Q_e - Q_b - *PROD*	-5 022	-3 433	-25 092	-7 618
Value of depletion	*VDI*	$DI * \overline{p}$	-6 825	-4 617	-29 759	-7 892
Value of physical change	ΔS	*VPROD + VDI*	-6 825	-4 617	17 275	-7 892
Inventory stock	*INV*	$INV_{t-1} + \Delta S_t$	344 162	339 545	356 820	348 928

Source: Eurostat-OECD Task Force on Land and other non-financial assets, based on compilation practice Statistics Canada; fictitious data

Estimation of livestock

Estimates of livestock (number of head) and the average market price are obtained from various agriculture surveys. The investment of farm inventories at current prices, the ΔS, is the difference between the closing and the opening inventory stocks (AN.12) within a quarter, multiplied by the average market price.

Equation 11: VPC of livestock

(11) $\Delta S_t = (Q_e - Q_b) * \overline{p}_t$

Estimation of grains in commercial channels

Grains in commercial channels are those grains held off farm (grains that have been sold but not yet delivered) within which inventories are compiled for barley, canola, wheat, oats, flaxseed and rye. Estimation is similar to that performed for livestock, except that the unit of measure is metric tonnes and the source data are from the Canadian Grain Commission rather than from surveys. As this type of agriculture inventory has been sold but not delivered, an inventory valuation adjustment (IVA) is calculated to reflect any holding gains due to price movements.

Equation 12: Inventory of grains in commercial channels

(12a) $\Delta S_t = (Q_e - Q_b) * \overline{p}_t$

(12b) $IVA_t = \Delta S_t - ((Q_e * \overline{p}_e) - (Q_b * \overline{p}_b))$

5.4 Estimating changes in inventories using commodity supply-demand method

Introduction

5.55. It might occur that information on the stocks of inventories (either book values or quantities) is unavailable for certain types of commodities and a direct estimate of the changes in inventories (P.52) is not possible. In cases such as these, the calculation of the changes in inventories may be possible if other flows of that commodity are available.

5.56. This section will provide an overview of the calculation of the changes in inventories, on a commodity basis, using a supply-demand model. It is important to note that this equation holds at the detailed, by commodity, level, but it will not at the aggregate.

Description of the method

5.57. As it is not always possible to obtain required estimates from available data sources, supply-demand models can be used to estimate the changes in inventories. These models compare the supply of a commodity to the demand of that commodity to ensure a balance.

As a simple formula, the supply of a certain commodity, which includes imports and domestic production, should equal the demand of that commodity, which comprises the final domestic demand (consumption and gross fixed capital formation), change (additions or withdrawals) in inventory and exports. If the changes in inventories estimate is missing, and the other variables are available, this estimate could be calculated as the residual, which results in an addition (or withdrawal if demand exceeded supply) to the stock of inventories of the previous time period.

Thus, the supply-demand model can be expressed in the equation:

(13) $\Delta\ Inventories = (imports + domestic\ production) - (exports + final\ domestic\ demand)$

5.58. The following is an example of a more specific supply-demand model which takes into account margins and intermediate use of that commodity. The changes in inventories for commodity XYZ is calculated as the residual after measuring, in constant price, the total supply, which is production, imports and applicable margins, and the demand, which includes intermediate inputs, final domestics demand and exports.

5.59. For this example, it is assumed that the production, trade and final domestic demand of commodity XYZ are known using other data sources. The margin variable is estimated using various margin ratios to cover margins such as wholesaling, retailing and transportation margins. The intermediate input ratio is calculated based on input data used in the manufacture of other commodities.

Table 5.15: Estimation changes in inventories with supply-demand model for commodity XYZ (1000 CAD)

	2009	2010	2011	2012	2013	2014
Production	5 200	5 320	4 610	4 590	5 170	5 200
Imports	6 110	5 820	5 990	6 210	4 960	5 090
Margins	9 581	9 500	8 895	9 029	8 745	8 867
Total supply	20 891	20 640	19 495	19 829	18 875	19 157
Intermediate inputs	5 390	5 480	4 748	4 728	5 325	5 356
Domestic consumption	2 618	3 440	2 945	3 021	3 178	3 124
Gross fixed capital formation	7 212	6 200	7 085	6 639	6 592	6 726
Exports	4 480	4 770	5 220	4 530	4 990	3 930
Total use	19 700	19 890	19 998	18 918	20 085	19 136
Changes in inventories	1 191	751	-503	911	-1 210	21

Source: Eurostat-OECD Task Force on Land and other non-financial assets, based on compilation practice Statistics Canada; fictitious data

5.60. A supply-demand model is an easy computation when the other variables are readily available. Although it would not provide the stock level of inventories, the changes in inventories can be added to a starting stock, with continued accumulation through time. In general, the economic concept of supply equal to demand of a commodity holds true when comparing an entire economy, regardless of the time component. However, it should be noted that inter-sector transfers and timing differences can result in supply/demand differences for specific time periods and sectors.

5.61. The supply equal to demand identity will only hold for the commodity level and should not be used at the aggregate level. This is because when two methods of calculating GDP are balanced there will most likely be a statistical discrepancy and this discrepancy will form a component of the residual as well. Therefore, if this method is used at the aggregate level, the statistical discrepancy will inevitably be included as well. The relationship between the statistical discrepancy and the changes in inventories is discussed in the appendix to this chapter.

Annex 5A: Statistical discrepancies and changes in inventories

5A.1. The statistical discrepancy is a residual amount, which could emerge in the closing of any total that could have another amount of reference, in this particular case the reference is the balancing item GDP. The next paragraphs explain this situation and underline the point that changes in inventories P.52) should not be used to close the measures of the GDP and thus include the statistical discrepancy.

5A.2. SNA 2008/ESA 2010 recognise that the consistency among the three approaches of GDP (production approach, expenditure approach and income approach) is more a conceptual issue than a statistical reality. This is because the wide disparity of data sources incorporated into the estimates makes it highly unlikely that the different approaches will produce the same result. For example, where only two methods are applied, and the production approach is the dominant one, then the expenditure approach will need an adjustment to reach the level of GDP in the former measure. In this case, one of the options used in the statistical exercise is to close the use side through the component changes in inventories. However, this may cause erratic effects in the trends that this transaction presents, since it will be only an adjustment, not a direct measure.

5A.3. The SNA 2008 describes two approaches, the first is to be open about the problem and publish a statistical discrepancy, in which case the discrepancy is attached to the GDP method that the national statistical institute feels less accurate (SNA 2008 paragraph18.16). The second is to examine the data in the light of the many accounting constraints, making the best judgement possible about where the errors are likely to have arisen and modifying the data accordingly. The supply and use framework is a very powerful tool for doing this sort of work (SNA 2008 paragraph18.17). For example, the national statistical institutes may feel that the production estimate of GDP is fairly sound but may have doubts about the expenditure components and therefore, may use some component of the expenditure approach as a balancing item to reach the level of GDP in the production approach, or do the same with the gross operating surplus in the income approach of the GDP.

5A.4. If the balancing item to close the expenditure approach is the changes in inventories, it is important to recognise that this consists of three elements: the changes in inventories itself, the holding gains/losses and the statistical discrepancy. It is recommended to avoid this kind of practice and to measure directly the changes in inventories, splitting the elements and isolating the treatment of the statistical discrepancy. In any case, it is desirable that the changes in inventories follow the trend of the source data.

5A.5. Table 5A.1 shows GDP at market prices and its components in each of the three approaches.

Table 5A.1: GDP approaches, components and statistical discrepancy

GDP Production approach		GDP Expenditure approach		GDP Income approach	
Output	36 000	Final consumption	13 500	Compensation of employees	9 800
Intermediate consumption	18 000	Changes in inventories	1 100	Taxes on production and imports, net of subsidies	2 100
Taxes less subsidies on products	1 300	Gross fixed capital formation	2 800	Operating surplus	2 900
		Acquisitions less disposals of valuables	650	Mixed income	4 400
		Exports (-) Imports of goods and services	1 200		
		Statistical discrepancy	50	Statistical discrepancy	100
GDP at market prices	19 300	GDP at market prices	19 300	GDP at market prices	19 300

Source: Eurostat-OECD Task Force on Land and other non-financial assets; fictitious data

5A.6. In this fictitious example, the GDP at market prices is the same in the three approaches, for this purpose, the assumption is that GDP on the production side (output (–) intermediate consumption (+) net taxes on products) is the more accurate measure, because the data sources by industry are of better quality. In order to close the gaps between the production approach and the other approaches, a statistical discrepancy is added to the expenditure approach and the income approach. It is important to mention that in practice countries may deem data sources used in one of the other approaches to be of higher quality, in these cases the statistical discrepancy could appear in the weakest ones.

5A.7. The description of the figures is as follows: the GDP in the production approach amounts to 19 300 and is the difference between the output which amounts to 36 000 and the intermediate consumption (18 000), plus the taxes less subsidies on products by 1 300. In the expenditure approach, the GDP is matched to the reference amount from the production approach (19 300), by the sum of final consumption (13 500), changes in inventories (1 100), gross fixed capital formation (2 800), acquisitions less disposals of valuables (650), the net amount of exports and imports of goods and services (1 200), and a statistical discrepancy (50). Finally, in the income approach the procedure is the same, the GDP is matched to the reference amount from the production approach (19 300), and the components are compensation of employees (9 800), taxes on production and imports, net of subsidies (2 100), operating surplus and mixed income (2 900 and 4 500) and a statistical discrepancy (100).

5A.8. In this way, the GDP is reconciled among the three approaches by referencing to the more accurate of the approaches. Coming back to the expenditure approach, the changes in inventories (1 100) are obtained directly and represent additions (purchases) less withdrawals (cost of goods sold) of inventories. In Table 5A.2, changes in inventories is split into components, for this case the fictitious examples from Chapter 4 will be reused, in addition to the figures of the GDP approaches in Table 5A.1.

Table 5A.2: Measurement of changes in inventories, components

	Value
Opening stock	10 000
Purchases	7 200
Sales	6 250
Cost of goods sold (withdrawals)	6 100
Closing stock	14 300
Change in balance sheet	4 300
Changes in inventories (amount included in the expenditure approach)	1 100 = 7 200 - 6 100
Holding gains	3 200 = 4 300 - 1 100
Other changes in volume	0

Source: Eurostat-OECD Task Force on Land and other non-financial assets; fictitious data

5A.9. The treatment of nominal holding gains and losses ('holding gains') in changes in inventories is important in order to guarantee the accuracy of the measurement of GDP in each of the three methods. In this sense, obtaining changes in inventories as a residual between GDP approaches or including the statistical discrepancy in changes in inventories makes it impossible to value holding gains and therefore to avoid an over or underestimation of GDP. A direct measurement of changes in inventories allows isolating transactions from non-transactions, and to give an accurate treatment of each of the three approaches.

6 Estimation methods inventory stocks

6.1 Introduction

6.1. Countries have utilised several methods for estimation of their annual inventory stocks (AN.12), as revealed in their responses to the Eurostat-OECD survey of national practices in estimating inventories. It also seems clear that the choice of methods for annual inventory stock estimation is highly related to the data sources that have been described in Chapter 3 of this guide. In a sense, the data sources may determine the estimation method.

6.2. Estimations of inventory stocks as well as of changes in inventories (P.52) have the same valuation principle: valuation at current prices. The difference between the two comes from the price and inventory items applied in valuation. The inventory stocks should be valued at prices as of a relevant date such as the end of the year or end of the quarter, whereas changes in inventories should be valued at average prices of the period. In addition, transactions in inventories (i.e. acquisitions less withdrawals from inventories) matter for estimation of changes in inventories, whereas the items remaining as inventories matter for estimation of inventory stocks. So, in estimating changes in inventories, only transactions in inventories are included, and other flows such as other changes in volume of inventories and nominal holding gains and losses ('holding gains') should be excluded. The estimates of inventory stocks, in contrast, show all of the results of transactions in inventories, other changes in the volume of inventories and holding gains. In this respect, when the value of annual inventory stocks is estimated, its similarity to and difference from the value of changes in inventories should be kept in mind.

6.3. In this chapter, three possible methods of estimation are presented for calculating the annual inventory stock at the national (or sectoral) level. The first method (for the most part) directly uses businesses' book value data on inventories. The second method is an application of a direct approach, in other words the price times quantity method. This method may be applicable to products in the agriculture, forestry and fishing industry or the fuel industry, where quantity and price data are often available. The third method of estimating the annual inventory stock in the national accounts is by application of the perpetual inventory method. This method accumulates the changes in inventories (the flows) compared to a prior period's inventory stock. These three methods should not be considered as an exhaustive list of the options, but rather as representative.

6.4. This chapter will discuss these three methods in order. On the first method, the means of matching business accounting book value data on inventories with the definitions in the national accounts is discussed in more depth. Each section starts with a description of the general methodology for estimating the inventory stock level, as well as its data requirement, and ends by considering the method's strengths and weaknesses. The methodological descriptions will be illustrated with numerical examples and country case studies. Finally, the annex to this chapter provides a figure that shows a simplified presentation of the process of estimating the transaction changes in inventories and the stock level of inventories.

6.2 Estimating inventory stocks from business accounts

Description of the method

6.5. In general, the method for estimating the annual inventory stock (AN.12) in the national accounts through direct use of businesses' book value data requires ensuring the coherencies of the company reported data with the definitions of the national accounts. As discussed in Chapter 4, business accounting valuation is not consistent with national accounts valuation principles. Therefore, conversion of valuation from business accounting to the national accounts accounting is one of the key factors in estimation. As described below, the method begins with the assumption that business book value data can be well matched, after some adjustments, with those of the national accounts. For practical application, it is also assumed that the inventory stock in the national accounts is estimated at the industry level. Under these assumptions, the inventory stock level across all industries under consideration can be computed by

$$(1) \quad INV_t = \sum_{j=1}^{m} \sum_{i=1}^{n} BV_{i,j,t} * a_{i,j,t} * b_{i,j,t} * c_{i,j,t}$$

where INV_t is the total value of the inventory stock in the observed year t for the whole economy, $BV_{i,j,t}$ reflects the value of businesses' i-type book values in industry j in the observed year t, and $a_{i,j,t}$ implies a conversion factor that converts business accounting to national accounting valuation. Business accounting usually records book values of inventories using several historical cost accounting methods, whereas national accounting requires valuation at current prices. The book value data should thus be converted or revalued to current prices for inclusion in the inventory stock of the national accounts ([25]). An additional conversion factor, $b_{i,j,t}$, is needed to convert businesses' work-in-progress and finished goods data to basic prices. The reasons for this adjustment are discussed in paragraphs 6.20–6.26. In addition, if countries' business reported data do not include information for example from unincorporated enterprises, then a coverage multiplier, $c_{i,j,t}$, should be applied at the industry level since the role of unincorporated enterprises will differ across industries ([26]). If the computation is summed across industries and inventory types, then the total value of the nationwide inventory stock can be obtained.

6.6. The method for estimating the annual inventory stock is described in more detail below; countries can apply adjustments as needed:

(a) The first step begins with matching business book value data to the definitions in the national accounts by inventory type. In some instances, certain book value data should be excluded when it differs from the definitions in the national accounts ([27]).

(b) Conversion factors, $a_{i,j,t}$ and $b_{i,j,t}$ are prepared for each industry and each inventory type, as needed.

In the case of materials and supplies and goods for resale, the factor adjusts for differences in the timing of recording. In other words, their acquisition costs should be revalued at the current prices prevailing on the date to which the balance sheet relates. In this case the factor adjusts for price changes during the holding period of materials and supplies and goods for resale.

In the case of work-in-progress and finished goods, the factor converts the production costs based on business book value data into basic prices as recommended in the national accounts. Basic prices

([25]) Box 2.1 in this guide shows why a conversion in valuation is required when business book value data are directly used, in order to estimate the value of annual inventory stock consistent with the national accounts concept. For example, while the inventory stock of finished goods or work-in-progress should be valued at basic prices in the national accounts, business accounting usually records them at production costs.

([26]) Here the case of unincorporated enterprises (especially small, self-operated ones) is mentioned as one example where the source data may not include all enterprises in the economy or in the industry. In addition, if government and non-profit institutions are also excluded from the source data, they may be treated separately. If the source data or surveyed data already cover all relevant enterprises across the nation, the coverage multiplier will be unity.

([27]) For example, in the case of real estate businesses the value of land sites is sometimes recorded as an inventory item.

include not only production costs from the business book value data but also operating surplus or other relevant costs not recorded in the business accounting.

(c) Next, if some enterprises (e.g. unincorporated ones) are not included in the source data, then a coverage multiplier should be used to include the inventories held by them. By multiplying the adjusted stock by the factor $c_{i,j,t}$, the all-enterprise stock of inventories in the relevant industry is computed.

(d) Summing the stocks of inventories across industries leads to the total stock of inventory for the economy as a whole.

(e) When the price indices for inventories by inventory type and industry are available, and the other changes in the volume of assets accounts, or the revaluation accounts are provided separately for inventories, then the annual changes between the opening and closing inventory stocks on the balance sheet can be decomposed into price changes and volume changes.

A) MATCHING BUSINESSES BOOK VALUE DATA WITH NATIONAL ACCOUNTS

6.7. Since business accounting practices differ across countries, generalisation to all countries is not plausible. Each country's national accountants must consider the business accounting practices in their country to determine whether the book value data as reported by businesses are well matched with the national accounts definitions.

6.8. In addition, in order to apply this method national accountants should have access to very comprehensive business accounting data. This data may come from surveys done by the national statistical institutes, from the tax authorities to whom business accounting records are submitted, or through regular disclosures of corporate accounting information by the corporations themselves. If there are differences in the concepts of businesses' recording across the data sources, this fact should be taken into account before moving to the next step of estimation.

6.9. Industries are classified in the national accounts according to their economic activities where establishments are the basis of the classification. Businesses may operate a variety of establishments. Accordingly, industry classifications may be somewhat different from national accounts in some cases when enterprise level book value data are directly used. This issue will not be serious if the industry classification is broad enough. However, the more detailed the industry classification, the more discrepancy may occur. Section 7.2 provides techniques to further disaggregate enterprise level book value data into more detailed industries (into kind-of-activity or establishment units). If further disaggregation cannot be done to the enterprise level book value data, it is suggested that national accountants start from a broader industry classification ([28]).

6.10. With these caveats in mind, the general procedure for estimating the annual inventory stock level in the national accounts through direct use of business book value data begins with Table 6.1, which describes how the book value data are to be matched with the national accounts, by type of inventory for the industry concerned. The first column in the table shows the types of inventories held by businesses in their accounting. At this stage, corporations' inventory categories differ from the classification of inventories in the national accounts.

([28]) If inventory data are collected in establishment surveys for most industries, this will not be a big issue.

Table 6.1: Matching of corporations' inventory data with national accounts, by type of inventory in the industry concerned

Corporations' inventory data	Type of inventories in national accounts				Notes
	Materials and supplies	Work-in-progress	Finished goods	Goods for resale	
Merchandise				X	-
Finished goods			X		-
Semi-finished goods		X			-
Raw materials	X				-
Work-in-progress		X			-
Buildings and structures under construction with contracts for sale					To be recorded as gross fixed capital formation
Buildings and structures under construction without contracts for sale		X			-
Completed buildings and structures without contracts for sale			X		-
Land sites					Excluded
Others not specified elsewhere					To be determined

Source: Eurostat-OECD Task Force on Land and other non-financial assets

6.11. The table provides examples of different types of business inventory data and indicates which national accounts definitions they match — materials and supplies, work-in-progress, etc. Merchandise in business accounting corresponds to goods for resale in national accounts. Buildings and structures under construction, or completed are recorded as work-in-progress or finished goods depending upon their stages of construction, until there is a contract for sale (in other words until ownership is transferred to the promised buyers). If a contract for sale has been concluded in advance, the transfer of legal ownership may be deemed to have taken place in stages as value is put in place. In this case, these buildings and structures under construction should be recorded as gross fixed capital formation rather than inventories (SNA 2008 paragraph 6.112, ESA 2010 paragraph 7.01). Chapter 8.3 discusses this borderline between gross fixed capital formation and inventories in more detail.

6.12. In addition, some business book value data may include items in inventory that should not be included for national accounting purposes. For example, businesses operating in the construction industry or real estate businesses usually purchase huge amounts of land, develop it and then resell it to promised buyers. From their perspectives the acquired land sites may be considered inventory, as the purpose of land site acquisition will be resale in an improved form rather than their own use. From the perspective of national accounting, however, land sites are separately identified as an independent item on the balance sheet. Land sites recorded as inventory in business accounting should therefore be excluded from the national accounts inventory and instead recorded under land on the balance sheet ([29]).

6.13. There may be other items in businesses' book value data judged as doubtful for inclusion in the national accounts inventories. Accounting practices may differ across countries, and so the national accountants in each country should determine which items are to be included as inventory in their national accounts, based on the guidance of SNA 2008 or ESA 2010. Once book value data have been matched with national accounts, by type of inventory at the industry level, it is then possible to move on to the next step.

([29]) The cost related to land improvements (activities to increase the value of land such as land clearance, land contouring, creation of wells and watering holes, etc.) should be recorded as fixed capital formation.

6.14. Table 6.2 displays the results of an experimental matching of businesses' inventory data with the definitions in national accounts ([30]). It is recommended to do the matching at the industry level if possible, as the next step can then be carried out with more relevance at the industry level.

Table 6.2: Results of experimental matching of business book value data national accounts definitions, by industry and inventory type

Year	Materials and supplies	Work-in-progress	Finished goods	Goods for resale	Total
	Manufacturing				
2009	14 900	7 500	11 300	2 900	36 600
2010	17 000	8 700	13 500	3 200	42 400
2011	19 300	10 500	15 900	3 700	49 400
2012	18 700	10 100	16 300	3 600	48 700
2013	18 500	10 000	16 800	3 800	49 100
Wholesale and retail trade					
2009	1 200	300	2 500	25 200	29 200
2010	1 300	400	3 300	27 600	32 600
2011	1 500	700	4 200	32 400	38 800
2012	1 400	600	4 100	33 600	39 700
2013	1 400	600	3 800	33 500	39 300

Source: Eurostat-OECD Task Force on Land and other non-financial assets; fictitious data

B) REVALUING BUSINESS BOOK VALUE DATA TO BE CONSISTENT WITH NATIONAL ACCOUNTS

6.15. As discussed in Chapter 4, business book value data are valued on the basis of business accounting, and their valuation principle may thus differ from that for national accounts even if their classification has been matched with national accounts. For national accounts accounting, meanwhile, business book value data should be readjusted differently depending upon the type of inventory. Materials and supplies and goods for resale are valued at purchasers' prices and prices paid. Work-in-progress and finished goods are on the other hand valued at basic prices.

6.16. Revaluing at current prices the business book value for materials and supplies or goods for resale can be thought of as reflecting price changes during their holding periods. These price change adjustments are also affected by the business accounting method, for example the FIFO or weighted-average cost method, as explained in Chapter 5. In conclusion, revaluing at current prices the business book values for materials and supplies or goods for resale is revaluing the business book values simply by using the ratio of the inventory price index (PI) to the (acquisition) cost index (CI) for inventories as of the relevant (end-of-period) date, which were already prepared for estimating the value of changes in inventories (P.52) in Section 5.2:

$$(2)\quad a_{i,j,t} = \frac{PI_{i,j,tE}}{CI_{i,j,tE}}$$

where i indicates materials and supplies or goods for resale, and j implies the relevant industry.

([30]) Interestingly work-in-progress and finished goods appear on the wholesale and retail trade industry. The reason is that the inventory figures in the table come at the enterprise level data rather than at the establishment level. Enterprises may operate in many businesses at the same time.

6.17. The following paragraphs show how the conversion factor can be computed for materials and supplies, under the assumption that the monthly price index and the monthly (acquisition) cost index in Tables 5.3 and 5.4 are related to materials and supplies. The same logic can be applied to goods for resale.

In the FIFO case ([31]), as explained in Box 5.1, the inventory stock holdings as of December 2015 comprise 0.24 of acquisition in December, 0.24 of acquisition in November, 0.24 of acquisition in October, 0.24 of acquisition in September and 0.04 of acquisition in August. Therefore, the acquisition cost index for the inventories in December 2015, which indicates how the value of inventories is recorded in the business accounting, is computed as 122.8 (0.24 * 126.0 + 0.24 * 124.2 + 0.24 * 122.3 + 0.24 * 119.5 + 0.04 * 116.8). On the other hand, the current price of the same materials and supplies can be regarded as identical to the inventory price index of December 2015, 126.0, because the index reflects the composition of inventory items and their current prices as of December 2015. So, the conversion factor in December 2015 is 1.026 — computed as the December inventory price index 126.0 divided by the inventory (acquisition) cost index 122.8. This is displayed in Table 6.3.

In the case of the weighted-average cost method in Box 5.2, more monthly data should be applied. The (acquisition) cost index in December 2015 is in this case 125.8, which is computed as 0.3300 * 128.9 + 0.2210 * 126.7 + 0.1481 * 125.4 + 0.0993 * 124.3 + 0.0665 * 122.1 + 0.0446 * 122.4 + 0.0299 * 121.0 + 0.0200 * 119.4 + 0.0160 * 116.6 + 0.0140 * 114.4 + 0.0106 * 112.4. And the inventory price index of December 2015 is 128.9. The conversion factor is therefore 1.025 (= 128.9/125.8). This is also displayed in Table 6.3.

6.18. As shown in the above examples for the FIFO and weighted-average methods, the conversion factor is a link from the historical cost-based business book values to those valued at current prices. If prices rise (fall) during the inventory holding period, the conversion factor becomes more (less) than one. In other words, the business book value data are under(over)reported at that time.

At any rate, it should be kept in mind that obtaining high quality data for the inventory cost index and the inventory price index is a pre-requisite for the feasibility of these methods.

6.19. If the business book values are recorded under the LIFO method, the inventory book value data may be valued at very old prices because the last items acquired are withdrawn first. The LIFO method is not allowed under the International Accounting Standards, but certain countries may allow it nationally. As discussed in Section 6.4 paragraph 6.78 the LIFO reserve may be used to convert LIFO valued inventories to a FIFO basis. Once this conversion is done then the techniques described above for the FIFO valuation method can be used.

([31]) Bloem, Adriaan M., Robert J. Dippelsman, Nils O. Maehle, *Quarterly National Accounts Manual — Concepts, Data Sources, and Compilation*, International Monetary Fund, 2001, p.62–63. Example 3.A.1 shows a similar case for raw materials. The book values for raw materials are reflated into current prices by using their price index-to-cost index ratios. Available at http://www.imf.org/external/pubs/ft/qna/2000/textbook/ch3.pdf

Table 6.3: Computing a conversion factor for materials and supplies or goods for resale under the first-in-first-out and weighted-average cost methods

Year	Month	FIFO method			Weighted-average cost method		
		Monthly price index (PI)	Monthly cost index (CI)	Conversion factor (a=PI/CI)	Monthly price index (PI)	Monthly cost index (CI)	Conversion factor (a=PI/CI)
2014	January	101.4			105.1		
	February	102.3			106.6		
	March	103.0			106.8		
	April	103.6			107.0		
	May	104.5			107.2		
	June	104.1			107.4		
	July	103.6			107.6		
	August	103.4			107.8		
	September	103.8			108.0		
	October	104.2			108.2		
	November	105.0			108.4		
	December	105.5	104.6	1.009	108.9	108.4	1.005
2015	January	110.6			110.3		
	February	115.0			112.4		
	March	112.8			114.4		
	April	119.6			116.6		
	May	122.5			119.4		
	June	114.6			121.0		
	July	115.6			122.4		
	August	116.8			122.1		
	September	119.5			124.3		
	October	122.3			125.4		
	November	124.2			126.7		
	December	126.0	122.8	1.026	128.9	125.8	1.025

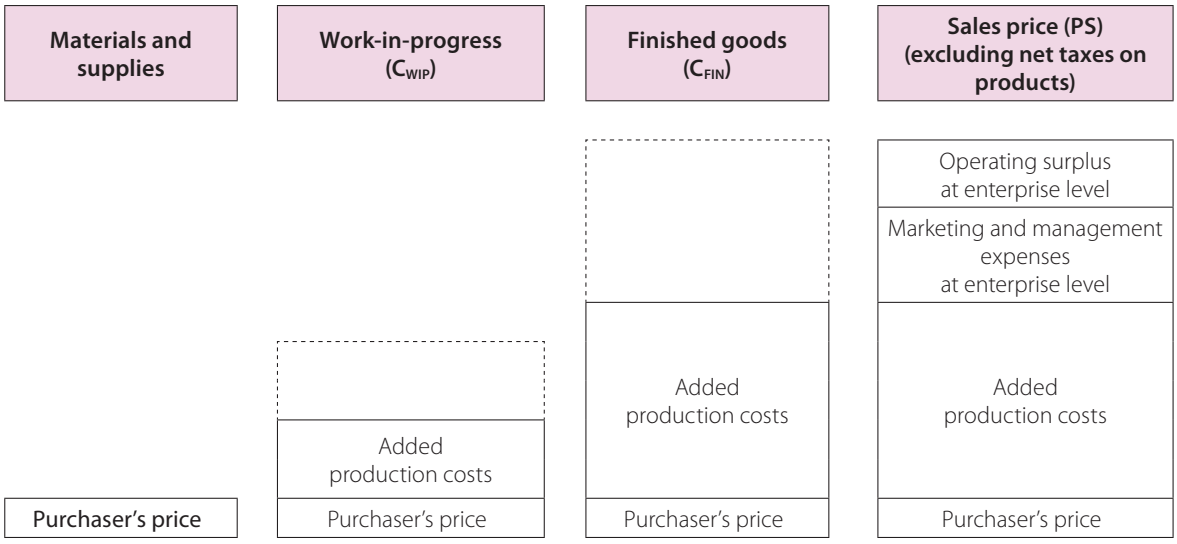
Source: Eurostat-OECD Task Force on Land and other non-financial assets; fictitious data

6.20. For work-in-progress and finished goods to be valued at basic prices according to national accounts, the conversion factor should include additional expenses not recorded in the business book value data, besides price changes occurring during the production process ([32]). As mentioned in Box 2.1, business book value data records mostly production related costs. From the national accounts perspective, expected operating surplus (or mixed income), and marketing and management costs borne at the enterprise level rather than at the establishment level need to be added in order to value them at basic prices ([33]). Figure 6.1 shows the current business accounting practices for inventories. Products are sold at *PS* and include operating surplus and marketing and management-related expenses. However, those accruing during the production process are not recorded as business production costs. The empty squares in Figure 6.1 show the missing expense items.

([32]) Business production cost means the cost incurred by a business when manufacturing a good or providing a service. The cost includes the direct material cost, direct labour cost and overhead cost. Here the overhead cost includes the rent, utility expenses, and depreciation of the factories, machinery, etc. related to the manufacturing or service provision. However, it does not include expected operating surplus, or marketing and administrative expenses incurred at the enterprise level rather than at the establishment or factory level. For valuation at basic prices, these relevant expenses should be added to the business production cost.

([33]) The *Quarterly National Accounts Manual* (published by the IMF, 2001) states in paragraph 10.14 that 'The usual principle to value an item when there is no transaction is the market-equivalent price. The market equivalent is what buyers would be prepared to pay if they wished to obtain the unfinished product or what suppliers would need to be paid to produce it. This value is equivalent to the total input costs for each period plus a mark-up. Because there is no separate mark-up for each quarter, the mark-up must be the ratio of output to costs for the whole production cycle. In other words, the net operating surplus is estimated as earned over the production cycle in proportion to costs in each period.

Figure 6.1: Business book value accounting of inventories according to the production process



Source: Eurostat-OECD Task Force on Land and other non-financial assets

6.21. What expense items should be added to the business accounting production costs in order for inventories to be valued at basic prices? For that purpose two possible computations are suggested. One is to use the business income statement in Table 6.4 that shows the cost components of the price. From the statement, the sales to cost of goods sold ratio as shown in equation (3) can be considered as a possible approximation for the missing expense items to be included. In the example, the conversion factor for work-in-progress and finished goods can be computed as 400/320 = 1.25. This means that, from the national accounts perspective, the business book value data for work-in-progress and finished goods should be valued at an amount 25 % higher:

(3) $$b_{i,j,t} = \frac{Sales}{Cost\ of\ goods\ sold}$$

if work-in-progress and finished goods are concerned.

6.22. As illustrated in Chapter 4, different business accounting methods will provide different cost of goods sold and therefore profits. If only one type of historical cost accounting method is used in a particular industry (or predominately used) then the national accountant can assume that $b_{i,j,t}$ is sufficient to convert the business book value data to national accounts concepts. If that national accountant finds that a particular industry uses different business accounting methods then the $a_{i,j,t}$ adjustment should also be applied.

6.23. Here, even though the conversion factor is basically for finished goods, the same factor is given for work-in-progress. However, this may not be true to the real world. With regard to valuation of work-in-progress, the SNA 2008 (paragraph 10.126) states 'For output with a production period of a year or less, and assuming that prices and costs remain stable during the period of production, the value of the additions to work-in-progress for non-agricultural products within a given accounting period can be approximated by calculating the proportion of the total production costs incurred in that period and applying that ratio to the basic price realised by the finished product. Thus, the value of the output of the finished product is distributed over the accounting periods in which it was produced in proportion to the costs incurred in each period.' Accordingly, if there is any additional information to distinguish between work-in-progress and finished goods, that information can be applied by the country concerned.

Table 6.4: Business income statement

Items	Amount	Ratio
Sales	400	100
Cost of goods sold	320	80
Gross profit or loss	80	20
Salses and administrative expenses	60	15
Operating income or loss	20	5
Non-operating income	16	4
Non-operating expenses	16	4
Income or loss before income tax	20	5
Income tax	4	1
Net income or loss	16	4

Source: Eurostat-OECD Task Force on Land and other non-financial assets; fictitious data

6.24. Another option is to use the supply-use tables (or input-output tables). Table 6.5 displays an example of a use table for an industry compiled at basic prices. If the national accountants can find out which expense items should be added to the business book value data from the use table information, this method can be another alternative. If it is assumed that expense items in intermediate consumption (132, 7.6 % of total input cost), compensation of employees (60, 3.5 %), consumption of fixed capital (25, 1.4 %) and operating surplus (110, 6.3 %), expensed at the enterprise level, are considered relevant as being added to the business book value for work-in-progress and finished goods, then the conversion factor can be approximated to 1.188 (= 1 + 18.8 %). In order to utilise the use table, it is important meanwhile to accurately pinpoint the relevant expense items at a detailed level.

Table 6.5: Example Industry use table, basic prices

Items	Amount of input items	Portion in total input (%)	Amount of items to be added to the inventory cost	Portion in total cost of the item (%)
Intermediate consumption	1 320	76.1	132	7.6
Compensation of employees	200	11.5	60	3.5
Operating surplus	110	6.3	110	6.3
Consumption of fixed capital	100	5.8	25	1.4
Other taxes on production	5	0.3		0.0
Total input	1 735	100.0	327	18.8

Source: Eurostat-OECD Task Force on Land and other non-financial assets; fictitious data

6.25. Now the information to move to the next step is available. Table 6.6 shows the conversion factors by inventory type and industry with fictitious data. Columns 2 and 5 list the conversion factors for materials and supplies and goods for resale across the years, and they move around unity. If prices rise (fall) during the holding period, the factors are higher (lower) than unity. For work-in-progress and finished goods, the conversion factors in Columns 3 and 4 range from 1.205 to 1.235, implying that their acquisition costs in business accounting need to be revalued from 20.5 % to 23.5 % in order for them to be valued at the basic prices.

Table 6.6: Factors to convert corporations' inventory stock data into national accounts valuation

Year	Materials and supplies	Work-in-progress	Finished goods	Goods for resale
	Manufacturing			
2009	1.018	1.235	1.235	1.010
2010	1.062	1.235	1.235	1.014
2011	0.992	1.220	1.220	0.998
2012	0.962	1.235	1.235	0.992
2013	0.983	1.220	1.220	1.000
	Wholesale and retail trade			
2009	1.014	1.205	1.205	1.009
2010	1.041	1.205	1.205	1.009
2011	0.992	1.205	1.205	1.004
2012	0.974	1.205	1.205	0.997
2013	0.990	1.220	1.220	1.002

Source: Eurostat-OECD Task Force on Land and other non-financial assets; fictitious data

6.26. By multiplying the initial values of corporations' inventory data by the conversion factors in Table 6.6, the value of inventory stock consistent with national accounts is calculated. Table 6.7 shows the resulting values of inventory stock, by inventory type for each industry. For example, the value of materials and supplies in manufacturing for 2013, 18 186 (column 2 in Table 6.7), is computed by multiplying the figure for the same year in Table 6.2, 18 500, by the corresponding conversion factor of 0.983 (18 186 = 18 500 * 0.983). The figures in that same row are computed likewise.

12 200 = 10 000 * 1.220

20 496 = 16 800 * 1.220

3 800 = 3 800 * 1.000

Table 6.7: Inventory stock estimates from national accounts perspective, by industry and inventory type

Year	Materials and supplies	Work-in-progress	Finished goods	Goods for resale	Total
	Manufacturing				
2009	15 168	9 263	13 956	2 929	41 315
2010	18 054	10 745	16 673	3 245	48 716
2011	19 146	12 810	19 398	3 693	55 046
2012	17 989	12 474	20 131	3 571	54 165
2013	18 186	12 200	20 496	3 800	54 682
	Wholesale and retail trade				
2009	1 217	362	3 013	25 427	30 018
2010	1 353	482	3 977	27 848	33 660
2011	1 488	844	5 061	32 530	39 922
2012	1 364	723	4 941	33 499	40 526
2013	1 386	732	4 636	33 567	40 321

Source: Eurostat-OECD Task Force on Land and other non-financial assets; fictitious data

C) THE COVERAGE MULTIPLIERS APPLIED TO INCLUDE ALL CORPORATIONS IN THE INDUSTRY

6.27. Even if the value of inventory stock owned by corporations has been computed through the above procedures, some enterprises such as unincorporated ones may not be included in the source data ([34]). In this case, the inventories owned by them should also be included in order to obtain the industry-wide inventory stock. This can be accomplished using a coverage multiplier, $c_{i,j,t}$, an estimate of how much inventory should be added to cover enterprises not reported in the source data.

6.28. Table 6.8 shows possible coverage multipliers by inventory type and industry, for use in expanding the coverage to inventories owned by enterprises not reported in the source data. Although the numbers are fictitious, the role of unincorporated and other missing enterprises may be higher in the wholesale and retail trade sector than in manufacturing.

6.29. The coverage multiplier can be computed in different ways depending upon the country's data situation. If there is a large-scale business census for a benchmark year, information may be available for the share of inventories held by unincorporated enterprises for each industry. This information can be used for estimating the coverage multiplier until the next census is carried out. If, on the other hand, the scale of revenue acquired by unincorporated enterprises in an industry, and their relative share in that industry, are available, this information may also be used as a proxy in computing the coverage multiplier for the industry.

Table 6.8: Coverage multipliers for inclusion of unincorporated enterprises

Year	Materials and supplies	Work-in-progress	Finished goods	Goods for resale
	Manufacturing			
2009	1.10	1.05	1.07	1.05
2010	1.09	1.04	1.07	1.04
2011	1.09	1.04	1.07	1.06
2012	1.09	1.04	1.07	1.04
2013	1.09	1.05	1.07	1.03
	Wholesale and retail trade			
2009	1.04	1.01	1.34	1.14
2010	1.04	1.01	1.36	1.12
2011	1.04	1.02	1.38	1.14
2012	1.03	1.01	1.25	1.09
2013	1.02	1.01	1.20	1.10

Source: Eurostat-OECD Task Force on Land and other non-financial assets; fictitious data

D) COMPUTING TOTAL INVENTORY STOCK FOR THE ECONOMY AS A WHOLE

6.30. Multiplying inventory stocks owned by corporations in Table 6.7 by the coverage multipliers in Table 6.8 results in the total inventory stock by industry as shown in Table 6.9. By summing up inventory stocks across industries the total value of inventory stock for the overall economy is obtained. The last five rows in Table 6.9 show the total values of inventory stock for the entire economy from 2009 to 2013. In addition, as procedures in Sections A) through D) are carried out by inventory type at the industry level, the result is the inventory stock by type, by industry, and by type and industry, as well as inventory stock for the economy as a whole.

([34]) Here unincorporated enterprises are suggested as one example of enterprises whose financial statements are not available. If government and non-profit institutions are not included in the source data, the inventories owned by them need to be separately considered. Corporations meanwhile include both incorporated enterprises and quasi-corporations. By definition according to the SNA 2008 paragraph 4.42 and ESA 2010 paragraph 2.13 quasi-corporations have complete sets of accounts and so may be deemed to have their own inventory accounts. If quasi-corporations are not included in the previous procedures, the multiplier should cover them as well.

Table 6.9: Inventory stock estimates from perspective of national accounts, by industry and inventory type

Year	Materials and supplies	Work-in-progress	Finished goods	Goods for resale	Total
	Manufacturing (A)				
2009	16 685	9 726	14 932	3 075	44 418
2010	19 589	11 174	17 840	3 375	51 977
2011	20 869	13 322	20 756	3 914	58 861
2012	19 608	12 972	21 540	3 714	57 835
2013	19 822	12 810	21 931	3 914	58 477
	Wholesale and retail trade (B)				
2009	1 265	365	4 037	28 987	34 654
2010	1 407	487	5 408	31 190	38 493
2011	1 548	860	6 984	37 084	46 476
2012	1 405	730	6 176	36 514	44 824
2013	1 414	739	5 563	36 924	44 640
	Manufacturing plus wholesale and retail trade (A+B)				
2009	17 950	10 091	18 969	32 062	79 072
2010	20 996	11 661	23 248	34 565	90 470
2011	22 416	14 183	27 740	40 998	105 337
2012	21 013	13 703	27 715	40 228	102 659
2013	21 236	13 549	27 494	40 838	103 117

Source: Eurostat-OECD Task Force on Land and other non-financial assets; fictitious data

6.31. Considering the above procedures, it can be concluded that if corporations' accounting data are available, then the annual inventory stock level for the entire economy in the national accounts can be estimated through direct use of that information ([35]). The availability and completeness of corporations' inventory data will therefore be a pre-requisite for using this approach. If these are inadequate, then different methods should be applied. Sections 6.3 and 6.4 introduce the direct method and the perpetual inventory method.

E) DECOMPOSING VALUE CHANGES INTO PRICE AND VOLUME CHANGES

6.32. The steps detailed above outline the estimation process for the annual inventory stock level. In order to compile more complete national accounts, it is necessary to decompose the annual increases or decreases in the values of inventory stock into changes in volumes and changes in prices. Here changes in volumes can be decomposed further into changes in inventories (also termed as transactions) and other changes in the volume of assets.

6.33. When moving to the work of decomposing the value of the annual inventory stock, inventory price indices should be available at the industry level ([36]). The method of compiling the price index for inventories is discussed in Chapter 5.2 ([37]). Table 6.10 shows how the end-of-year volume of inventory is computed, by inventory type, when price indices are available. If the nominal values of the inventory stock (in the first five lines) are deflated with the relevant end-of-year price indices (in the middle five lines), then the volumes of inventories are obtained (in the last five lines). For example, the volume of materials and supplies for 2013, 20 360, is computed by the value 21 236 deflated with its price index of 1.043 (20 360 = 21 236/1.043).

([35]) If government and non-profit institutions, etc., are not included in the above procedure, they should be considered separately and added to the inventory estimates.

([36]) As the value of inventories is estimated at the industry level in the above explanation, the decomposition is also done at the same industry level. For simplicity, however, Table 6.10 explains the decomposition at the national level.

([37]) The *Quarterly National Accounts Manual* (published by the IMF, 2001), suggests in paragraph 3.A1.8 that '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.

Table 6.10: Price deflators and volume measures of inventories

Year	Materials and supplies	Work-in-progress	Finished goods	Goods for resale	Total
	Values of inventory stock as of the year-end (A) (from Table 6.9)				
2009	17 950	10 091	18 969	32 062	79 072
2010	20 996	11 661	23 248	34 565	90 470
2011	22 416	14 183	27 740	40 998	105 337
2012	21 013	13 703	27 715	40 228	102 659
2013	21 236	13 549	27 494	40 838	103 117
	Price indices as of the year-end, with 2010=1 (B)				
2009	0.986	0.990	0.990	0.990	
2010	1.013	1.010	1.010	1.008	
2011	1.030	1.030	1.030	1.025	
2012	1.038	1.051	1.051	1.043	
2013	1.043	1.072	1.072	1.059	
	Volumes of inventories as of the year-end (A/B)				
2009	18 205.4	10 192.7	19 160.7	32 385.9	
2010	20 726.6	11 545.6	23 017.4	34 290.5	
2011	21 763.3	13 769.7	26 932.1	39 998.0	
2012	20 243.7	13 037.7	26 370.4	38 569.7	
2013	20 360.4	12 639.3	25 647.3	38 562.5	

Source: Eurostat-OECD Task Force on Land and other non-financial assets; fictitious data

6.34. Depending upon data availability, the annual increase or decrease in the value of inventory stock can be decomposed into other changes in volume and nominal holding gains and losses ('holding gains') in two different ways. In general, holding gains can be estimated as the residual from the total changes in value of inventories by deducting those changes in value that are attributable to transactions (also recorded as changes in inventories in the capital account) and to other changes in volume ([38]).

On the other hand, if information on the developments of inventory prices is available, it might be possible to estimate the holding gains first and then derive other changes in the volume of assets as a residual. However, both principles lead to the same results for other changes in volume and the corresponding holding gains and vice versa. In the following example, it is assumed that transactions come from the capital account in the national accounts.

([38]) If other changes in the volume of assets cannot be computed separately, then the next suggestion will be a more feasible option for the decomposition.

6.35. Both methods start with the increase or decrease in the value of inventory stock (per inventory type i) during period t, $\Delta INV_{i,t}$.This can be estimated by

$$(4)\ \Delta INV_{i,t} = INV_{i,tE} - INV_{i,tE-1} = PI_{i,tE} * \frac{INV_{i,tE}}{PI_{i,tE}} - PI_{i,tE-1} * \frac{INV_{tE-1}}{PI_{tE-1}}$$

$$= (PI_{i,tE} + PI_{i,tE-1})/2 * \left(\frac{INV_{i,tE}}{PI_{i,tE}} - \frac{INV_{tE-1}}{PI_{tE-1}}\right) + \left(\frac{INV_{tE}}{PI_{tE}} + \frac{INV_{tE-1}}{PI_{tE-1}}\right)/2 * (PI_{i,tE} - PI_{i,tE-1})$$

$$= \overline{PI}_{i,tE} * (INVQ_{i,tE} - INVQ_{i,tE}) + \overline{INVQ}_{i,tE} * (PI_{i,tE} - PI_{i,tE-1})$$

$$= \Delta S_{i,t} + \Delta Vol_{i,t} + Hold_{i,t}$$

where $INV_{i,tE} - INV_{i,tE-1}$ reflects the increase or decrease in the value of inventory (per inventory type i) during time t, and can be decomposed into price changes, $\overline{INVQ}_{i,tE} * (PI_{i,tE} - PI_{i,tE-1})$, and volume changes, $\overline{PI}_{i,tE} * (INVQ_{i,tE} - INVQ_{i,tE-1})$. Otherwise the increase or decrease in the value of inventories can be decomposed into transactions, $\Delta S_{i,t}$, other changes in volume, $\Delta Vol_{i,t}$,and the holding gains, $Hold_{i,t}$.

Here the average volume data during time t is defined as $\overline{INVQ}_{i,tE}$ or $\left(\frac{INV_{tE}}{PI_{tE}} + \frac{INV_{tE-1}}{PI_{tE-1}}\right)/2$,and the corresponding average price, as $\overline{PI}_{i,tE}$ or $\frac{(PI_{i,tE} + PI_{i,tE-1})}{2}$.

6.36. If information on the developments of inventory prices is available, then holding gains (per inventory type) can be approximately estimated by

$$(5)\quad Hold_{i,t} = \left(\frac{INV_{tE}}{PI_{tE}} + \frac{INV_{tE-1}}{PI_{tE-1}}\right)/2 * (PI_{i,tE} - PI_{i,tE-1})$$ [39]

and, correspondingly, other changes in volume (per inventory type i) can be deduced by

$$(6)\quad \Delta Vol_{i,t} = \Delta INV_{i,t} - \Delta S_{i,t} - Hold_{i,t}$$

where transactions, i.e. data on acquisition less withdrawals of inventories, $\Delta S_{i,t}$, are assumed to be obtained from the capital account.

6.37. If the other changes in the volume of assets can be estimated separately, then holding gains and losses can also be deduced as the residual of the total increase or decrease in the value of inventories less transactions less other changes in the volume of assets. If so, the holding gains can then be deduced by

$$(7)\quad Hold_{i,t} = \Delta INV_{i,t} - \Delta S_{i,t} - Hold_{i,t}$$

6.38. Table 6.11 illustrates the procedure for separating the difference between opening and closing stock values into transactions, other changes in volume, and holding gains based on the information in Table 6.10, where the value data on the stock of inventories, volume data on the stock of inventories, and price data of inventories are available ([40]).

([39]) In the Eurostat-OECD compilation guide on land estimations equation (5) was mentioned as an alternative way of computing nominal holding gains and losses. The volume of inventories changes continuously depending on market demand and supply, while the land area will scarcely change. This is why the alternative way for computing nominal holding gains and losses suggested in the case of land is treated as the base method in the case of inventories. See Eurostat/Organisation for Economic Co-operation and Development, *The Eurostat-OECD compilation guide on land estimation*, Publication Office of the European Union, Luxembourg, 2015. Available at http://ec.europa.eu/eurostat/documents/3859598/6893405/KS-GQ-14-012-EN-N.pdf

([40]) In Tables 6.11 and 6.12, other changes in the volume of inventories are computed under the assumption that they occupy 2 % of the value changes.

Table 6.11: Decomposition of difference between opening and closing stock values with other changes in volume as residual

Year	Materials and supplies	Work-in-progress	Finished goods	Goods for resale	Total
	Ending stock value less opening stock value (computed from Table 6.10)				
2010	3 046	1 570	4 278	2 503	11 397
2011	1 420	2 522	4 492	6 433	14 867
2012	-1 403	-480	-25	-770	-2 678
2013	223	-153	-221	610	458
	Holding gains (computed from Table 6.10)				
2010	526	217	422	600	1 765
2011	361	253	499	631	1 745
2012	168	281	560	707	1 716
2013	102	270	546	617	1 534
	Transactions in inventories from the capital accounts				
2010	2 459	1 322	3 771	1 853	9 404
2011	1 031	2 219	3 903	5 673	12 825
2012	-1 543	-752	-584	-1 462	-4 341
2013	117	-420	-764	-20	-1 086
	Other changes in volume of inventories (from above data)				
2010	61	31	86	50	228
2011	28	50	90	129	297
2012	-28	-10	0	-15	-53
2013	4	-3	-4	12	9

Source: Eurostat-OECD Task Force on Land and other non-financial assets; fictitious data

6.39. Table 6.11 shows the case where the other changes in the volume of assets are estimated as the residual. Using a different approach, holding gains can be also computed as the residual. Table 6.12 displays an example of this case.

Table 6.12: Decomposition of difference between opening and closing stock values with holding gains and losses as residual

Year	Materials and supplies	Work-in-progress	Finished goods	Goods for resale	Total
	Ending stock value less opening stock value (computed from Table 6.10)				
2010	3 046	1 570	4 278	2 503	11 397
2011	1 420	2 522	4 492	6 433	14 867
2012	-1 403	-480	-25	-770	-2 678
2013	223	-153	-221	610	458
	Other changes in volume of inventories (separately computed)				
2010	61	31	86	50	228
2011	28	50	90	129	297
2012	-28	-10	0	-15	-53
2013	4	-3	-4	12	9
	Transactions in inventories from the capital accounts				
2010	2 459	1 322	3 771	1 853	9 404
2011	1 031	2 219	3 903	5 673	12 825
2012	-1 543	-752	-584	-1 462	-4 341
2013	117	-420	-764	-20	-1 086
	Holding gains (from above data)				
2010	526	217	422	600	1 765
2011	361	253	499	631	1 745
2012	168	281	560	707	1 716
2013	102	270	546	617	1 534

Source: Eurostat-OECD Task Force on Land and other non-financial assets; fictitious data

Strengths and weaknesses

6.40. Before applying the method and directly using the business book value data for estimating the value of the annual inventory stock in the national accounts, users should consider the method's major strengths and weaknesses. While it has a general advantage as a simple and easy computational methodology, its data requirements are highly burdensome. First of all, very comprehensive corporate accounting data should be available to and accessible by the national accountants. The conversion factors and coverage multipliers should be computed separately. The price indices for inventories should also be compiled in a consistent way.

6.41. Compiling the price indices for inventories may be one of the most difficult tasks. In the ideal case, every component of inventories in each industry should be known to national accountants. These components differ across industry, and should be matched with the relevant price index data. Compiling the indices for work-in-progress and finished goods adds to the difficulty, because their price indices should be based on basic price valuations.

6.42. It should in addition be decided at which industry level the computation should start. A more detailed breakdown of industries will usually give more realistic results. However, when businesses' book value data are used directly, such a breakdown may worsen the mismatching of corporations with industries. In a sense, therefore, a broader industry classification may be more desirable for estimating the annual inventory stock level through direct use of corporations' inventory data. All these choices depend upon countries' data sources.

6.43. When the annual inventory stock is estimated by direct use of corporations' inventory data, the process needs to be consistent with the estimation of the annual changes in inventories of the national accounts.

If the data and methodology are applied differently, this can lead to unexplainable gaps between them. A harmonising process may be necessary to ensure consistency between them.

6.44. It should be noted that estimating the annual inventory stock level in the national accounts by directly using businesses' book value data may not always be possible. If businesses' accounting data are unavailable or their coverage is not comprehensive, different methods of estimation should be considered. Two other approaches explained below will be possible options in such cases. It is inevitable that countries develop their own reasonable alternatives, in consideration of their own data constraints.

Box 6.1: Estimation of inventory stock by direct use of business book value — Korea

Introduction

In Korea the value of annual inventory stock (AN.12) is estimated by industry using basically one of two methods:

(a) the direct use of business book value data; or

(b) the price times quantity method.

For most industries, inventory stocks are estimated through the former method, whereas petroleum products or products such as cereals, livestock and marine products included in agriculture, forestry and fishing, etc. are estimated by the latter.

In the following it is explained in more detail how inventory stocks for relevant industries in Korea are estimated through direct use of business accounts data. In next section the basic estimation equation is presented. Subsequently the data sources used in applying the method are explained. The section 'estimation of conversion factors' then shows how the business book value data are converted into basic prices for work-in-progress and finished goods. In the section 'estimation of coverage multiplier' the initial estimate of the value of inventory stock for an industry is expanded to include all enterprises in the same industry. In the following section changes in the value of annual inventory stocks are split into changes in price and in volume. The inventory price deflator is thus also touched on. The final section then presents a comparison of inventory stock-to-GDP ratios across countries.

Basic estimation equation

Whenever the value of inventory stock is estimated from business accounts by industry, Korea uses equation (0)', similar to equation (1) introduced previously in this chapter. The total value of the inventory stock in the observed year t, INV_t, is computed as the accumulation of inventories across industries. In the case of a specific industry, the value of businesses' i-type book values in industry j in the observed year t, $CBV_{i,j,t}$, is converted into current prices as suggested in the national accounts by conversion factors, $a_{i,j,t}$, and $b_{i,j,t}$, under the assumption that business book value data can be well matched with the definitions of the national accounts. The conversion factor, $a_{i,j,t}$, is applied to materials and supplies and goods for resale. The conversion factor, $b_{i,j,t}$, is applied to work-in-progress and finished goods among the different inventory types in order to add operating surplus and other relevant cost items. A coverage multiplier, $c_{i,j,t}$, is then applied to include all enterprises in the same industry. In Korea, business accounts are not available for so called small, unincorporated enterprises. Accordingly, it is inevitable that a coverage multiplier be used for most industries. In Korea, the relative revenue acquired by the unincorporated enterprises within an industry is used as a proxy for the relative inventory amount in the industry:

(8) $$INV_t = \sum_{j=1}^{m} \sum_{i=1}^{n} CBV_{i,j,t} * a_{i,j,t} * b_{i,j,t} * c_{i,j,t}$$

Data sources

Business inventory data in Korea comes basically from one of two sources: the annual mining and manufacturing survey, or businesses' financial statements. Businesses' financial statements are those announced by the businesses themselves or reported to the authorities for taxation purposes. As the mining and manufacturing survey, which is done on an establishment basis, does not include goods for resale, those items are added by referring to businesses' financial statements. Since manufacturing enterprises may operate in several business areas, in wholesale and retail trade for example, items related to goods for resale may appear on their financial statements and so need to be added in their inventory stock estimations.

When inventory items in businesses' financial statements are used, items conceptually inconsistent with the national accounts are excluded, if identified, and the remaining items are then matched with the inventory type classifications of the national accounts.

Table 6.13: Data sources for estimating inventories, by type and industry

National accounts industries	Data sources			
	Materials and supplies	Work-in-progress	Finished goods	Goods for resale
Mining and quarrying	Mining and manufacturing survey			Businesses' financial statements
Manufacturing				
Electricity, gas, steam and water supply	Businesses' financial statements			
Services excluding public administration and defense				
Construction				

Source: The Bank of Korea

Estimation of conversion factors

After businesses' inventory items are matched with the inventory type classifications of the national accounts, they are converted into current prices by conversion factors. In the case of materials and supplies or goods for resale, the conversion factor, $a_{i,j,t}$, plays a role. It has, meanwhile, not been seriously considered in the current estimation programme since the holding period for materials and supplies or goods for resale is considered as not so long, and the price-sensitive inventory items are estimated by the direct approach. This practice is scheduled to be reviewed in the next base year revision. For work-in-progress and finished goods, the conversion factor, $b_{i,j,t}$,is computed by the ratio of sales to cost of goods sold. More specifically, the SNA-based i-type inventory item in industry j, $INV_{i,j,t}$,is computed as the book value-based i-type inventory item in industry j, $CBV_{i,j,t}$, multiplied by the sales to cost of goods sold ratio in industry j, $\frac{SALES_{j,t}}{COST_{j,t}}$ as displayed in equation (9). Here the sales to cost ratio is the conversion factor, $b_{i,j,t}$, in that industry. It is computed and applied in each industry.

(9) $$INV_{i,j,t} = CBV_{i,j,t} * b_{i,j,t} = CBV_{i,j,t} * \frac{SALES_{j,t}}{COST_{j,t}}$$

Estimation of coverage multiplier

In Korea, financial statements are usually only available for incorporated enterprises and large unincorporated enterprises that are classified as quasi-corporations and included in the corporate sector of the national accounts. The mining and manufacturing survey also collects inventory data only for enterprises employing 10 or more workers. In order to estimate the industry-wide inventory stock value, therefore, the remaining small, unincorporated enterprises whose financial accounts are not available must inevitably be added.

In Korea the ratio of revenue by small unincorporated enterprises relative to those of incorporated and large unincorporated enterprises is used as a proxy for computing their relative inventory amount. This figure can be considered the coverage multiplier, $c_{i,j,t}$,as displayed in equation (8). It is also computed and applied separately for each industry, so that the industrial structure is reflected in the ratio of each industry. This ratio tends to cause an increase of less than 3 % in the total inventory stock of the relevant industries in Korea, although that differs considerably across industries.

Decomposition of value changes in inventory stock into price and volume effects

If the values of inventory stock and inventory price deflators by industry and inventory type are all available, as well as changes in inventories (P.52) from the capital accounts, then the annual increase or decrease in the value of inventory stocks can be split into transactions and other flows, or into transactions, nominal holding gains and losses and other changes in the volume of assets, as shown in equation (10).

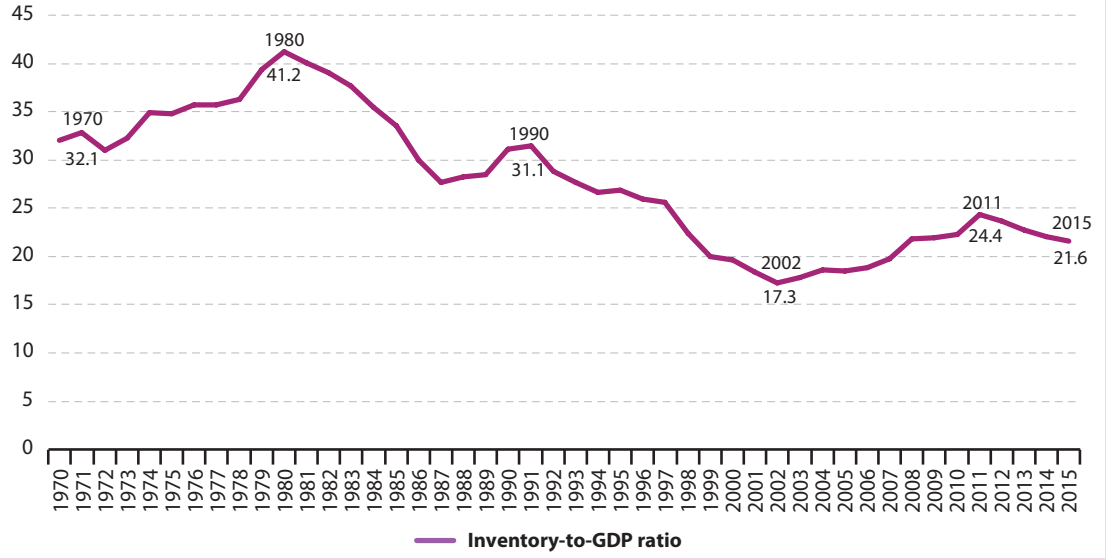
(10) *Value changes in annual inventory stock*
= transactions + other flows
= transactions + nominal holding gains and losses
+ remaining other changes in the volume of assets

If the relevant deflators are available, changes in inventories (in other words transactions) are usually computed by changes in inventory volume during the period concerned multiplied by the average price deflator during the same period. Nominal holding gains and losses are computed next, and the remaining part is attributed to other changes in the volume of assets. When nominal holding gains and losses are computed according to equation (10), the industry gross output (control totals) deflator is used in Korea at present. More elaboration is scheduled in the next benchmark revision regarding inventory-specific price deflators.

Cross-country inventory-to-GDP ratio comparison

Figure 6.2 displays the values of the inventory stock-to-GDP ratio in Korea. The Korean inventory-to-GDP ratio showed a decline from the 1980s to the early 2000s, then reversed to rise from 17.3 % in 2002 to 24.4 % in 2011, and has since fallen again to a value of 21.6 % in 2015. Since the 1970s the necessity for stockpiling inventories seems to have eased, due to the development and upgrading of transportation and communication technology. The ratio's increase since the early 2000s seems to have been due basically to the more heightened geopolitical risks across regions, and to increases in international raw materials prices.

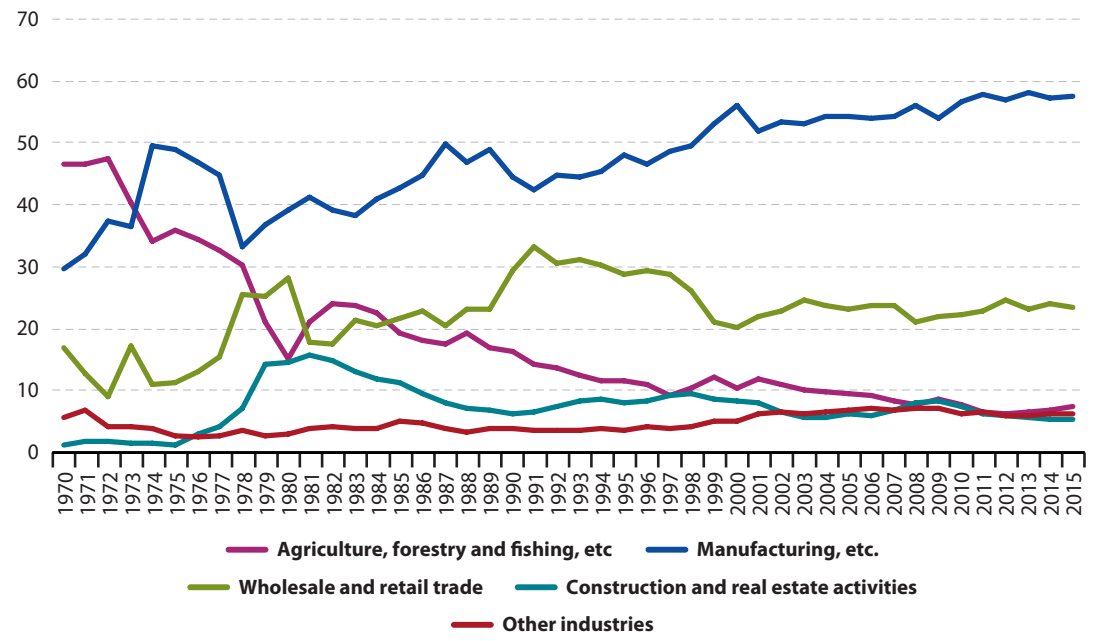
Figure 6.2: Korean inventory-to-GDP ratio movements (%)



Source: The Bank of Korea

Figure 6.3 compares the shares of different industries in the total inventory stock value in Korea. The most striking feature is that the inventory stock in agriculture, forestry and fishing industries has fallen from over 40 % of the total in 1970 to less than 10 % today. The inventory stock in manufacturing has in contrast shown a continued increase in its share, to surpass 50 % in 2015. The wholesale and retail trade, etc. industry has accounted for more than 20 % of the total inventory stock since the 2000s. The inventory stock in construction and real estate activities seems to have moved in accord with investments in social infrastructure or with domestic real estate market conditions.

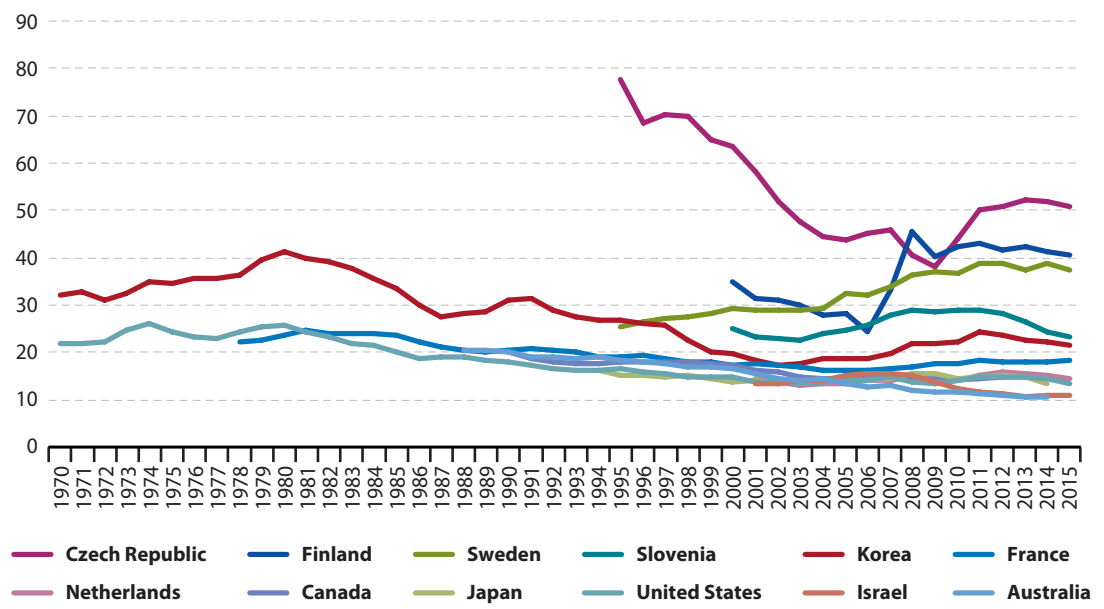
Figure 6.3: Industry shares of the inventory stock value in Korea (%)



Source: The Bank of Korea

Figure 6.4 compares the inventory-to-GDP ratios across different OECD countries. While there have been variations in the ratios among countries, ratios declined overall from the early 1980s until the early 2000s. Since then the trends have diverged across countries. For some countries they have reversed to show increases until recently, while for other countries they have continued declining or showed stagnation.

Figure 6.4: Cross-country inventory-to-GDP ratio comparison (%)



Source: OECD statistics database

6.3 Direct estimation inventory stocks

Introduction

6.45. For some products that are classified as inventories, price and quantity data are directly available to national accountants. This may usually be the case in most countries for cereals, livestock, fuel-related products, etc. In such cases, the price times quantity method leads to more accurate and timely estimates of inventories. This chapter therefore explains the price times quantity method, as another option for estimating the annual inventory stock (AN.12) in national accounts.

6.46. If the price times quantity method is to be employed, the price and quantity information for the relevant inventory items should be available. For example, most countries cultivate crops and breed livestock for their own food supplies or further manufacturing processing. The prices for these agricultural products are also available or collectable from the market. However, for a more detailed discussion of estimation of agricultural products see Section 8.2.

6.47. Additionally, fuel-related items such as coal, crude oil, petroleum products, natural gas, etc. are mined domestically or imported from abroad. The domestic prices of these products are highly affected by international prices, and their quantity information is relatively well recorded in order to facilitate meeting national energy consumption goals or maintaining reasonable energy stock levels. Some countries may moreover record inventories for steel industry products in quantity terms, and their prices may also be available. In these cases the price times quantity approach can give quite reasonable and timely estimates of the inventory stock levels at the relevant domestic, import or international prices.

6.48. Given that the collection of both price and quantity data may not be possible for all products in the economy, the price times quantity method should be understood as a supplementary tool rather than a comprehensive one. When the direct use of corporate inventory data or the perpetual inventory method cannot be applied, the price times quantity approach can be considered as an alternative choice.

Description of method

6.49. The price times quantity method seems quite simple, because where both are available the price of a product is readily combined with its quantity. This approach may be more suitably applied at the product rather than the industry level, since price and quantity data are particularly product-specific. Under these assumptions, the inventory stock level for the relevant product can be computed by

(11) $INV_t = \sum_{i=1}^{n} p_{i,t} * q_{i,t}$

where INV_t is the value of the inventory stock at time t for the product, which is estimated using the direct approach, $p_{i,t}$ the price of the product, and $q_{i,t}$ its quantity. The price $p_{i,t}$ should be valued according to the valuation principle of the SNA 2008, and can be derived from the domestic or the international markets.

6.50. The price times quantity method for estimating the annual inventory stock in the national accounts can be described in more detail by the following steps:

(a) Selection of the products for which inventories can be estimated through the price times quantity method. This is because the direct method is considered a supplementary approach, only for products whose price and quantity data are relatively easy to obtain. The product selection needs to be as specific as possible, in order for the price to be well matched with the quantity.

(b) The quantity information on the selected products should then be collected. In the case of livestock bred for meat, or petroleum or steel products, quantities may be available as of the end of the year. For agricultural products such as wheat or rice, quantities should be adjusted as of the end of the year since their harvests are usually concentrated in particular seasons within the year.

(c) The quantity of the product under consideration is now multiplied by its price, which gives its value as inventories. Here the price data may come from the domestic market price, the import price or the international market price.

(d) The summed values of products as inventories should be allocated by inventory type, by relevant institutional sector, and by industry.

(e) As the price, quantity and value are all available for a product, any change in their value can be decomposed into volume changes and price changes, or into transactions, other changes in the volume of assets, and nominal holding gains and losses. This decomposition of course requires transaction information from the sectoral capital accounts.

A) SELECTION OF PRODUCTS TO BE ESTIMATED USING DIRECT METHOD

6.51. In order to apply the direct approach, the products to be estimated using it should first be selected. The availability of both price and quantity data will be the first criteria for this choice. For most countries, agricultural products, fuel-related products and steel industry products may be possible candidates. Cereals, oilseeds, livestock, fish, cotton, etc. can be objects among agricultural products; crude oil, petroleum products, natural gas, coal, biofuels, etc. among fuel-related products; and iron ore, cokes, plate, rolled steel, certain types of beams, deformed steel bars, etc., among steel industry products.

6.52. The selection of products in this case should be done at a level as specific as possible, since the price data can be available at very detailed levels. For example, cereals comprise wheat, rice, maize, barley, oats and sorghum, and each of these items may also include numerous varieties that differ in price. This will be the same for fuel-related and steel industry products.

6.53. For cultivated biological resources it is necessary to distinguish between single-use plants, trees and livestock, which produce output only once, and trees and animals that are used repeatedly or continuously for more than one year. Work-in-progress single-use cultivated biological resources should be treated as inventories, whereas repeat yield resources should be excluded from the annual inventory stock estimation since they are classified as fixed capital. Animal resources that are classified as fixed capital include dairy cattle, draft animals, sheep or other animals used for wool production, and animals used for transportation, racing or entertainment. Tree, crop and plant resources include trees (including vines and shrubs) cultivated for fruits and nuts, for sap and resin, and for bark and leaf products (SNA 2008 paragraphs 10.92 and 10.95, ESA 2010 Annex 7.1).

6.54. In the following, four products are chosen as examples: wheat, beef cattle, crude oil and hot coil steel. Although the detailed specification of each product is not explained here, the product specification should be as detailed as possible so that the product is well matched with its price data.

B) QUANTITY DATA FOR SELECTED INVENTORY ITEMS PREPARED

6.55. Once the items to be estimated through the direct approach have been chosen, their quantity data should be prepared. In obtaining the quantity data, care should be given to avoiding any problems of under counting or double counting. For agricultural products, most of the harvest or livestock will be sold to manufacturing or wholesale and retail businesses as of the end of the year, and the businesses purchasing them will record them as inventories on their accounts. The unsold remaining portions will however be held by the farmers for their own purposes or for later sale. This part should be added as annual inventories of agricultural products in the national accounts. In the case for example of fuel-related and steel industry products, when inventory items are estimated using the direct method, the related corporate inventory data should be reduced by the same amount in order to avoid double counting.

6.56. Further, if the inventory types, industries and institutional sectors for the estimated products are determined at the initial estimation stage, step d) can be carried out more straightforwardly. It is therefore recommended that, when the direct approach is applied, this information be worked out during the early stage of the estimation.

6.57. Table 6.14 shows the quantity data of the four example items: wheat in units of 1 000 tonnes, beef cattle in 1 000 head, crude oil in 1 000 barrels, and hot coil steel in 1 000 tonnes. In the example, the products' inventory types are determined in advance. Crude oil is categorised as materials and supplies, wheat and

beef cattle as work-in-progress, and hot coil as finished goods. The industries to which the products belong are also shown in order to clarify the scope of estimation.

Table 6.14: Quantities to be estimated as inventories by price times quantity method (end-of-year basis)

Year	Wheat (1 000 tons)	Beef cattle (1 000 heads)	Crude oil (1 000 barrels)	Hot coil (1 000 tons)
	Work-in-progress	Work-in-progress	Materials and supplies	Finished goods
	Agriculture	Agriculture	Manufacturing of coke and refined petroleum products	Manufacturing of basic metals
2010	3 430	2 900	7 600	3 000
2011	3 410	2 950	11 000	3 200
2012	3 260	3 060	13 000	3 500
2013	3 530	2 900	19 000	3 400
2014	3 730	2 800	27 000	3 700
2015	3 630	2 700	37 000	3 500

Source: Eurostat-OECD Task Force on Land and other non-financial assets; fictitious data

C) PRICE DATA MULTIPLIED BY QUANTITY DATA TO OBTAIN VALUE OF INVENTORY

6.58. The direct estimation of inventories requires not only the quantity data of the items concerned but also their appropriate price information. The prices should reflect the valuation principle, as required by the SNA 2008 and ESA 2010. Materials and supplies should be valued at purchasers' prices, work-in-progress and finished goods at basic prices, and goods for resale at the prices paid. The price data comes from the relevant market, and is chosen from the transaction price of the same or the most similar product. It can therefore be said that the valuation principle of the SNA 2008 for inventory items is well preserved in the direct approach.

6.59. Table 6.15 provides an illustration of the unit prices for the various items. The price for beef cattle is denominated in values per 400 kilograms. Since the beef cattle quantity is counted in 1 000 head, as shown in Table 6.14, 400 kilograms can be understood as an approximation of the average weight of all beef cattle under consideration.

Table 6.15: Market prices for respective items (end-of-year basis)

Year	Wheat (price per tonne)	Beef cattle (price per 400 kg)	Crude oil (price per barrel)	Hot coil (price per tonne)
2010	200	1 150	68	510
2011	184	1 296	80	475
2012	229	1 306	77	485
2013	177	1 190	76	455
2014	192	1 740	50	414
2015	150	1 351	33	375

Source: Eurostat-OECD Task Force on Land and other non-financial assets; fictitious data

6.60. In practice, the matching of quantity and price for an inventory item may not be so straightforward. As the quantity data boil down to more detailed specifications, the price data for some items may not be available. In such a case a method of approximation should be applied so that reliable prices for the items can be obtained ([41]).

([41]) Egg-bearing chickens can perhaps be one example. Egg-bearing chickens are usually not traded among farmers, and so their prices are not observable. The price of an egg, which is the main product of an egg-bearing chicken, is meanwhile easily available. If a relationship can be derived between the egg-bearing chickens' prices by age, and the price of an egg, then the value of an egg-bearing chicken can be computed through the egg price.

6.61. Table 6.16 shows the estimated value of inventory for each item. The item's quantity is multiplied by the price to obtain its value as inventory. For example, the inventory value of wheat for 2015 is computed by multiplying 3 630 (* 1 000 tonnes) by a price of 150 per tonne, resulting in a value of 545 (in millions).

Table 6.16: Values of inventory items estimated using price times quantity method (in millions)

Year	Wheat	Beef cattle	Crude oil	Hot coil
2010	686	3 335	517	1 530
2011	627	3 823	880	1 520
2012	747	3 996	1 001	1 698
2013	625	3 451	1 444	1 547
2014	716	4 872	1 350	1 532
2015	545	3 648	1 221	1 313

Source: Eurostat-OECD Task Force on Land and other non-financial assets; fictitious data

D) ALLOCATION BY INVENTORY TYPE, INDUSTRY AND INSTITUTIONAL SECTOR

6.62. As mentioned in paragraph 6.56, it is recommended that the ownership allocation information for each inventory item among industries and sectors be available at an early stage of estimation using the direct approach. An ownership distribution table for each inventory item across industries and sectors may be a useful tool for this work. And if this is not available, the ownership information should be obtained from relevant sources at a later stage of the estimation. It may come from the census, or from regular surveys, administrative records or taxation data.

6.63. Table 6.17 provides the institutional sector allocations of the estimated values of inventories for the selected items. The inventory type of each item, and the industry that it belongs to, have already been determined (as shown in Table 6.14). In this example, wheat and beef cattle are assumed to be held by farmers that are classified in the household sector. With regard to crude oil and hot coil, inventories held by the coke and refined petroleum product manufacturing industries in the former case, and by the basic metals manufacturing industries in the latter are estimated. These industries are assumed to consist of non-financial corporations and households. Around 95 % of crude oil inventories in the industries manufacturing coke and refined petroleum products are owned by non-financial corporations, and 5 % by households. In contrast, around 85 % of hot coil steel inventories in basic metals manufacturing are owned by non-financial corporations ([42]), with around 15 % owned by households.

([42]) Here non-financial corporations include quasi-corporations, i.e. unincorporated enterprises that compile their own complete sets of accounts. According to the SNA 2008, paragraph 4.42, a quasi-corporation is: (a) either an unincorporated enterprise owned by a resident institutional unit that has sufficient information to compile a complete set of accounts and is operated as if it were a separate corporation, and whose de facto relationship to its owner is that of a corporation to its shareholders, or (b) an unincorporated enterprise owned by a non-resident institutional unit that is deemed to be a resident institutional unit because it engages in a significant amount of production in the economic territory over a long or indefinite period of time.

Table 6.17: Inventory value allocations into institutional sectors

Year	Wheat	Beef cattle	Crude oil		Hot coil	
	Work-in-progress	Work-in-progress	Materials and supplies		Finished goods	
	Agriculture	Agriculture	Manufacturing of coke and refined petroleum products		Manufacturing of basic metals	
	Households	Households	Non-financial corporations	Households	Non-financial corporation	Households
Proportions of inventories allocated to the relevant sectors (%)						
2010	100	100	95.0	5.0	85.0	15.0
2011	100	100	95.0	5.0	85.0	15.0
2012	100	100	95.2	4.8	85.2	14.8
2013	100	100	95.4	4.6	85.4	14.6
2014	100	100	95.6	4.4	85.6	14.4
2015	100	100	95.8	4.2	85.8	14.2
Inventories by type and institutional sector (values, in millions)						
2010	686	3 335	3 168	167	1 301	230
2011	627	3 823	3 632	191	1 292	228
2012	747	3 996	3 805	192	1 446	251
2013	625	3 451	3 292	159	1 321	226
2014	716	4 872	4 658	214	1 311	221
2015	545	3 648	3 494	153	1 126	186

Source: Eurostat-OECD Task Force on Land and other non-financial assets; fictitious data

E) DECOMPOSING VALUE CHANGES INTO PRICE AND VOLUME CHANGES

6.64. In the price times quantity method, price and quantity data are available for each inventory item. The increase or decrease in the annual value of inventory can thus be decomposed into volume changes and price changes. The logic of decomposition is exactly the same as in Sections 6.32 to 6.39. For detailed procedures, those sections can be referred to.

Strengths and weaknesses

6.65. Before applying the direct method, users should consider its major strengths and weaknesses.

First of all, the direct method is a very straightforward and easy computational methodology. For each inventory item, its price and quantity data are available and so its value can be easily computed.

Second, as the prices of the various inventory items come mainly from the relevant market transaction prices, the valuation principle as recommended by the SNA 2008 and ESA 2010 can be fully satisfied.

Third, if the information about inventory type, industry and sector for each inventory item is added, then the inventory value can be computed easily by inventory type, by industry and by institutional sector.

6.66. While having the above listed advantages, however, the direct method also has some weaknesses.

First, this approach is not suitable for all types of inventories and should be understood as a supplementary tool rather than a comprehensive option. Full availability of quantity data for each inventory item is only possible for some products. Cereals, livestock, fuel-related products and steel industry products may be possible candidates for the direct approach.

Second, quantity and price data should be very product-specific. This means that the national accountants may need to collect a large amount of price and quantity data for each item, because within the item there

may be many different specifications and the respective prices may differ. The matching of quantity and price data will sometimes not be straightforward.

6.67. Third, there may be issues of under counting or double counting. As there are so many items, some could be omitted if not enough attention is paid to this problem. In addition, if the direct method is mixed with the direct use of corporate inventory data, there may be some areas of overlap which could give rise to double counting. Statisticians will need to be aware of this problem.

6.4 Estimation inventory stocks by using the perpetual inventory method

Introduction

6.68. The third method for estimating annual inventory stocks (AN.12) for national or sectoral balance sheets is the perpetual inventory method (PIM). While the first method directly uses businesses' reported book values of inventories, and the second method relies on data on quantities and prices of inventories, the PIM estimates the value of inventory stocks as the accumulation of year-to-year changes in the value of inventories added to an initial stock level estimated for a base year. This chapter explains the PIM-based approach, provides some specific numerical examples, and discusses some of its strengths and weaknesses.

6.69. In national accounts, the PIM is perhaps most frequently used to estimate net stocks of fixed assets for balance sheets. It is based on the idea that stocks are the sum of accumulated flows of additions less subtractions. Changes in the stock of fixed assets consist of additions through fixed investment, less subtractions through depreciation and retirements, plus nominal holding gains and losses ('holding gains') plus other changes in the volumes of the assets.

6.70. Similarly, countries may employ a variation of the PIM to estimate rolling stocks of inventories based on accumulated sums of net flows. The closing value of the stock of inventories in a period, valued at current prices, is equal to the opening value of stocks, plus the transactions that add to the stock (e.g. the purchase of materials and supplies or the production of new finished or work-in-progress inventories), less the transactions that subtract from the stock (e.g. the use of materials and supplies or the sale of inventories), plus other changes in volume (such as losses that result from natural disasters ([43])), plus revaluations (holding gains arising from price changes). If the necessary source data are available, the PIM can produce estimates of all stocks and flows of inventories for a balance sheet (see Section 2.2 for a discussion of inventories in national balance sheets.).

6.71. According to the responses of the Task Force survey on methods for estimating annual inventories, at least 12 countries employ a PIM to estimate inventories ([44]). Many of these countries have data on annual stocks but prefer to estimate annual changes in inventories (P.52), and then estimate stocks as the sum of these changes, accumulated from an initial base year. Most lack detailed data on specific transactions, and instead estimate transactions and holding gains from the change in inventory stocks using data on price changes and assumptions on turnover rates, as described in Section 5.2.

Description of the method

6.72. The PIM begins with an estimate of the value of the stock of inventories for an initial base year. These initial stock levels should be estimated in a manner consistent with national accounting concepts and, ideally, by industry, by type of inventories (materials and supplies, work-in-progress, finished goods, military

([43]) As paragraphs 4.25 – 4.30 explain, recurrent losses of goods held in inventories are classified as withdrawals, while exceptional losses (such as losses from natural disasters) are classified as other changes in volume. More information on exceptional and recurrent losses is available in section 8.6.

([44]) The expression 'at least 10 countries' is used because the distinction between the direct estimates of stocks and the PIM approach is not always clear for countries that use data on inventory stocks. Some countries may report using the methods described in Sections 6.2 or 6.3 but the details of their methods suggest the use of stock data to estimate some changes in inventories, consistent with a PIM approach.

inventories, and goods for resale) and by method of accounting (FIFO, weighted-average cost, etc.). The estimates of inventory stocks should be matched with corresponding price indices to estimate constant price inventory stock levels. For subsequent years, data on annual changes in inventories, estimated using similar definitions and at a similar level of detail, are also matched with price indices to estimate constant price changes in inventories. The inventory stock levels for later years are equal to the accumulated sums of these changes added to the initial stock levels.

6.73. The PIM can be summarised by these equations

(12) $$\frac{INV_{tE}}{PI_{tE}} = \frac{INV_{tE-1}}{PI_{tE-1}} + \frac{\Delta S_t}{\overline{PI}_t}$$

or

(13) $$INVQ_{tE} = INVQ_{tE-1} + \Delta SQ_t$$

where $INVQ_{tE}$ equals the constant price stock of inventories in year t, ΔSQ_t equals the constant price change in inventories, INV_{tE} are current price stocks and ΔS_t changes in inventories, $\overline{PI}_t$ are average prices during year t and PI_{tE} are end-of-year prices. End-of-year prices are appropriate for stocks, which are measured at the end of the year, while average prices are appropriate for changes, which occur over the course of a year.

6.74. The same price indices are used to revalue constant price stocks and flows to estimate current price stocks and flows, with the exception that stocks use end-of-period prices and flows use average-period prices. In addition, these prices can also be used to decompose the flows into transactions and holding gains, taking into account information on other changes in volume such as losses from natural disasters. The change in the national accounts inventory stock level, valued in current prices, can be expressed as

(14) $$\begin{aligned} \Delta INV_t &= INV_{tE} - INV_{tE-1} = PI_{tE} * INVQ_{tE} - PI_{tE-1} * INVQ_{tE-1} \\ &= \overline{PI}_{tE} * (INVQ_{tE} - INVQ_{tE-1}) + \overline{INVQ}_{tE} * (PI_{tE} - PI_{tE-1}) \\ &= \Delta S_t + \Delta Vol_t + Hold_t \end{aligned}$$

where $\overline{PI}_{tE}$ are average of the end-of-year price indices $\left(\frac{PI_{tE} + PI_{tE-1}}{2}\right)$, $\overline{INVQ}_{tE}$ are average inventory stocks over year $t\left(\frac{INVQ_{tE} + INVQ_{tE-1}}{2}\right)$, ΔS_t equals the transactions (the value of changes in inventories that appears in P.52 in the capital account), ΔVol_t equals other changes in volume on the balance sheet, and $Hold_t$ equals the holding gains on the balance sheet.

6.75. While each country has a different version of the PIM, the typical steps are as follows:

(a) estimate initial stock levels for a base year;

(b) calculate prices for estimating constant price stock levels for the base year (end-of-year prices) and current and constant price changes (average prices);

(c) estimate constant price stock levels for the base year;

(d) for years after the base year, estimate constant price changes in inventories and add to the prior year's constant price stock level to estimate constant price inventory stocks for subsequent years;

(e) revalue constant price stocks to current price stocks using appropriate prices;

(f) calculate holding gains (for the revaluation account) and the inventory valuation adjustment (IVA);

(g) add other changes in volume, if necessary.

6.76. With these steps the PIM produces all estimates of flows for the capital account (P.52) and stocks of inventories for balance sheets (AN.12) (see paragraphs 2.47 and 2.48). As one can see from the steps described above the bulk of the information that constitutes this method is the same information needed in estimating the changes in inventories as shown in Section 5.2. Therefore, for simplicity, the illustrative calculations in this chapter extend the calculations of changes in inventories in Section 5.2 to estimate stocks for balance sheets.

A) ESTIMATE INITIAL STOCK LEVELS IN THE BASE YEAR

6.77. The estimate of the initial stock of inventories is typically produced in a base year in which relatively more detailed data (such as an economic census) on inventories are available. The initial stock estimate may be based on especially detailed data from business accounts; as Section 6.2 explains, several adjustments are usually needed to make businesses' reported accounting data consistent with definitions in the national accounts. The base year estimate of stocks may also be based on data on quantities of inventories and prices, as explained in Section 6.3. These initial stock levels should be estimated by industry, by type of inventories (materials and supplies, work-in-progress, finished goods, military inventories, and goods for resale) and by method of accounting (FIFO, weighted-average cost, etc.). An example of an estimate of initial stocks of inventories by valuation method for 2014 is shown in the first row of Table 6.18 (which is the same as Table 5.1 from Section 5.2).

Table 6.18: Book value of inventories, by valuation method

Year	Book value of inventories	FIFO inventories	Weighted-average inventories	LIFO Inventories
2014	2 000	1 500	333	167
2015	3 000	2 160	600	240

Source: Eurostat-OECD Task Force on Land and other non-financial assets; fictitious data

6.78. It should be noted that book values of inventories on a LIFO basis can be valued at very old prices because the last items acquired are withdrawn first, thus the oldest valued stocks can potentially remain in the system for years. The LIFO method is not allowed under the International Accounting Standards, but certain countries may allow them nationally. When countries allow LIFO reporting nationally, such as under the US generally accepted accounting principles (GAAP), companies that use the LIFO valuation methods must also report their LIFO reserve. The LIFO reserve is the difference between the cost of inventory that is calculated using the FIFO method and one using the LIFO method. The LIFO reserve can then be used to convert LIFO valued inventories to FIFO valued inventories, a concept closer to the national accounts concept of inventories being valued at prices of the current period. Table 6.19 illustrates this conversion.

Table 6.19: Conversion of last-in-first-out book value of inventories

Year	LIFO Inventories	LIFO reserve	Converted to FIFO
2014	167	60	227
2015	240	72	312

Source: Eurostat-OECD Task Force on Land and other non-financial assets; fictitious data

B) CALCULATING PRICE INDICES

6.79. The end-of-year- and average price indices should be matched in terms of definition, scope, and timing to the inventory data at the most disaggregated level possible (by type of inventory and industry, imported or domestically produced) to take into account differences in holding periods and prices across products. Deflators at each group level should be built up as weighted-averages of price indices for products in that group. The weights may need to be determined based on more detailed information (from an economic census or other source) available in the base year. Sometimes, however, more detailed data may suffer from problems with industry classification, and so the appropriate level of detail requires some judgement. As the survey responses indicate, countries rely mostly on producer price indices, with some consumer price indices, wholesale price indices, import price indices and labour cost measures to build estimates of prices for inventories.

6.80. Because the reported book value of a stock of inventories is the sum of the book values of inventories purchased at different times, the price index for the total book value of the stock of inventories will be a weighted-average of prices of inventories of prior months, where the weights reflect the proportions of the stock purchased in each of the prior months. The weights depend on the turnover rate, the number of months during which items remain in inventories until withdrawn. As explained in Section 5.2, the turnover

rate can be estimated as the ratio of monthly inventory stocks to monthly sales. In the example in Section 5.2 (see Box 5.1), monthly inventories on a FIFO basis are slightly more than 4 times monthly sales, and the turnover rate is 4.12, meaning that the stock holding period is just over 4 months.

6.81. Under FIFO valuation of inventories, and assuming that inventories are held for (k) months, the deflator for the book value of inventories at the end of a certain month would be:

(15) $CI_{FIFO,t} = \sum_{n=0}^{k} PI_{t-n} * W_{t-n}$

where PI_t are the monthly price indices, n is the length of time inventories are held, and W_t are the weights of the quantity of inventories acquired in each month which remain in the stock, based on the turnover rate. Continuing with the example in Section 5.2 (Box 5.1), the weights, based on a turnover rate of 4.12, are [0.24, 0.24, 0.24, 0.24, 0.04]. Assuming that the inventory composition for this group of products is 40 % commodity A and 60 % commodity B, the monthly price and cost index are calculated as follows (see Table 6.20, which uses the same numbers as Table 5.3).

Monthly price index (PI_t)for December 2014: (107.2 * 0.4) + (104.4 * 0.6) = 105.5

Monthly cost index $CI_{FIFO,t}$: equal to the monthly price indices for the stock holding period weighted by the turnover pattern. For December 2014: (105.5 * 0.24) + (105.0 * 0.24) + (104.2 *0.24) + (103.8 * 0.24) + (103.4 * 0.04) = 104.6. For December 2015, the monthly cost index is 122.8.

Table 6.20: Price indices for first-in-first-out valuation method

Year	Month	Price Commodity A	Price Commodity B	Monthly price index	Average annual price index	Monthly cost index, FIFO
2014	January	101.5	101.4	101.4	103.7	
	February	102.7	102.1	102.3		
	March	103.1	103.0	103.0		
	April	103.8	103.4	103.6		
	May	104.5	104.5	104.5		103.3
	June	105.0	103.5	104.1		103.8
	July	105.9	102.0	103.6		103.9
	August	106.4	101.4	103.4		103.9
	September	106.6	102.0	103.8		103.7
	October	106.8	102.5	104.2		103.8
	November	107.0	103.7	105.0		104.1
	December	107.2	104.4	105.5		104.6
2015	January	107.4	112.7	110.6	118.3	106.3
	February	107.6	119.9	115.0		108.9
	March	107.8	116.1	112.8		110.8
	April	108.0	127.3	119.6		114.2
	May	108.2	132.0	122.5		117.3
	June	108.4	118.8	114.6		117.3
	July	108.6	120.2	115.6		117.9
	August	110.0	121.4	116.8		117.4
	September	112.6	124.1	119.5		116.8
	October	114.6	127.4	122.3		118.4
	November	116.0	129.7	124.2		120.6
	December	119.8	130.2	126.0		122.8

Source: Eurostat-OECD Task Force on Land and other non-financial assets; fictitious data

6.82. Under the weighted-average cost valuation of inventories, the price weights are calculated in a different way. Prices are based on an average of the price of the last acquisition and the average prices of the stock prior to the last acquisition. The latter, in turn, is calculated as the average of the price of the acquisition prior to the last acquisition and the average prices of the stock before the second to last acquisition, and so on. The weights for the calculation of average stock prices are based on turnover rates and other factors. Section 5.2 explains the estimation of the weights and the weighted-average cost method in more detail (see Box 5.2 and related text, and Table 5.4, which is repeated in Table 6.21 below).

6.83. For December 2014, the weighted cost index equals (108.9 * 0.3300) + (108.4 * 0.2210) + (108.2 * 0.1481) + (108.0 * 0.0993) + (107.8 * 0.0665) + (107.6 * 0.0446) + (107.4 * 0.0299) + (107.2 * 0.0200) + (107.0 * 0.0160) + (106.8 * 0.0140) + (106.6 * 0.0115) = 108.4

Table 6.21: Price indices for weighted-average cost method

Year	Month	Monthly price index	Average annual price index	Monthly cost index	Weights for December monthly cost index
2014	January	105.1	107.4		
	February	106.6			0.012
	March	106.8			0.014
	April	107.0			0.016
	May	107.2			0.020
	June	107.4			0.030
	July	107.6			0.045
	August	107.8			0.067
	September	108.0			0.099
	October	108.2			0.148
	November	108.4		108.1	0.221
	December	108.9		108.4	0.330
2015	January	110.3	120.3	109.1	
	February	112.4		110.2	0.012
	March	114.4		111.6	0.014
	April	116.6		113.3	0.016
	May	119.4		115.3	0.020
	June	121.0		117.2	0.030
	July	122.4		119.0	0.045
	August	122.1		120.0	0.067
	September	124.3		121.5	0.099
	October	125.4		122.8	0.148
	November	126.7		124.2	0.221
	December	128.9		125.8	0.330

Source: Eurostat-OECD Task Force on Land and other non-financial assets; fictitious data

6.84. Under LIFO accounting, as discussed in paragraph 6.78 and illustrated in Table 6.2, the LIFO reserve can be used to convert the LIFO book value to a FIFO book value. Therefore, this converted FIFO based book value can simply use the monthly cost index that is calculated for the FIFO method (assuming the same composition of products held in inventory). Under this assumption, the end-of-year price index for the 2014 stock is 104.6 (see paragraph 6.81 and Table 6.20 for calculation).

C) ESTIMATE THE INITIAL CONSTANT PRICE STOCK OF INVENTORIES

6.85. Assuming the initial year for the PIM estimates is 2014, the constant price inventory stock for this year is the sum of the constant price stocks valued under FIFO, weighted-average cost, and LIFO methods. Using the reported book values of stocks in Table 6.18 and Table 6.19 and the monthly acquisition cost price indices for December 2014 in Tables 6.20 and 6.21, the constant price inventory stock for 2014 is estimated as follows:

$INVQ_{FIFO}$ = (1 500/(104.6/100)) = 1 434

$INVQ_{WAC}$ = (333 /(108.4/100)) = 307

$INVQ_{LIFO}$ = (227/(104.6/100)) = 217

$INVQ_{2014} = INVQ_{FIFO} + INVQ_{WAC} + INVQ_{LIFO}$ = 1 958

Table 6.22: Constant price stocks of inventories

Year	Total inventories	FIFO inventories	Weighted-average inventories	Converted LIFO inventories
2014	1 958	1 434	307	217

Source: Eurostat-OECD Task Force on Land and other non-financial assets; fictitious data

D) ESTIMATE CONSTANT PRICE CHANGES IN INVENTORIES AND CONSTANT PRICE STOCK OF INVENTORIES IN LATER YEARS

6.86. Under the PIM, the next year's (2015) constant price stock level will equal the initial year constant price stock level plus the constant price change in inventories (equation 12). The constant price changes in inventories can be estimated as the current price changes in inventories divided by the average price for the year. How to calculate the current price change in inventories for this example is illustrated in Section 5.2. Table 6.23 reproduces those current price changes for convenience.

Table 6.23: Current price changes in inventories

Year	Total	FIFO inventories	Weighted-average inventories	LIFO inventories
2015	661	384	204	73

Source: Eurostat-OECD Task Force on Land and other non-financial assets; fictitious data

6.87. Then simply divide the current price changes in inventories by the average price for 2015 given in Tables 6.20 (for the FIFO and LIFO method) and 6.21 (for the average-cost method).

$$\Delta SQ_{FIFO,t} = \frac{\Delta S_{FIFO,t}}{PI_{FIFO,t}} = 384 / (118.3/100) = 325$$

$$\Delta SQ_{WAC,t} = \frac{\Delta S_{WAC,t}}{PI_{WAC,t}} = 204 / (120.3/100) = 170$$

6.88. Note that for the FIFO and weighted-average cost methods, the constant price change in inventories can be estimated as the difference between the deflated book values for 2014 and 2015 (see paragraph 5.31 and Table 5.5).

6.89. For the LIFO case in this example, it is assumed that the appropriate annual price deflator is the same deflator that is used for the FIFO case.

$$\Delta SQ_{LIFO,t} = \frac{\Delta S_{LIFO,t}}{PI_{LIFO,t}} = 73 / (118.3/100) = 62$$

The total constant price changes in inventories equals the sum of the constant price changes for the three valuation methods.

Table 6.24: Constant price changes in inventories

Year	Total inventories	FIFO inventories	Weighted-average inventories	LIFO inventories
2015	556	325	170	62

Source: Eurostat-OECD Task Force on Land and other non-financial assets; fictitious data

6.90. The constant price inventory stocks for 2015 (Table 6.25) are calculated using the initial year (2014) constant price stocks (in Table 6.22) plus the constant price change in inventories for 2015 (in Table 6.24). For subsequent years, constant price stock levels are calculated using the prior year's constant price stock plus the next year's constant price change in inventories. Note that if the benchmark stock level does not come at the start of the time series one can also de-cumulate the changes by subtracting the constant price changes in inventories from the benchmark stock level to obtain the stock levels for years prior to the benchmark year.

Table 6.25: Constant price stocks of inventories, perpetual inventory method

Year	Total inventories	FIFO inventories	Weighted-average inventories	LIFO inventories
2014	1 958	1 434	307	217
2015	2 514	1 758	477	279

Source: Eurostat-OECD Task Force on Land and other non-financial assets; fictitious data

6.91. There are other ways in which the PIM may produce constant price stock levels after the base year that are not the same as the constant price stock levels implied by the annual source data on stocks for that year. In the FIFO and weighted-average cost estimates in this example, the 2015 constant price stock level does match the 2014 level plus the change because the change was effectively 'forced' to equal the difference in stocks. But in other situations, national statistical institutes may estimate base year stocks using one (more comprehensive) data source and annual changes using a different (less comprehensive) data source that yields a different estimate of stocks for the base year; if so, the PIM will produce subsequent stock values that differ from those reported by the less comprehensive surveys used to estimate changes. For example, if the base year stock estimate is 100 and the data source used for changes provides stock estimates of 105 in the base year and 115 the following year, then the PIM estimates a stock of 110 for the second year (100 + (115 – 105)), which differs from the stock level of 115 reported in the annual data. This issue with source data should probably be dealt with by benchmarking the less detailed information to the more detailed information in order to make them consistent. To the extent that the data used to estimate changes have limitations, the stock series estimated with a PIM may need to be revised when a new base year estimate is obtained (from a new economic census, for example).

E) REVALUE CONSTANT PRICE STOCKS TO CURRENT PRICE STOCKS

6.92. The 2015 current price inventory stock level, estimated with a PIM, equals the constant price stock level revalued using the price index for the end of 2015, approximated by the December 2015 monthly price index. Note this is the price index for the end of the year, and not the acquisition cost index because the goal is to express stocks in current prices as of the end of the calendar year.

INV_{FIFO} = 1 758 * (126.0/100) = 2 216

INV_{WAC} = 477 * (128.9/100) = 615

INV_{LIFO} = 279 * (126.0/100) = 351

$INV_{2015} = INV_{FIFO} + INV_{WAC} + INV_{LIFO}$ = 3 182

Table 6.26: Current price stocks of inventories, perpetual inventory method

Year	Total	FIFO inventories	Weighted-average inventories	LIFO inventories
2014	2 077	1 513	335	229
2015	3 182	2 216	615	351

Source: Eurostat-OECD Task Force on Land and other non-financial assets; fictitious data

6.93. In these illustrative calculations, the constant price change in inventories are added to the previous constant price stock of inventories to estimate the next stock level in volume terms, and then revalued using the end-of-period price index to calculate the next current price stock level. An alternative approach is to add the current price change in inventories to the previous current price stock of inventories to estimate the next current price stock level, and then divide by the end-of-period price index to obtain the next constant price stock level. The two approaches do not lead to identical measures of current or constant price stocks because stocks are revalued using end-of-period prices while the change in inventories is revalued using average prices, and the average and end-year prices are not the same.

6.94. Under the approach highlighted in this chapter, the usual 'stock-flow identity' (the previous stock level plus the change equals the next stock level) holds for constant price inventories but not for current price inventories. Under the alternative approach, the stock-flow identity holds for current price inventories but not for constant price inventories. The survey responses suggest that countries may use either approach to estimate stocks. A key advantage of the approach highlighted here is that the stock-flow identify is maintained for the estimates of changes in real GDP, a measure that receives widespread attention.

6.95. With the approach highlighted here, however, the break in the current price stock-flow identity creates a discrepancy in balance sheets, valued in current prices. This discrepancy can be placed in the balance sheet as an 'other change in the volume of assets', perhaps along with statistical discrepancies from other sources, or simply ignored (if small enough),or placed elsewhere. The placement of the statistical discrepancy should be documented, especially when it is noticeably large.

F) CALCULATE NOMINAL HOLDING GAINS AND LOSSES AND THE INVENTORY VALUATION ADJUSTMENT

6.96. Following equation 3 in this chapter, the holding gains may be calculated by multiplying the average of the constant price stocks (end of prior year and end of current year) by the change in end-year prices (December monthly price index). Intuitively, holding gains should be greater than zero because businesses held inventories while prices rose.

$Hold_{FIFO} = ((1\ 758 + 1\ 434)/2) * (126.0 - 105.5)/100 = 328$

$Hold_{WAC} = ((477 + 307)/2) * (128.9 - 108.9)/100 = 78$

$Hold_{LIFO} = ((279 + 217)/2) * (126.0 - 105.5)/100 = 51$

$Hold_{FIFO} + Hold_{WAC} + Hold_{LIFO} = 457$

Table 6.27: Nominal holding gains and losses

Year	Total	FIFO inventories	Weighted-average inventories	LIFO inventories
2015	457	328	78	51

Source: Eurostat-OECD Task Force on Land and other non-financial assets; fictitious data

6.97. As described in Chapter 4, one can also calculate an IVA. The IVA is a measure of holding gains included in the change in book values of inventories shown in the balance sheets of businesses. The IVA is also an adjustment applied to income-based measures of value added to remove the holding gains from inventories that appear in profits reported by businesses if the estimates of operating surplus are calculated using information from business accounting. The IVA equals the difference between the change in book

values and the current price change in inventories, thus as prices rise the IVA is positive ([45]); in this example, the total IVA equals 339.

$IVA_{FIFO} = (2\,160 - 1\,500) - 384 = 276$

$IVA_{WAC} = (600 - 333) - 204 = 63$

$IVA_{LIFO} = (240 - 167) - 73 = 0$

In this example, the IVA arises solely from the FIFO and weighted-average cost inventories; for the LIFO inventories alone, the change in book value estimates and the current price estimates are equal, and the IVA equals zero.

Table 6.28: Inventory valuation adjustment

Year	Total	FIFO inventories	Weighted-average inventories	LIFO inventories
2015	339	276	63	0

Source: Eurostat-OECD Task Force on Land and other non-financial assets; fictitious data

Inventory stocks and flows on the balance sheet

6.98. When fully implemented, the PIM produces a full set of estimates of stocks and flows of inventories in current prices for balance sheets, as described in Chapter 2. For each year, the PIM produces estimates of initial stock levels (Table 6.26), changes in inventories from transactions (Table 6.23), revaluations (Table 6.27), other changes in volume, and the end-of-year stock levels (Table 6.26).

Table 6.29: Inventories on the balance sheet, current prices, estimated with the perpetual inventory method

Flows/stocks, year	Total	FIFO inventories	Weighted-average inventories	LIFO inventories
Opening stock, 2014 (Table 6.26)	2 077	1 513	335	229
Transactions, 2015 (Table 6.23)	661	384	204	73
Revaluations or net holding gains, 2015 (Table 6.27)	457	328	78	51
Other volume changes, 2015	-12	-8	-2	-2
Closing stock, 2015 (Table 6.26)	3 182	2 216	615	351

Source: Eurostat-OECD Task Force on Land and other non-financial assets; fictitious data

6.99. In this example, the stock-flow identity (starting stock plus changes equal closing stock) holds in Table 6.29 because other changes in volume are estimated residually. This residual estimate is equivalent to including all statistical discrepancies as other changes in volume. For all inventories in this example, the discrepancy equals –12. These discrepancies can arise for the reasons listed throughout this chapter. Alternatively, statistical discrepancies can be ignored (if small enough), or included as part of other lines, or itemised separately. Ideally the size of the discrepancy should be noted and the possible sources described. Another option is to calculate the revaluations as a residual and assume that the other changes in volume are zero unless there is some known event.

6.100. This is because other changes in volume may also include losses from damages due to catastrophic events. These losses are assumed to be zero in this example. If these losses occur and if information on the value of these damages is available, the estimated value of these losses can be listed as other changes in volume. The calculations of closing stocks, changes in inventories, and holding gains should be estimated net of

([45]) In some countries, for example the US, the IVA is calculated as the difference between the current price change in inventories and the business change in book values. In this case the IVA moves counter to the direction of price movements, so as prices increase the IVA is negative.

these damages, and then the value of the damages should be entered as part of other changes in volume, so that the stock-flow identify continues to hold.

Box 6.2: Work-in-progress and finished goods inventory

This chapter describes the perpetual inventory method (PIM) for estimating inventory stocks (AN.12), without distinguishing between components of inventory stocks, such as materials and supplies, work-in-progress, or finished goods. The general PIM approach can be applied separately to each of these components of inventory stocks, just as the methods for estimating changes in inventories (see Chapter 5, Box 5.4) can be applied to each of the components of inventories, as long as appropriate data are available. Section 6.2, paragraphs 6.20–6.23, provides a discussion of what is included in the value of work-progress and finished goods inventories as reported by businesses. As discussed in Chapter 2, Box 2.1, work-in-progress and finished goods should be valued at basic prices, including a mark-up for operating surplus. Paragraph 6.21 explains how this mark-up can be calculated. See Chapter 9, Table 9.5, for an overview of the types of price indices used for deflating inventories.

Strengths and weaknesses

6.101. The key advantage of the PIM is its ability to estimate stocks and flows for balance sheets. The PIM is ideal when one has relatively reliable data on base year inventory stocks, changes in inventory stocks, prices, and turnover rates. The PIM functions especially well when data on stocks and flows are consistent with national accounts definitions and are available by industry, type of inventories, and accounting method. As the Task Force survey indicates, many countries do have these data.

6.102. The values of stocks estimated through a PIM should ideally be periodically benchmarked for years in which more detailed reliable data on stock levels are available. These benchmark stock levels can be a valuable check for the reliability of the PIM assumptions. When benchmarking to a new stock level care needs to be taken with going backwards in time. In some cases de-cumulating the changes in inventories can yield negative stock levels at the start of the series.

6.103. The PIM also has limitations, however. For the PIM, like the other approaches for estimating stocks, the requirement for extensive information on inventories and prices can also be a disadvantage if these detailed data are unavailable. Countries with less detailed data may still implement a PIM although the results may be less informative. A point that was glossed over in this chapter is that the estimates of changes in inventories that use data on only the annual opening and closing book values can correctly measure these transactions at current prices if inventories are changing at a constant rate or by a constant amount; the approach described in this chapter should be viewed as an approximation. When inventories and their prices are volatile, the PIM may be less accurate. The use of higher frequency data (such as monthly) will capture price and quantity movements within the year and may produce more accurate estimates, if the data are reliable. One key weakness of the PIM is the lack of strong data on turnover rates: according to the survey, almost all countries can only provide rough approximations of turnover rates and weights for estimating prices for valuing stocks. When prices are highly volatile over short periods, even smaller errors in assumed turnover patterns can lead to large errors in estimated changes in inventories.

6.104. In addition, if the source data contain erroneous volatility, estimates of changes in inventories may be volatile and may lead to excessive volatility in estimates of GDP. Notable revisions can occur whenever original source data are revised significantly. Because changes in inventories can be a major component of quarterly fluctuations in GDP, these revisions can lead to major revisions to GDP growth rates. Despite these potential problems, the PIM as described in this chapter can produce informative and useful estimates for balance sheets and for estimates of GDP.

Box 6.3: Estimating inventories by using the perpetual inventory method — United States

The US Bureau of Economic Analysis (BEA) uses a version of the perpetual inventory method (PIM) to estimate inventory stock levels (AN.12) for the US national accounts. For non-farm industries, the estimates of the changes in inventories are generally prepared beginning with data on the end-of-period book value of inventories, as reported by private business using a variety of accounting methods. The inventory data are then adjusted — annually for 417 detailed industries — to value the inventories at a uniform set of prices and to remove nominal holding gains and losses ('holding gains'). BEA estimates changes in inventories (P.52), based on consecutive stock levels, and then employs a PIM to estimate stocks of inventories as accumulated sums of these changes from a prior benchmark stock level that has not been re-estimated for several years. This method, while very detailed, essentially applies the calculations shown in this chapter (as well as Section 5.2) for a large number of industries ([46]).

Recording of inventories in the US national accounts

The estimates of inventories are shown by industry classification, using the North American Industry Classification System (NAICS), rather than by product classification. In the published tables, estimates of changes in inventories by major industry, in current and constant (chain) dollars, are presented in table group 5.7 ([47]). Stocks of private inventories by major industry, in current and constant (chain) dollars, and implicit price deflators are shown in table group 5.8 ([48]). BEA also prepares 'Underlying Detail' tables for the inventory estimates, including detail for change in the book values and for inventory valuation adjustment (IVA) by industry, at a greater level of detail than is shown in the published estimates.

The IVA is also shown on the income side of the accounts to exclude the inventory holding gains (or losses) from business income in the calculation of corporate profits and of non-farm proprietors' income. Since profit and income data come from tabulations of tax returns (from the Internal Revenue Service), the product-side IVA must be adjusted for any accounting basis differences between the IRS data and the Census Bureau data ([49]). Holding gains (real and nominal) for all private inventories are shown in Table 5.10 'Changes in Net Stock of Produced Assets (Fixed Assets and Inventories)' and also in the Integrated Macroeconomic Accounts (The US sectoral accounts, produced jointly with the Federal Reserve Board).

Recording of inventories

For manufacturing and trade industries, data on the end-of-year book value of total inventory stocks and on the methods of inventory valuation are collected in the annual surveys conducted by the Census Bureau. For the most recent year, the Census Bureau's annual surveys are not yet available, and so BEA relies on data on inventory stocks at the end of the month collected in the Census Bureau's monthly surveys. For most other non-farm industries, annual data on the book value of inventory stocks are available from Internal Revenue Service (IRS) tabulations of business tax returns.

For most industries, the principal price data used to estimate inventories are producer price indices (PPIs) and import price indices, both from the Bureau of Labor Statistics. For the manufacturing and publishing industries, the prices for work-in-process and finished goods inventories consist of a combination of the following: the cost of materials and supplies, based on PPIs; labour costs, based on unit labour cost indices; and overhead costs — including rent, depreciation charges, and repair costs — primarily based on PPIs. The BEA labour cost indices cover compensation of production workers, supervisors, and non-production personnel working at the plant and are based on wage data. The price indices for each industry are a weighted-average of these components, where the weights are obtained from the detailed five-year economic census.

Estimating methods

BEA performs inventory calculations at a very detailed industry level (4–6 digit NAICS codes) and then aggregates the estimates using chain aggregation methods. The source data are used to estimate LIFO and non-LIFO stocks of inventories

([46]) For a more detailed explanation of inventories see Bureau of Economic Analysis, NIPA Handbook: Concepts and Methods of the U.S. National Income *and Product Accounts, 2016, Chapter 7: Change in Private Inventories. Available at* http://www.bea.gov/national/pdf/chapter7.pdf

([47]) Go to https://www.bea.gov/, click on 'National', and under 'Gross Domestic Product (GDP)' click on 'Interactive Tables'. In addition, estimates of change in motor vehicle inventories are shown in tables 7.2.5B and 7.2.6B, and estimates of change in farm inventories are shown in tables 7.3.5 and 7.3.6.

([48]) Go to https://www.bea.gov/, click on 'National' and under 'Supplemental Estimates', click on 'Underlying Detail Tables'.

([49]) See NIPA table 6.14D, 'Inventory Valuation Adjustment to Nonfarm Incomes by Legal Form of Organization and by Industry'.

at the end of each year, as well as end-of-month prices, average monthly and annual prices, and monthly acquisition cost indices based on price indices, price weights, and turnover patterns. To describe BEA's approach, it is assumed that the data sources provide the following information:

- LIFO and FIFO are the only accounting methods used in the industry;
- the Census Bureau published value of non-LIFO inventories (that is, the value of inventories without using LIFO accounting) for this industry is USD 1 767 in December 2014 and USD 2 500 in December 2015;
- the percentage of inventories for this industry that are accounted for on a LIFO basis is reported, and the LIFO reserve (the adjustment that converts a LIFO valuation to a non-LIFO valuation) is USD 100.

Table 6.30: Estimating first-in-first-out and last-in-first-out inventories (billion USD)

Year	Census Bureau non-LIFO Inventories	LIFO reserve	Book value of inventories	LIFO inventories	FIFO inventories
Dec-14	1 767	100	1 667	167	1 500
Dec-15	2 500	100	2 400	240	2 160

Source: Eurostat-OECD Task Force on Land and other non-financial assets based on BEA compilation practice; fictitious data

In this example, the book value of inventories is calculated as Census Bureau non-LIFO inventories minus the LIFO reserve: for December 2015, USD 2 500 – USD 100 = USD 2 400. Of this USD 2 400, USD 240 is valued on a LIFO accounting basis (according to the reported LIFO share), and the remaining USD 2 160 is valued on a non-LIFO (FIFO) accounting basis

Using the detailed price indices and the appropriate weights, the monthly price indices (similar to the third column of Table 6.20) for the industry are constructed. Then, following the same methods in the example, end-of-month price indices, average monthly prices, and average annual prices are constructed. The monthly acquisition cost index equals the weighted-average of the average monthly prices, where the weights follow the turnover pattern.

With these prices, BEA then calculates estimated changes in inventories, the IVA, inventory stocks, and holding gains, following the same methods explained Section 6.4. These calculations are performed for over 400 industries. The results are aggregated using chain aggregation methods ([50]).

Published US statistics on inventories

Table 6.31 shows published statistics on inventories from the US national accounts, for major industries. These estimated are aggregated from detailed calculations at the 4–6 digit NAICS level, following the methods described. Consistent with this approach, the current price change in inventories equals the sum of the change in the book value of inventories and the IVA. Note that this implies that the IVA is calculated as the difference between changes in inventories and the change in book value (opposite of how it is described in the main text). Also, the constant price change in inventories equals the difference between the constant price stock levels of inventories in 2015 and 2014. This identity is consistent with the PIM approach, in which successive constant dollar stock levels are estimated as accumulated sums of constant dollar change in inventories. The current dollar change in inventories is, however, not equal to the difference in consecutive current dollar inventory stock levels. Because stocks are revalued using end-of-period prices while the change in inventories is revalued using average prices, it is not possible to satisfy this stock-flow identity for both constant and current dollars. BEA chooses to impose the identity for constant dollar estimates, in part because of the focus on volume changes in GDP. Holding losses (not shown) reflect reductions in prices. Because

([50]) For farm inventories, the estimates of crop and of livestock changes in inventories are prepared as the product of the change in the physical volume and of the average price, based on data from the US Department of Agriculture (USDA). The estimates of farm inventories include materials and supplies — such as feed, fertilizer, and purchased seed — that are used as inputs to farm production. Because the estimates of farm inventories are prepared using data on quantities and current prices rather than business-accounting data, an IVA is not calculated. Inventories for motor vehicles and for utilities (stocks of coal, petroleum, and natural gas) are also prepared using data on quantities.

chain-weighted aggregates are not additive, the residual term measures the discrepancy between the sum of inventories for the major industries and total inventories.

Table 6.31: US inventories statistics (billion USD)

Industry	Changes in inventories, current prices 2015	Changes in inventories, book value 2015	Inventory value adjustment, 2015	Inventory stocks, current prices December 2014	Inventory stocks, current prices December 2015	Constant-price change in inventories, 2015	Constant-price stocks, December 2014	Constant-price stocks, December 2015
Total	109.2	37.3	71.9	2 501.1	2 490.9	97.5	2 163.2	2 260.8
Farm	6.2	6.2	0.0	258.2	214.7	5.2	168.7	173.8
Mining, utilities, construction	6.7	-4.5	11.3	92.3	86.3	6.7	82.1	88.8
Manufacturing	19.7	-11.3	31.0	729.7	729.8	16.9	648.3	665.3
Durable goods industries	13.0	-1.3	14.3	438.8	451.2	11.6	404.6	416.2
Nondurable goods industries	6.7	-10.1	16.7	290.8	278.6	5.5	247.2	252.7
Wholesale trade	35.1	11.1	24.0	678.3	685.2	31.8	596.3	628.1
Durable goods industries	13.8	4.3	9.5	376.2	378.1	12.9	348.8	361.7
Nondurable goods industries	21.3	6.8	14.5	302.2	307.2	18.5	251.0	269.6
Retail trade	33.7	31.1	2.6	573.9	604.0	30.8	520.6	551.4
Motor vehicle and parts dealers	14.9	15.0	-0.2	181.6	197.5	13.6	169.4	183.1
Food and beverage stores	1.2	0.8	0.3	52.6	52.7	1.0	43.3	44.3
General merchandise stores	3.2	2.7	0.5	91.1	93.2	2.9	81.6	84.5
Other retail stores	14.5	12.5	2.0	248.6	260.5	13.5	226.7	240.2
Other industries	7.8	4.8	3.0	168.7	170.8	7.4	152.8	160.2
Residual						-1.3	-13.1	-14.3
Addenda:								
Total	109.2	37.3	71.9	2 501.1	2 490.9	109.2	97.5	2 163.2
Durable goods industries	48.2	4.3	43.9	1 090.3	1 125.8	48.2	44.3	1 012.0
Nondurable goods industries	61.0	6.8	54.2	1 410.8	1 365.1	61.0	53.7	1 162.5
Nonfarm industries	103.0	31.1	71.9	2 242.9	2 276.1	103.0	93.2	2 001.3
Wholesale trade	35.1	11.1	24.0	678.3	685.2	35.1	31.8	596.3
Merchant wholesale trade	29.7	13.8	15.9	578.3	588.3	29.7	27.0	509.8
Durable goods industries	11.4	4.0	7.4	331.6	332.6	11.4	10.6	307.6
Nondurable goods industries	18.4	9.8	8.6	246.7	255.6	18.4	16.0	205.0
Nonmerchant wholesale trade	5.4	-2.7	8.1	100.0	97.0	5.4	4.9	87.1

Source: US Bureau of Economic Analysis

Annex 6A: Simplified estimation process stocks and changes in inventories

6A.1. Figure 6A.1 below provides a simplified presentation of the process of estimating the transaction changes in inventories (P.52) and the stock level of inventories (AN.12). The estimation methods may differ depending on the available source data so the flow chart is organised by methods used when either business book value data are available or when both unit price and quantity data are available.

6A.2. If business book value data are used, information on the business accounting practices, various prices of the products held in inventories are needed, as well as any information on the various adjustments that may be needed to convert the data to national accounting concepts.

6A.3. If both unit price and quantity data are available then the estimation methods are more straightforward.

6A.4. Chapters 5 and 6 provide a more in-depth discussion on the estimation methods. The specific section is referred in the figure below for more information. It should be noted that the commodity supply-demand model discussed in Section 5.4 is not illustrated in the figure below.

Figure 6A.1: Simplified estimation process stocks and changes in inventories

Data sources	Business book value (BV) data available	Both unit price (P) and quantity (Q) data available
Surveying of business accounting practices	FIFO, Weighted-average cost, LIFO, etc.	
Selection of method	Use of business accounts	Price times quantity method
Estimating price data for inventory	Various price indices are needed: Average-period price index ($\overline{PI}_t$) End-of-period price index (PI_{tE}) End-of-period cost index (CI_{tE})	Unit prices of products comprising inventories should be obtained
Estimating nominal changes in inventories (Transactions; ΔS_t)	Option shown in Section 5.2: $\left(\frac{BV_{tE} * b_t * c_t}{CI_{tE}} - \frac{BV_{tE-1} * b_{t-1} * c_{t-1}}{CI_{tE-1}}\right) * \overline{PI}_t$	Option shown in Section 5.3: Quantities of the inventories held at the beginning (Q_{tE-1}) and end-of-period (Q_{tE}) and average unit prices $(\overline{P}_t)$ of products $(Q_{tE} - Q_{tE-1}) * \overline{P}_t$
Estimating the value of annual inventory stocks (INV_{tE})	Option shown in Section 6.2: $BV_{tE} * a_t * b_t * c_t$ Option shown in Section 6.4: $\left(\frac{INV_{tE-1}}{PI_{tE-1}} + \frac{\Delta S_t}{\overline{PI}_t}\right) * PI_{tE}$	Option shown in Section 6.3: $P_{tE} * Q_{tE}$
Estimating nominal holding gains and losses for inventories: a simple approximation ($Hold_t$)	$\left(\frac{INV_{tE}}{PI_{tE}} + \frac{INV_{tE-1}}{PI_{tE-1}}\right) / 2 * (PI_{tE} - PI_{tE-1})$	$\bar{Q}_{tE} * (P_{tE} - P_{tE-1})$
Decomposing value changes into price and volume changes	$\Delta INV_t = INV_{tE} - INV_{tE-1} = \Delta S_t + \Delta Vol_t + Hold_t$ Where other changes in the volume of inventories (ΔVol_t) is computed as the residual of the opening and closing inventory stocks on the balance sheet (ΔINV_t) less changes in inventories (ΔS_t) less nominal holding gains and losses ($Hold_t$).	

Source: Eurostat-OECD Task Force on Land and other non-financial assets

6A.5. Regarding Figure 6A.1 the following comments could be added:

(a) 't' and 'tE' indicate an average during time t and as of end of time t, respectively.

(b) 'a' indicates a conversion factor that takes into account the inventory price at the end of the current period (PI_{tE})relative to the cost index (i.e. the price at which the inventories are valued on an historical cost basis) (CI_{tE}). This is used to revalue business book value data and the factor can have many different figures depending on the inventory valuation method, the type of inventory and industries concerned.

(c) 'b' indicates a mark-up for operating surplus and other relevant costs that are not included in work-in-progress and finished goods inventories in business accounting. Thus, it is only applicable to work-in-progress and finished goods inventories because these are recorded at basic prices. See Section 6.2 paragraphs 6.20–6.26 for a discussion on how this can be calculated.

(d) 'c' indicates coverage multipliers which can also have different figures depending on the scope of data sources concerned.

7 Estimation: product and industry breakdown, sectorisation, supply and use tables

7.1 Introduction

7.1. Previous chapters have examined general principles and approaches to estimate the changes in inventories and the stocks of inventories. However, changes in inventories (P.52) should be validated within a supply and use framework. Therefore Section 7.2 discusses the changes in inventories within the supply and use tables.

7.2. However, changes in inventories should also be confronted and validated within a supply and use framework. Therefore Section 7.3 discusses the changes in inventories within the supply and use tables.

7.2 Inventories by product, industry, and institutional sector

Introduction

7.3. Section 7.2 looks at breaking down stocks and changes in inventories into products, industries and institutional sectors.

7.4. It is organised as follows. The next part provides the definitions. The following part discusses the merits and necessity of a breakdown. The third part gives guidance for the breakdown into products and industries and the final part discusses the breakdown into changes and stocks for the institutional sectors. The case study for France and Poland deal with the product and industry breakdown, the case study for the Netherlands discusses the breakdown into institutional sectors.

Definitions

7.5. The identified industries for the breakdown of inventories are based on the official industrial classification system in use in a Member State. Examples are the ISIC Rev. 4 ([51]), the NACE Rev. 2 ([52]) and the NAICS ([53]).

([51]) International Standard Industrial Classification of All Economic Activities,see footnote 7.

([52]) Statistical classification of economic activities in the European Community, see footnote 8.

([53]) United States' Census Bureau website, *North American Industry Classification System*. Available at https://www.census.gov/eos/www/naics/

7.6. The same applies to products. The product breakdown should be based on an official system in use, e.g. CPC ([54]) or the CPA ([55]), in line with recommendations of SNA 2008 or ESA 2010.

7.7. Cross-classification refers to a breakdown of industries or institutional sectors by different types of inventory. Table 7.1 shows the cross-classification for industries and inventory types.

Table 7.1: The cross-classification of inventories by industry and type of inventories

	Total inventories (AN.12)	Materials and supplies (AN.121)	Work-in-progress (AN.122)	Finished goods (AN.123)	Military inventories (AN.124)	Goods for resale (AN.125)
Total industry	100	21	19	21	5	34
Agriculture	16	2	8	6	0	0
Other production	6	3	0	3	0	0
Manufacturing	17	4	6	7	0	0
Construction	12	7	0	5	0	0
Services, of which:	49	5	5	0	5	34
Retail & wholesale trade	30	4	0	0	0	30

Source: Eurostat-OECD Task Force on Land and other non-financial assets; fictitious data

7.8. The main institutional sectors of the national economy are non-financial corporations, financial corporations, general government, non-profit institutions serving households and households. The asset inventories does not appear on the balance sheet of the rest of the world towards the national economy. If necessary for estimation purposes and possible, subsectors can also be distinguished. Table 7.2 shows the institutional sectors.

Table 7.2: Sectors of the economy

Code	Institutional sector
S.1	Total economy
S.11	Non-financial corporations
S.12	Financial corporations
S.13	General government
S.14	Households
S.15	Non-profit institutions serving households (NPISH)

Source: European system of accounts 2010

7.9. Table 7.3 shows the cross-classification for industries and institutional sectors. Table 7.4 shows the cross-classification of sectors by type of inventories held by these sectors.

([54]) United Nations, Central Product Classification (CPC), Version 2.1, New York, 2015. Available at http://unstats.un.org/unsd/cr/downloads/CPCv2.1_complete%28PDF%29_English.pdf

([55]) European Commission/Eurostat, *Statistical Classification of Products by Activity, Version 2.1 (CPA 2.1)*, Official Journal of the European Union, 2014. Available at http://ec.europa.eu/eurostat/ramon/nomenclatures/index.cfm?TargetUrl=LST_NOM_DTL&StrNom=CPA_2_1&StrLanguageCode=EN&IntPcKey=&StrLayoutCode=HIERARCHIC

Table 7.3: Cross-classification of inventories by industry and sector

	Total economy	Non-financial corporations	Financial corporations	General government	Households	NPISH
Total all industries	100	65	4	11	18	2
Agriculture	16	6	0	0	10	0
Other production	6	2	0	0	4	0
Manufacturing	17	17	0	0	0	0
Construction	12	12	0	0	0	0
Services, of which:	49	28	4	11	4	2
Retail & wholesale trade	30	26	0	0	4	0

Source: Eurostat-OECD Task Force on Land and other non-financial assets; fictitious data

Table 7.4: Cross-classification of inventories by sector

	Total economy	Non-financial corporations	Financial corporations	General government	Households	NPISH
Total inventories (AN.12)	100	65	4	11	18	2
Materials and supplies (AN.121)	21	10	2	6	2	1
Work-in-progress (AN.122)	19	8	2	0	8	1
Finished goods (AN.123)	21	17	0	0	4	0
Military inventories (AN.124)	5	0	0	5	0	0
Goods for resale (AN.125)	34	30	0	0	4	0

Source: Eurostat-OECD Task Force on Land and other non-financial assets; fictitious data

Why is a breakdown and cross-classification important?

7.10. The SNA 2008 recognises that any unit can hold inventories: 'Every enterprise, including non-market producers owned by government units, may be expected to hold some inventories of materials and supplies, if only inventories of office supplies' (SNA 2008 paragraph 10.132).

7.11. Generally and as explained in Chapter 1, both stocks and changes in inventories (P.52) have to be compiled according to ESA 2010 on the level of institutional sectors (e.g. ESA 2010 transmission programme of data, Tables 8 and 26).

7.12. A breakdown of inventories by industries and products can be particularly needed:

(a) When the breakdown of inventories by products is not otherwise available and the method to estimate it requires data by industries. The breakdown of inventories by products is sometimes needed to revalue the changes in inventories and estimate the nominal holding gains and losses. Each type of inventory usually consists of several products or commodities, each with its own price index. The breakdown into products can be used to establish the correct weights for the inventory type deflator.

(b) When changes in inventories by products are required in the commodity flows and for balancing the supply and use tables (SUTs).

(c) For the trade margins. In fact, in order to calculate the trade margins (revalued), a breakdown of goods for resale inventories by trade industries can be required.

(d) As a basis for the estimation of inventories by institutional sectors.

7.13. To a large extent, data on inventories are an important variable for describing the behaviour of economic agents. Specifically, these types of assets are an important source of information when studying major economic upheavals such as the 2008 economic crisis (cf. Udenio, Fransoo and Peels) ([56]). As a consequence of the sudden collapse of financing possibilities in the crisis, firms have sought ways to retain working capital, which materialised as rapid destocking. Separate information by industry and sector improves the usefulness of such studies.

7.14. For productivity analysis the full range of capital inputs needs to be considered, which includes inventories. Especially in the framework of an exogenous return to capital, the full range of capital inputs is needed to correctly determine the volume and share of capital inputs. The additional break down of inventories for industries is helpful when doing further analyses and is required when publishing growth accounts at the industry level.

Breakdown of inventories by industry and product

7.15. This section proposes methods for breaking down inventory stocks (AN.12) by industries and by products/commodities for inventories of work-in-progress and finished goods (AN.122 and AN.123), inventories of materials and supplies (AN.121), and inventories of goods for resale (AN.125). These methods can be applied to both inventory stocks and changes in inventories.

7.16. Military inventories (AN.124) are a special case because they correspond to one or two products in the CPA nomenclature and they are usually held by a few industries. Military inventories are dealt with in Section 8.4.

7.17. Inventories of work-in-progress on cultivated biological assets (AN.1221) are a subcategory of inventories of work-in-progress. This kind of inventory is also a special case because the data often have specific sources not used for other estimates of changes in inventories or stocks (for example, standing timber may be estimated by the national forestry offices). They are not addressed in this chapter, but information on inventories of agricultural products can be found in Sections 8.2 and 5.3.

7.18. In general, all estimates are as good as their sources. Surveys might be preferable, but place an administrative burden on companies and the national statistical institute as they require detailed accounting data; in addition results might not always be plausible. More on data sources can be found in Chapter 3.

In many countries source data for inventories are already available by industries. Nevertheless, it is possible, that the data collection is done at the enterprise or legal unit level. For example, if inventory data are taken from the structural business survey then data will usually be based on the enterprise. Also, if the source of inventory data is enterprise administrative data (and therefore not always related to one kind-of-activity unit), it is possible that each enterprise may be assigned to one industry, which corresponds to its main industry (in terms of value added for instance). In those cases, the inventory data look like they correspond to a single industry whereas in fact the stocks or changes should be spread over the industries of the kind-of-activity units of that enterprise. Thus, if inventory data are only available at the enterprise level or only by product or even by institutional sector, a method to break down inventories by industries might be necessary.

A breakdown of inventories by products can provide figures of changes in inventories for the commodity flows or at least provide a benchmark or starting point. Indeed, in the supply-use approach, some commodity flows might have a different figure for changes in inventories than those obtained by breakdown methods. This can be the case because for some products there is an alternative source which allows more accurate estimates for the changes in inventories (for instance agricultural products and military inventories). Another reason may be problems occurring when balancing the commodity flow (changes in inventories are sometimes the balancing item in the commodity flows). However, the changes in inventories obtained with the breakdown method may be the only source of data for most products.

([56]) Udenio, M., J.C. Fransoo, R. Peels, R., 'Destocking, the bullwhip effect, and the credit crisis: empirical modelling of supply chain dynamics', *International Journal of Production Economics*, 160, February 2015, p.34–46. Available at https://pure.tue.nl/ws/files/3820044/585164889591905.pdf

7.19. Prior to the breakdown of inventories by products/commodities, for each type of inventories a list of storable products must be established. Storable products are products that can be stored or held in inventories. Each country should draw up this list of storable products, in line with the recommendations of SNA 2008 and ESA 2010, and apply it to all reporting periods.

7.20. One of the main reasons for drawing up a list of products by inventory type and by industry is missing data on the product structure. The list of products helps to divide the changes, but also stocks, between products per inventory type.

7.21. In general the inventories of finished goods and work-in-progress are based on the output structure from the SUTs, whereas products within the materials and supplies use the intermediate consumption structure.

7.22. All goods of the CPA nomenclature are storable. However, services are generally intangible assets; therefore, most of them are not considered as storable products. Inventories of services are described in more detail in Section 8.5.

7.23. Some products can be considered storable only as one type of inventory. For instance, Architectural and engineering services can be considered storable only as inventories of work-in-progress (in the case the service is not yet finished, or is not yet sold). Buildings and other structures can only be included in one category/type of inventories, namely work-in-progress. Section 8.3 on treatment of buildings and other structures describes this special kind of inventory.

7.24. For each type of inventory (finished goods, work-in-progress, materials and supplies and goods for resale) an appropriate method for the breakdown can be used. These methods use different tools or information that can help to break down inventories by industries and/or by products. They assume that figures for inventories (stocks or/and changes) are available by type of inventory.

INVENTORIES OF WORK-IN-PROGRESS AND FINISHED GOODS (AN.122 AND AN.123)

7.25. Inventories of work-in-progress and finished goods are products which result from the production of the enterprise that holds them. When these types of inventories are not available by industry, information (or estimation) on the breakdown of production by industries or products for each enterprise can be used. Such an estimation of the breakdown of production by industries or products for each enterprise can be derived from a survey and it can be facilitated by the knowledge of the main industry of the enterprise. It could be an estimation established and fixed for all reporting periods. Nevertheless, if the information is available each year, it is preferable to use the most recent one to the current year, because the structure of work-in-progress and finished goods inventories of an enterprise is more likely to be similar to its recent structure of storable production.

7.26. It can be assumed that the industries store the products that they produce. Moreover, an even more constraining assumption could be made that only products related to the main activity are stored, i.e. the diagonal output matrix is used (product = industry).

7.27. The shares or ratios obtained with the breakdown of production needs to be adjusted by a restriction to the list of storable products, previously mentioned. In fact, all the products from the production of an enterprise are not necessarily storable. Such a breakdown of inventories can give a good estimation of producer inventories by industries or by products and even both.

INVENTORIES OF MATERIALS AND SUPPLIES (AN.121)

7.28. For the materials and supplies inventories, information on intermediate inputs for each industry can be used. The products used as intermediate inputs in production need to be restricted in order to remove the non-storable products. For instance, most services are non-storable products, but they may represent an important part of the intermediate inputs of an enterprise. For each industry, the structure of materials and supplies inventories by product can thus be estimated from its structure of storable intermediate inputs. It should also be checked whether the structure of inputs and the structure of materials and supplies inventories are the same. Fuel is usually consumed in all industries; however most industries do not store it.

7.29. For this type of inventories, if the basic information is not provided by industries but by enterprises (for those the main industry is known), each enterprise can be considered to be a kind-of-activity unit. However, by doing so some bias will be introduced in the estimates of stocks and changes of materials and supplies.

7.30. Table 7.5 below provides an example of a breakdown in stocks of inventories for a single industry (manufacture of beverages). It is assumed that only products of agriculture, hunting and related services (A01); food products (C10); beverages (C11); and other non-metallic mineral products (C23) are storable. Therefore, the percentage of intermediate inputs must be adjusted to include only those storable products to obtain the structure breakdown of the inventory stock shown in the last column.

7.31. In this chapter, the tables only refer to stocks, but the methods presented also apply to changes in inventories. However, it must be noted that the shares of stocks can differ from the shares of changes in inventories for the same inventory type, industry and product (e.g. the percentage of food products stocks in the manufacture of beverages industry may differ from the percentage of food products changes in inventories in the manufacture of beverages industry).

Table 7.5: Example of materials and supplies inventory stocks for industry C11 Manufacture of beverages, by product

Industry	Intermediate inputs (structure of the most recent year available)	(% of intermediate inputs)	Storable products (% of intermediate inputs)	Structure obtained to breakdown inventory stock (% of storable products)
Manufacture of beverages (C11)	Products of agriculture, hunting and related services (A01)	10	10	13
	Food products (C10)	24	24	31
	Beverages (C11)	36	36	47
	Other non-metallic mineral products (C23)	7	7	9
	Warehousing and support services for transportation (H52)	4		
	Services of head offices; management consulting services (M70)	5		
	Advertising and market research services (M73)	11		
	Office administrative, office support and other business support services (N82)	3		
	Total	100	77	100

Source: Eurostat-OECD Task Force on Land and other non-financial assets; fictitious data

INVENTORIES OF GOODS FOR RESALE (AN.125)

7.32. Methods may vary on how to breakdown goods for resale inventories depending on the kind of industry that holds the inventory. At a minimum, a distinction should be made between the trade industries and the other industries.

7.33. For goods for resale inventories held by one of the trade industries (wholesale and retail), information on the breakdown of turnover (sales) by products of these industries can be used to obtain an estimated structure of the breakdown of inventories by products. For example, in Table 7.6 it is assumed that for the wholesale and retail trade and repair of motor vehicles and motorcycles industry the following items are storable (based on what products are sold in that industry): rubber and plastic products (30 %), motor vehicles, trailers, and semi-trailers (53 %), and other storable products not separately identified in the table (17 %). These percentages can then be multiplied by the total inventory stock for that industry. For instance, the stock of rubber and plastic products is 0.3 * 2 283 = 685.

Table 7.6: Breakdown of goods for resale inventory stocks by products, based on the breakdown of turnover by products

Industry	Inventory stock	Products	Structure obtained to breakdown inventory stock (% of storable products)	Inventory stock
Wholesale and retail trade and repair of motor vehicles and motorcycles (G45)	2283	Rubber and plastic products (C22)	30	0,3 * 2283 = 685
		Motor vehicles, trailers and semi-trailers (C29)	53	0,53 * 2283 = 1210
		Etc….	…	…
Wholesale trade, except of motor vehicles and motorcycles (G46)	5570	Products of agriculture, hunting and related services (A01)	8	0,08 * 5570 = 446
		Food products (C10)	20	0,2 * 5570 = 1114
		Furniture (C31)	3	0,03 * 5570 = 167
		Etc…	…	…
Retail trade, except of motor vehicles and motorcycles (G47)	4727	Products of agriculture, hunting and related services (A01)	3	0,03 * 4727 = 142
		Food products (C10)	24	0,24 * 4727 = 1134
		Wearing apparel (C14)	13	0,13 * 4727 = 615
		Furniture (C31)	5	0,05 * 4727 = 236
		Etc…	…	…

Source: Eurostat-OECD Task Force on Land and other non-financial assets; fictitious data

7.34. For goods for resale inventories held by the other industries (other than trade industries), there are two cases. A diagonal breakdown from industries to product is a good solution for all the industries for which a diagonal assignment to product gives a storable product. For example, in Table 7.7, it is assumed that the manufacture of beverages industry would hold beverage products for resale. For the other industries (broadly service industries), an assignment to one storable product for each industry can be fixed for all reporting periods. For instance, in Table 7.7 it is assumed that both the manufacture of other non-metallic mineral products industry and the construction industry hold goods for resale of other non-metallic mineral products.

Table 7.7: Assignments of each industry to one product, for goods for resale inventory stocks (held by industries other than trade)

Industry	Product assigned
Crop and animal production, hunting and related service activities (A01)	Products of agriculture, hunting and related services (A01)
Forestry and logging (A02)	Products of forestry, logging and related services (A02)
Etc…	…
Manufacture of beverages (C11)	Beverages (C11)
Accommodation (I55)	
Food and beverage service activities (I56)	
Etc…	…
Manufacture of basic pharmaceutical products and pharmaceutical preparations (C21)	Basic pharmaceutical products and pharmaceutical preparations (C21)
Veterinary activities (M75)	
Human health activities (Q86)	
Manufacture of rubber and plastic products (C22)	Rubber and plastic products (C22)
Manufacture of other non-metallic mineral products (C23)	Other non-metallic mineral products (C23)
Construction of buildings (F41)	
Etc…	…

Source: Eurostat-OECD Task Force on Land and other non-financial assets

7.35. Thus using the assignments provided in Table 7.7, Table 7.8 illustrates the procedure to calculate the inventory stock level for the products held for resale in industries other than trade. For example, in Table 7.8 the total food and beverage product for resale (158) is calculated as the sum of the goods for resale inventory stock for the manufacture of beverage industry (73) + the accommodation industry (20) + the food and beverage service industry (65).

Table 7.8: Breakdown of goods for resale inventory stocks by product, using the product assignment of Table 7.7

Industry	Inventory stock	Product assigned	Inventory stock
Crop and animal production, hunting and related service activities (A01)	36	Products of agriculture, hunting and related services (A01)	36
Forestry and logging (A02)	24	Products of forestry, logging and related services (A02)	24
Etc…	…	…	…
Manufacture of beverages (C11)	73	Beverages (C11)	73 + 20 + 65 = 158
Accommodation (I55)	20		
Food and beverage service activities (I56)	65		
Etc…	…	…	…
Manufacture of basic pharmaceutical products and pharmaceutical preparations (C21)	74	Basic pharmaceutical products and pharmaceutical preparations (C21)	74 + 6 + 4 = 84
Veterinary activities (M75)	6		
Human health activities (Q86)	4		
Manufacture of rubber and plastic products (C22)	45	Rubber and plastic products (C22)	45
Manufacture of other non-metallic mineral products (C23)	35	Other non-metallic mineral products (C23)	35 + 21 = 56
Construction of buildings (F41)	21		
Etc…	…	…	…

Source: Eurostat-OECD Task Force on Land and other non-financial assets

Box 7.1: Breaking down inventories by industries and products — France

In France, each year accounting data for non-financial companies and unincorporated enterprises are transmitted from the tax administration to INSEE (the French National Institute for Statistics and Economic Research). They include the profit and loss account and the balance sheet. These data, based on the French generally accepted accounting principles (GAAP), provide an annual quasi-census data (not based on samples). Thus, closing inventory stock (AN.12) and changes in inventories (P.52) are available for each enterprise.

In the source of data, the closing inventory stock is directly split into work-in-progress of goods, work-in-progress of services, finished goods, materials and supplies and goods for resale. But the changes in inventories are split into work-in-progress and finished goods (together), materials and supplies and goods for resale. Therefore, the calculation is done at this aggregation level of type of inventories.

The closing inventory stock and the changes in inventories are not available by industry. However, the main industry (in terms of turnover) of each enterprise is known and the Annual Sectoral Survey provides the breakdown of their turnover into industries. This information is used for breaking down inventories of work-in-progress and finished goods by products.

No information on the breakdown of inventories by products is available in the accounting data mentioned above. Therefore, methods for estimating the changes in inventories by product (commodities) are implemented. The main purpose of these methods is to obtain, for each type of inventory, an estimation of the changes in inventories broken down by products and, at the same time, an estimation of the nominal holding gains and losses.

For inventories of work-in-progress, finished goods, materials and supplies and goods for resale, the methods of breakdown by industries and by products described Section 7.2 are implemented. For each type of inventory the breakdown by product is done for the stocks of inventory (the method is both applied for the opening inventory stock and for the closing inventory stock). The opening book value (of the current year) is calculated as the closing book

value minus the changes in inventories, which are directly provided by the accounting data. Then, for each product, the calculation of the changes in inventories in national accounts concepts is done using previous year's book values as well as the product's price trend throughout the year. The calculation also gives an estimation of the nominal holding gains and losses.

Inventories of work-in-progress and finished goods are broken down with the method described in Section 7.2. The structure of turnover broken down by industries which is used for estimating the inventories of year t is that of year t-1. This is for reasons of availability of the data from ESA at the time of the first estimation of inventories. The structure of intermediate inputs by industries, used for breaking down materials and supplies inventories, is also the structure of year t-1, for the same reasons. As regards the goods for resale inventories, the structure, described in Section 7.2, has been established during the preparation of the base year 2010.

The work from the main industry of enterprises is done at level 138, which is a French intermediate nomenclature level, between levels divisions and groups of the statistical classification of economic activities in the European Community (NACE Rev. 2). The same level of detail is used to estimate the breakdown of inventories by products (CPA at the level of 138 products).

The changes in inventories broken down by products, obtained by the methods described, provide figures for a majority of the commodity flows. For these products, there is no other data source for inventories. For a few other products, there is a more accurate source which allows estimating changes in inventories. This is particularly the case for agricultural products and military inventories, and sometimes also for oil or other strategic inventories. The total amount of changes in inventories (estimated with the methods for breaking down and then methods for valuation) provides a benchmark for the supply-use approach.

Box 7.2: Breakdown (changes in) inventories into industries and products — Poland

Introduction

A breakdown by types of inventories and, if possible, by industries should be implemented in order to allow for the use of more suitable price indices in the calculation reflecting the composition of materials and supplies, work-in-progress, finished goods and goods for resale by product.

Data sources

The calculation of changes in inventories (P.52) and nominal holding gains and losses ('holding gains') for changes in inventories is carried out on a quarterly basis for four types of inventories broken down by industries (NACE Rev. 2) and by size of units:

- materials and supplies (AN.121);
- work-in-progress (AN.122);
- finished foods (AN.124);
- goods for resale (AN.125).

The data sources for inventories for large and medium ([57]) units are provided by CSO (Polish Central Statistical Office) reports on income, costs, financial results and investment outlays on fixed assets. The inventories structure of large units is applied to small ones as for the latter no quarterly information is available. The value is corrected when data from the annual reports on the economic activity of enterprises, covering information on inventories in small units, becomes available.

([57]) For the purpose of statistical reporting units are classified according their size: large, medium and small ones depending on the number of employees (more than 49 employees, 10–49 employees, up to 9 employees respectively)

The method presented makes it possible to calculate changes in inventories and holding gains with price indices for relevant products, industries and stages of processing (materials and supplies, work-in-progress, finished goods and goods for resale). Information on the composition of inventories is taken from supply and use tables, separately for large, medium and small units.

The assumption is made that the closing book value of the accounting period is equal to the opening book value of the following accounting period. The difference between the closing and the opening stocks is the book value of changes in inventories.

As there is no direct information on inventories by product, the commodity composition of stocks is estimated from the product structure in the supply and use framework. For calculating materials the structure of intermediate consumption from the use table is used, whereas for calculating work-in-progress, finished goods and goods for resale the output structure from the supply table is used. The structures are applied for weighting aggregated values of inventories in particular industries to produce the matrix of inventories by products. The difference between these both matrices with the closing and the opening book values provides the book value of changes in inventories by products and by industries. To revalue inventories at historical prices to constant prices the following steps are taken:

- the matrix with opening book values of inventories is divided by the column with price indices at the beginning of the period;
- the matrix with closing book values of inventories is divided by the column with price indices at the end of the period;
- the difference between deflated values in both matrices at the end and at the beginning of the accounting period reflects changes in inventories at constant prices.

To derive changes in inventories at average current prices of accounting period by product groups and by industries (NACE Rev. 2) the value of changes in inventories at constant prices is multiplied by the column with average price indices of period.

Table 7.9: The structures for products and industries (uses) (share of intermediate consumption)

Products (CPA 2008)		Industries (NACE Rev.2)								
		Crop and animal production, hunting and related service activities	Forestry and logging	Fishing and aquaculture	Mining of coal and lignite	Other industries	Sports activities and amusement and recreation activities	Activities of membership organisations	Repair of computers and personal and household goods	Other personal service activities
		(01)	(02)	(03)	(05)	(06-92)	(93)	(94)	(95)	(96)
Products of agriculture, hunting and related services	01									
Wheat	01.11.1	0,03935	0,00019	0,01937	0,00000	…	0,00013	0,00000	0,00000	0,00000
Maize	01.11.2	0,00531	0,00000	0,00252	0,00000	…	0,00011	0,00030	0,00000	0,00000
Barley, rye and oats	01.11.3	0,01779	0,00000	0,00563	0,00000	…	0,00000	0,00000	0,00000	0,00000
Etc.…	…	…	…	…	…	…	…	…	…	…
Raw fur skins and miscellaneous raw hides and skins	01.49.3	0,00059	0,00000	0,00000	0,00000	…	0,00000	0,00000	0,00000	0,00000
Products of forestry, logging and related services	02									
Forest trees and nursery services	02.10	0,00002	0,00211	0,00000	0,00000	…	0,00000	0,00000	0,00000	0,00000
Wood in the rough	02.2	0,00041	0,54118	0,00012	0,00905	…	0,00061	0,00062	0,00000	0,01002
Wild growing non-wood products	02.3	0,00087	0,00223	0,00020	0,00000	…	0,00000	0,00046	0,00000	0,00000
Fish and other fishing products; aquaculture products; support services to fishing	03									
Fish, live	03.00.1	0,00005	0,00148	0,16514	0,00000	…	0,00010	0,00017	0,00000	0,00139
Other fishing products	03.00.x	0,00001	0,00011	0,03817	0,00000	…	0,00001	0,00002	0,00000	0,00000
Coal and lignite	05					…				
Hard coal	05.1	0,01081	1,00000	1,00000	0,93734	…	1,00000	1,00000	1,00000	1,00000
Lignite	05.2	0,03959	0,00000	0,00000	0,06266	…	0,00000	0,00000	0,00000	0,00000
Etc.…	…	…	…	…	…	…	…	…	…	…

Source: Central Statistical Office of Poland

Calculations

(1) Apply the structures to aggregated values in particular industries to derive opening and closing book values for products and industries.

The tables below show the calculation for opening book value. For example, the opening book value of wheat in Division 01 is computed by multiplying the inventory structure by aggregated opening book value in Division 01 (i.e. 0.03935 * 634 530.0 = 24 968.8).

Table 7.10: Opening book values by industry and product, current prices (thousand PLN)

Products (CPA 2008)		Opening book values, by industry (NACE Rev.2)								
		Crop and animal production, hunting and related service activities	Forestry and logging	Fishing and aquaculture	Mining of coal and lignite	Other industries	Sports activities and amusement and recreation activities	Activities of membership organisations	Repair of computers and personal and household goods	Other personal service activities
		(01)	(02)	(03)	(05)	(06-92)	(93)	(94)	(95)	(96)
Products of agriculture, hunting and related services	01									
Wheat	01.11.1	24 968.8	7.1	36.9		…	0.1	0.0	0.0	0.0
Maize	01.11.2	3 369.4	0.0	4.8		…	0.1	0.0	0.0	0.0
Barley, rye and oats	01.11.3	11 288.3	0.0	10.7		…	0.0	0.0	0.0	0.0
Etc.…	…	…	…	…	…	…	…	…	…	…
Raw fur skins and miscellaneous raw hides and skins	01.49.3	374.4	0.0	0.0		…	0.0	0.0	0.0	0.0
Products of forestry, logging and related services	02									
Forest trees and nursery services	02.10	12.7	78.7	0.0	0.0	…	0.0	0.0	0.0	0.0
Wood in the rough	02.2	260.2	20 194.1	0.2	2 085.0	…	0.5	0.0	0.0	190.7
Wild growing non-wood products	02.3	552.0	83.2	0.4	0.0	…	0.0	0.0	0.0	0.0
Fish and other fishing products; aquaculture products; support services to fishing	03									
Fish, live	03.00.1	31.7	55.2	314.6		…	0.1	0.0	0.0	26.5
Other fishing products	03.00.x	6.3	4.1	72.7		…	0.0	0.0	0.0	0.0
Coal and lignite	05		0.0	0.0		…	0.0	0.0	0.0	0.0
Hard coal	05.1	6 859.3	37 315.0	1 905.0	1 586.0	…	836.1	0.0	76 706.3	19 035.5
Lignite	05.2	25 121.0	0.0	0.0	106.0	…	0.0	0.0	0.0	0.0
Etc.…	…	…	…	…	…	…	…	…	…	…
Opening book value (aggregated totals)		634 530.0	37 315.0	1 905.0	230 395.0	…	836.1		76 706.3	19 035.5

Source: Central Statistical Office of Poland

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

For example, the opening book value of wheat in Division 01 is divided by the proper price index for the product/or product group to obtain opening values in constant prices (i.e. 24 968.8/(100.2/100) = 24 919.0) (Table 7.11). Similarly the closing book value of wheat in Division 01 is divided by the proper price index for the product/or product group to obtain the closing value in constant prices (i.e. 22 365.0/(99.9/100) = 22 387.4) (Table 7.12).

Table 7.11: An example of the calculation of opening stock values in constant prices by industry and product (thousand PLN)

Products (CPA 2008)		Opening values, constant prices, by industry (NACE Rev.2)				
		Price index (beginning of the period)	Crop and animal production, hunting and related service activities	Forestry and logging	Fishing and aquaculture	Mining of coal and lignite
			(01)	(02)	(03)	(05)
Products of agriculture, hunting and related services	01					
Wheat	01.11.1	100.2	24 919.0	7.1	36.8	0.0
Maize	01.11.2	100.2	3 362.7	0.0	4.8	0.0
Barley, rye and oats	01.11.3	100.2	11 265.8	0.0	10.7	0.0
Etc…	…	…	…	…	…	…
Raw fur skins and miscellaneous raw hides and skins	01.49.3	99.5	376.3	0.0	0.0	0.0
Products of forestry, logging and related services	02					
Forest trees and nursery services	02.10	99.5	12.8	79.1	0.0	0.0
Wood in the rough	02.2	99.5	261.5	20 295.6	0.2	2 095.5
Wild growing non-wood products	02.3	99.5	554.8	83.6	0.4	0.0
Fish and other fishing products; aquaculture products; support services to fishing	03					
Fish, live	03.00.1	101.3	31.3	54.5	310.6	0.0
Other fishing products	03.00.x	100.4	6.3	4.1	72.4	0.0
Coal and lignite	05					
Hard coal	05.1	98.7	6 949.6	37 806.5	1 930.1	1 606.9
Lignite	05.2	98.4	25 529.5	0.0	0.0	107.7
Etc….	…	…	…	…	…	…

Source: Central Statistical Office of Poland

Table 7.12: An example of the calculation of closing stock values in constant prices by industry and product (thousand PLN)

Products (CPA 2008)		Closing book values, by industry (NACE Rev.2)				Price index (end of the period)	Closing values, constant prices, by industry (NACE Rev.2)			
		Crop and animal production, hunting and related service activities	Forestry and logging	Fishing and aquaculture	Mining of coal and lignite		Crop and animal production, hunting and related service activities	Forestry and logging	Fishing and aquaculture	Mining of coal and lignite
		(01)	(02)	(03)	(05)		(01)	(02)	(03)	(05)
Products of agriculture, hunting and related services	01									
Wheat	01.11.1	22 365.0	2.1	24.1	0.0	99.9	22 387.4	2.1	24.1	0.0
Maize	01.11.2	3 018.7	0.0	3.1	0.0	99.9	3 021.7	0.0	3.1	0.0
Barley, rye and oats	01.11.3	10 111.8	0.0	7.1	0.0	99.9	10 121.9	0.0	7.1	0.0
Etc…	…	…	…	…	…	…	…	…	…	…
Raw fur skins and miscellaneous raw hides and skins	01.49.3	334.3	0.0	0.0	0.0	99.5	336.0	0.0	0.0	0.0
Products of forestry, logging and related services	02									
Forest trees and nursery services	02.10					99.5	0.0	0.0	0.0	0.0
Wood in the rough	02.2	232.0	26 901.0	0.2	1 987.0	99.5	233.2	27 036.2	0.2	1 997.0
Wild growing non-wood products	02.3	492.5	111.3	1.1	0.0	99.5	495.0	111.9	1.1	0.0
Fish and other fishing products; aquaculture products; support services to fishing	03									
Fish, live	03.00.1	29.1	75.0	519.8	0.0	101.3	28.7	74.0	513.1	0.0
Other fishing products	03.00.x	6.3	5.1	118.4	0.0	100.4	6.3	5.1	117.9	0.0
Coal and lignite	05									
Hard coal	05.1	6 107.2	37 458.5	1 907.1	1 504.9	98.7	6 187.6	37 951.9	1 932.2	1 524.7
Lignite	05.2	25 089.8	0.0	0.0	100.9	98.4	25 497.8	0.0	0.0	102.5
Etc….	…	…	…	…	…	…	…	…	…	…

Source: Central Statistical Office of Poland

(3) Revalue constant prices values to obtain current price values.

For example, the estimated changes in inventories for wheat is 22 387.4 – 24 919.0 = –2 531.6. This value is then revalued with the price index (average for the quarter) to obtain the current price value (i.e. –2 531.6/(100.1/100) = –2 534.1).

Table 7.13: An example of the calculation of changes in inventories in constant and current prices by industry and product (thousand PLN)

Products (CPA 2008)		Changes in inventories, constant prices, by industry (NACE Rev.2)				Price index (average of the period)	Changes in inventories, current prices, by industriy (NACE Rev.2)			
		Crop and animal production, hunting	Forestry and logging	Fishing and aquaculture	Mining of coal and lignite		Crop and animal production, hunting and related service activities	Forestry and logging	Fishing and aquaculture	Mining of coal and lignite
		(01)	(02)	(03)	(05)		(01)	(02)	(03)	(05)
Products of agriculture, hunting and related services	01									
Wheat	01.11.1	-2 531.6	-5.0	-12.7	0.0	100.1	-2 534.1	-5.0	-12.7	0.0
Maize	01.11.2	-341.0	0.0	-1.7	0.0	100.1	-341.3	0.0	-1.7	0.0
Barley, rye and oats	01.11.3	-1 143.9	0.0	-3.6	0.0	100.1	-1 145.0	0.0	-3.6	0.0
Etc…	…	…	…	…	…	…	…	…	…	…
Raw fur skins and miscellaneous raw hides and skins	01.49.3	-40.3	0.0	0.0	0.0	99.8	-40.2	0.0	0.0	0.0
Products of forestry, logging and related services	02									
Forest trees and nursery services	02.10	-12.8	-79.1	0.0	0.0	99.8	-12.8	-78.9	0.0	0.0
Wood in the rough	02.2	-28.3	6 740.6	0.0	-98.5	99.8	-28.2	6 727.1	0.0	-98.3
Wild growing non-wood products	02.3	-59.8	28.3	0.7	0.0	99.8	-59.7	28.2	0.7	0.0
Fish and other fishing products; aquaculture products; support services to fishing	03									
Fish, live	03.00.1	-2.6	19.5	202.5	0.0	101.5	-2.6	19.8	205.5	0.0
Other fishing products	03.00.x	0.0	1.0	45.5	0.0	100.7	0.0	1.0	45.8	0.0
Coal and lignite	05									
Hard coal	05.1	-762.0	145.4	2.1	-82.2	99.2	-755.9	144.2	2.1	-81.5
Lignite	05.2	-31.7	0.0	0.0	-5.2	99.2	-31.4	0.0	0.0	-5.2
Etc….	…	…	…	…	…	…	…	…	…	…

Source: Central Statistical Office of Poland

Methods of estimating the changes and stocks of inventories by institutional sector or cross-classification

7.36. This section describes some of the methods which were presented earlier in this compilation guide and shows how to extend them to sectorise and cross-classify inventories and changes in inventories.

7.37. For estimating the full set of accounts for an institutional sector, changes in inventories are needed. For estimating balance sheets of institutional sectors, stocks are needed.

7.38. Compilers of national accounts inventory statistics have to decide which method to employ for the estimation of sectors and cross-classification. They first of all should decide whether they use the bottom-up approach or the top-down approach. The first requires the use of sources and preparation of results at the level of institutional sectors or subsectors, and then adding them up for the total economy. For adding up, no consolidation is necessary as inventories are a non-financial asset without a counterpart liability. The latter requires the estimation of total stocks or changes in stocks and distributing the totals over the institutional sectors.

7.39. Second, the compilers should decide if they want to use an indirect or a direct estimation of stocks and changes in inventories. Examples of direct estimations are the quantity times price (p * q) method and the use of business surveys and registers. Indirect estimations can be obtained by applying the supply-demand model or the perpetual inventory method. Detailed information on these methods can be found in Chapter 5 for changes in inventories and in Chapter 6 for stocks of inventories.

7.40. The availability of sources determines the approach which is used for the estimation. For some sectors administrative records may show the stocks and changes in inventories. However, for other sectors, indirect estimation can be necessary. If the breakdown for the industries and products has been made first and the estimates are balanced and exhaustive, i.e. all economic activities are covered, the totals from that exercise should be used to compile the sector estimates.

7.41. The bottom-up approach is the preferred method because it allows more detail and a higher level of accuracy. Care should be taken that national accounts sources are not added up with sources that are not brought in line with national accounts definitions. For further discussion on national accounts concepts see Chapter 2.

7.42. All methods should result in sectorisation and cross-classification as illustrated by Tables 7.3 and 7.4 in this section.

7.43. Sources for estimating the sectoral changes and stocks of inventories are (sample) surveys, data from tax authorities, annual financial reports and statements and/or government reports. Government reports can be drawn from any level of government. See for data sources Chapter 3 and for specific issues with government inventories Section 8.4.

7.44. Although in theory any institutional sector can hold any type of inventory, some types of inventory are strongly associated with a single institutional sector. One such example is military inventories, usually only found in the government sector.

7.45. If an institutional sector fully coincides with an industry or multiple industries, the estimation of those industries can be used for the sector. This can for example be the case for the financial services industry and financial corporations sector.

7.46. Non-profit institutions serving households and financial corporations will usually hold small amounts of inventories in comparison to the non-financial corporations or government sector. They will most likely hold stocks of materials and supplies. Also, work-in-progress of services, for instance in the production of movies or software originals, may be found in these sectors.

7.47. The government sector has special types of inventories. SNA 2008 paragraph 10.12 states 'Inventories held by government include, but are not limited to, inventories of strategic materials, and grain and other commodities of special importance to the nation.' Section 8.4 gives a more extensive overview of government inventories.

7.48. Any (strategic) inventory of oil or gas should avoid double counting with oil and gas reserves. The non-produced non-financial asset of oil and gas reserves, or any subsoil asset, should not be counted as inventory and vice versa.

7.49. Compilers may also assume that a specific sector does not have a certain type of inventory, e.g. that there will be no military inventories in the financial service sector. In addition, if specific quantitative information is lacking but some sources suggest that certain stocks of inventories remain stable over the course of a reporting period, compilers can assume the changes (entries plus withdrawals) to be zero.

Sectorisation of incorporated and unincorporated enterprises

7.50. One of the most difficult estimations is the split between incorporated and unincorporated enterprises. The incorporated enterprises are part of the sector non-financial corporations, whereas the unincorporated enterprises are part of the households sector. The unincorporated enterprises are small, usually large in number, and administrative records in many countries do not contain the variables stocks and changes in inventories. When using sample surveys, estimates may be unreliable due to unit or item non-response. Also, as part of the goal to reduce the administrative burden, these units are frequently exempted from participating in the survey, e.g. when a threshold in the survey design has been applied. However, there are also countries that hold exhaustive administrative records on types of inventories.

7.51. Some general recommendations for imputing values due to non-response or undercoverage in surveys are:

- Set the missing opening balance sheet of period t equal to the closing balance sheet of period t-1. This avoids the problem of imputing stocks on stratum averages.
- The missing changes in inventories should however be based on stratum averages; the sum of withdrawals and additions should be calculated by taking the highest level of detail for the industry classification and size class. Corrections when size classes are completely missing in the survey results, e.g. as a result of survey design which leaves out smaller size classes, can be based on persons employed or value added. Also business sentiment indicators can provide qualitative information on changes in inventories.

7.52. When no direct source is available to distinguish between stocks and changes in inventories of incorporated and unincorporated enterprises, proxy variables can be used. The two types of enterprises can for example be distinguished with information from labour accounts, tax authorities or chambers of commerce. These sources usually do not directly relate to inventories, but variables such as production can be derived from these sources and may serve to distinguish between the two institutional sectors. The results of the questionnaire on country practices regarding inventory estimation, presented in Chapter 9, show that many countries employ a share of output or sales. The share of output or sales and changes in inventories for larger size classes is then applied to sales or output of smaller enterprises in order to estimate their changes in inventories. It should however be noted that not all smaller enterprises are part of the households sector. Countries also mention in their replies to the questionnaire the use of balance sheet information to estimate changes. It is clear that this can lead to measurement errors, but it is reasonable to assume that variables such as production or intermediate use are strongly related to the changes in inventories. Some countries may utilise administrative tax records to allocate the share of inventories between the corporate and households sectors. For instance the US uses business surveys (containing data from both incorporated and unincorporated enterprises) to estimate changes and stocks of inventories, and then breaks these totals down to institutional sector based on tax records for corporations that are then classified to the corporate sector, and sole proprietorships and partnerships that are then classified to the household sector.

7.53. Table 7.14 provides a numerical example of the sectorisation, where changes in stocks by industry are already known, for example from the SUTs. Here the changes in inventories, which can be any of the five types, are set at –100 for industry X and +120 for industry Y. Sources as mentioned above allocate 60 % of industry X to non-financial corporations (S.11) and so 40 % to households (S.14). For industry Y, 95 % of the change is allocated to non-financial corporations and 5 % to households. This way, the changes in inventories for non-financial corporations amount to –100 * 0.6 + 120 * 0.95 = 54. The changes in inventories for households can then be calculated as the residual, –100 + 120 – 54 = –34, or, alternatively, in the same way the changes in inventories for households are calculated.

Table 7.14: Example of a split between non-financial corporations and unincorporated enterprises (S.11 and S.14)

Institutional sector		Share of sector in industry	Industry	Changes in inventories (entries + withdrawals)
S.11 + S.14	Non-financial corporations and households		Industry X	-100
S.11 + S.14	Non-financial corporations and households		Industry Y	120
S.11	Non-financial corporations	60%	Industry X	-60
S.14	Households	40%	Industry X	-40
S.11	Non-financial corporations	95%	Industry Y	114
S.14	Households	5%	Industry Y	6
S.11	Non-financial corporations		Industry X + Y	54
S.14	Households		Industry X + Y	-34

Source: Eurostat-OECD Task Force on Land and other non-financial assets; fictitious data

7.54. A drawback is that stocks of small enterprises are usually disproportionately smaller than those of larger enterprises, at least for inventories that require lots of physical storage space. This is usually much less the case for changes in inventories. A benchmark for stock levels ameliorates much of this problem.

Indirect estimation with the supply and demand model

7.55. Indirect estimation methods can be employed for any sector or for the total economy when applying the top-down approach. Direct sources can be used to estimate separate sectors or fill in the 'blank' sectors. Table 7.15 provides a numerical example, for a single good which is balanced with the supply and use model. The first row (S.1, total economy) shows the changes in inventories as estimated by using the supply-demand model. The following rows use direct information on the changes in inventories, so that the change in the final row, consisting of the incorporated and unincorporated enterprises together, can be calculated as the residual. This residual of two institutional sectors can subsequently be separated for example as shown in Table 7.14.

Table 7.15: Example of supply-demand measurement of changes in inventories and sectorisation

Institutional sector		Changes in inventories	Imports	Domestic production	Exports	Investment (GFCF) and/or consumption
S.1	Total economy	(200 + 750) - (450 + 700) = -200	200	750	450	700
S.12	Financial corporations	0				
S.13	General government	-100				
S.15	NPISH	0				
S.11 + S.14	Non-financial corporations and households	-200 + 100 = -100				

Source: Eurostat-OECD Task Force on Land and other non-financial assets; fictitious data

7.56. From the example shown in Table 7.15 it becomes clear that the supply-demand model can only be used for estimating changes in inventories. For estimating stocks indirectly the perpetual inventory method can be used, however when applying this method an initial stock level is needed. The changes in inventories that feed into the perpetual inventory method can be derived from the supply-demand model, but also from other sources. A drawback of using a residual is that it possibly also includes a statistical discrepancy. More on the statistical discrepancy and indirect estimations can be found in Chapter 5.

Reclassification in and out of a sector

7.57. All inventories can be reclassified between institutional sectors, as mentioned in paragraph 2.62. Reclassification of inventories should be recorded as other changes in volume (K.61).

7.58. Only stocks of inventories can be reclassified from one sector to another. The transfer of the stock is done at a fixed point in time. The choice is between transferring the stock of the unit at the start or at the end of the reporting period, whichever is closest to the actual event.

7.59. The reclassification of inventories should be matched in size and timing with the reclassification of other produced and non-produced assets. Any unit holding inventories that undergo reclassification will transfer its entire stock of inventories, fixed capital valuables and / or non-produced assets into the recipient sector at the same time.

7.60. From a conceptual point of view changes in inventories cannot be reclassified. Reclassification only concerns financial and non-financial balance sheet items and takes place at one single point in time. Reclassification does not apply to transactions (like changes in inventories) as transactions take place during a period.

7.61. A stock of inventories may be sold from one institutional sector to another institutional sector. This is not a reclassification, but should be recorded as a transaction (P.52 changes in inventories, e.g. a withdrawal of inventories from one sector and an acquisition of another sector).

7.62. Inventories have to be reclassified when an unincorporated enterprise becomes incorporated. Of particular interest are reclassifications in and out of the government sector, because it influences the estimates of government debt and deficit.

7.63. A special case is the sale of households to the non-financial sector or another sector. For instance if a private person sells his second-hand car to a car dealer. The second-hand car in this case enters the inventory stock of the car dealer, part of the non-financial corporations. However, since households do not have a stock of cars (neither AN.11 fixed assets nor AN.12 inventories), the transaction should be recorded as negative final consumption expenditure (P.3) for the household and changes in inventories (P.52) for the car dealer. The same applies to imports. See also SNA 2008 paragraph 10.41.

Box 7.3: Breaking down inventories by sector — The Netherlands

Annual estimates for changes in inventories (P.52) are largely based on business survey information. Military inventories come directly from the Ministry of Defence and government inventories are directly derived from government finance statistics. Quarterly estimates are only made indirectly, where a percentage of the discrepancy between supply and use, based on historical data, is assigned to the changes in inventories.

The estimation procedure starts with the preparation of a cross-classification of industries by type of inventory. Each inventory type is then cross-classified into product groups. Goods for resale are 'sliced up' with a fixed ratio, i.e. a fixed share of the change is attributed to each product group within goods for resale. Work-in-progress is split up into two parts: cultivated biological assets (livestock) and other work-in-progress. For inventories of finished products and work-in-progress and goods for resale in manufacturing the PRODCOM statistics (statistics on the production of manufactured goods) are used. PRODCOM statistics provide sales data by product (CPA) that can be linked to product groups of the supply and use tables. Inventories that are linked to large investment projects are a special case. They are also regarded as work-in-progress, but in general this special category could also be partly finished assets or assets that are finished but are not yet ready to be used in a production process.

The annual figures are divided between the unincorporated enterprises that have to be included in the households sector (S.14) and the incorporated enterprises that belong to the sector non-financial corporations (S.11). The share of production of unincorporated enterprises (S.14/(S.11 + S.14)) and incorporated enterprises (S.11/(S.11 + S.14)) within an industry is taken, in total for 92 industries and for each reporting year. The estimates for the unincorporated enterprises rely on statistics on the self-employed and make use of variables such as income, taxes and subsidies. Finally, each stock and change in stock is multiplied with the share of the sector so that the dataset contains information per sector, industry, inventory type and product. Table 7.16 shows the breakdown for a single industry (retail trade) and product (shoes). The share of households

is 21 %, and so, the share of non-financial corporations is 79 %. A statistical discrepancy arises because survey data of end-of-year stock and start of the following year stock do not match and could not be reconciled. For non-profit institutions serving households (S.15) and financial corporations (S.12) no reliable or comprehensive data source is available, and as a practical solution all stocks and changes are set to zero. Stocks and changes of government inventories (S.13), which have a separate source, are added to the dataset to compile balance sheets on inventories.

Table 7.16: Breakdown of a single industry and product into sectors non-financial corporations and households in the Netherlands

Year	Type of inventory	Product type	Industry	Sector	Opening stock	Revaluation	Changes in inventories	Statistical discrepancy	Closing stock
2009	Goods for resale	Shoes	Retail trade	S.11 + S.14	418	20	-10	22	450
2009	Goods for resale	Shoes	Retail trade	S.11	330	16	-8	18	355
2009	Goods for resale	Shoes	Retail trade	S.14	88	4	-2	5	95

Source: Statistics Netherlands

For publication no separate products and inventory types are identified.

7.3 Changes in inventories within supply and use tables

7.64. As discussed in the previous chapters, approaches to the estimation of changes in inventories (P.52) differ depending on available data sources, methods and accounting principles. However, it is common that at least some data from business accounting are available and transformed to reflect national accounts concepts. Because of differences in valuation methods in national accounts as compared to business accounts, business data have to be adjusted in order to be in line with national accounts concepts, as discussed throughout this guide.

7.65. In addition, data on inventories are generally available by industry and not by type of product. Therefore, as discussed in Section 7.2, techniques are used to break down inventories into products so that they can be used within the supply and use framework. Once the product detail is obtained then the data can be confronted and validated within the supply and use framework. During the balancing process, the changes in inventories components derived from various methods discussed in Chapter 5 may be adjusted in order to realise coherence with other transactions in the economy. The inclusion of these adjustments provides consistent figures between supply and use tables (SUTs), institutional sector accounts, and balance sheets.

Supply and use tables and their balancing

7.66. Balanced macroeconomic data can be derived on an aggregated level by applying the production, income and expenditure approaches for GDP, but as discussed in Annex 5A estimates of changes in inventories should not include the statistical discrepancy. Instead a better way to validate the estimates of changes in inventories is to do so within the supply and use framework. In the ideal situation, the supply and use tables would be based on full information on all dimensions required and the two sides would present a perfect balance for each product. Of course in practice this perfect balance rarely occurs because SUTs will initially be populated with data containing inexhaustive coverage, inexact classifications of products or transactions, imperfect reflections of national accounts concepts, or simply sampling error from business surveys ([58]).

([58]) For more information on supply and use tables see Eurostat, 'Building the System of National Accounts — supply and use tables', *Statistics Explained*. Available at http://ec.europa.eu/eurostat/statistics-explained/index.php/Building_the_System_of_National_Accounts_-_supply_and_use_tables

7.67. Balancing allows for tracing inconsistencies of basic data and estimation methods used. It is recommended to balance the SUTs both at current prices and constant prices, simultaneously. Some relationships in production processes are more likely to hold in volume rather than in value terms. Examples include processes using oil or energy, where in the short term, the national accountant would not expect to see significant changes in the volume of inputs of energy or oil without a similar volume change in output. Such quality checks are not visible when SUTs are balanced in current prices only and data may be difficult to interpret when the prices of these primary materials are volatile. However, it should be noted that because changes in inventories can be positive or negative volume indices are not very meaningful.

7.68. The approach to balancing each product differs and usually depends on the reliability of data sources for the particular GDP component and product. It can vary by country. Generally it can be said that data on output of industrial products, exports, imports, and government consumption expenditures are reliable as these tend to be furnished by administrative sources. On the contrary, data on use components such as the consumption of specific products by households, gross capital formation of some products, and intermediate consumption are usually less reliable. Thus each product is balanced in a way reflecting the strengths of the various supply and use components. Changes in inventories are often considered to be a less reliable GDP component. Therefore changes in inventories are frequently adjusted during the balancing process. However, all data should be checked for reasonableness and statistical discrepancies should not just be simply added to changes in inventories. Adjustments can be made at the product level, and is likely these will result in an overall adjustment to changes in inventories.

7.69. While the source information on changes in inventories is normally not as strong as other transactions in the supply and use framework, they are sometimes considered to be 'balanced' components. This means that the same source may have been used in order to populate the supply and the use of the changes in inventories, as the estimates used normally furnish another component of the tables to show both sides of a transaction. An example is where a particular unit records an increase in work-in-progress inventories. This must be added to their turnover in order to estimate their output, and as this increase in work-in-progress is also recorded in the use table as changes in inventories, the transaction is balanced as the source is the same. Similarly, when a unit withdraws products from its inventory of materials and supplies, this is recorded as a negative entry in changes in inventories and a positive one in intermediate consumption. Notably this transaction occurs fully within the use table, and this is common where existing assets are transferred from the balance sheet to another use, such as final consumption or exports. These examples describe where imbalances in products cannot be explained by changes in inventories, however when transactions occur between units, such as when output is sold from one unit to be the goods for resale of another, this relationship cannot be relied upon. A more detailed description of SUTs can be found in SNA 2008, Chapter 14 of Eurostat Manual of Supply, Use and Input-Output Tables ([59]). The structure of SUTs is shown in the Figure 7.1.

([59]) European Commission/Eurostat, *Eurostat Manual of Supply, Use and Input-Output Tables*, Office for Official Publications of the European Communities, Luxembourg, 2008. Available at: http://ec.europa.eu/eurostat/documents/3859598/5902113/KS-RA-07-013-EN.PDF/b0b3d71e-3930-4442-94be-70b36cea9b39?version=1.0

Figure 7.1: Structure of supply and use tables

Products	Supply						Use								
								Final consumption expenditure			Gross capital formation				
	Output	Taxes on products	Subsidies on products	Trade and transport margins	Import	Total supplies	Intermediate consumption	General government	Households	NPISH	Gross fixed capital formation	Changes in inventories	Valuables	Export	Total use
1															
2															
3															
.															
.															
.															
.															
n															
Total															

Source: Eurostat Manual of Supply, Use and Input-Output Tables

7.70. As show in Figure 7.1 data on changes in inventories by type of product according to an agreed product classification, e.g. CPA or CPC, are required. Ideally, the product structure of each type of inventories is surveyed regularly. A few countries carry out such surveys. For a further discussion on how inventories can be disaggregated by type of product and industry see Section 7.2.

7.71. Once a vector of changes in inventories by product is prepared it can be used in the SUTs. When SUTs are balanced, balancing adjustments can be applied to any component of the goods and services account. Deflation can also be carried out at the same time so that simultaneous balancing of supply and use in current and constant prices can occur.

Valuation

7.72. In order to balance total supply and total use, both must be valued in the same way. One way to achieve this is to raise total supply to purchasers' prices (as shown on the left hand-side of Figure 7.1). An alternative is to reduce the use table to basic prices. One reason to undertake this more arduous task is to facilitate compiling SUTs in volume terms.

7.73. In looking at any element of the use table at purchasers' prices it is clear that it may be made up of as many as six components:

(a) domestic production at basic prices;

(b) imports;

(c) trade margins;

(d) transport margins;

(e) taxes on products;

(f) subsidies on products.

7.74. In order to reduce the use table to basic prices, each element of the table must be decomposed into these six items. This can be seen as creating six similarly sized tables, each of which contains all the items for one of the components. Therefore, changes in inventories that are recorded at purchasers' prices must be transformed to basic prices.

7.75. The difference between valuation at purchasers' prices and basic prices is taxes less subsidies on products and trade and transport margins (also referred to as components of the valuation matrices in the supply and use framework). Moving from purchasers' prices to basic prices is illustrated in Figure 7.2. Each valuation matrix is estimated separately.

Figure 7.2: Moving from purchasers' prices to basic prices

Current prices			Previous year's prices
	Purchasers' prices	=	
-	VAT	+	
-	Trade margin	+	
-	Transport margin	+	
+	Subsidies on products	-	
-	Taxes on products	+	
=	Basic prices		

Source: Czech approach based on Eurostat Manual of Supply, Use and Input-Output Tables

7.76. It should be noted that each valuation matrix is not applicable to all uses. For example, in the case of changes in inventories of work-in-progress, finished goods, and military inventories are already valued at basic prices in the use table, thus the rate of margins and taxes/subsidies are zero.

7.77. Valuation matrices at current prices are calculated as follows:

1. VAT

$$VAT = \left(U^{PP} - \frac{U^{PP}}{1+r}\right)s$$

where
U^{PP} is changes in inventories at purchasers' prices,
s is a share of non-payment,
r is the rate of unrecoverable value added tax on a product.

2. Margins (trade and transport)

$$TM = \left(U^{PP} - VAT - \frac{U^{PP} - VAT}{1+r}\right)$$

where
U^{PP} is changes in inventories at purchasers' prices,
VAT is value added tax,
r is the rate of trade and transport margin on a product.

Trade and transport margins should be calculated separately, but the formula is the same.

3. Taxes without value added tax and subsidies on products

This item is usually applicable only for specific products, such as agricultural products, household energy, tobacco or gasoline. The allocation to uses for this item is done proportionally to uses which taxes and subsidies are related to.

7.78. Generally, the estimation of valuation matrices in SUTs is considered to be a difficult task as data are scarce. However, it is crucial to ensure high quality of deflation and production of symmetric input-output tables. Tax legislation may differ by country and some highly taxed products (e.g. tobacco products) can be stored either with tax (label) or without. This should be taken into account when SUTs are transformed to basic

prices. Taxes, subsidies and margins on products are recorded in the period when inventories are purchased. If changes in inventories at purchasers' prices of particular products have a negative sign, values of taxes, subsidies and margins on products are also negative. It simply means that withdrawals are larger than additions and these withdrawals go to other types of uses (e.g. intermediate consumption or household consumption) where they are recorded with positive sign.

The following example illustrates the recording of tobacco products that were produced in year t but not sold until year t+1. Table 7.17 shows that the tobacco products were produced in year t and taxed and are stored in inventories with the tax.

Table 7.17: Recording of additions to inventories in supply and use tables for year t

	Supply year *t*			Use year *t*		
	Output	Taxes	Total supply	Households consumption	Changes in inventories	Total use
Purchasers' prices	500	1 000	1 500		1 500	1 500
Basic prices	500		500		500	500

Source: Eurostat-OECD Task Force on Land and other non-financial assets; fictitious data

7.79. Table 7.18 shows that the tobacco products are withdrawn from inventories and consumed by households in the year t+1. Recording in SUTs is as follows:

Table 7.18: Recording of withdrawals of inventories in supply and use tables for year t+1

	Supply year t			Use year t		
	Output	Taxes	Total supply	Households consumption	Changes in inventories	Total use
Purchasers' prices			0	1 500	-1 500	0
Basic prices			0	500	-500	0

Source: Eurostat-OECD Task Force on Land and other non-financial assets; fictitious data

7.80. The value of taxes 'stored' in inventories in the form of tax labels is 1 000 (1 500 – 500). It is calculated as the difference between changes in inventories at purchasers' prices and changes in inventories at basic prices. These tobacco products are counted in final household consumption expenditure in year t+1. The value of taxes related to changes in inventories is –1 000 (= –1 500 – (–500)) and the same value of taxes, with opposite sign, is in final household consumption expenditure 1 000 (= 1 500 – 500). In the example, there is no other tax collected in the year t+1.

7.81. This result may seem counterintuitive, but it simply means that withdrawals are higher than additions and these withdrawals go to other type of uses (e.g. intermediate consumption or household consumption) where they are recorded with a positive sign. This is no different to an example where a car is sold from a business to a household, resulting in negative gross fixed capital formation and positive household final consumption expenditures, and therefore a transaction completed within the use table.

Deflation of supply and use tables

7.82. SUTs represent a powerful tool for deflation. Deflation can be carried out in different ways and a detailed description of deflation can be found in manuals or scientific papers, for instance the Eurostat Manual of Supply, Use and Input-Output Tables or Handbook on prices and volume measures in national accounts ([60]). Deflation is carried out at the detailed product breakdown by the most appropriate price indices corresponding to the product for each indicator. The price indices chosen should match the valuation concepts of national accounts as discussed in Chapter 2.

([60]) Eurostat, *Handbook on prices and volume measures in national accounts*, Publications Office of the European Union, Luxembourg, 2016. Available at http://ec.europa.eu/eurostat/documents/3859598/7152852/KS-GQ-14-005-EN-N.pdf/839297d1-3456-487b-8788-24e47b7d98b2

7.83. Deflation within SUTs ensures consistency in deflation techniques between resources and uses of each product. Various price indices, e.g. producer price indices (PPIs), consumer price indices (CPIs), export and import price indices, wage indices, are required for deflation within SUTs. However, PPIs and import price indices are the most important for deflation of changes in inventories. The deflation process is carried out within several steps.

7.84. The process results in fully balanced SUTs in the prices of previous year by creating a price index for each product at different valuation stages. In other words, the price for a particular product is disaggregated into a basic price, a price for transportation, trade and wholesale margins, of taxes and subsidies on products. This allows consistency with the balanced estimates of margins, taxes and subsidies and the basic and purchaser's price of a product. These indices can then be used in order to deflate the supply and use components at different valuation basis while maintaining a balanced table. If desired, the tables can be further disaggregated into output going to each use component and imports going to each use component, with specific margins for each. This maintains balance in volume terms while permitting highly precise deflation, however the data requirements in order to do this are onerous ([61]).

7.85. As described in the previous section, data at current prices are transformed from purchasers' prices to basic prices. Valuation matrices at previous year's prices (PYPs) are estimated subsequently.

7.86. To deflate the valuation matrices the prices of the previous year are applied. The tax rates from the previous year are applied to the changes in inventories at basic prices. Taxes on products at PYPs are calculated as follows:

$$TAX = (INV^{PYP})r_{t-1}$$

where
INV^{PYP} is changes in inventories at previous year's prices basic prices,
r_{t-1} is rate of taxes from the previous year.

Other valuation sets are calculated in a similar manner. A more detailed description can be found in the Eurostat Manual of Supply, Use, and Input-Output Tables.

7.87. Price indices for changes in inventories need to be constructed and should take into account that goods held in inventories may be produced domestically or imported. Therefore, the domestically produced goods should be deflated by PPIs and the goods that have been imported by an import price index. Then valuation matrices can be added to estimate changes in inventories at previous year's purchasers' prices.

7.88. The deflation of changes in inventories is described in the following example. Changes in inventories in years t and t+1 are taken over from balanced SUTs. Year-on-year price index for this particular product is 99 and it is calculated as weighted-average of price indices of domestic production and imports. Changes in inventories in year t+1 at basic prices are deflated by the price index (505 = 500/99 * 100) to obtain these data in PYPs. Taxes at PYPs is calculated as the changes in inventories in year t+1 at PYPs multiplied by the rate of taxes in year t (1 515 = 505 * 3). Changes in inventories at previous year's purchasers' prices is calculated as sum of the changes in inventories at previous year's basic prices and taxes at PYPs (2 020 = 1 515 + 505). Implicit price deflators are calculated in the last column.

Table 7.19: Deflation of changes in inventories

	Year t, current prices	Year t+1, current prices	Year t+1, previous year's prices	Year t+1, deflators
Purchasers' prices	2 000	2 500	2 020	123.8
Taxes	1 500	2 000	1 515	132.0
Basic prices	500	500	505	99.0
Rate of taxes	3	4		
Price index			99.0	

Source: Eurostat-OECD Task Force on Land and other non-financial assets; fictitious data

([61]) This is a description of the 'H' method which will be introduced in the upcoming UN Handbook on Supply, Use, and Input-Output Tables.

7.89. This approach ensures consistency with other components of GDP at current and PYPs. For instance domestically produced inventories as well as related net taxes on products and margins are recorded on both sides. If deflation is not carried out within the SUTs, then at least the product structures from SUTs should be used to weight together price indices for changes in inventories (weights of domestic and import components and also product structure) if SUTs are not compiled regularly.

Box 7.4: Estimating changes in inventories with supply and use tables — Czech Republic

Annual national accounts in the Czech Republic are compiled in several steps. At the beginning data are extracted from sources and the necessary national accounts adjustments are estimated. In this stage national accounts are compiled, however they are not yet balanced. The balancing of the goods and services account is carried out within the supply and use tables (SUTs). Balancing adjustments are incorporated in the sector accounts in order to have consistent figures. Deflation of the goods and services account is also performed within SUTs.

The estimation of inventories is carried out for each subsector, industry and type of inventories separately. It means that for each industry in each subsector the balance sheet of inventories is compiled, see the following scheme.

Figure 7.3: Scheme of balance sheet of inventories for a subsector

	Type of inventories	Industry A	Industry B	Industry…	Industry N	Total
Opening stock	Finished good					
	Work-in-progress					
	Material					
	Good for resale					
Changes in inventories	Finished good					
	Work-in-progress					
	Material					
	Good for resale					
Revaluation	Finished good					
	Work-in-progress					
	Material					
	Good for resale					
Other changes in volume	Finished good					
	Work-in-progress					
	Material					
	Good for resale					
Closing stock	Finished good					
	Work-in-progress					
	Material					
	Good for resale					

Source: Eurostat-OECD Task Force on Land and other non-financial assets

This balance is compiled for source data, national accounts adjustments and the final estimate. The estimation of inventories is carried out in the following steps:

(1) data are taken over to national accounts, missing data are estimated;
(2) data are transformed from book value to current prices; holding gains are estimated;
(3) other conceptual adjustments are added;
(4) changes in inventories (P.52) are validated using SUTs; deflation of changes in inventories is carried out;
(5) balancing adjustments are incorporated to balance sheet.

Step 1

Data on stocks are extracted from statistical surveys or administrative records. All large non-financial corporations are surveyed by statistical questionnaires; a sample survey is carried out for medium-sized and small-sized companies. The following data are collected: subsector and industry of statistical unit, opening and closing stocks of inventories by type of inventories. State treasury (IT system) provides data from business accounts of units classified to general government sector. Data on opening and closing stocks of inventories held by small entrepreneurs are taken over from tax declarations, however, breakdowns by type of inventories are not available and are estimated by a model based on the structure of inventories held by small-sized non-financial corporations.

Step 2

The next step is to recalculate data from historical prices used in business accounts to current prices for a particular period that should be applied in national accounts. A specific price index for each type of inventories is calculated. Each price index is estimated as a weighted-average of particular price indices (mainly producer price indices (PPIs) and import price indices in the given product breakdown) taking into account the product structure of stocks of inventories. In the Czech Republic as in many other countries there is no survey on product structure of inventories of materials and supplies. Generally, it is assumed that the product structure of materials and supplies inventories is the same as the product structure of inputs that are available in the SUT. However, it is clear that some inputs are not stored, e.g. petrol in most industries, and should be excluded from the calculation. The share of products that are imported should be taken into consideration. The use table at basic prices can be divided into a use table of domestic products and a use table of imported products. For each product a weighted price index can be calculated based on PPIs and import prices.

Basic producer price indices (average 2005 = 100) are used in the Czech Republic; nevertheless other types of indices may be applied. Calculations are carried out on a quarterly basis; annual data are derived as the sum of four quarters. The example below illustrates the calculation for materials and supplies inventories.

Monthly price indices are taken over from price statistics. These indices express price changes as of the middle of the month. Since materials and supplies can be imported the appropriate price deflator is a weighted-average of the PPI and import price index. The share of domestic and imported product is available from the use table at basic prices from the previous year. In this example, it is assumed that the share of imported products is 30 % and the share of domestic products is 70 %. Using these shares a weighted index is calculated. Indices are recalculated in order to express price changes at the end-of-month, e.g. the price index at the end of November is calculated as the average of indices in November and December (129 = (132.3 + 125.6)/2).

Table 7.20: Price indices used to convert historical prices into current prices
(Indices, average of 2005=100)

	Year t-1		Year t			
	November	December	January	February	March	April
Producer's price index	133.0	127.0	130.0	132.0	135.0	137.0
Import price index	130.7	122.3	123.0	134.3	137.3	137.0
Price index	132.3	125.6	127.9	132.7	135.7	137.0
Price index for closing stock	129.0	126.7	130.3	134.2	136.3	

Source: Eurostat-OECD Task Force on Land and other non-financial assets, based on compilation practice of Czech Statistical Office; fictitious data

Data from business accounting are transformed to constant prices using the price index for the end of the month. Let's assume that the opening stock in business accounts is 1 000 and the closing stock is 1 400, see Table 7.21. Opening stock is estimated at constant prices by applying the price index that expresses the price evolution at the end of December in comparison to the average price level in year 2005 (126.7) on opening stocks in book values (1 000) thus the calculation is 1 000/126.7 * 100 = 789. The March closing stock at constant prices is estimated similarly (1 400/136.3 * 100 = 1 027). Changes in inventories at constant prices are calculated as the difference between closing and opening stock at constant prices (1 027 – 789 = 238). The revaluation of changes in inventories to current prices is carried out by multiplying the average price index for the quarter (238 * 132.1/100 = 314.4) which is estimated as the average of the monthly price indices ((127.9 + 132.7 + 135.7)/3 = 132.1).

It is assumed that the stock holding period is 1 month for materials and supplies. The price index for opening stock is derived as the basic price index in December divided by the basic price index in November (125.6/132.3 = 94.9). Similarly the price index is calculated for the closing stock (102.3 = 135.7/132.7). Opening and closing stocks are subsequently revalued from historical prices in business accounting to market prices by using monthly price indices for market price (opening stock 1 000* (94.9/100) = 949 and closing stock 1 400 * (102.3/100) = 1 432). The non-realised holding gain is calculated as the difference between opening and closing stocks at market prices (1 432 – 949 = 483) and changes in book values at historical costs as recorded in business accounts (1 400 – 1 000 = 400), thus the non-realised holding gain is 483 – 400 = 83. Realised holding gain, which influences intermediate consumption, is the difference between changes in book values recorded in business accounts and the transaction changes in inventories in current prices (400 – 314 = 86). Note that the sum of the non-realised (83) and realised (86) holding gain equals the revaluation (169) in Tables 7.24 and 7.25.

Table 7.21: Computation of balance sheet values inventories

Indicator	Opening stock	Changes	Closing stock
Price index for market price (2005=100)	94.9		102.3
Average price index for quarter (2005=100)		132.1	
Data from business accounting (million CZK)	1 000	400	1 400
Revaluation to constant prices (million CZK)	789	238	1 027
Change in inventories in current prices (million CZK)		314	
Realised holding gain (million CZK)		86	
Revaluation of opening and closing stock to market prices (million CZK)	949	483	1 432
Non-realised holding gain (million CZK)	-51	83	32

Source: Eurostat-OECD Task Force on Land and other non-financial assets, based on compilation practice of Czech Statistical Office; fictitious data

Step 3

It is assumed that there are no other conceptual adjustments. Generally, other conceptual adjustments are not significant with the exception of standing timber.

Step 4

An initial estimate has been prepared by carrying out steps 1–3. Likewise other indicators of the goods and services account have been estimated. However, usually there is a balancing difference between supply and use side. The difference is solved with the balancing procedure of the SUTs. For that purpose the product structure of changes in inventories has to be estimated. Since there is no source information on the product breakdown, the product structure of intermediates is applied. Only inventories of products A and B (see Table 7.22) are considered in this example, however, inventories of more products are actually observed. Shares are derived from the intermediate consumption matrix.
In the balancing procedure of the SUTs, balancing adjustments can be done to any component including changes in inventories. The initial estimates of changes in inventories of product A has been decreased by 30, see Table 7.22. The final estimate is 111 = 141 – 30. Similarly, the initial estimate for product B has been increased by 50. Finally, the supply of each product has to be equal to uses of the product.

Actually, quarterly SUTs are not compiled in the Czech Republic. Balancing of commodity flows within SUTs is only carried out annually. However, balancing principles are completely the same in SUTs regardless the periodicity.

Table 7.22: Balancing changes in inventories in supply and use tables
(million CZK)

	Share A and B	Value before balancing	Balancing adjustment	Value final estimate
Product A	0.45	141	-30	111
Product B	0.55	173	50	223
Total	1.00	314	20	334

Source: Eurostat-OECD Task Force on Land and other non-financial assets, based on compilation practice of Czech Statistical Office; fictitious data

SUTs at previous year's prices (PYPs) are compiled simultaneously with SUTs at current prices. Balancing adjustments are simultaneously revalued to PYPs. The import price index is not used for product A because product A is not imported but domestically produced. Weighted price indices are applied to changes in inventories at current prices in order to produce data at PYPs (last column). The weighted index of product B is calculated as 0.7 * 104.0 + 0.3 * 102.0 = 103.4. Changes in inventories at PYPs for product B (216) is calculated by dividing the data at current prices (223) by the weighted price index (103.4). The total changes in inventories at PYPs (321) is the sum of changes in inventories for product A and B and are part of GDP at PYPs according to the expenditure approach.

Table 7.23: Computation of changes in inventories in previous year's prices

	Domestic share	Imported share	Producer's price index (2005=100)	Price index of import (2005=100)	Weighted index (2005=100)	Value of estimate at previous year's prices (million CZK)
Product A	1.00	0.00	105	101	105.0	106
Product B	0.70	0.30	104	102	103 .4	216
Total						321

Source: Eurostat-OECD Task Force on Land and other non-financial assets, based on compilation practice of Czech Statistical Office; fictitious data

Step 5

Balancing adjustments of inventory stocks (AN.12) at current prices are incorporated in the balance sheet. Changes in inventories in the sector accounts are reconciled with SUTs in order to produce consistent figures. Two approaches are applied in the Czech national accounts. The prevailing method assumes that opening and closing stocks are reliable. In order to keep the initial estimate of stocks and revaluations, the other changes in volume are introduced. The value recorded as other changes in volume is the balancing adjustment with opposite sign, see Table 7.24.

Table 7.24: Stocks and flows of inventories (1)
(million CZK)

Opening stock	949
Changes in inventories	334
Revaluations	169
Other changes in volume	-20
Closing stock	1 432

Source: Eurostat-OECD Task Force on Land and other non-financial assets, based on compilation practice of Czech Statistical Office; fictitious data

The second approach does not introduce other changes in volume, but leads to a change in the closing stocks, see Table 7.25.

Table 7.25: Stocks and flows of inventories (2)
(million CZK)

Opening stock	949
Changes in inventories	334
Revaluations	169
Other changes in volume	0
Closing stock	1 452

Source: Eurostat-OECD Task Force on Land and other non-financial assets, based on compilation practice of Czech Statistical Office; fictitious data

A very similar approach is used for other types of inventories. However, for those other types of inventories holding gains have an impact on output instead of intermediate consumption. In addition, the assumptions utilised for the stock holding period also differs.

8 Special cases and estimation challenges

8.1 Introduction

8.1. The previous chapters of this compilation guide provided general information on sources and methods for the estimation of stocks of inventories (AN.12) and changes in inventories (P.52). Although this information is also valid for the special cases addressed in this chapter, some specific guidance might be needed for these cases. Therefore, the aim of this chapter is to provide some supplementary guidance that specifically applies to the addressed special cases.

8.2. The first three sections of this chapter discuss the peculiarities of the estimation of inventories for some specific industries: agricultural and timber inventories (Section 8.2), inventories and the gross fixed capital formation asset boundary (Section 8.3), government inventories including military inventories (Section 8.4).

8.3. The next five sections address some other special estimation cases that are not directly linked to specific industries: inventories of finished services (Section 8.5), the treatment of exceptional and recurrent losses (Section 8.6), inventories held under global production (Section 8.7), the treatment of differences between closing and next period opening stocks (Section 8.8), and inventories under high inflation (Section 8.9).

8.2 Agricultural and timber inventories

8.4. This section consists of two parts. The first part discusses the peculiarities of the estimation of agricultural inventory stocks (AN.12) and changes in inventories (P.52). The second part deals with the estimation of timber inventories. Both parts pay attention to theoretical and conceptual issues, such as definitions and registration, but also to more practical aspects, such as sources to be used and compilation practices. In addition, both parts contain a case study in which the Swedish method for the estimation of agricultural and timber inventories are elaborated, respectively.

Agricultural inventories

8.5. The definitions of inventory stocks and changes in inventories as discussed in Chapter 2 of this compilation guide also apply to agricultural inventories. The conceptual principles regarding valuation, time of recording, and netting and consolidation are also valid for agricultural inventories. However, the application of the definitions and conceptual principles mentioned above might not always be straightforward in the case of agricultural inventories. Therefore, this part of Section 8.2 will provide some more guidance on the registration, time of recording, valuation and estimation of agricultural inventories.

AGRICULTURAL RESOURCES AND REGISTRATION OF AGRICULTURAL INVENTORIES

8.6. As mentioned in paragraph 2.23 of this compilation guide, it is important to distinguish between two types of agricultural resources as their registration in the national accounts differs. The first type concerns single-use agricultural resources that produce output once-only: when plants are cut down or livestock is slaughtered. The second type concerns plants and livestock that are used repeatedly or continuously for more than one year to produce agricultural products.

8.7. The first type includes single-use plants (grain, potatoes, etc.) and livestock that produces output only once (beef cattle, poultry, fish raised commercially, etc.). The acquisition less disposals of these agricultural resources should be registered in the national accounts as changes in inventories (P.52). The corresponding inventory stocks are part of work-in-progress on cultivated biological resources (AN.1221). The same registration applies to cultivated assets that yield repeat products but that are not yet mature, for example young fruit trees that need further growth before being marketable.

8.8. The second type of agricultural resources covers animal resources and tree, crop and plant resources yielding repeat products whose natural growth and regeneration are under the direct control of institutional units. The animal resources yielding repeat products include breeding stocks, dairy cattle, draft animals, sheep or other animals used for wool production and animals used for transportation, racing or entertainment. The tree, crop and plant resources include trees (including vines and shrubs) cultivated for fruits and nuts, for sap and resin and for bark and leaf products The acquisition less disposals of all these biological resources are not changes in inventories, but have to be registered in the national accounts as gross fixed capital formation (P.51g). The corresponding stocks are part of the asset cultivated biological resources (AN.115). The products that this type of agricultural resources generate — milk, wool, fruits, etc. — can be part of (changes in) inventories if these products are produced but not yet sold.

TIME OF RECORDING, VALUATION AND ESTIMATION OF AGRICULTURAL INVENTORIES

8.9. As noted in paragraph 8.5 the general principles regarding the time of recording and valuation of inventory stocks and changes in inventories also apply to agricultural inventories. Entries and withdrawals of agricultural products to and from stocks should be valued at the date they enter and leave the inventory, respectively. The time of recording (and valuation) of stock entries and withdrawals should be consistent with that of other transactions in products (output and intermediate consumption).

8.10. According to the manual on the economic accounts for Agriculture and Forestry (EAA/EAF 97) ([62]), the basic price is the price to be used for valuing changes in the stocks of agricultural products. As regards entries of work-in-progress, the price used should be estimated by applying the fraction of the total production cost incurred by the end of the period to the basic price of a similar finished product. Alternatively, the value of the entries of work-in-progress can be estimated by the value of the production cost with a mark-up for expected operating surplus or (estimated) mixed income.

8.11. Changes in agricultural inventories and/or inventory stocks can probably be estimated by using one of the common general methods:

- direct estimation method (see Sections 5.3 and 6.3);
- commodity supply-demand model if source data on inventories are lacking (see Section 5.4);
- using the basic equation regarding the link between stocks and flows (see Section 2.4, in particular paragraph 2.47).

8.12. However, many agricultural products are seasonal products whose entries into stocks only occur after the harvest and whose withdrawals are spread over several months after the harvest. Main estimation problem

([62]) European Commission/Eurostat, *Manual on the economic accounts for Agriculture and Forestry EAA/EAF 97 (Rev.1.1)*, Office for Official Publications of the European Communities, Luxembourg, 2000. Available at http://bookshop.europa.eu/en/manual-on-the-economic-accounts-for-agriculture-and-forestry-eaa-eaf-97-rev.1.1--pbKS2700782/.The text in this section is mainly derived from this manual. The manual is based on the SNA 1993/ESA 1995 methodology, but most of the content is still valid under the SNA 2008/ESA 2010 guidelines.

is that the prices of these products are often subject to substantial fluctuations. Therefore, the methods mentioned in paragraph 8.11 can often not (directly) be used.

8.13. Regarding this estimation/valuation problem, the EAA/EAF manual distinguishes three inventory categories:

- livestock and animal products;
- seasonal products;
- wine (from grapes produced by the same holding).

8.14. On the (single-use) livestock and animal products the value at basic prices can be estimated as the sum of the production costs throughout the life of the average animal in the different livestock classes plus a mark-up for the estimated operating surplus or an estimate of mixed income. Because of the generally regular changes of the prices of animals, the changes in inventories can be approximated by multiplying the change in the population volume between the end and the start of the accounting period by the average price (direct estimation method).

8.15. The direct estimation method can usually not be applied for most seasonal products because of their irregular changes in prices and quantities. The section 'Goods with seasonal patterns of supply and demand' in paragraphs 2A.16– 2A.19 of Annex 2A of this compilation guide gives some conceptual and practical guidance on the estimation of this type of agricultural products. In addition, paragraphs 2.70.1–2.70.10 of the EAA/EFF manual also provides information on methods that can be used for the estimation of changes in inventories for seasonal products.

8.16. Wine is a product which is generally stocked for several years for ageing and maturing. During this storage period, the quality changes. Therefore, the storage activity should be regarded as an extension of the wine production process since the wine leaving storage is different (of better quality) from the wine that entered the inventory. The section 'Goods whose physical characteristics change' in paragraphs 2A.9–2A.15 of Annex 2A of this compilation guide discusses the peculiarities and estimation of agricultural products like wine. Moreover, paragraphs 2.71.1–2.71.6 of the EAA/EFF manual also provide guidance on estimation and estimation methods for wine.

Box 8.1: Estimation of agricultural inventories — Sweden

The main source for the estimation of agricultural inventories in the Swedish national accounts, is the Swedish Board of Agriculture. This organisation is responsible for producing all statistics on agricultural activities, such as production, inventories and prices. For inventories separate records are made for cereal, animals raised for slaughter and field crops. Supplies of bread cereals are mainly stored by the farmers' organisations and are therefore recorded as inventories in the wholesale and retail trade industry. Only smaller quantities of the harvest are stored on farms. The quantities stored on farms and the changes in the quantities are recorded at the end of each year and only included in annual national accounts.

In the Swedish output calculations the value of crop production is spread evenly over the year. The reason for this procedure is that production activities are carried out during most of the year, whereas deliveries in the form of sales of crops are concentrated in the second half of the year. The difference between production and farm deliveries is treated as production building up inventories. The sum over a year is zero, while inventories are built up in the first and second quarters and correspondingly reduced in the third and fourth quarters.

The example below illustrates the quarterly calculation of work-in-progress on agricultural products.

Table 8.1: Estimation agricultural inventories in Sweden
(million SEK)

Quarter	Production			Deliveries/sales			Work-in-progress, current prices (C) = (A - B)	Price index (D)	Work-in-progress, constant prices (= C/D)
	Cereal	Field crops	Total production (A)	Cereal	Field crops	Total deliveries (B)			
Q1	765	862	1 627	367	0	367	1 260	91.83	1 372
Q2	765	862	1 627	153	56	209	1 418	95.93	1 478
Q3	765	862	1 627	2 174	1 256	3 430	-1 803	76.13	-2 368
Q4	765	862	1 627	367	2 135	2 502	-875	81.12	-1 079
Year	3 060	3 448	6 508	3 061	3 447	6 508	0		-597

Source: Statistics Sweden

- In the quarterly calculations five representative crops are used in the model to calculate production, deliveries and inventories. Annual calculations are made on a more detailed level.
- Deliveries: the deliveries in the form of crops are concentrated in the second half of the year. The estimated annual deliveries (which is equal to annual production) is broken down into quarterly sales by using a seasonal pattern. The preliminary quarterly calculations are based on forecasts and the annual calculations on new data from the Swedish Board of Agriculture.
- Production: the preliminary quarterly calculation is based on forecasts and the annual calculations on new data from the Swedish Board of Agriculture. Work-in-progress is defined as production minus deliveries, i.e. crops still growing in the fields.
- The price index used in the quarterly calculation is a weighted index for the five representative crops.

Timber inventories

8.17. This part of Section 8.2 provides guidance on the registration of timber inventories and some suggestions regarding possible sources and compilation issues. But before elaborating on these issues, the relationship between types of forests and the production of timber should be clarified, as not all woods from forests will generate timber.

8.18. The first question that should be answered is whether a tract of forestry land falls within the asset boundary of an economy. It only falls within the asset boundary if there is a unit that exercises effective ownerships rights over the land. If not, the forestry land should not be registered on the balance sheet. Below only the forestry land will be considered that falls within the asset boundary.

TYPES OF FORESTS AND REGISTRATION OF INVENTORIES

8.19. In the European Framework for Integrated Environmental and Economic Accounting for Forests (IEEAF ([63])) a breakdown of forests and other wooded land is proposed. In that manual the following types of wooded land are distinguished or can be derived:

- forests available for wood supply, cultivated;
- forests available for wood supply, not cultivated;
- forests not available for wood supply, related to legal restrictions;
- forests not available for wood supply, not related to legal restrictions.

([63]) Eurostat, *The European Framework for Integrated Environmental and Economic Accounting for Forests — IEEAF*, Office for Official Publications of the European Communities, Luxembourg, 2002. Available at http://ec.europa.eu/eurostat/documents/39314/44178/Handbook-IEEAF-2002.pdf/c7b2aeaa-c4dd-49ce-bf25-05740d90e043

8.20. The first category of forests concerns forests used for regular wood production. These forests are cultivated for economic exploitation; they are managed and controlled by an institutional unit. Regular human intervention takes place. In this case the standing timber will be classified as a produced asset and the value added corresponding to the growth of timber will enter GDP. These forests should, according to SNA 2008 and ESA 2010 guidelines, be registered on the balance sheet under inventories, work-in-progress on cultivated biological resources (AN.12(21)). The growth of these forests should be registered as changes in inventories (P.52). The land underlying the forests should be separated from the trees and has to be classified under land (AN.211), sub-item forestry land (AN.21122) ([64]). In terms of products and industries, timber (Classification of Products by Activity, CPA 02.10.3 forest trees) is the main product of the forestry activity (statistical classification of economic activities in the European Community, NACE 02.1 silviculture and other forestry activities).

8.21. The category forests available for (non-cultivated) wood supply consists of forests that are in principle available for wood supply, but that are not harvested in practice. It concerns natural forests in which for many years no human intervention has taken place.

8.22. Forests from the third category concern forests areas where forestry for wood production is forbidden by legislation or other official measures. This can be the case for strict nature reserves, national parks or wilderness areas.

8.23. The fourth category of forests contains non-protected forests that are, however, not suited for wood supply for economic reasons. Reasons might be that the physical productivity is too low or harvesting and transportations costs are too high to warrant regular wood harvesting. Examples could be mountain forests and swamps.

8.24. All forests from the second, third and fourth category should be registered under balance sheet item non-cultivated biological resources (AN.213). The natural growth of the trees is not managed and controlled by an institutional unit and therefore does not generate output; no registration under changes in inventories, as was the case for the production of timber (first category of forest types), should be done either. Instead, the natural growth has to be entered in the flow accounts as economic appearance of assets (K.1).

8.25. Even for the second, third and fourth category of forests it remains for several reasons possible that the trees will be chopped and harvested at a certain point in time. As soon as they are harvested, this has to be registered as economic disappearance of non-produced assets (K.2).

8.26. The breakdown of forests into the four categories as discussed above is not only important for a correct registration according to SNA 2008 and ESA 2010 guidelines, but might also be important for the correct valuation of the wood. Of course, also other characteristics, like damage to trees, level of biodiversity, forest soil acidification or degradation are of importance for a correct valuation.

SOURCES AND COMPILATION PRACTICE

8.27. In most European countries almost all the forests are considered as cultivated as they are managed by public or private institutional units. Only the protected areas and the forests not exploitable from a technical or an economic-convenience point of view are excluded from cultivated forests.

8.28. Usually, no micro data are available at the level of forestry units and thus the magnitude of the cultivated forests is unknown. Therefore, in the practical compilation of the accounts some approximations and assumptions are necessary due to lack of data available at national level.

8.29. In many countries the annual growth of standing timber is fully based on the data from the multiannual (five yearly) national forest inventory. The produced timber (in assets, output and inventories) may be approximated with the timber already in stock and growing during the year.

8.30. The way of valuing standing timber is to discount the future proceeds of selling the timber at current prices after deducting the expenses of bringing the timber to maturity, felling, etc. (SNA 2008 paragraph 13.41).

([64]) For more details see Eurostat/Organisation for Economic Co-operation and Development, *The Eurostat-OECD compilation guide on land estimation*, Publication Office of the European Union, Luxembourg, 2015, Chapters 3 and 8.1. Available at http://ec.europa.eu/eurostat/documents/3859598/6893405/KS-GQ-14-012-EN-N.pdf

This implies that the standing timber should be estimated at the value in its original place rather than after its removal, see SEEA 2012 ([65]) paragraph 5.102. The stumpage price would be the most relevant price. The stumpage price is the amount paid per cubic metre of timber by the harvester to the owner of the timber resources. The stumpage price could also be derived by deducting various harvesting costs from roadside pickup prices (also called wood-in-the-rough or raw wood prices). The harvesting costs should include felling costs as well as costs of thinning (net of any receipts), other management costs, and rent on land (SEEA 2012 paragraph 5.380).

8.31. There are two types of inventories of timber: work-in-progress and finished goods. Inventories of work-in-progress equal the net growth (gross growth minus timber felled and casualties) in cultivated forests. The production is equal to net growth plus timber felled and the new stock of standing timber is the old stock plus net growth. The inventories of finished goods is the timber felled but still remaining at forest roads and in terminals, and which is still owned by the forestry enterprise or kind-of-activity unit (establishment). Timber sold is transformed to material and supplies in other industries. Material and supplies in forestry activities in general concern other products than timber, for example forest harvesting machines and tools. Goods for resale are negligible.

8.32. To be able to estimate the timber inventories, information on the growth, timber felled and the inventories at forest roads and terminals is needed. Usually data on quantities in cubic metres are available, however, to calculate inventories in monetary terms, both in current and in constant prices, also price information is necessary. The timber price differs depending on the kind of timber and the kind of a tree species. For that reason the quantities and prices should be available for (or should be distributed over) the different kind of timber and tree species. The stumpage prices should be used for work-in-progress. Finished goods have to be valued against basic prices.

Box 8.2: Estimation of timber inventories — Sweden

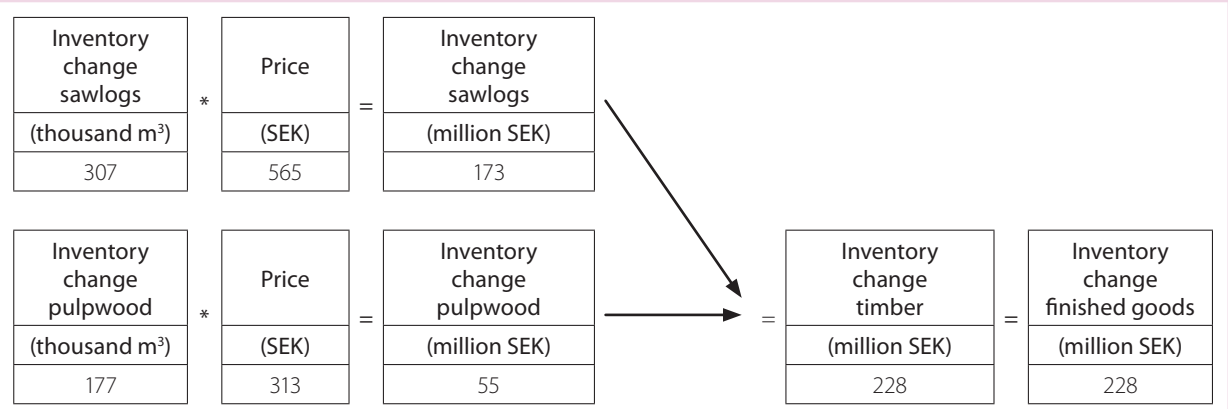
The main sources for the estimation of timber inventories in the Swedish national accounts are the Swedish Forest Agency and the Swedish University of Agriculture Sciences. The Forest Agency is responsible for producing the statistics on timber, which also includes price information. The University of Agriculture calculates the gross growth in the forests. Only the forests available for wood supply are included in the national account estimations.

In the forest industry, changes in inventories (P.52) are recorded for the net growth of standing timber and for felled timber. Inventories of felled timber consist of the change in coniferous saw logs and pulpwood. Timber that is used for intermediate consumption by the processing industries, such as timber that has been bought by the manufacturing industry, is excluded. These inventories are registered as material and supplies in the manufacturing industry.

Figure 8.1 below illustrates the quarterly calculation of changes in inventories for finished goods in the forest industry (in current prices).

([65]) United Nations, European Commission, Food and Agriculture Organization of the United Nations, Organisation for Economic Co-operation and Development, World Bank Group, *System of Environmental-Economic Accounting 2012 — Experimental Ecosystem Accounting*, New York, 2014. Available at http://unstats.un.org/unsd/envaccounting/seeaRev/eea_final_en.pdf

Figure 8.1: Estimation of quarterly changes in inventories for finished goods in the forest industry in Sweden



Source: Statistics Sweden

- Inventory change: the Swedish Forest Agency provides source information on quarterly stocks in terminals and at forest roads, split by coniferous saw logs and pulpwood. Statistics Sweden calculates the changes and uses forecasts if the data are not available.
- Prices are delivered by The Swedish Forest Agency.

In addition to the felled timber, the inventories of forestry also include the net growth of standing timber. Source data for the net growth are provided by The Swedish Forest Agency and Statistics Sweden. This concerns data on the inventory of coniferous saw logs, pulpwood and chips and average prices of pulpwood of spruce, pine and birch and delivery logs.

Figure 8.2 below elaborates an example regarding the annual calculation of work-in-progress in the forest industry (in current prices).

Figure 8.2: Annual estimation work-in-progress in the forest industry in Sweden

Gross growth		Timber felled		Net growth		Price		Net growth		Inventory change 'work in progress'
(million m³)	-	(million m³)	=	(million m³)	*	(SEK)	=	(million SEK)	=	(million SEK)
112.13		88.93		23.2		443		10 278		10 278

Source: Statistics Sweden

- Gross growth: Gross growth of the total forest stands in the entire country is calculated by the Swedish University of Agricultural Sciences and published annually. This process involves studies and compilations of annual growth of trees that are based on several sample plots that are geographically well dispersed over the country. Only the cultivated forests are included. The tree volume increment is calculated in cubic metres. In the primarily quarterly calculation the figures of the gross growth is based on an extrapolation.
- Timber felled: the total annual drain (decrement) of trees is the amount of timber felled in the forest together with the amount remaining (of branches, tops etc.). Timber felled is calculated by a method, which takes account of the relation between the material extracted (saw timber, etc.) and the trees from which this timber was produced. The Swedish Forest Agency provides this information.
- The net growth of standing forests is the difference between gross growth and timber felled. The net growth in forestry increases or reduces total supply in the form of an output value and at the same time affects total use as changes in inventories.
- The price used to calculate the net growth value should be the price of standing forest timber for sale. The price is the stumpage price, in other words the amount paid per cubic metre by the harvester to the owner of the forest.

8.3 Inventories and the gross fixed capital formation asset boundary

Introduction

8.33. Whether production of certain assets is recorded as inventories or as gross fixed capital formation (GFCF) by countries is sometimes unclear. The treatment can be rather nuanced as to whether it is included in inventories or whether it is recorded as GFCF.

8.34. The SNA 2008/ESA 2010 states that the general time of recording of acquisitions less disposals of fixed assets is when the ownership of the fixed assets is transferred to the institutional unit that intends to use them in production. As discussed in Chapter 2 (paragraphs 2.96–2.98), this time is not generally the same as the time at which the fixed assets are produced. Nor is it necessarily the time at which they are put to use in the production of other goods or services. The two exceptions to this arise for assets that take some time to produce such as construction projects and some cultivated biological resources.

8.35. The SNA 2008/ESA 2010 also states that when the assets are being produced on own account, the partially complete products are recorded as fixed capital formation as the work takes place. For the production of certain assets such as research and development and software, the distinction between own account production and speculative production may not always be clear.

8.36. This section focuses on the complexities of recording the production of buildings and other structures as well as the production of research and development and software. The production of cultivated biological resources such as agricultural and timber inventories is discussed in Section 8.2.

Buildings and other structures

8.37. The production of buildings and other structures has special features that give rise to complex accounting issues, both in national and business accounts. The production process often extends over two or more accounting periods, so that output must be accounted for during periods where the asset is still not finalised. The corresponding expenditure flows in national accounts, in turn, need to be allocated to the appropriate category, which may or may not coincide with that required when the finished product is put to its final use. A similar question arises for the classification of the related balance sheet position.

8.38. This section looks at the treatment of this issue in both the SNA 2008/ESA 2010 and business accounts under various possible situations arising for assets under construction. It also looks at the adjustments that may be required when using business accounts data as a source for the national accounts compilation of expenditure on such assets.

SNA 2008 TREATMENT

8.39. A general principle of national accounts is that output should be allocated to the accounting periods in which production takes place. Due to the length of time required to produce a building or other structure, a significant part of an accounting period's production may correspond to assets that are still under construction. Since intermediate inputs have been consumed in the process, wages been paid and the capital services of the producer's fixed assets utilised, output has been produced and a corresponding expenditure must be recognised in the system.

8.40. In respect to expenditure on buildings or other structures still under construction, national accounts standards (SNA 2008 paragraph 6.110–6.112, ESA 2010 paragraph 3.55) distinguishes two main scenarios:

(a) If a contract of sale has been concluded in advance so that there is certainty as to the ultimate purchaser or final user of the asset, the output produced in each period is treated as if it was sold to the final user at the end of each period. So, GFCF (P.51) by the final user is recorded rather than work-in-progress (P.52) by the producer. This also applies in the case of production of fixed assets for own use.

(b) If the construction does not take place under contract so that there is no certainty as to the ultimate purchaser of the asset, the output produced in each period is treated as an addition to the inventory of work-in-progress of the producer.

8.41. In the production of buildings and other structures there is often also a contract between a main contractor and a developer. The contractor engages other subcontractors and uses its own labour and capital in producing the building for the developer. A contract between the contractor and the developer should not automatically lead to recording the expenditure on the asset as GFCF, since in most cases the developer is not the ultimate purchaser or final user of the asset. A few possible scenarios are presented in Table 8.1 below.

Table 8.2: Possible scenarios and required classification of expenditure

	Scenario	Classification
a)	The developer intends to sell the asset upon finalisation, but a contract of sale with a purchaser does not exist	Inventory of work in progress (P.52)
b)	The developer intends to sell the asset upon finalisation and has concluded a contract of sale with a final user	GFCF by developer's customer (P.51)
c)	The developer intends to exploit the asset for rental income, or for own use	GFCF by developer (P.52)
d)	Contractor and developer are the same unit, work undertaken without a contract	Inventory of work in progress (P.52)
e)	Contractor and developer are the same unit, work undertaken under contract	GFCF by contractor's customer (P.51)

Source: Eurostat-OECD Task Force on Land and other non-financial assets

8.42. Some countries routinely allocate all expenditure related to building and other structures under construction as GFCF, irrespective of whether the assets are being built under contract for a final user or not. To the extent that source data permits differentiating between the two cases, this approach should be avoided as it may produce a misleading view of effective demand for buildings and other structures, especially around turning points in the business and/or real estate cycles.

TREATMENT IN BUSINESS ACCOUNTS AND IMPLICATIONS FOR THE COMPILATION OF ASSETS UNDER CONSTRUCTION IN NATIONAL ACCOUNTS

8.43. In many cases, business accounts envisage a treatment similar to that for the SNA 2008 of assets under construction. Some adjustments may nevertheless be necessary. The nature and relevance of these may vary depending on the combination of sources used and the national particularities of the treatment and presentation of construction work-in-progress in the business accounts.

8.44. Adjustments to business accounts data on construction inventory may be required in the following cases:

- Work-in-progress in business accounts will be typically valued at the direct costs incurred in building the asset, while basic prices are required in national accounts.
- Inventory of construction in progress or unsold finished buildings and structures may include the value of land, whereas this is to be excluded in national accounts.
- When both the producer and the buyer record capital investment on the same asset under construction within the same accounting period (the producer as work-in-progress, and the buyer as investment in fixed capital in progress). An adjustment to business accounts would be needed to avoid double counting in national accounts.

8.45. Additions to work-in-progress in business accounts are typically restricted to the direct costs incurred in building the asset. In national accounts, on the other hand, work-in-progress is measured at basic prices which also include indirect costs and expected profit. In practice, a conversion factor from direct construction costs to basic prices thus needs to be applied as discussed in paragraph 6.20 and Figure 6.1 of this compilation guide.

8.46. A similar operation is required for assets under construction for own account. Accounting standards may permit the inclusion of financing costs for own account fixed investment. The conversion factor for own account construction may need to take this into account, should this effect be significant for the national economy.

8.47. National accounts balance sheets should exclude the value of land from inventories, since land is a non-produced asset. Inventories of buildings and other structures in business accounts, however, will in general include the value of the land on which the related building or other structures are built. An adjustment will thus be required when business inventory data are directly used to estimate inventory levels in the national accounts.

8.48. A possible adjustment could be performed by utilising an economy-wide ratio of the value of land to buildings and other structures (known as a land-to-structure ratio). This ratio may be applied with none or only minor changes to the stock of finished construction products. In applying a ratio to the stock of work-in-progress, however, account should be made of the average time to completion of the asset concerned. For instance, if the average time to completion for a building is two years and it is assumed that value is put in place at a constant rate, the land-to-structure ratio used should be double that used for the finished construction product.

8.49. With regards to changes in construction inventories, business accounts may require adjustments when land is purchased from other institutional sectors (e.g. local government or households), or when the finished buildings and other structures are sold. Alternative sources may be required to perform these adjustments ([66]). Failing these, a practical solution may be to perform an adjustment in the manner described in the previous paragraph based on the opening and closing business accounts balance sheets. However, output related to any land improvement falls within the production boundary so that the related expenditure should be treated as either part of inventories or GFCF using the same guidelines provided in this section for other construction work ([67]).

8.50. A third situation that may require adjustments arises when both the producer and the buyer units record capital investment on the same asset under construction within the same accounting period. If the asset is being constructed for an already existing buyer, GFCF by the buyer should be recorded for the value put in place. However, some business accounting standards may permit or require that construction work-in-progress be recorded as an asset by the constructor until delivery of the finished asset to the buyer, even when a contract of sale does exist.

8.51. Table 8.3 below demonstrates with a numeric example such a situation. The construction of the asset runs over three years under a contract of sale with a customer. The agreed price is 300, of which the constructor expects 270 in costs and 30 of net operating revenue (profit). Construction takes place at a constant rate of completion, so that national accounts should record both output and expenditure of 100 per year. However, local accounting standards require that the constructor only recognises revenue when the transfer of ownership to the customer has taken place, at the end-of-period t+2. So, the constructor capitalises as inventory the costs incurred in constructing the asset at a rate of 90 per year, while booking stage payments from the customer as advances. In turn, the customer, a non-financial corporation, records 'fixed investment' in its business accounts for the amounts invoiced by the constructor. If the estimation source used for GFCF are the business accounts of the non-financial corporations (case A), the 'fixed investment' item will include the stage payments made by the buyer. As a result, a double counting of expenditure on the asset will occur in periods t and t+1 (since total P.5, gross capital formation, is 200 in each period) while underestimation will occur in t+2 (since total P.5 is –100).

8.52. When the source used for GFCF for the buyer's sector does not include the stage payments made by the buyer, total expenditure is correctly estimated, but the breakdown of gross capital formation into fixed capital formation and changes in inventories is not. Case B in Table 8.2 presents this case, where the customer is a household purchasing a dwelling making the same stage payment schedule as in case A. Further assume that the source for household investment in dwellings is the property registry, which records the legal transfer of ownership to the household only at completion. GFCF of households will

([66]) For instance, structural business statistics may have information on purchases and disposals of land. See also paragraphs 2.39–2.49 of the *Eurostat-OECD compilation guide on land estimation*. For complete reference see footnote 64 and bibliography.

([67]) For a precise definition of land improvements and a discussion of the problems related to its measurement, see paragraph 8.12 of the *Eurostat-OECD compilation guide on land estimation* For complete reference see footnote 64 and bibliography.

register a transaction for +300 at t+2 and 0 elsewhere. The breakdown of gross capital formation (P.5) between GFCF (P.51) and changes in inventories (P.52) will be incorrect, with P.51 = {0, 0, 300} for periods {t, t+1, t+2} whereas the correct recording would require P.51 = {100,100,100} and P.52 = {0, 0, 0}. However, aggregate gross capital formation, in contrast to case A, will have the desired time profile since P.5 = P.51 + P.52 = {100,100,100}.

Table 8.3: A case of double counting of expenditure relating to assets under construction

Unit	Event and treatment		Year t	Year t+1	Year t+2
	Business accounts				
Producer	Stage payments from customer	Advances received	100	100	100
Producer	Costs of building asset	Work-in-progress (WIP)	90	90	90
Producer	Transfer of ownership to customer	Work-in-progress	0	0	-270
Producer		Net revenue recognition	0	0	-30
Producer		Advances received	0	0	-300
Customer is NFC	Stage payments to constructor	Fixed investment	100	100	100
Customer is HH	Stage payments to constructor	No business accounts exist	:	:	:
	(A) National accounts, purchaser is a non-financial corporation				
Constructor (S.11)	Business accounts WIP, which indistinguishably includes WIP under contract, is used as source for P.52 (converted to basic prices)		100	100	-200
Customer (S.11)	Fixed investment in business accounts, o/w advances on fixed assets used as source for P.51		100	100	100
Total economy (S.1)	Total estimate for P.5		200	200	-100
	(B) National accounts, purchaser is a household				
Constructor (S.11)	Business accounts WIP, which indistinguishably includes WIP under contract, is used as source for P.52 (converted to basic prices)		100	100	-200
Customer (S.14)	GFCF in dwellings estimated from property registry inscription		0	0	300
Total economy (S.1)	Total estimate for P.5		100	100	100

Source: Eurostat-OECD Task Force on Land and other non-financial assets; fictitious data

8.53. In practice it may be difficult for the national accountant to know which part of the work-in-progress inventory in the business accounts requires an adjustment because it is being built under contract. Ideally, the source data should allow distinguishing work-in-progress from contracts/orders in progress. Failing that, progress payments received will often be a good proxy for the actual work for contracts in progress already carried out ([68]). Sometimes progress payments may be reported in the notes to the balance sheet when not available in the main set of accounts. Otherwise total advances from customers may be used in an editing rule to be applied to individual returns that contain implausibly large amounts of inventories suspected to consist primarily of orders in progress.

8.54. Tax data may also offer a solution. Recording the work-in-progress inventory for assets built under contract in the business accounts defers income recognition until the completion of the asset. The units concerned may therefore have to inform the tax authorities about this practice, and/or include an adjustment to their accounting profit when calculating their tax base. This information may be used to estimate the required adjustment to business accounts data.

([68]) For instance, in the context of the Quarterly Stocks Inquiry (QSI) for the construction industry, the UK instructs reporters to report the value of stocks held, net of progress payments on long-term contracts. By requiring progress payments to be netted from the overall inventory figure, most work-in-progress associated to contract work is thus correctly eliminated from national accounts inventories.

Box 8.3: Estimation construction and real estate inventories — Belgium

Belgium estimates the inventories of non-financial corporations, including those in the construction and real estate industry, based on balance sheet data for the annual accounts filed with the Central Balance Sheet Office. The table below details the items included as part of business inventories in these filings, together with the default treatment used in compiling ESA 2010 inventories based on the business accounts data ([69]).

Table 8.4: Belgium, inventories of non-financial corporations — correspondence between annual accounts and ESA 2010 concepts

Account	Description on annual accounts	ESA 2010
3	Inventories and orders in progress	
30/31	Materials and supplies	AN.121
32	Work in progress	AN.122
33	Finished goods	AN.123
34	Goods for resale	AN.125
35	Immovable property intended for resale	AN.112
36	Advance payments	Not significant (see text)
37	Orders in progress	AN.11 for industries NACE 41-43, 62 and 68; AN.122 otherwise

Source: Central Balance Sheet Office, National Bank of Belgium

Advanced payments (36) are not considered significant on an aggregate level and are therefore disregarded in estimating national accounts inventories. Immovable property intended for resale (35) are treated as fixed assets (AN.11), with changes in stocks allocated to GFCF, P.51). Orders in progress (37) are excluded from national accounts inventories for producers of assets that take a long time to complete, namely those within the industries with codes 41–43 (construction), 62 (computer programming) and 68 (real estate activities) of the statistical classification of economic activities in the European Communities, NACE Rev. 2. This is in line with SNA 2008 and ESA 2010 that require that expenditure related to unfinished fixed assets be allocated to GFCF and not inventories when a contract of sale has been concluded in advance. Assets included in (37) are presumably built under contract, whereas those included in (32) are presumably not. The latter are therefore allocated to inventories in the national accounts. For industries other than 41–43, 62 and 68, both work-in-progress (32) and orders in progress (37) are treated as inventories (AN.122) in the national accounts.

The solution implemented by Belgium is also necessary to prevent the double counting of expenditure described paragraph 8.50. This is most readily seen when the purchaser of an asset under construction is another corporation. GFCF for non-financial corporations is also sourced from the annual accounts filed with the CBSO. The purchaser's filing would include an asset under construction within an item entitled ('Tangible fixed assets, of which assets under construction and advanced payments'). This item is always allocated to GFCF in the national accounts. If item (37) in the producer's filing was allocated to changes in inventories (P.52), expenditure in the asset would be duplicated in the national accounts.

([69]) The table refers to reporters filing a full set of accounts. Entities below a certain threshold provide less detail. However, the solution applied with regards to converting business inventories into either national accounts inventories or fixed assets is essentially the same. For details, see National Accounts Institute of Belgium, Gross National Income Methodological Inventory, 30 June 2016. available at https://www.nbb.be/doc/dq/e_method/m_esr2010_en.pdf.

Research and development and software

8.55. The output of research and development (R&D) and software companies may be classified as three different types: own account, custom-made, and speculative production. Own account R&D and software is produced and used internally. Custom-made R&D and software is produced on behalf of another unit, usually under contract. Speculative production refers to self-funded production not intended for internal use and with no advanced secured buyer. Since production of R&D and software may take longer than one year, there will also be work-in-progress until the R&D and software is finished.

8.56. As stated in paragraph 8.35 the SNA 2008/ESA 2010 recommend that the production of assets on own account should be recorded as GFCF as it occurs. In principle the output of speculative and custom-made R&D and software should be recorded in inventories (work-in-progress or finished) until it is disposed of to a final user. However, the Handbook on Deriving Capital Measures of Intellectual Property Products (OECD 2010) states that 'in practice the difficulty of implementation will generally outweigh the benefits'. The Handbook also goes on to say that if there is significant production of R&D for sale (as is the case for exporting countries such as Israel) ([70]), then it should be recorded in inventories as work-in-progress. This is particularly important for R&D produced by affiliates of multinational firms, which may ultimately be exported ([71]).

8.57. Another special case may be R&D and software development by start-up companies who undertake a large amount of production of R&D and software but are aiming to 'exit' the market, hoping to generate a huge return on the investment, by being sold to foreign or internal enterprises. The production of this R&D and software could be seen as work-in-progress inventories (at least while the company is still in its early stages of existence), since they are not meant to become a means of future local production. Unless the national accountant has good access to this type of information and that the activity is very common in a given country the difficultly of recording this activity as inventories instead of GFCF will generally outweigh the benefits.

8.4 Treatment of government and military inventories

8.58. Government units perform their functions in the same way as other institutional units, in that they incur expenses and receive incomes, as well as make use of financial and non-financial assets. However, there are three important characteristics to consider:

- most of government units' production is non-market;
- the time of recording frequently applied by government units is cash accounting which may deviate from the accrual accounting that is the standard that has to be applied in the national accounts;
- the government sector is the only sector that holds military inventories (or weapon systems) in order to accomplish its function of defence.

8.59. This section starts discussing the peculiarities of the government as producers and the government's accounting and time of recording practices, and continues with the treatment of government inventories, its definitions and breakdowns. The final part of this section is dedicated to the particular case of military inventories.

8.60. As the IMF Government Finance Statistics Manual (GFSM 2014) ([72]) provides adequate guidance regarding government and military inventories, its theory and its measurement, large parts of the text of this chapter is extracted from that manual. More detailed information can be found in the GFSM, in particular in paragraphs 7.75–7.86 (inventory stocks, AN.12) and paragraphs 8.44–8.47 (changes in inventories, P.52).

Government as producers

8.61. In SNA 2008 and ESA 2010, government units are defined as unique kinds of legal entities established by political processes that have legislative, judicial or executive authority over other institutional units within a given area. Viewed as institutional units, the principal functions of government are to assume

([70]) The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

([71]) Organisation for Economic Co-operation and Development, *Handbook on Deriving Capital Measures of Intellectual Property Products*, Paris, 2010, Chapter II. Available at http://www.oecd.org/std/na/44312350.pdf

([72]) International Monetary Fund, *Government Finance Statistics Manual 2014*, IMF Publication Services, Washington, 2014. Available at https://www.imf.org/external/Pubs/FT/GFS/Manual/2014/gfsfinal.pdf

responsibility for providing goods and services to the community or to individual households and to finance their provision out of taxation or other incomes, to redistribute income and wealth by means of transfers, and to engage in non-market production.

8.62. The fact that governments choose to supply not only collective services but also many goods and individual services free, or at prices that are not economically significant, to households or other units does not necessitate that they produce them themselves. Governments may only be organising and financing their production. They are not obliged to produce them. However, government units do usually engage in a wide range of productive activities in practice, covering not only collective services but also many other goods and individual services (SNA 2008 paragraph 4.119).

8.63. Producer units of government consist largely of non-market producers: that is, producers most or all of whose output is supplied to other units free, or at prices that are not economically significant. In addition, such units may include government producers supplying non-market goods and services to other government units for purposes of intermediate consumption or GFCF. Examples are munitions factories, government printing offices, transport agencies, computer or communication agencies, etc. However, it is possible for an unincorporated enterprise within a government to be a market producer. The example often quoted is that of a bookshop within a museum (SNA 2008 paragraph 4.123).

8.64. Non-market output undertaken by general government takes place in the absence of economically significant prices. Therefore, national accountants by convention measure its output as the sum of intermediate consumption, compensation of employees, consumption of fixed capital, and other taxes on production.

Government's accounting and time of recording

8.65. The type of accounting, whether on an accrual or cash basis, affects the measurement of flows as well as the stock positions, because one transaction could have different moments of recording depending on the type of accounting followed. In the accrual basis of recording, flows are recorded at the time economic value is created, transformed, exchanged, transferred, or extinguished. In the cash basis of recording, flows are recorded when cash is received and disbursed and this timing may diverge significantly from the time of the economic activities and the transactions to which they relate (GFSM paragraphs 3.60, 3.62 and 3.70).

8.66. A consequence of recording on a cash basis is that the category changes in inventories is limited to changes in strategic stocks. Other inventories are, by definition of the cash basis of recording, considered an expense when acquired (GFSM Table 4.2). National accountants should be aware of the time of recording (i.e. accrual or cash) of the source data used and make appropriate adjustments where needed.

Definitions and breakdowns government inventories

8.67. The above-mentioned GFSM mentions in paragraph 7.75-7.78: Inventories are produced assets consisting of goods and services, which came into existence in the current period or in an earlier period, and that are held for sale, use in production, or other use at a later date. Inventories are classified as materials and supplies, work-in-progress, finished goods, goods for resale, and military inventories. Each of these types of inventories has a different economic function. Inventories consist of stocks of:

- goods that are still held by the units that produced them prior to their being further processed, sold, delivered to other units, or used in other ways;
- products acquired from other units that are intended to be used in the production of market and non-market goods and services by units, or for resale without further processing;
- strategic stocks that are goods held for strategic and emergency purposes, goods held by market regulatory organisations, and other goods of special importance to the nation, such as grain ([73]), military inventories, and petroleum.

([73]) According to ESA 2010 agricultural inventories held by public agencies, like grain inventories, are not necessarily inventories of the government sector, see ESA 2010 paragraph 20.53.

8.68. Inventories should be valued at their current market prices on the balance sheet date rather their acquisition prices. In principle, current market prices should be available for most types of inventories, but in practice, the values of inventories frequently are estimated by adjusting book or acquisition values of inventories with the aid of price indices.

8.69. From the two paragraphs above it can be concluded that the definition, breakdown and valuation of government inventories as defined in the GFSM is fully in line with the guidelines from SNA 2008/ESA 2010 as discussed in Chapter 2. Below some peculiarities for government inventories are addressed.

8.70. Regarding materials and supplies, public sector units may hold a variety of goods as materials and supplies, including office supplies, fuel, and foodstuffs. Every public sector unit may be expected to hold some materials and supplies, if only office supplies. Materials and supplies often can be valued on the basis of the current market prices for the same goods.

8.71. On work-in-progress: general government units primarily produce non-market services are likely to have little or no work-in-progress, as the production of most such services is completed in a short time span or continuously. However, public infrastructure might be an exception and show considerable values for work-in-progress. Work-in-progress inventories are valued on the basis of the cost of production at current prices as of the balance sheet date.

8.72. General government units will have finished goods only if they produce goods for sale or transfer to other units. Inventories of finished goods are valued at their current sales value (before adding any taxes, transport, or distribution charges) if the good is sold at market (i.e. if it is part of market output of general government) or at the cost to produce them currently (i.e. their current replacement prices) if the good is part of non-market output.

8.73. Any general government unit that sells goods for economically significant prices, such as a museum gift shop, is likely to possess an inventory of goods for resale. This category also includes goods purchased by general government units for provision free of charge or at prices that are not economically significant to other units. Goods acquired by government for distribution as social transfers in kind but that have not yet been so delivered are also included in goods for resale. Inventories of goods intended for resale are valued at their current replacement prices.

8.74. The principles and measurement of the transaction changes in inventories is discussed in paragraphs 8.44–8.47 of the GFSM. From this discussion it can be concluded that principles and measurement are fully in line with those presented in Chapter 2 of this compilation guide.

8.75. However, the changes in inventories are likely to be small for government units and other non-market producers, as they are mostly engaged in the production of services rather than in the production of goods.

Military inventories

8.76. Military inventories include ammunition, missiles, rockets, bombs and other single-use military items delivered by weapons or weapons systems; it excludes some types of missiles with highly destructive capability (SNA 2008 paragraph 10.144 and ESA 2010 Annex 7.1). Most single-use items are treated as inventories but some types of missiles with highly destructive capability may be treated as fixed capital because of their ability to provide an ongoing deterrence service against aggressors.

8.77. Thus military inventories can be held only by general government in their capacity of producing defence activities. The types of inventories that manufacturers of military-type goods can record would follow the types of inventories that can be recorded as producers of goods: materials and supplies; work-in-progress; and finished goods. These inventories would be classified to the industry and institutional sector where the producer of these military-type goods is classified.

8.78. Table 8.5 shows the possible type of inventories according to the economic activity and cross-classification with institutional sectors.

Table 8.5: Classification of government inventories in SNA 2008 and GFSM

Type of inventories	S.11 Non-financial corporations/S.13 General government (1)			S.13 General government
	C20.5.1 - Manufacture of explosives	C25.4.0 - Manufacture of weapons and ammunition	C30.4.0 - Manufacture of military fighting vehicles	O84.2.2 - Defence activities
AN.121 Materials and supplies	x	x	x	x
AN.122 Work-in-progress		x	x	x
AN.123 Finished goods	x	x	x	x
AN.124 Military inventories				x
AN.125 Goods for resale				

(1) Specific government units engaged in production process under these activities

Source: Eurostat-OECD Task Force on Land and other non-financial assets

Issues raised by military inventories

8.79. Because military inventories are strategic, the availability of information to measure them could be scarce. Even when national statistical institutes can obtain the data there may be restrictions to release them because of confidentiality reasons. In other cases, when the information to compile these inventories is not of high enough quality or sufficient, the decision could be to aggregate them in other items of inventories, not separately showing data for military inventories (which, however, will cause problems for estimating a breakdown by government functions). The Eurostat-OECD survey of national practices in estimating inventories showed these practices in the countries that answered affirmative to estimating inventories held by the government.

8.80. There is a specific type of military contract for heavy equipment that takes many years to build/produce; for instance large ships, airplanes or submarines. This is an example where it may be necessary to use the category work-in-progress in the inventories of the producer to record the unfinished goods until the transfer to the purchaser (the government). Under these conditions, the military equipment would be recorded at the time of the transfer of ownership, on a delivery basis.

8.81. The availability of market prices that could be used to assign value to the military inventories may prove difficult. In this case, national accountants could consider using available data from producer price indices for the industry that produces weapons and ammunitions.

8.82. In some cases, certain types of inventories may become obsolete due to changes in equipment or procedures. For example, a type of ammunition may no longer be needed when the weapon that launches it is replaced. Without good data on military inventories, these types of changes may be missed and the result would be an overestimate of military inventories. In these cases an effort should be made to obtain appropriate current replacement prices to withdrawal from inventories these goods.

Box 8.4: Measuring government and military inventories — United Kingdom

The data source used by the Office for National Statistics (ONS) for measuring most central government activity in the UK is the HM Treasury (HMT) managed Online System for Central Accounting and Reporting (OSCAR) database. This database is updated monthly using accounting data from all UK government departments. The highly disaggregated nature of these data mean that additions and withdraws of inventories can be identified and classified by Classifications of the Functions of Government (COFOG) ([74]), which is mapped to the UK Standard Industrial Classification (SIC).

([74]) European Commission/Eurostat, Manual on sources and methods for *the compilation of COFOG Statistics – Classification of the Functions of Government (COFOG), Luxembourg, 2011. Available at* http://ec.europa.eu/eurostat/en/web/products-manuals-and-guidelines/-/KS-RA-11-013

In general, UK central government inventories cover materials and supplies and military inventories. As the central government is mainly a producer of services, works in progress and finished goods are not common.

Changes in inventories of materials and supplies are estimated directly using the additions and withdraws estimates from the OSCAR database, where adjustments are made using price indices in order to revalue withdraws to current prices.

In 2014, the UK national accounts were for the first time compiled on an ESA 2010 basis. This added military inventories and weapons systems to the asset boundary. These items had previously been classified as intermediate consumption. The OSCAR dataset contains expenditure items for Single Use Military Equipment however on investigation, it was found that some of the purchases included in this entry were weapons systems, not military inventories. There was therefore a need to further disaggregate these data into a component of fixed assets and one of inventories. After querying the data with the Ministry of Defence (MoD), more detailed information is now provided to ONS allowing this component to be split into the different assets.

Table 8.6: Example of the treatment of expenditure on weapons systems and military inventories
(billion GBP)

	Expenditure on military equipment	Fixed assets	Addition to inventory	Obsolescence	Discharge of ammunition	Change in inventory	Intermediate consumption
ESA 1995 treatment	5.00						5.00
ESA 2010 treatment (no military action)	5.00	4.50	0.50	0.10	0.05	0.35	0.15
ESA 2010 treatment (military action)	5.00	4.50	0.50	0.10	0.50	-0.10	0.60

Source: Eurostat-OECD Task Force on Land and other non-financial assets, based on compilation practice of the UK Office for National Statistics

For disposals of military inventories, the MoD provides data on the value of ammunition discharged on a financial year basis. These data are simply divided by four in order to obtain quarterly estimates. As these values are recorded at historic prices, they are revalued to current prices using estimates of the average holding time provided by the MoD and by the UK producer price index for weapons and ammunition (CPA 25.4).

A weakness of the MoD data is that they do not provide any information on the deterioration of the stock of military inventories which occurs over time and therefore is unlikely to fully explain the differences between the opening and closing stock of military inventories, even after nominal holding gains or losses have been accounted for. To adjust for this, analytical work from MoD reports was utilised in order to make assumptions about the proportion of ammunition becoming obsolete for this reason over time. This suggested that 5 % of purchases of ammunition were obsolete after 10 years and 15 % were obsolete after 15 years. Adjustments are therefore made to disposals estimates prior to the calculation of the changes in inventories.

8.5 Inventories of finished services

8.83. The purpose of this chapter is to discuss the possibility of storage of finished services. The SNA 2008, has a heading for inventories of finished goods (products), but could this heading also contain finished services. In other words, do inventories of finished services exist? Inventories of finished services are not a straight forward thing as most services are consumed at the time they are produced. Neither cleaning nor consulting can be stored and kept for future use. However, other types of services might be stored, such as drafting services. This chapter tries — based on responses from a questionnaire about inventories — to highlight country practice and to identify some examples of inventories of finished services.

Characteristics of inventories of finished products

8.84. Inventories of finished products are characterised by the fact that they are produced without any negotiated sale; the producer has produced the product with a speculative purpose since no purchaser has accepted to buy the product prior to its fabrication. After the product is produced it ends up as an inventory until the product is sold. This applies for all products, no matter if they are goods or services.

Information by industries

8.85. The joint Eurostat-OECD Task Force on non-financial assets has conducted a questionnaire on inventories that was completed by many national statistical institutes (NSIs) on inventories, and one of the questions concerned inventories of finished services (Chapter 9 summarises the responses to the survey). A few countries responded that they estimate inventories of finished services. The identification of industries with inventories of finished services is mostly based on reports from structural business statistics. If companies report inventories of finished services then they are included in the national accounts. The table below shows examples of industries where inventories of finished services occur according the responses of the NSIs.

Table 8.7: Industries reporting inventories of finished services

NACE code	Industry
NACE 58	Publishing activities
NACE 59	Motion picture, video and television programme production, sound recording and music publishing activities
NACE 62	Computer programming, consultancy and related activities
NACE 63	Information service activities
NACE 71	Architectural and engineering activities
NACE 72	Scientific research and development
NACE 73	Advertising and market research
NACE 74	Other professional, scientific and technical activities

Source: Eurostat-OECD Task Force on Land and other non-financial assets, based on survey completed by 34 countries

8.86. Some reservations should be mentioned regarding the questionnaire results. One NSI reporting finished services mentioned that the category 'finished services' is merged with 'work-in-progress of services'. Another country mentioned that inventories of 'finished products' by service industries could contain secondary outputs which do not qualify as services. Nevertheless, according to the questionnaire it is clear that companies do report inventories of finished services.

Information by products

8.87. A subsequent consultation has revealed that most countries that reported inventories of finished services in the questionnaire have information by industries and not by products. This makes it difficult to identify products which are stored. However, a few countries have this information, and for those countries the products match the industries ([75]): CPA 58 in NACE 58 (CPC 891 in ISIC 18 / ISIC 58), CPA 59 in NACE 59 (CPC 961 in ISIC 59) and so forth — see Table 8.8 below. This implies that the finished services that are most likely to be stored are products such as architectural drawings, computer software, TV programmes as well as research and development results.

([75]) Explanation of acronyms: CPS – Classification of Products by Activity; NACE – statistical classification of economic activities in the European Community; CPC – Central Product Classification; ISIC – International Standard Industrial Classification of All Economic Activities.

Table 8.8: Possible inventories of finished services by products

CPA code	Product
CPA 58	Publishing services
CPA 59	Motion picture, video and television programme production services, sound recording and music publishing
CPA 62	Computer programming, consultancy and related services
CPA 63	Information services
CPA 71	Architectural and engineering services, technical testing and analysis services
CPA 72	Scientific research and development services
CPA 73	Advertising and market services
CPA 74	Other professional, scientific and technical services

Source: Eurostat-OECD Task Force on Land and other non-financial assets, based on survey completed by 34 countries

8.88. Some of the stored services can be attributed to the category 'knowledge capturing products', which are labelled as intellectual property products in the national accounts and treated as fixed asset when used in the production process. Other products do not exactly fit into this category, but come close to. Inventories of finished services look in many aspects like produced assets not put into operation.

8.6 Treatment of exceptional and recurrent losses

The boundary between exceptional losses and recurrent losses

8.89. Goods held in inventories could be subject to losses, for example, in the form of wastage or damage. The size of the losses and the frequency of the losses are important determinants for their treatment in the national accounts.

8.90. According to national accounts concepts (SNA 2008/ESA 2010) two types of losses from inventories can be distinguished: exceptional losses and recurrent losses. Exceptional losses should be treated as other changes in volume n.e.c. (K.5), whereas recurrent losses are included in changes in inventories (P.52).

8.91. The guidelines (SNA 2008/ESA 2010)make the following distinction between the two types of losses:

- Exceptional losses are defined as losses which are large in size and irregular in occurrence. Examples are events — if they occur irregularly — such as floods, earthquakes, major fires or unusually high level of disease. Examples of losses which could be attributed to these irregular events are losses from fire damage, robberies, insect infestation of grain stores, and unusually high level of disease in livestock (SNA 2008, paragraphs 12.58 and 12.98).
- Recurrent losses are defined as losses which could vary in size from small to large. If the losses are large in size, they must occur on a regular basis to qualify. Examples of recurrent losses are wastage, accidental damage or pilfering (SNA 2008, paragraph 6.109 and 10.131).

8.92. In order to distinguish between exceptional losses and recurrent losses, the words 'irregular' and 'large' are important. If the loss is both large and occurs irregularly, the loss should be treated as exceptional loss, otherwise it is a recurrent loss.

Business accounting

8.93. In business accounting, write-downs because of losses on inventories should be treated as expenses when they occur. Write-downs include normal as well as abnormal waste. Both types of write-downs would

under normal circumstances be displayed as one combined item. Separation for national account purposes requires additional sources. Chapter 4 provides a more in-depth discussion on business accounting.

Insurance claims as a data source for exceptional losses

8.94. The most likely data source for identifying values for exceptional losses is (approved) insurance claims. Most companies will likely try to cover any large losses by demanding compensation from their insurance company (assuming the company is covered by the specific insurance). If the necessary information on insurance claims is not published, national statistical institutes could request this information.

8.95. Insurance companies or associations of insurance companies might publish values for the cost of the damage from an extraordinary event. However, such values could show the combined values for losses on inventories and damage on other types of assets such as buildings and/or lost revenues. In this case, the combined value has to be separated, either by asking for additional information or by making assumptions.

Recurrent losses and insurance claims

8.96. Large or very large losses can occur on regular basis. In that case SNA 2008 paragraph 12.58 states that the loss should be treated as recurrent losses. If insurance information is used for identifying exceptional losses, it must be ensured that no payments regarding recurrent losses are included.

8.97. However, insurance policies usually do not cover large recurrent losses. The purpose of insurance is to spread risks between units and over time and the principle of spreading risks and regular occurrence of large losses do not very well fit together. It would be expensive to purchase such an insurance policy. Therefore it is more likely that companies cover large and regular losses by their margins. Similarly, small losses will probably not be reported to insurance companies and will also be absorbed by the companies' margins.

Force majeure

8.98. Some very extreme exceptional losses — such as large earthquakes — might not be covered by insurance because of a force majeure clause in the insurance contract which exempts the insurance company from its obligations. If such losses occur, the government might grant compensation for the exceptional losses, and government statistics could be used as a source. For example, in Canada the government maintains a 'disaster database' which contains relevant information on force majeure events. However, not all government will grants compensation for extreme losses.

8.7 Inventories held under global production

Introduction

8.99. The Guide to Measuring Global Production ([76]) has identified eight typical global production arrangements. Although all eight are involved with the production of goods and/or services, there are three types, in particular, where the economic activity is concentrated in the movement of goods.

8.100. The global production arrangements of goods sent abroad for processing, goods under merchanting, and factoryless goods production would include the transfer of goods and should be included within inventories if the resident institutional unit owns them.

([76]) United Nations Economic Commission for Europe, *Guide to Measuring Global Production*, Geneva, 2015. Available at https://www.unece.org/fileadmin/DAM/stats/publications/2015/Guide_to_Measuring_Global_Production__2015_.pdf

8.101. Although not addressed in the Guide to Measuring Global Production, goods entering free trade zones and goods for re-exports also involve movement of goods. According to the Balance of Payments Manual (BPM6), free trade zones should always be included in the economic statistics of that economy in which the free trade zone is situated (BPM6 paragraph 4.8). Therefore, goods that change ownership when entering these free trade zones should be recorded in inventories of the resident economic owner if that unit owns them. Re-exports are foreign goods (goods produced in other economies and previously imported with a change of economic ownership) that are exported with no substantial transformation from the state in which they were previously imported. Goods that have been imported and are waiting to be re-exported are recorded in inventories of the resident economic owner.

8.102. The next sections focus on the three types of global production arrangements where the economic activity is concentrated in the movement of goods as discussed in the Guide to Measuring Global Production.

Goods sent abroad for processing

8.103. Under the goods sent abroad for processing arrangement, part of the production process is carried out by a company in a different country. Under this type of global production arrangement, the resident company (known as the principal) owns the input materials (such as the raw materials or intermediate goods) and the intellectual property associated with the production process (such as the blue prints, technology, know-how and product design) and is purchasing manufacturing services from abroad to transform its inputs into another product. This is sometimes referred to as outward processing.

8.104. If the input materials are sent from the resident economy to the processor abroad for further processing they should not be recorded as being withdrawn from inventories because there is no change in ownership and no subsequent export of a good. Since the resident company still owns these material inventories they are most likely being registered on the business accounts of the domestic company.

8.105. Another possible scenario is that the principal does not send input materials from a stock of materials stored in the resident economy but rather purchases them directly in another economy (which may include the country of the processor). Again, since the resident company owns these material inventories they are most likely being registered on the business accounts of the domestic company.

8.106. If the processing straddles more than one accounting period in theory an accumulation of work-in-progress inventories should occur with a corresponding transaction of an import of manufacturing services in the same period so that GDP is left unaffected by foreign production.

8.107. In practice most countries likely assume there is no accumulation of work-in-progress inventories by the domestic principal while the processor is transforming the inputs into another product. It is likely that this assumption is valid if the processing is completed within one accounting period. One way to check to see if this assumption is valid is to look at the reported intermediate consumption to turnover (sales) ratios of the principal and compare them to other companies within the industry to see if they deviate from the norm. If so then this assumption may need to be further investigated by the country.

8.108. However, there may be instances such as ship building that may need review on how to handle such situations. Most likely the import of the manufacturing service would only be registered when the item is finished.

8.109. After processing, the goods may be sent back to the country in which the principal company is resident and registered as (finished) goods inventories (if they have not yet been sold), or directly to customers that are resident in the country. Of course there will be a corresponding import of manufacturing services registered as well representing the foreign production. However, it is also possible that after processing the goods do not return and are directly delivered to customers in the country where the processing takes place or yet another country, under this scenario the goods would be recorded as exports from the country of the principal.

8.110. The reverse of this arrangement can also occur, in other words the resident company may be the manufacturing service provider. Under this scenario, the resident company, the processor, is engaged in the physical transformation of goods that are before and after processing under ownership of a foreign principal. Because the processor is not the owner of the inventories they should not be recorded on the accounting records of the processor. Implementing the SNA 2008 may require some changes to surveys to

ensure that they do not incorrectly include inventories owned by the principal in the balance sheet of the processor.

8.111. After processing, the goods may return to the country of the principal, or be supplied to customers in the country of the processor, or shipped to yet another country. This phenomenon is sometimes referred to as inward processing.

Goods under merchanting

8.112. Goods under merchanting, which will be explained more in detail below, are those arrangements where products are bought from one country and sold 'as is' to another country, no further substantial processing is completed.

8.113. Merchanting is a process whereby a unit in economy A purchases goods from economy B for sale in economy B or C. The goods legally change ownership but do not physically enter the economy where the owner is resident. The key features of this arrangement are that

(a) The goods never enter the domestic entity's territory while the sales are credited to the domestic entity, and

(b) The physical form of the goods, while owned by the domestic entity, does not change. In other words, the domestic entity does not carry out any substantial transformation on the purchased goods.

8.114. By convention, the acquisition of the goods intended for resale is shown as negative exports. When the goods are sold, they are shown as (positive) exports. The difference between the value of the good when acquired (i.e. negative export value) and the value of the good when sold (export value) represents the trade margin received by the merchant. When acquisition and sale take place in the same period, the difference shows as an addition to exports. Note that the merchanting margin should have the same impact as in the balance of payments, i.e. the net export of goods should be identical in both sets of accounts.

8.115. When transactions straddle accounting periods, the initial transaction (the negative export recorded in the accounts of the country in which the merchant is resident) must be matched by an increase in inventories of goods for resale even though those goods are held abroad, since otherwise GDP will be reduced by the amount of the purchase of the goods. In a subsequent period when the goods are sold, the sale of the goods must be recorded as a [positive] export largely offset by a reduction in inventories, leaving the margin earned on the merchanting transaction as a net addition to GDP. As normal, the withdrawals should be valued at the replacement cost of the goods at the date of the withdrawal, any increase in value due to a change in the price of the goods being shown as nominal holding gains and losses. (SNA 2008 paragraph 14.73, ESA paragraph18.38)

8.116. Figure 8.3 is an example of a merchanting transaction that straddles recording periods, adapted from the example shown in the Impact of Globalisation on National Accounts guide to more explicitly show the transactions related to inventories. The resident of A purchases goods from the resident of B in period t and resells the goods to a resident of C in period t+1. The goods physically move from country B to the consumers in country C directly, without entering country A. It is assumed that all transactions are settled by transfers of deposits. Country A records an increase in inventories in period t, and a corresponding fall in t+1.

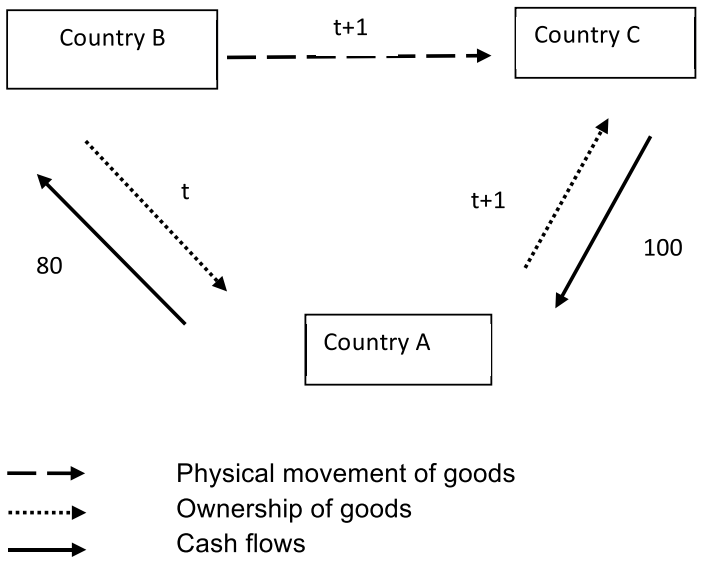
- 10 units of goods with a price of 8 per unit are purchased by a resident of country A from a resident of B in period t. The total value of the goods in period t is 80 (10 units * 8).
- The company that is resident in country A resells the 10 units with a sales price of 10 per unit to a consumer resident in country C in period t+1 (total value 100 = 10 units * 10); the price to replace the goods held in inventory increases from 8 in period t to 9 in period t+1 (thus, there has been a price increase while the goods were held in inventory), therefore, the trade margin of the merchant resident in country A is 10.
- Note that the company resident in country A will most likely record its withdrawals at the value of acquisition costs (in this example 8), so the company reported change in book value should be adjusted for the nominal holding gains and losses (Table 8.9).

Table 8.9: Accounting records of company resident in country A

	Period t	Period t+1
Sales	0	100
Beginning inventory	0	80
Purchases	80	0
Ending inventory	80	0
Cost of goods sold	0	80
Revenue minus cost of goods sold	0	20

Source: Eurostat-OECD Task Force on Land and other non-financial assets; fictitious data

Figure 8.3: Merchanting when transactions straddle recording periods



Source: Eurostat-OECD Task Force on Land and other non-financial assets; fictitious data

8.117. Table 8.10 is a simple example of the recording of the transactions and their impact on GDP (view point expenditure approach).

Table 8.10: Recording of merchanting when transactions straddle recording periods

	Period t	Period t+1
Country A		
GDP- expenditure approach	0	10
Consumption	0	0
GFCF	0	0
Changes in inventories	80	-90
Net exports	-80	100
Exports	-80	100
Goods	-80	100
Net exports of goods under merchanting	-80	100
Goods acquired under merchanting	-80	0
Goods sold under merchanting	0	100
Services		
Imports	0	0
Country B		
GDP- expenditure approach	80	(no transactions)
Consumption	0	
GFCF	0	
Changes in inventories	0	
Net exports	80	
Exports	80	
Goods	80	
Services	0	
Imports	0	
Country C		
GDP- expenditure approach	(no transactions)	0
Consumption		100
GFCF		0
Changes in inventories		0
Net exports		-100
Exports		0
Goods		0
Services		0
Imports		100

Source: Eurostat-OECD Task Force on Land and other non-financial assets; fictitious data

8.118. It should be noted that if country B uses customs data for the estimation of exports, the value of exports in period t must be imputed (and in period t+1 excluded from the customs data source) otherwise the physical movement of goods would be recorded and imbalance in the supply and use tables would occur (since inventories are physically held in country B but owned by country A in period t). Analogously, the problem could occur in country C if goods are physically moved into C in period t, stored by resident of A in country C and sold in period t+1. If the recording of the purchase in country B (and sale in country C) are followed (i.e. purchases/sales by non-residents) instead of the physical movement of goods (customs data) then no such problem would occur.

Factoryless goods production

8.119. A factoryless goods production arrangement occurs when a resident company, the principal, owns the intellectual property (such as the blue prints, technology, know-how and product design) but outsources production to a foreign company who supplies the inputs. Under the current guidance in the International Standard Industrial Classification of All Economic Activities (ISIC), a factoryless goods producer that does not own the material inputs is most likely classified in the wholesale and retail trade sector, thus the change in ownership of the good would follow the merchanting type of transactions (described above).

How to identify foreign held inventories?

8.120. To identify foreign held inventories, survey questions should be focused on inventories that are on the business's accounting records but that are physically located outside of the country. The data on inventories are usually collected as part of a business survey. Therefore, the design of business surveys should be such that inventories held abroad are explicitly captured. A split between domestic and foreign held inventories would be very helpful. In particular, surveying inventories held abroad (apart from domestically held inventories) by wholesalers and retailers may also serve as a data source supplementing customs data when measuring imports and exports on a change of ownership basis. A simple rule for identifying merchanting could be if the recorded merchanting margin in a given period falls significantly below the norm in one period and significantly above in another. Also a split of raw materials versus processed goods would be useful, particularly in providing a broader picture of the commodity flows subject to outward processing. This split would also help properly measure revaluations.

8.121. According to the Eurostat-OECD survey of national practices in estimating inventories (Chapter 9) a few countries make adjustments related to inventories held outside of their countries for merchanting and goods for processing. The source for the information is business surveys (to derive, in the case of Canada inventory held abroad for manufacturing, retail trade and wholesale trade), the structural business survey, tax records and inventory inquiries or consolidated financial statements.

8.122. Box 8.5 is an example of a survey conducted in the United States that asks for data on inventories held outside of the United States.

Box 8.5: Using surveys to identify inventories held abroad — United States

In the United States a combination of information collected on various surveys is needed to appropriately record the transactions related to merchanting activities and the corresponding changes in inventories held abroad. Two separate agencies are responsible for the collection of the survey data. The Bureau of Economic Analysis (BEA) conducts mandatory surveys under a law known as the International Investment and Trade in Services Survey Act. Among its provisions, this act requires the periodic collection of data on international trade in services and direct-investment-related activities. The United States Census Bureau conducts the annual wholesale trade survey (AWTS) and the annual retail trade survey (ARTS) which collects information on sales (turnover) and inventories.

Census bureau wholesale and retail trade surveys

The reporting unit on the Census Bureau's AWTS or ARTS survey cover all wholesale (or retail) establishments in the United States reporting payroll under a single employer identification number (EIN). The EIN is a federal tax identification number, and is used to identify a business entity. The end-of-year inventories and inventories held outside the US are collected by industry and not by type of product. Below is an excerpt from the AWTS for the questions specific to inventories. The same questions appear on the ARTS survey.

The questions do not specifically target goods bought and sold under merchanting arrangements. The data collected could reflect timing differences of when a good is imported into the US and when the change in ownership occurs. However, the data could be used as an indication of the amount of inventories held abroad under merchanting arrangements. The highest percentage of inventories held abroad for merchant wholesalers excluding manufacturing sales branch offices was in the petroleum and products industry, an industry known for its merchanting type arrangements. The results also show that in the year 2013 inventories held abroad by merchant wholesalers represent 4.4 % of total inventories.

Figure 8.4: Excerpt from the US annual wholesale trade survey

U.S. DEPARTMENT OF COMMERCE
Economics and Statistics Administration
U.S. CENSUS BUREAU

Worksheet
SA-42 (01-05-2016)

2015 ANNUAL WHOLESALE TRADE REPORT

7 VALUE OF INVENTORIES

INCLUDE

- All inventories of products covered by this report, including auxiliary locations (such as warehouses, garages, and central administrative offices) servicing these establishments, regardless of where held
- Inventory held in Foreign Trade Zones or in bond warehouses in the United States
- Report at cost or market value as of December 31 (or the end of the period for which you are reporting)

EXCLUDE

- Items such as fixtures, equipment, and supplies not held for resale
- Products owned by others that are being held on consignment

A. Did this EIN own inventories, regardless of where held, at the end of 2015 (or the end of the period for which you are reporting)?

☐ Yes

☐ No - *Go to* 9 *on the next page*

B. What was the value of inventories?

	Mark "X" if None	2015 $ Bil.	Mil.	Thou.	Dol.
1. Total inventories (if applicable, before Last-in, First-out (LIFO) adjustment)					
2. LIFO reserve (if applicable)	☐				
3. Book value of inventories 7B1 *minus* 7B2.					

C. Were inventories reported as of December 31?

☐ Yes - *Go to* 7E

☐ No

	2015 Month	Day	Year
D. If not December 31, inventories were reported as of what date?			

E. Were any of the inventories reported in 7B1 stored outside, or en route to, the 50 states and the District of Columbia in 2015?

☐ Yes

☐ No - *Go to* 8

	2015 $ Bil.	Mil.	Thou.	Dol.
F. What was the value of the inventories stored outside, or en route to, the 50 states and the District of Columbia in 2015? *Exclude inventory held in Foreign Trade Zones or in bond warehouses in the U.S.*				

8 INVENTORY VALUATION METHOD

A. Were any of the inventories reported in 7B1 subject to the LIFO valuation method?

☐ Yes

☐ No - *Go to* 9 *on the next page*

B. How much of the inventory reported in 7B1 was subject to:

	Mark "X" if None	2015 $ Bil.	Mil.	Thou.	Dol.
1. LIFO valuation method before adjustment					
2. Any other valuation method	☐				
3. Verify Total *Sum of* 8B1 *and* 8B2. *Total must equal* 7B1.					

Source: US Census Bureau

8.8 Differences between closing and next period opening stocks in source data

8.123. Many countries base their estimates of annual inventory stocks and annual changes in inventories (P.52) on the end-of-year inventory stock levels (AN.12) reported by corporations. As Chapter 3 notes, the most widely used data source for estimates of inventories are business surveys, which typically ask respondents to report stocks of inventories at the opening of the year (for example, 1 January 2015) and the closing of the same year (31 December 2015). For each respondent, the closing inventory stocks reported for one year (31 December 2015) should, in theory, be identical to the opening stocks reported for the following year (1 January 2016). As the results of the Task Force's questionnaire on inventories indicate, however, many countries report inconsistencies between closing and next opening stock levels from business surveys (for a summary of the survey results see Chapter 9). This section describes the frequency of this problem and possible reasons and solutions, citing the results of the questionnaire.

Frequency of inconsistencies of reported inventory stocks

8.124. A total of 22 countries (about two thirds of respondents) answered 'yes' when asked 'Do you experience problems where there are differences between company reported opening and closing stocks of inventories collected on the same survey across different years?' (question D.1). According to the survey results, a majority of responding countries (23 of 34 countries, or over two thirds) estimate annual stock levels of inventories (question B.1). Most countries that currently do not estimate annual stock levels plan to do so in the future. Thus, for many countries in the survey, inconsistencies in reported closing and next period opening stock values are at least a potential problem that needs to be considered.

Reasons for inconsistencies of reported inventory stocks

8.125. The survey respondents provided a wide range of explanations as to why these discrepancies between closing and next period opening stock levels may occur. The possible explanations are briefly summarised here.

8.126. For many reasons, discrepancies may exist in earlier and later responses for a single company:

- companies may choose to revalue stocks of inventories (upward or downward), based on information they received after reporting the closing stock level in the prior period, or based on a change in the method of valuation;
- companies may correct previous errors in the reported closing stock when they report the next opening stock (or they may commit new errors);
- problems with changes in the survey design may lead to confusion and reporting problems, which result in differences between the closing stock levels reported previously and the opening stock levels reported later, even for the same company;
- companies may appear in the survey samples of both years but fail to report inventories either for the closing stocks in the previous survey or for the opening stocks in the later survey.

Companies may revise their responses because of restructuring (mergers or acquisitions).

8.127. Discrepancies may also arise in aggregate estimates of stocks rather than in successive observations for the same company:

- The sample of businesses may change over successive surveys. The selection of random samples each year may lead to chance variation in closing and next opening stock levels. Also, the survey sample may be redrawn, perhaps based on a new sampling strategy or based on information from an updated business register. As a result, aggregate estimates of closing and next opening stocks may differ.
- Companies may appear in only the earlier sample because they disappear (go out of business).

Solutions for inconsistencies of reported inventory stocks

8.128. Respondents reported employing a variety of solutions to these discrepancies. Several countries reported responding to discrepancies at the company level by calling individual statistical survey respondents, asking them about the discrepancies, and adjusting estimates based on their explanations. These inquiries are recommended as a 'best practice' because they may lead to corrections or explanations of errors, or to information about restructuring or about 'births and deaths' of companies.

8.129. Several countries replace the closing stock reported previously with the next opening stock reported in the later survey. They may estimate stock levels directly this way, or they may employ a perpetual inventory method (for more details see Section 6.4) to estimate changes in inventories and then estimate stock levels as the sum of an initial benchmark level of stocks (perhaps from several years earlier) and accumulated year-to-year changes. This solution is preferred if the discrepancy reflects the correction of an error, the use of better information for the next opening stock, or the use of an improved sample (perhaps because of an updated business register or improved survey). If this new sample is in some way non-representative of relevant companies, however, biases in estimates may result.

8.130. When discrepancies emerge because companies restructure through mergers and acquisitions, the best approach may depend on whether the restructuring affects more than one industry. If the restructuring only affects companies within a single industry, then the aggregate inventory estimates for that industry may be accurate even if the estimates for specific companies may be inconsistent; in this case, discrepancies may cancel one another within the industry. If the restructuring leads to the reclassification of inventories to different industries, then estimated inventories for specific industries may be biased, although these biases may again cancel for the total economy. (These discrepancies at the industry level may be recorded as other changes in volume or statistical discrepancies for each industry.) If, on the other hand, restructuring leads to the reclassification of companies to industries for which inventories are not reported by available source data, then biases in inventory estimates may persist even for the total economy. It is best to contact individual respondents to learn about any restructuring and the possible impacts it might have on inventory estimates.

8.131. In the case of companies that disappear (go out of business) within a year, the previously reported closing stock should be used, rather than a missing (zero) value for the opening stock from the survey in the following year.

8.132. For some countries, the problem does not appear because they do not obtain both opening and next closing estimates of stocks in an annual survey but only closing stocks. Others do not face this problem because they base their estimates of changes in inventories on estimates of flows (changes) without information on stock. Some report resolving the discrepancies as they take into account any adjustments made to the changes in inventories as a result of analysis of supply and use tables, price changes, comparisons of GDP and gross domestic income, and so on.

8.133. These discrepancies may emerge with annual data or with more frequent quarterly or monthly data. More frequent data allow more frequent monitoring and resolution of the discrepancies (perhaps by contacting businesses). In some cases, however, more frequent data may be less useful for resolving discrepancies because the surveys are not mandatory and cover only a subset of businesses that report estimates, and this sample may vary across months and quarters. More frequent data on inventories from smaller samples of businesses should be periodically benchmarked to levels from more comprehensive data from annual surveys, or from an economic census. Analysts should obtain as much information as possible about discrepancies to benchmark the estimates.

8.134. Of the respondents who report these discrepancies in closing and next opening stock levels, some ignore them and do not report them. Others place the discrepancy in the other changes in the volume of assets account. Still others place the discrepancy in the revaluation account, or include them in net transactions.

8.135. Of these options, placing the discrepancies in the other changes in the volume of assets account may be preferred. These discrepancies are not really revaluations or transactions, and so classifying them as other changes in volume (which includes a diverse range of items) seems reasonable. Itemising these discrepancies as other changes in volume and describing their potential sources is informative for data users, especially if they are substantial. If the discrepancies are relatively small, on the other hand, ignoring the discrepancies is a sensible option.

Box 8.6: Differences in opening and closing stock — United Kingdom

The Office for National Statistics (ONS) uses the Quarterly Stocks Inquiry (QSI) to collect data on book values of inventories. The questionnaire has a sample size of approximately 5 500 businesses each quarter.

Those businesses that are included in the survey are asked to report opening and closing stocks for the required assets. The change in stock level is taken from the difference in closing values between periods. This avoids the issue that occurs when there are differences between closing values of one period and opening values of the following period. In theory, these values should be equal, but this is not always the case.

Differences arise for a variety of reasons, many of which are discussed above in this Section 8.8. The main source of the discrepancy is that businesses often report estimates for closing balances, which they then revise for the next quarter's opening balance.

Figure 8.5: Quarterly Stocks Inquiry for construction industry firms

(A) Relating to anything other than dwellings		Value at start of period to nearest £ thousand		Value at end of period to nearest £ thousand	
1.1	Materials, stores and fuel	219	000	220	000
1.2	Work in progress and goods on hand for sale	229	000	230	000
1.3	**Total**	298	000	299	000
(B) Relating to dwellings					
1.4	Materials, stores and fuel	249	000	250	000
1.5	Work in progress and goods on hand for sale	259	000	260	000
1.6	**Total**	398	000	399	000

2. Please put a cross in the box if closing figure is estimated 15

Source: UK Office for National Statistics

The ONS uses a selective editing process for its respondents' forms, where differences can be queried and businesses can be contacted if the difference has a significant impact on the results. Around 60 % of the returned forms pass selective editing, and 40 % are queried. Most queries relate to discrepancies between values reported in current period opening and previous period closing stocks.

The problem of differences between opening and closing stocks reported by the same company mostly arises due to the short turnaround time between the end of the quarter, the respondent receiving the survey and the return by date. If accurate closing stock figures are not available, then estimates are provided, with the actual data returned as the opening stock for the next period. As the estimation of closing stocks by respondents is not uncommon, the questionnaire asks respondents to indicate if they have been estimated or not.

For the QSI, the opening stock level is used purely for data validation purposes. For example, if one period's closing stock level is given as an estimated figure and the next has an actual value for the opening stock, the closing stock level will be updated to reflect this correction.

Inconsistencies between opening and closing stocks at the aggregate level can occur due to sample rotation. For example a company selected for the survey in a specific industry with 150 employees may hold a high level of stock at the end of their selection period and be replaced by a company in the same industry with the same number of employees who routinely holds a lower level of stock. In this instance, the UK may look to make an adjustment to ensure continuity where possible.

Table 8.11: Example of closing and opening stocks
(million GBP)

	Quarter 1		Quarter 2		Closing stock value quarter 1 used in results
	Opening stock value	Closing stock value	Opening stock value	Closing stock value	
Materials, stores and fuel	2 000	1 500 (e)	1 800	1 200 (e)	1 800
Work in progress and goods on hand for sale	3 000	3 800	3 700	4 500 (e)	3 800
Total	5 000	5 300 (e)	5 500	5 700 (e)	5 600

(e) Estimated figure
Source: Eurostat-OECD Task Force on Land and other non-financial assets, based on compilation practices of the UK Office for National Statistics

8.9 Inventories under high inflation

8.136. Special consideration should be given when measuring inventories (especially changes in inventories, P.52) in countries experiencing high inflation. One important way to appropriately remove nominal holding gains and losses under periods of high inflation is to calculate the changes in inventories at a high frequency (i.e. calculate changes in inventories at a quarterly or even monthly frequency).

8.137. As discussed throughout this guide, even in periods with normal inflation, the measurement of inventories using business book value data is not straightforward because businesses value inventories at various historical cost accounting methods as discussed in Chapter 4. It is therefore not recommended to simply use the change in the business book value as a proxy for the changes in inventories for national accounts purposes, especially in countries experiencing high inflation.

8.138. The following paragraphs reproduce the recommendations on how to measure changes in inventories under periods of high inflation as discussed by Peleg and Finzi ([77]).

8.139. For measuring changes in inventories based on business book values the recommendations are:

- the prices of different types of inventories (e.g. materials and supplies, work-in-progress, finished goods, goods for resale) varied a lot under high inflation so adjustments for each type of inventory is recommended;
- the price changes of goods from different industries varied a lot so that there is a much greater need to make detailed estimates;
- the simplified assumption that all firms used the FIFO method was changed and information on the method of inventory valuation was surveyed regularly.

8.140. For measuring changes in inventories using the direct method (based on quantities and average prices of the period) the issues are:

- due to the problems with comparisons of flows and the computation of average prices under high inflation, the main problem is to obtain suitable prices;
- data on quantities could only be obtained quarterly, but for the computation of the increase in inventories at current prices, monthly prices were used and weighted according to assumptions about the changes in inventories during the quarter;
- especially in agriculture, the changes in inventories are not smooth, and monthly data on production were used to estimate the increase in inventories each month.

([77]) Peleg, S. and D. Finzi, 'Measuring Inventories under High Inflation', March/April 2000. Available at http://www.unece.org/fileadmin/DAM/stats/documents/ces/ac.68/2000/24.e.pdf

9 Inventories questionnaire

9.1. This chapter presents a summary of the responses to a 2015 Eurostat-OECD survey of national practices in estimating inventories. The purpose of the survey was to provide a better understanding of the methods countries employ to estimate the annual stock of inventories on the balance sheet, identify best practices, and promote international discussions on a number of issues. Since the guidance on measuring the stocks of inventories (P.52) cannot be isolated from the issues that arise when estimating the changes in inventories questions pertaining to the changes in inventories were also asked.

9.1 Overview of the survey

9.2. The survey asked respondents to provide their annual data sources for inventories as well as the classification and level of detail at which inventory information is available. Respondents reported whether they use survey, administrative sources etc. or a combination of sources, on the classification used and the level of detail available, on the accounting method used to value the inventories, if inventory estimates were believed to match well with national accounts definitions and if inventories owned by small unincorporated enterprises were estimated.

9.3. The survey then asked respondents about their methodology for estimating the stock of inventories (AN.12), respondents reported whether they use directly quantity and price information, if business accounting book values were used as the national accounts inventory stock level without any adjustments and if business accounting is not directly used, how inventory stocks are estimated. Respondents also reported if inventory stock is estimated in volume terms, if other changes in the volume of assets and revaluations of inventories on the balance sheet are separately identified, and if revaluations recorded on the balance sheet are the same as the inventory valuation adjustment that are used to adjust changes in reported business book values to changes in inventories (P.52) on a national accounts basis.

9.4. The survey also asked respondents about their methodology for estimating the changes in inventories, respondents described their methods to derive annual changes in inventories, the models used to estimate changes (and on when these are used), the price indices used for deflating the inventories of the major inventory holding industries, the different valuation methods used by business within an industry. They also reported on the assumptions made on how businesses value their inventories, on the weighting patterns used to derive deflators for inventories and more generally on how these inventory deflators are constructed.

9.5. The survey finally asked respondents about various issues including if they are challenged with differences between company reported opening and closing book values of inventories collected on the same survey across different years, and on how these discrepancies are solved, if they perform adjustments related to inventories held outside of their country for goods for processing and merchanting, how partially completed buildings and structures are treated in their national accounts, if inventories for service industries (other than wholesale and retail trade) are available, and finally if (and how) they estimate inventories held by the government.

9.2 Country practices: results of questionnaire

9.6. Responses were received from a total of 34 countries — Australia, Austria, Belgium, Canada, Chile, Croatia, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Israel, Italy, Japan, Korea, Latvia, Lithuania, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain, Sweden, United Kingdom, United States.

Annual data sources for inventories (and type of inventory collected)

9.7. Almost all respondents (33 out of 34) compile inventories by industry. Information on inventories is often collected from a combination of sources. Most countries (24) depend on business surveys for collecting information on manufacturing, retail trade, wholesale trade, mining and agriculture. Countries (15) also rely on tax records generally as supplementary source of information on industries, or sectors (e.g. household sector S.14) which are not covered by business surveys. Some (14) rely on company reports which are only in a few instances the main source and usually used for collecting specific information (e.g. public corporations, government accounts). Finally, 18 countries use other sources such as other governmental statistics (e.g. natural resource institute); government finance statistics; survey of non-profits; news briefs.

9.8. Regarding the level of detail available and the classification used, 4 countries are only publishing inventories by industry. Most countries (29) are publishing inventories by industry and type of inventory (e.g. materials and supplies, work-in-progress, finished goods, military inventories, goods for resale) while 7 are publishing by industry and type of product. Some inventory data are not available by industry, but other types of data are then available. Canada projects changes in inventories (P.52), in the case of construction, using labour data while changes in inventories for finance and insurance are projected using data taken from personal expenditure on consumer financial services. Supply and use methods are also used. Italy derives information on inventories of energy products using price and quantity information.

9.9. Most countries (20) have information on the accounting method used to value the inventories. It is sourced from legal views and policies related to income tax and accounting rules (some state from experience, or through consultation with accountants, FIFO is the most used valuation method), from ad hoc questions in surveys, from financial statements or economic censuses. For example, in the United States data are available annually on the proportion of inventories valued using the LIFO method for the retail, wholesale, and manufacturing industries from business surveys. In addition, for manufacturing industries, data are obtained on the other valuation methods every 5 years from the economic census.

9.10. Figure 9.1 and Table 9.1 below illustrate which accounting methods are used by businesses to value inventories. A majority of countries (23) indicated businesses use FIFO, businesses also use LIFO in 9 countries; a weighted-average method ([78]) is used in 16 countries, a specific identification method ([79]) in 5 countries, and standard costs ([80]) in 5 countries. In some countries (3) additional valuations not listed above may be used. In the Czech Republic fixed storage costs may also be used by businesses when valuing inventories ([81]). Japan also mentions that businesses can use 'most recent purchase method', 'lower than cost or market value method', and 'retail method ' etc. and the US notes that wholesale and retail trade businesses also report inventories valued at lower than cost or 'market'.

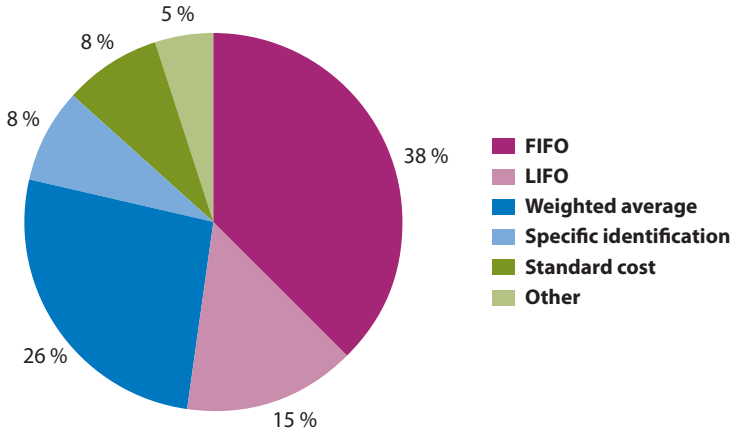
([78]) A method used in business accounting which values goods withdrawn from inventory at the weighted-average of the prices at which they entered; this method values withdrawals at prices between those used for FIFO and LIFO.

([79]) A method of tracking and costing inventory based on the movement of specific, identifiable inventory items in and out of stock. This method is applicable when individual items can be clearly identified, such as with a serial number, stamped receipt date, or RFID tag.

([80]) A method used in business accounting in which broad groups of items held in inventory are valued on the basis of a 'standard ' unit price for each group.

([81]) Fixed storage costs is an inventory valuation method that uses predetermined (stock) prices. These prices are usually set at the level of assumed acquisition prices or at prices known at the moment of the determination of stock prices.

Figure 9.1: Accounting methods used to value inventories



Source: Eurostat-OECD Task Force on Land and other non-financial assets, survey of general methods for estimating the stock of inventories in national accounts

Table 9.1: Accounting methods used to value inventories

Accounting method	Australia	Austria	Belgium	Canada	Chile	Croatia	Czech Republic	Denmark	Estonia	Finland	France	Germany	Greece	Hungary	Ireland	Israel	Italy	Japan	Korea	Latvia	Lithuania	Mexico	The Netherlands	New Zealand	Norway	Poland	Portugal	Romania	Slovak Republic	Slovenia	Spain	Sweden	United Kingdom	United States
First-in-first-out (FIFO)	x	x	x	x			x			x	x	x	x	x				x	x	x	x	x		x		x		x	x	x		x	x	x
Last-in-first-out (LIFO)	x	x	x	x						x		x	x									x												x
Weighted average	x	x	x				x			x	x		x	x				x	x		x			x					x	x			x	x
Specific identification		x	x															x												x			x	
Standard cost	x	x												x																x				x
Other							x											x																x
No information on method					x	x		x	x						x	x	x						x		x		x				x			

Source: Eurostat-OECD Task Force on Land and other non-financial assets, survey of general methods for estimating the stock of inventories in national accounts

9.11. A majority of countries (22) considers that, when business financial reports, surveys, or tax records are used in estimating inventories for national accounts (besides the business accounting methods mentioned above), they are well matched with national accounts definitions. Among the reasons for poor match mentioned by the other responding countries (10), some specify, issues in price valuation, length of time goods are held in inventories, or capital gains/losses (9), some the inclusion of land (2), or issues with types of inventories (e.g. material and supplies, military inventories) (3). Austria mentions the issue of work being done by a business on a specific good/order for longer than a year not being properly reported as work-in-progress, thus corrections of values in business reports or surveys are sometimes necessary. In Finland the case of multinational enterprises holding global inventories was highlighted as an issue.

9.12. Regarding the inclusion of inventories owned by small unincorporated enterprises which may not be included on a regular sampled business survey, these can be estimated by using a derived inventories-to-sales (or turnover/inventories) ratio based on information of other larger units within the same industry. It is noted here that the underlying assumption is that the stock turnover is an industry specific characteristic (and is the same for unincorporated enterprises and small and medium-sized companies within the same

industry). Estimates are also derived by applying a grossing up factor (6), by using administrative data such as value added tax and income tax data (9) or estimated within the source statistics (such as structural business statistics (SBS)).

Estimating the stock of inventories

9.13. A majority of the respondents (23) estimate the stock of inventories. Among the countries (10) where annual stocks of inventories are not available, half plan to provide data in the future (often because of EU regulations). Estimates of stock of inventories can be derived from price and quantity information (13) but also, as often, from other methods. The application of the price and quantity method is dependent on the type of industry considered and most often used for energy products (electric or gas utilities), estimation of fuels for manufacturing or wholesale and retail trade, forestry and agriculture.

9.14. For those that estimate the stock of inventories most (15) use reported business accounting inventory (either from company reports or business surveys) as the national accounts inventory stock level (AN.12) without any adjustments in at least some instances. This is true for all industries in 8 countries: Belgium, Finland, Lithuania, the Netherlands, New Zealand, Poland, the Slovak Republic, and Slovenia. For the remaining 6 countries (France, Hungary, Israel, Korea, Mexico, Sweden) it depends on the industry, as illustrated in Table 9.2 below. One country responded that they used reported business accounting inventory but did not specify if it was true for all industries.

Table 9.2: Adjustments made to business accounts inventories for countries mostly using this source for estimating stock of inventories

Country	Business accounts inventories used for what industry?	Type of industry/sector where adjustments are made	Adjustments made
Belgium	All	N.A.	
Finland	All		Both the opening and closing values / levels are taken from the structural business statistics. The closing value of the inventories is the balance sheet value of current assets. In most of the cases closing value of the previous year is copied as the opening value. Finland compares this change in balance sheet values to the values in the profit and loss account to find out possible errors in the data (manual adjustments if necessary).
France	Most	Inventories of agricultural products and inventories held by agricultural industries Inventories held by the general government Inventories of standing timber	
Hungary	All, except agricultural	Agricultural own produced stocks.	
Israel	Manufacturing and wholesale trade		

Country	Business accounts inventories used for what industry?	Type of industry/sector where adjustments are made	Adjustments made
Korea	All except following industries where price time quantity approach is used: Agricultural, forestry and fishing, agricultural products operated by government, petroleum products for the purpose of stockpiling by corporations. For mining and manufacturing industries, Mining and Manufacturing Survey data is used rather than business accounting data in their industry.	When business accounting for inventories is used, some doubtful items are excluded.	Valuation for work-in-progress and finished goods in the business accounting is converted into the basic prices, in most cases (not for government accounts, etc.), by applying the ratio of acquisition cost to sales.
Lithuania	All	All except government and household sectors.	
Mexico	Manufacturing, mining and some agricultural products		In future, possible incorporation of stock of inventory of Commerce and Construction, also derived from the census data and updated with the results of Annual surveys. Institutional sectors would be treated in the same way.
Netherlands	All	Adjustments are only made for errors in the number of thousands or negative balances.	
New Zealand	All	N.A	
Poland	All	N.A.	
Slovak rep.	All	N.A.	
Slovenia	All except individual farmers (S.14)	Individual farmers (S.14) taken from Economic Accounts for Agriculture	
Sweden	Only construction industries (material and supplies) and services industries (work in progress)	Directly reported business accounting inventories (that is not revaluated at all) are mainly the inventories in construction industries (materials and supplies) and services industries (work-in-progress). For the other industries, inventories are revalued. The sources for each type are basically the same as in the calculations of changes in inventories.	In manufacturing industries and wholesale and retail industries inventory, where the most significant stocks are, stock level data are collected in the corresponding surveys. Depending on type of inventory and valuation method used, the business accounting figures from the firms are revalued using proper index to match NA definitions. Based on this stock level information, changes in inventories are calculated.

Source: Eurostat-OECD Task Force on Land and other non-financial assets, survey of general methods for estimating the stock of inventories in national accounts

9.15. Regarding the question on how the national accounts inventory stock level is estimated when business accounting is not directly used, some countries (12), shown in Table 9.3, are adding to the prior period's stock the changes in inventories of the current period (in other words a perpetual inventory method (PIM) type method). Among these Japan and Portugal appear to benchmark the stock level. In Japan, the national wealth survey conducted in 1970, which directly surveys detailed annual stock of inventory owned by corporations, government and households is used as the benchmark level. In Portugal, stocks are compiled for the benchmark year (2011) and PIM is used for the following years.

Table 9.3: Description of perpetual inventory methods for countries not directly using business accounting information for estimating inventory stocks

Country	Industry/sector/ institutional sector where PIM is used?	Description of PIM method and issues
Australia		Stocks of inventories are calculated using the PIM method by industry on a quarterly basis. Stocks of inventories are available by industry and by institutional sector (farm, households (including NPISH), private non-financial corporations, general government, public non-financial corporations).
Canada		PIM based model applied, but using current dollar values. The current dollar stock for year t is current dollar stock (year t-1) + current dollar change in inventories (flow for year t) – current $ IVA (inventory valuation adjustment year t). To derive the current dollar change in inventories and IVA, the deflation of the details is done then a revaluation process is performed.
Estonia		Methodology under development.
France	Inventories of the general government	
Greece		Businesses set the value of stocks at the beginning of a year equal to the value of stocks at the end of previous the year.
Israel		When current data is not available, information from quarterly surveys is used for deriving changes in stocks.
Japan		Closing stock estimated in a particular period by adding the changes in inventories in the period in question to the opening stock in the same period, and adjusting the revaluation changes and other changes in the inventories. Opening stock in the period is assumed to be the same as the closing stock in the prior period. Exceptionally, cultivated assets as work-in-progress inventories is estimated by the Realized Inventory Method (RIM).
Korea		When price times quantity approach is used, this kind of PIM method may be applied because quantity data is more consistent with this approach.
Mexico	Sectoral accounts	The data on flows by institutional units in the capital account is aggregated period by period.
Portugal		Information reported by business accounting used but with some adaptation. For example, data from NACE F and L, the buildings and structures completed or in work-in-progress inventories are considered gross fixed capital formation. Agricultural and forestry products aren't included in business accounting and are added in national accounts, following specific approaches (adopted for the benchmark year).
United Kingdom		The value of physical increase in level is calculated as a cumulative series of changes. VPILt (CP) = BV t=1996 Q4 + VPICt=1 (CP) + VPICt=2 (CP) + … + VPICT (CP) where BV = book value and VPIC is the value of physical change increase.
United States		At the most detailed level for which BEA prepares estimates, the procedure for nonfarm inventories generally consists of the following steps that yield current-dollar and constant-dollar estimates for changes in inventories and for the stocks of goods held in inventory. 1. Separating Census Bureau published inventories (which are on a non-LIFO basis) into those that were reported on a LIFO basis and those that were reported using other accounting methods. 2. Construction of current-period inventory price indexes for each industry, and for manufacturing and for publishing, each stage of fabrication. 3. Construction of monthly cost indexes for each industry, and for manufacturing and publishing, each stage of fabrication. 4. Revaluation of the book-value inventories to yield constant-dollar and current-dollar change in inventories. 5. Calculation of the Inventory Valuation Adjustment (IVA). 6. Calculation of constant-dollar stocks for year t by adding the real change in inventories in t to the prior period's constant-dollar stock level. 7. Calculation of current-dollar stocks by multiplying the end of period constant-dollar stock level t by the end of period price in year t

Source: Eurostat-OECD Task Force on Land and other non-financial assets, survey of general methods for estimating the stock of inventories in national accounts

9.16. The United Kingdom benchmarks annually the stock level calculated on a quarterly basis to the Annual Business Survey. A couple of respondents mentioned benchmarking (presumably the changes in inventories) to the supply and use tables. The Czech Republic and Croatia report not using PIM but an alternative method. The Czech Republic starts with the company reported book values (based on historical prices) and revalues the stocks to market prices.

9.17. Countries (15) estimate the stock of inventories in volume terms as well as in nominal terms. When this is the case the same deflator as for estimating changes in inventories in volume terms is used.

9.18. A minority of respondents (9) separately identify other changes in the volume of assets and revaluations of inventories on the balance sheet. When revaluations are recorded on the balance sheet, only in the case of five countries (Australia, Czech Republic, the Netherlands, Sweden and the United Kingdom) they are the same as the inventory valuation adjustment that are used to adjust changes in reported business inventories to changes in inventories on a national accounts basis. In France, the revaluations recorded on the balance sheet, includes the inventory valuation adjustment as well as any differences in value between opening stock and previous closing stock. It is interesting to note at least two countries consider the discrepancy between opening and closing stocks as other changes in volume. Guidance with what to do with this discrepancy is provided in Section 8.8. Table 9.4 below presents the methodology used for estimating other changes in volume for the Czech Republic, Japan, Korea and the Netherlands.

Table 9.4: Methodology for estimating other changes in the volume of assets on the balance sheet

Country	Methodology for estimating other changes in volume of assets
Czech Republic	Other changes in volume of assets account serves for example for recording of exceptional losses caused by fire, floods or large-scale thefts. It also serves for recording statistical discrepancies between the closing balance sheet stock of previous period and the corresponding opening balance sheet stock.
Japan	We usually record 'other changes in volume of assets' of inventories only when changes in sector classification occur (for example, occurred by privatization of public company), estimating such changes from business financial reports. Other than that, we exceptionally estimated the catastrophic losses in inventories by the Great East Japan Earthquake in 2011.
Korea	For the national balance sheet, when the other changes in the volume of assets are computable, they are compiled first for relevant assets (this is the case for livestock, etc.). For most cases that the other changes in the volume of assets are not computable the revaluation accounts are compiled first by using the nominal value of inventory stock level and its volume measures. This is usually done at the industry and inventory type level. Then the residual of annual nominal changes in inventories stock level on the national accounts balance sheet, transactions (in other words annual changes in inventories from the capital accounts), and revaluation, is allocated to the other changes in the volume of assets account in the balance sheet. In addition, if there is any minor difference between annual changes in inventories (coming from the capital account) and changes in inventory stock levels for the two consecutive years, it is harmonized in the balance sheet and recorded as the other changes in the volume of assets account.
Netherlands	Other changes in volumes are not estimated for all types of inventories but only for inventories of livestock.

Source: Eurostat-OECD Task Force on Land and other non-financial assets, survey of general methods for estimating the stock of inventories in national accounts

Estimating changes in inventories

9.19. For estimating changes in inventories, a vast majority of respondents (30) use inventory book value data based on business accounting methods (from sources such as business surveys, tax records, or business financial reports) to obtain inventory levels followed by a process of deflation, differencing and revaluation (or reflation) to the average prices of the period as described in Section 5.2. To a lesser extent, other methods are also used. These include calculating changes in the physical quantity times appropriate price (used by 11 countries), commodity flow balancing (i.e. supply and use) to derive changes in inventories as a residual, product by product (7), obtained as a residual between GDP (E) and one of the other measures of GDP, and therefore includes the statistical discrepancy (4). In the case of Israel, models are also used in the case of start-up companies (mostly software work-in-progress and research and development), they are based on venture-funds investment in the companies. New Zealand also estimates changes in

inventories based on modelled forest growth. Belgium uses information obtained from the profit and loss account of large corporations (for changes in inventories of produced and purchased goods) and for small and medium-sized enterprises the changes in inventories are estimated as the difference between two consecutive balance sheet positions. Belgium tries to ensure that the changes in inventories derived from business accounts conform as closely as possible to the valuation principles of the national accounts, thus valuation differences are estimated and taken into account. In practice Belgium only estimates these valuation differences for purchased inventories for firms which value their inventories according to the FIFO method. Israel states that in the energy branch, information is gathered from administrative sources and appropriate price indices are used. Table 9.5 below provides an overview of the type of price which is used for deflating the inventories of the major inventory holding industries.

Table 9.5: Overview of the type of price for deflating the inventories of the major inventory holding industries

Industry	Type of price index,(i.e. PPI,CPI,wage indices)	How frequently are the prices reweighted?
Manufacturing – intermediate inputs	Most countries use PPIs or a combination of PPIs, import prices. A few use CPIs.	Most re-weight annually. However, a few countries every 5 years (at least one country every 6). One country responded 3 times per statistical year. Two countries are reweighing on a monthly bases.
Manufacturing – work-in-progress	Most countries use PPIs; a couple compute a composite deflator or PPIs and labour indexes; Some countries a combination of PPIs and import prices (sometimes export prices); CPIs can also be used.	Same as above
Manufacturing – finished goods	Generally the same as above. PPIs are mostly used. More countries also report using export prices	Same as above
Wholesale trade	PPI, wholesale price index; PPIs and import prices; PPI and CPI; just CPI.	Same as above
Retail trade	Many countries just use CPIs; some use a combination of PPIs and CPIs; or CPIs and import prices.	Same as above

Source: Eurostat-OECD Task Force on Land and other non-financial assets, survey of general methods for estimating the stock of inventories in national accounts

9.20. A majority of countries (21) assume that the same valuation methods are used by businesses within an industry (which is usually the FIFO method). On the other hand, 10 countries assume different valuation methods are used by businesses within an industry. The US explains that for each industry an aggregation of responses of individual businesses is received and the percentages (shown in Table 9.6 reflecting an aggregation of each detailed industry), illustrates the assumptions made in the US on the proportion of inventories valued under each method.

Table 9.6: Assumptions made in the US on how businesses value their inventories (%)

Industry\valuation method	Historic costs - FIFO	Historic costs - LIFO	Historic costs - specific identification	Historic costs - average costs	Other
Manufacturing – intermediate inputs	35	20	--	15	Standard cost 30
Manufacturing – work-in-progress	35	20	--	15	Standard cost 30
Manufacturing – finished goods	35	20	--	15	Standard cost 30
Wholesale trade	55	20	--	15	Lower of cost or market cost: 10
Retail trade	45	25		15	Lower of cost or market cost: 15

Source: Eurostat-OECD Task Force on Land and other non-financial assets, survey of general methods for estimating the stock of inventories in national accounts

9.21. For those countries that are using a FIFO accounting method, some appear to weight the underlying prices (producer price indices, import prices, etc.) to derive deflators for the reported book values. The most common method to determine the weighting structure is to calculate how long a good remains in inventory using inventory-to-sales ratios (11). New Zealand makes a simple assumption that all goods turnover within 2 periods. Some countries responded they make assumptions of how long the goods are held in inventory but they didn't describe how they came up with those assumptions (2).

9.22. For the other non-FIFO accounting methods country practices vary and in some cases countries do not know how the inventories are valued. For instance in Denmark, the deflators used are beginning and end-of-year indices for re/deflating the inventories to the price level in the middle of the year. Denmark, therefore, assumes that the book values in the company financial reports are recorded in the price level of the relevant point in time (i.e. the beginning and the end of the year).

9.23. Responding countries usually use the same data sources to derive the annual changes in inventories and the annual stock levels (26). Only two countries reported not using the same source but they do not currently publish stocks of inventories on the balance sheet.

Additional questions

9.24. Most respondents (22) experience problems, with differences between company reported opening and closing book values of inventories collected on the same survey across different years. Among the reasons mentioned for these differences are business entering/exiting the survey (7), restructuring (3), mistakes in internal company reports (2), problems in grossing up (2), survey design (2), issues in industries with large price variations (2), revaluation of inventories made by companies at the end of the financial year or revaluation depending on specifically applied accounting method. These discrepancies are then solved either by using the closing information in t as opening stock at t+1 (5), by calling the provider (3), by calculating changes in inventories on a year-on-year basis (1), by manual editing following automatised checks (2). In some cases the differences are simply ignored or recorded as 'statistical discrepancies'.

9.25. Several countries (Canada, Finland, France, Korea, New Zealand, and Sweden) make adjustments related to inventories held outside of their countries for merchanting and goods for processing. The source for the information is business surveys (to derive, in the case of Canada inventory held abroad for manufacturing, retail trade and wholesale trade), the structural business survey, tax records and inventory inquiries or consolidated financial statements. Usually, the same estimation techniques for changes and stocks of inventories as described above are applied to inventories held outside of the country (i.e. no specific estimation method is applied).

9.26. The borderline between inventories of partially completed buildings and structures and GFCF may not always be clear. SNA 2008 paragraph 6.112/ESA 2010 paragraph 3.148 recommends to move partially completed buildings and structures from inventories to GFCF when a change of ownership occurs (i.e. when the buildings are sold) and 4 respondents make explicit mention of this rule. However countries may have different treatments as 16 respondents treat partially completed buildings and structures as GFCF, 6 as inventories, one notes the recording may depend on the data provider who responded to the (business) survey and another that partially completed buildings and structures are transferred from inventories to GFCF when work is advancing.

9.27. Most respondents (25) estimate inventories for services (other than for wholesale and retail trade). Half of respondents then only assume material and supply can be held by service industries but the other half assumes more or all types of inventories can be held by service industries as data are available from the SBS (Austria), from annual accounts (Belgium) from the economic census (Mexico) or from the business survey (the Netherlands).

9.28. Eleven respondents estimate inventories of work-in-progress or finished services (such as architectural drawings, movies, research and development) when these types of inventories are available in their respective sources.

9.29. A majority of respondents estimate that inventories are held by the government (26). Australia ([82]) considers the following elements as government inventories: Materials and supplies, work-in-progress, finished goods, stocks of demonetised gold, marketing boards (when applicable), goods for resale and military inventories. Those government inventories are estimated from the current market value of material and supplies (excluding ownership transfer cost). This primarily includes items such as fuel, supplies and foodstuffs. Current market value of work-in-progress are also used. Military inventories include the current value of single-use items, such as ammunition, missiles, rockets, bombs, torpedoes and spare parts but exclude finished goods and goods for resale.

9.30. In the case of Austria, government held inventories are mainly recorded as inventories in materials and supplies, unless there is clear evidence for a different treatment. They are estimated on the basis of government finance statistics as well as on the SBS. Company financial reports are also used when necessary. Italy, due to data availability, also only estimates changes in material and supplies held specifically by units belonging to the general government sector (S.13) operating in the health industry. The information is taken from their annual accounts as the units have to provide data regarding their profit and loss account to the Ministry of health (the so called 'form CE'). ISTAT receives the data regarding the form CE, including data on changes in inventories, aggregated at the regional level (nomenclature of territorial units for statistics, NUTS 2).

9.31. Sweden notes that inventories in departments and agencies of central government (so called contingency stocks) are recorded together with those of the wholesale trade for secrecy reasons. Contingency stocks are calculated in three sub-items: stocks of crude oil, other fuel stocks and other contingency stocks. Data are collected from the firms that are obligated to hold contingency stocks. This is carried out by Swedish Energy Agency. Korea estimates government held inventories of rice stored in the public granary, etc. Estimates are derived from settlement accounts of revenue and expenditure. Israel estimate emergency-use inventories of foodstuffs, drugs, and energy products which are published in government reports. United Kingdom only considers single-use military items as government held inventories.

Conclusions

9.32. As the survey results indicate, country practices vary in their assumptions and methods for estimating both the stocks and flows of inventories. However, there are some common themes. In general, countries utilise two main methods in estimating the stock levels on the balance sheet

(a) the direct use of company reported book values, without adjustments, or sometimes with minor adjustments; or

(b) a PIM type method where the current stock level is the accumulation of changes in inventories.

9.33. In estimating the changes in inventories, most countries use inventory book value data based on business accounting methods to obtain inventory levels followed by a process of deflation, differencing and revaluation (sometimes referred to as reflation) to the average prices of the period. Where country practices diverge under this method is how the deflator and the revaluer are constructed.

([82]) Data for government inventories are sourced from accounting statements and reports of governments as part of Government Finance Statistics, Australia (ABS.cat.no. 5519.0.55.001) publication. Public non-financial corporations are collected from surveys from the public non-financial corporations sector as part of the same publication.

Annex 9A. Inventories questionnaire

Introduction

The Eurostat-OECD Task Force (TF) on land and other non-financial assets has endorsed a survey of general methods for estimating the stock of inventories in national accounts. Inventories play several roles in the national accounts. First, inventories or rather the changes in inventories are a component of demand and, as one of the more volatile components of GDP, an important determinant of short-term variations in GDP growth. Second, changes in inventories of materials and supplies are needed to move purchases to intermediate consumption and changes in inventories of work-in-progress and finished goods not sold are needed to move from sales to output. Third, stocks of inventories are a component of the balance sheet and more recently inventories have also been recognised as assets that provide capital services.

The purpose of this survey is to provide a better understanding of the methods countries employ to estimate the annual stock of inventories on the balance sheet, identify best practices, and promote international discussions on a number of issues. Since the guidance on measuring the stocks of inventories cannot be isolated from the issues that arise when estimating the changes in inventories questions pertaining to the changes in inventories are also asked.

It is hoped that responses to this survey can be provided by no later than 9 November 2015 so that the TF will be able to review the responses in advance of the next TF meeting on December, 3-4. For any assistance in completing the survey please contact Jennifer Ribarsky at Jennifer.Ribarsky@OECD.org. Completed forms should be returned to Ms Jennifer Ribarsky (Jennifer.Ribarsky@OECD.org) and Mr Hans Wouters (Johannes.Wouters@ec.europa.eu).

The survey is designed as a tool to motivate wider discussions at the international level and so we hope it does not raise any issues of confidentiality. If however your response raises confidentiality issues we ask you to please stipulate, if necessary, whether the responses provided should be considered as confidential and not to be circulated in the public domain.

Background

Changes in inventories in the national accounts can be classified either on the basis of the kind of activity of their owner or by the type of inventory held. It is necessary to classify inventories by both type of inventory and by the industry which is holding them.

Five broad types of inventories can be identified: materials and supplies; work-in-progress; finished goods; military inventories; goods for resale.

Inventories in agriculture can fall into any of the above categories; livestock raised for slaughter are included in 'work-in-progress'.

Inventories held by wholesalers or retailers are largely those which have been purchased for sale and which will not be physically transformed; these goods are termed 'goods for resale' in the SNA 2008/ESA 2010. There is also a small part of their total inventories which are for intermediate consumption (fuels or supplies).

The extent of inventory holding in other industries varies from one country to another depending on the structure of each country's economy (e.g. some countries could have significant inventories held by the mining industry while others will not). Inventories of finished goods and of materials and supplies in manufacturing are generally sufficiently large for them to be treated separately in the national accounts. In most industries, there will be fairly small inventories of work-in-progress. The main exceptions are for major activities, such as in building ships or in large engineering or construction projects. However, the borderline between inventories of partially completed buildings and structures and GFCF is not always clear. Service activities, other than wholesale/retail, will usually only hold inventories of materials and supplies, but some may record work-in-progress or finished products, for example,

architectural drawing services that are not completed within a single accounting period, or are completed and waiting for the building to which they relate to be started.

The overall principle involved in valuing inventories is described in SNA 2008 and ESA 2010. Broadly, output should be recorded at the time it is produced and valued at the same price whether it is immediately sold or otherwise used or entered into inventories for sale or use later (i.e. entries into inventories must be valued at the basic prices prevailing at the time of entry, while withdrawals must be valued at the basic prices at that time: that is, at the prices at which they can then be sold. Goods for resale entering inventories are valued at their actual or estimated purchasers' prices, while withdrawals from inventories are valued at the purchasers' prices at which they can be replaced at the time they are withdrawn.). However, it is also recognised that business accounting principles are not generally consistent with national accounting concepts as far as inventories are concerned.

The attached questionnaire uses terms that are commonly associated with inventories but there may be differences in terminology in different countries. Therefore, the accounting methods are described in the questionnaire.

Eurostat-OECD Survey of National Practices in Estimating Inventories

Country:	Respondent:
E-mail:	

A. Annual data sources for inventories

1. Are annual inventory data available by industry?

Response: ☐ Yes ☐ No

1a. If yes, please indicate below which source you use for each particular industry: Agriculture, Mining, Manufacturing, Retail trade, Wholesale trade, other industries?

Response:

Business surveys:

Tax records:

Company (business) financial reports:

Other information:

1b. Are only inventory totals available by industry or are they also available by

☐ Industry and by type of inventory (e.g. materials and supplies; work-in-progress; finished goods; military inventories; goods for resale)

☐ Industry and by type of product (e.g. Central Product Classification/Classification of Products by Activity (CPC/CPA))

Please describe the availability and level of detail.

Response:

2. If data are not available by industry what other type of data are available (such as only product data)?

Please describe what is available and the source of the information.

Response:

3. Do you have information on the accounting method used to value the inventories?

Response: ☐ Yes ☐ No

If yes, please answer questions 3a and 3b.

3a. Please describe where the information on the accounting method was sourced.

Response:

3b. Please indicate which accounting methods are used to value inventories in your country (tick all boxes that apply)

☐ First-in-first-out (FIFO) – A cost assignment system in which goods are withdrawn from inventories in the same order in which they entered (in other words, the goods withdrawn from inventories are those which were acquired earliest so that, at any stage, inventories will consist of the most recently acquired goods).

☐ Last-in-first-out (LIFO) – A cost assignment system in which the goods withdrawn from inventories will be those which were most recently acquired (in other words, inventories will consist of the items purchased earliest, which is the opposite assumption to FIFO); the implication is that withdrawals are valued at current prices provided that the level of inventories is not depleted.

☐ Weighted-average – A method sometimes used in business accounting which values goods withdrawn from inventory at the weighted average of the prices at which they entered; this method values withdrawals at prices between those used for FIFO and LIFO.

☐ Specific identification – A method of tracking and costing inventory based on the movement of specific, identifiable inventory items in and out of stock. This method is applicable when individual items can be clearly identified, such as with a serial number, stamped receipt date, or RFID tag.

☐ Standard cost – A method used in business accounting in which broad groups of items held in inventory are valued on the basis of a 'standard' unit price for each group.

☐ Other – Please describe

Description of other method:

4. Besides the business accounting methods in question 3, when business financial reports, surveys, or tax records are used in estimating inventories for national accounts, do you think they are well matched with national accounts definitions?

Response: ☐ Yes ☐ No

4a. If no, what issues are considered as the most important? (For example, some items like acquisition of land which are sometimes recorded in the business accounting in some industries should be excluded for their consistency with national accounts definitions. And there will be more cases depending on countries experiences.)

Response:

5. How do you include inventories owned by small unincorporated enterprises which are not usually observed on a regular sampled business survey?

Response:

B. Estimating the stock of inventories (AN.12)

1. Do you estimate annual stocks (levels) of inventories?

Response: ☐ Yes ☐ No

1a. If no, do you plan to do so in the future?

Response:

2. Do you estimate the stock of inventory directly from price and quantity information?

Response: ☐ Yes ☐ No

2a. If yes, does it depend on the type of industry/product/institutional sector that you are estimating? Please describe.

Response:

3. Do you directly use the reported business accounting inventory as your inventory stock level without any adjustments (i.e. adjust for differences in valuation methods)?

Response: ☐ Yes ☐ No (if no, go to question 4)

3a. If yes, is this true for all inventories or does it vary depending on what industry/product/institutional sector you are estimating? Please describe.

Response:

4. If you do NOT directly use reported business accounting data as your inventory stock level, how do you estimate it?

4a. By adding to the prior period's stock the changes in inventories of the current period (in other words a PIM type method). Please describe.

Response: ☐ Yes ☐ No (if no, go to question 4c)

Description:

4b. If you use a PIM type method to calculate your inventory stock, do you benchmark your inventory stock level? Please describe.

Response:

4c. If you do not use a PIM type method, please describe your estimation method.

Response:

5. Do you estimate inventory stock level in volume terms?

Response: ☐ Yes ☐ No

5a. If yes, is it the same deflator that is used in estimating changes in inventories in volume terms?

Response: ☐ Yes ☐ No

5b. If it is not the same deflator then what source is used instead?

6. Do you separately identify other changes in volume of assets and revaluations of inventories on the balance sheet?

Response: ☐ Yes ☐ No

6a. If yes, please describe your method for this decomposition.

Response:

6b. If you record revaluations on the balance sheet, is it the same as the inventory valuation adjustment that is used to adjust changes in reported business inventories to changes in inventories (P52) on a national accounts basis?

Response: ☐ Yes ☐ No

C. Estimating changes in inventories (P.52)

1. What methods do you use to derive annual changes in inventories?

A previous OECD survey identified six different methods that are used by countries to estimate changes in inventories (i-vii below). Please indicate (by ticking the applicable boxes and providing a short description) which methods you use and where (for example if you estimate changes in inventories by industry).

☐ i) Using inventory 'book value' data based on business accounting methods (from sources such as business surveys, tax records, or business financial reports) to obtain inventory levels followed by a process of deflation, differencing and reflation to the average prices of the period.

Description: (In addition, please answer the detailed questions 2-5)

☐ ii) Change in the physical quantity times appropriate price

Description:

☐ iii) Commodity flow balancing (i.e. supply and use) to derive changes in inventories as a residual, product by product

Description:

☐ iv) Obtained as a residual between GDP (E) and one of the other measures of GDP, and therefore includes the statistical discrepancy

Description:

☐ v) Using a model

Description:

☐ vi) Qualitative data from an enterprise survey to supplement methods iv) and v)

Description:

☐ vii) Other method

Description:

If you use method i) please answer questions 2-5

2. Please provide the following information for the price indices used for deflating the inventories of the major inventory holding industries.

Industry	Type of price index, i.e. PPI, CPI, wage indices	Level of detail at which deflation is conducted, i.e. subdivision, product	Level of detail at which deflators are compiled, i.e. 4-digit ISIC/NACE, 5-digit CPC/CPA	How frequently are the prices reweighted?
Manufacturing-intermediate inputs				
Manufacturing-work-in-progress				
Manufacturing-Finished goods				
Wholesale trade				
Retail trade				

3. Do you assume that different valuation methods are used by business within an industry?

Response: ☐ Yes ☐ No

3a. Please provide the following information on the assumptions you make regarding how businesses value their inventories. If you answered yes to question 3, please indicate the proportional composition of the different valuation methods in the table below.

Industry\price index	Historic costs-FIFO Per cent	Historic costs-LIFO Per cent	Historic costs- Specific identification Per cent	Historic costs-weighted-average costs Per cent	Other Per cent
Manufacturing-intermediate inputs					
Manufacturing-work-in-progress					
Manufacturing-Finished goods					
Wholesale trade					
Retail trade					

4. Weighting patterns to derive deflators for inventories valued according to FIFO

4a. If you are using FIFO, please describe the weighting patterns you use to derive the deflators for the inventory levels.

Response:

4b. How are the weighting patterns derived (inventory-to-sales ratios)?

Response:

5. Deflators for other valuation methods

For other type of valuation method, please describe how you derive the deflators for the inventory levels and/or changes in inventories.

Response:

6. Please provide any other information that you think is important in understanding your methodology.

Response:

7. Do you use the same data sources to derive the annual changes in inventories and the annual stock levels?

Response: ☐ Yes ☐ No

7a. If no, please explain why the sources differ. (If, for example, annual changes in inventories are derived residually as the difference between income-based GDP and the sum of the expenditure components but the stock levels are based on business financial reports).

Response:

D. Additional questions

1. Do you experience problems where there are differences between company reported opening and closing stocks of inventories collected on the same survey across different years?

1a. Please describe some reasons why the opening of the current year's stock of inventories differs from the prior year's closing stock of inventories reported by companies. (e.g. the stock levels differ because companies write-down inventories, problems with survey design, companies entering/exiting the survey.)

Response:

1b. Please describe how you solve these discrepancies?

Response:

2. Impact of globalisation on inventory data.

Do you make adjustments related to inventories held outside of your country for:

Processing: goods owned by domestically resident units that are being processed abroad

Merchanting: goods purchased by domestically resident units and resold 'as is' abroad (without entering the territory of the domestic economy)

Response: ☐ Yes ☐ No

2a. If yes, then what is the source of the information (e.g. business surveys)?

Response:

2b. If yes, then do you estimate the changes and stocks of inventories as described above or is there a special estimation technique?

Description:

3. The borderline between inventories of partially completed buildings and structures and GFCF may not always be clear (see SNA 6.112/ESA 3.148).

In practice, how do you treat partially completed buildings and structures in your national accounts? Do you include partially completed buildings and structures as changes in work-in-progress inventories or are they part of gross fixed capital formation?

Response:

4. Do you estimate inventories for services (other than for wholesale and retail trade)?

Response: ☐ Yes ☐ No

4a. What type of inventories do you assume are held by service industries? Do you only assume materials and supplies?

Response:

4b. Do you estimate inventories of work-in-progress or finished services (such as architectural drawings, movies, R&D)?

Response:

5. Do you estimate inventories held by the government?

Response: ☐ Yes ☐ No

5a. If yes, what is considered government held inventories?

Response:

5b. If yes, how do you estimate government held inventories?

Response:

6. Please submit details of any other national documentation, additional estimates, tables, and so on, you feel may be useful for the purposes of this survey.

Response:

7. Do you agree that your response can be included in any future publication by Eurostat and the OECD?

Response:

List of abbreviations and acronyms

AN	non-financial assets
BPM	Balance of Payments and International Investment Position Manual
COFOG	Classifications of the Functions of Government
COGS	cost of goods sold
CPA	Classification of Products by Activity
CPC	Central Product Classification
CPI	consumer price index
DG ECFIN	Directorate-General on Economic and Financial Affairs of the European Commission
EC	European Commission
ECB	European Central Bank
ESA	European system of accounts (European system of national and regional accounts in the European Union)
EU	European Union
Eurostat	statistical office of the European Union
FIFO	first-in-first-out accounting method
GAAP	generally accepted accounting principles
GDP	gross domestic product
GFCF	gross fixed capital formation
GFS	government finance statistics
GFSM	Government Finance Statistics Manual
HICP	Harmonised Index of Consumer Prices
IAS	International Accounting Standards
IEEAF	The European Framework for Integrated Environmental and Economic Accounting for Forests
IMF	International Monetary Fund
ISIC	International Standard Industrial Classification of All Economic Activities
ISWGNA	Inter-Secretariat Working Group on National Accounts
IVA	inventory valuation adjustment
LIFO	last-in-first-out accounting method
NACE (Rev. 2)	statistical classification of economic activities in the European Community (Nomenclature statistique des Activités Economiques dans la Communauté Européenne)
NAICS	North American Industry Classification System
NSI	national statistical institute
NUTS	nomenclature of territorial units for statistics
OECD	Organisation for Economic Cooperation and Development
PIM	perpetual inventory method
PPI	producer price index
PRODCOM	statistics on the production of manufactured goods (PRODuction COMmunautaire)
PYP	previous year's prices
R&D	research and development
SBS	structural business statistics
SEEA	System of Environmental-Economic Accounting
SNA	System of National Accounts

SUTs	supply and use tables
TM	trade margin
UN	United Nations
UNECE	United Nations Economic Commission for Europe
UNSC	United Nations Statistical Commission
VAT	value added tax
WB	World Bank

Glossary

Accrual accounting	Accrual accounting records flows at the time economic value is created, transformed, exchanged, transferred or extinguished. This means that flows that imply a change of ownership are entered when the change occurs, services are recorded when provided, output at the time products are created and intermediate consumption when materials and supplies are being used. It is different from cash recording and, in principle, from due-for-payment recording, defined as the latest time payments can be made without additional charges or penalties.
Acquisition cost index	The price index representing inventories that are valued on an historical cost basis. It can vary depending on the type of valuation method used by businesses in valuing their book values at historical cost. The acquisition cost index can be used to revalue business book values to national accounts concepts. (Also see monthly cost index)
Asset boundary	Assets as defined in ESA 2010 and SNA 2008 are entities that must be owned by some unit, or units, and from which economic benefits are derived by their owner(s) by holding or using them over a period of time. The asset boundary is the borderline between assets that do and do not fulfil these conditions.
Asset	An asset is a store of value representing a benefit or series of benefits accruing to the economic owner by holding or using the entity over a period of time. It is a means of carrying forward value from one accounting period to another.
Balance sheet (IV.1, IV.3)	A statement, drawn up in respect of a particular point in time, of the values of assets owned and of the liabilities owed by an institutional unit or group of units.
Basic price	The price receivable by the producer from the purchaser for a unit of a good or service produced as output minus any tax payable on that unit as a consequence of its production or sale, plus any subsidy receivable on that unit as a consequence of its production or sale. It excludes any transport charges invoiced separately by the producer as well as nominal holding gains and losses on financial and non-financial assets.
Book value	Stocks of inventories as valued by businesses on their balance sheet. The International Accounting Standards require that inventories be valued at the lower of cost or net realisable value. There are several ways in which businesses can calculate costs using various historical cost accounting methods.
Bottom-up approach	The bottom-up approach takes low level data and aggregates them to produce totals.
Business production cost	Business production cost refers to the cost incurred by a business when manufacturing a good or providing a service. The cost includes direct material cost, direct labour cost and overhead cost. Here the overhead cost includes rent, utility expenses, depreciation of factory or machinery, etc. which is related to the good or service provided. Meanwhile, business production cost does not include expected operating surplus, marketing and administrative expenses incurred at the enterprise level rather than at the establishment or factory level.
Capital account (III.1)	The capital account records acquisitions less disposals of non-financial assets by resident units and measures the change in net worth due to saving (final balancing item in the current accounts) and capital transfers. The capital account makes it possible to determine the extent to which acquisitions less disposals of non-financial assets have been financed out of saving and by capital transfers. It shows a net lending corresponding to the amount available to a unit or sector for financing, directly or indirectly, other units or sectors, or a net borrowing corresponding to the amount which a unit or sector is obliged to borrow from other units or sectors.
Cash accounting	Cash accounting records cash payments at the times these payments occur. Cash accounting cannot be used generally for economic and national accounting as the times at which payments take place may diverge significantly from the economic activities and transactions to which they relate.

Catastrophic losses (K.3)	Catastrophic losses include major earthquakes, volcanic eruptions, tidal waves, exceptionally severe hurricanes, drought and other natural disasters; acts of war, riots and other political events; and technological accidents such as major toxic spills or release of radioactive particles into the air. Catastrophic losses recorded as other changes in volume result from large-scale, discrete and recognisable events that destroy economic assets. For the asset inventories an example is the destruction of inventories as a result of an earthquake or flooding.
Changes in classification of assets and liabilities (K.62)	Changes in classification of assets and liabilities occur where assets and liabilities appear under one category in the opening balance sheet and under another in the closing balance sheet.
Changes in inventories (P.52)	Value of the entries into inventories less the value of withdrawals and less the value of any recurrent losses of goods held in inventories during the accounting period.
Changes in sector classification and institutional unit structure (K.61)	Sector reclassification takes place when an institutional unit, based on SNA 2008/ESA 2010 classification rules, is excluded from the one and included in another sector; it requires the transfer of the entire balance sheet of that unit. Changes in structure cover appearance and disappearance of certain financial assets and liabilities arising from corporate restructuring.
Commodity supply-demand model	A method to estimate the value of changes in inventories indirectly, where the changes in inventories are calculated as a residual using the commodity flow method by balancing the supply and demand of a product within a supply and use framework.
Consolidation	Consolidation is a method of presenting the accounts for a set of units as if they constituted one single entity (unit, sector, or subsector). It involves eliminating transactions and reciprocal stock positions and associated other economic flows among the units being consolidated. Consolidation is neither applicable to inventory stocks nor to changes in inventories.
Conversion factor	The conversion factor converts business book value data valued at historical costs into the national accounts inventory stock levels that are valued at current prices. Two types of conversion factors are needed. For materials and supplies and goods for resale, the factor is calculated as the inventory price index at the end of the current period ($\boldsymbol{PI}_{tE}$) divided by the cost index (i.e. the price at which the inventories are valued on an historical cost basis, $\boldsymbol{CI}_{tE}$). For work-in-progress and finished goods, the factor also includes an additional mark-up for operating surplus and other relevant costs that are not included in work-in-progress and finished goods book values in business accounting. For work-in-progress and finished goods, the factor can be calculated as sales divided by cost of goods sold.
Cost of goods sold	Costs of goods sold include all costs of purchase, costs of conversion and other costs incurred in bringing inventories to their present location and condition.
Coverage multiplier	When the primary data source does not include all enterprises in an industry, the coverage multiplier converts the primary data to full coverage of the respective industry. The coverage multiplier is often used to extend the data for incorporated enterprises that are included in a survey to include the non-covered unincorporated enterprises.
Cross-classification	Refers to a breakdown of a variable, such as inventories, in two dimensions. For example, inventories (or a certain type of inventories) can be broken down by industry and by institutional sector.
Direct estimation method	The direct estimation method estimates the value of the inventory stock of a product by directly multiplying its price and quantity. The direct method is also known as price times quantity method.
Direct use of business accounts	Business accounting data that are directly used for the estimation of the national accounts value of the annual inventory stocks. The data should, however, be adjusted in order to comply with the national accounts definitions of (types of) inventories and revalued to reflect the national accounts valuation requirements.

Economic (dis)appearance of assets (K.1, K.2)	Economic appearance/disappearance of assets is the increase/decrease in the volume of produced and non-produced assets that is not the result of production. It includes entries/exits from the asset boundary of natural resources. The transfer of land from a wild or waste state to land that can be put to economic use is an example of an economic appearance.
Enterprise	An enterprise is an institutional unit in its capacity as a producer of goods and services; an enterprise may be a corporation, a quasi- corporation, a non-profit institution, or an unincorporated enterprise.
ESA 2010	European system of accounts. ESA 2010 is an internationally compatible accounting framework for a systematic and detailed description of a total economy, its components and its relations with other total economies. ESA 2010 is consistent with the System of National Accounts (SNA) 2008, but adapted to the circumstances and needs of the European Union. It has legal status in the European Union. See also SNA 2008.
Establishment	An establishment is an enterprise, or part of an enterprise, that is situated in a single location and in which only a single (non- ancillary) productive activity is carried out or in which the principal productive activity accounts for most of the value added. Also see local kind-of-activity unit.
Exceptional losses	Exceptional losses arise from natural disasters, fire damage, exceptional insect infestation of grains, and other irregular, non-recurring events. They are classified as other changes in the volume of assets.
Expenditure measure of GDP	The expenditure measure of GDP is derived as the sum of expenditure on final consumption plus gross capital formation plus exports less imports.
Finished goods (AN.123)	Goods that are ready for sale or shipment by the producer.
First-in-first-out method	By applying the first-in-first-out method it is assumed that the first items that enter the inventories are also withdrawn first. This means that withdrawals from inventories are recorded at the prices of acquisition of the oldest items held in inventories.
Fixed assets (AN.11)	Produced non-financial assets that are used repeatedly or continuously in production processes for more than one year. Fixed assets consist of dwellings, other buildings and structures, machinery and equipment, weapons systems, cultivated biological resources, and intellectual property products.
Flows (III)	Flows reflect the creation, transformation, exchange, transfer or extinction of economic value. They involve changes in the value of an institutional unit's assets or liabilities. Economic flows are of two kinds: transactions, and other changes.
GDP expenditure approach	See expenditure measure of GDP.
GDP income approach	See income measure of GDP.
GDP production approach	See production measure of GDP.
Goods for resale (AN.125)	Goods acquired by enterprises, such as wholesalers and retailers, for reselling them without further processing to their customers.
Gross capital formation (P.5)	Total value of gross fixed capital formation, changes in inventories and acquisitions less disposals of valuables.
Gross fixed capital formation (P.51g)	Gross fixed capital formation consists of resident producers' acquisitions, less disposals, of fixed assets during a given period plus certain additions to the value of non-produced assets realised by the productive activity of producer or institutional units. Fixed assets are produced assets used in production for more than one year.
Harmonised Index of Consumer Prices	A standardised average of the final costs paid by European consumers for the items in a representative basket of common goods in urban and rural surroundings. The HICP is produced by each European Union Member State to help measure inflation and to guide the European Central Bank in formulating monetary policy. The HICP is also used as the basis of the European index of consumer prices, which is weighted towards household expenditures.

Historic cost accounting methods	Historic cost accounting methods are used in business accounting for the valuation of inventories. By applying historic cost methods withdrawals from inventories are recorded at the prices at the time of acquisition (historic cost) and not at the time of withdrawal.
Holding gains	See nominal holding gains and losses.
Income measure of GDP	The income measure of GDP is derived as compensation of employees plus gross operating surplus plus gross mixed incomes plus taxes less subsidies on both production and imports.
Industry	A group of establishments engaged in the same, or similar, kinds of activity.
Institutional sector	A grouping of institutional units.
Institutional units	Institutional units are economic entities that are capable of owning goods and assets, of incurring liabilities and of engaging in economic activities and transactions with other units in their own right.
Inventories (AN.12)	Produced assets that consist of goods and services that came into existence in the current period or in an earlier period held for sale, use in production or other use at a later date. Inventories are broken down into materials and supplies, work-in-progress, finished goods, military inventories and goods for resale.
Inventory price index	The inventory price index reflects the current prices of the items held in inventory.
Inventory turnover rate	Measure of the number of times the inventory is sold or used in a time period. It can be used to determine the stock holding period.
Inventory valuation adjustment	The inventory valuation adjustment is an implicit difference between the changes in inventories in national accounting and the changes in book values obtained from business accounting. Different historic cost flow methods lead to different inventory valuation adjustments as they generate different book values of inventories. When book values of inventories are used in compiling national accounts, valuation effects arising from historic cost flow methods should be removed from inventories and incomes through an inventory valuation adjustment, which depends on the type of historic cost flow method. It is not the same concept as nominal holding gains and losses in national accounts.
Last-in-first-out method	By applying the last-in-first-out method it is assumed that the last items that enter the inventories are withdrawn first. This means that withdrawals are valued at the prices of the most recent acquisitions held in inventories.
Legal unit	A legal or social entity is one whose existence is recognised by law or society independently of the persons, or other entities, that may own or control it. Such units are responsible and accountable for the economic decisions or actions they take, although their autonomy may be constrained to some extent by other institutional units; for example, corporations are ultimately controlled by their shareholders.
Local kind-of-activity unit	The local kind-of-activity unit (local KAU) is the part of a kind-of-activity unit (KAU) which corresponds to a local unit. The local KAU is called establishment in the SNA 2008 and ISIC Rev. 4. A KAU groups all the parts of an institutional unit in its capacity as producer contributing to the performance of an activity at class level (four digits) of the NACE Rev. 2 and corresponds to one or more operational subdivisions of the institutional unit. The institutional unit's information system must be capable of indicating or calculating for each local KAU at least the value of production, intermediate consumption, compensation of employees, operating surplus, employment and gross fixed capital formation. Also see establishment.
Lower of cost or net realisable value / lower of cost or market	The principle that enterprises should value their inventories by the lower of cost and net realisable value.
Market price	The price payable by the buyer after taking into account not only appropriate taxes and subsidies but any rebates, refunds, adjustments, etc. from the seller, including illegal and inadvertent elements as long as the transaction partners agree upon the results.

Materials and supplies (AN.121)	Goods that their owners intend to use as intermediate inputs to their own production processes, not to resell.
Military inventories (AN.124)	Single-use items, such as ammunition, missiles, rockets, bombs, etc., delivered by weapons or weapons systems; it excludes some types of missiles with highly destructive capability.
Monthly cost index	The monthly cost index is calculated as a weighted-average of the monthly price indices for the stock holding period weighted by the turnover pattern. The cost index can vary depending on the type of valuation method used by businesses in valuing their book values at historical cost. The monthly cost index can be used to revalue business book values to national accounts concepts.
NACE Rev. 2	Statistical classification of economic activities in the European Union;Regulation (EC) No 1893/2006 of the European Parliament and of the Council of 20 December 2006 establishing the statistical classification of economic activities NACE Revision 2 (OJ L 393, 30.12.2006, p. 1).
Net realisable value	The estimated selling price in the ordinary course of business less the estimated costs of completion and the estimated costs necessary to make the sale.
Netting	Net recording concerns a registration whereby the values of some elementary items are offset against items on the other side of the account (for example asset against corresponding liability) or which have an opposite sign. As the balance sheet item inventories can only appear on the asset side of the balance sheet and as the value is always positive, inventory stocks cannot be netted. However, changes in inventories are netted by definition as these transactions are defined as the value of goods that enter the inventories minus the value of goods that leave the inventories.
Nominal holding gains and losses (K.7)	Nominal holding gains and losses that relate to an asset are the increases or decreases in the asset's value accruing to its economic owner as a result of increases or decreases in its price. They have to be registered on the revaluation account. They do not contribute to GDP and must be excluded from production, income, and expenditure data according to the regulations of national accounting.
Non-cultivated biological resources (AN.213)	Animal, tree, crop and plant resources that yield both once-only and repeat products over which ownership rights are enforced but for which natural growth and/or regeneration is not under the direct control, responsibility and management of institutional units. Examples are virgin forests and fisheries within the territory of the country. Only those resources that are currently, or are likely soon to be, exploitable for economic purposes should be included.
Non-financial assets (AN)	Non-financial items over which ownership rights are enforced by institutional units, individually or collectively, and from which economic benefits may be derived by their owners by holding, using or allowing others to use them over a period of time. Non-financial assets are further subdivided into those that are produced and those that are non-produced.
Other changes in assets (K)	Other changes in assets are economic flows, other than those that occur through transactions recorded in the capital and financial accounts, that change the value of assets. Other changes can be decomposed into other changes in volume and nominal holding gains and losses. Synonym for other flows.
Other changes in assets account (III.3)	The other changes in assets account records changes in assets and liabilities of units, other than in connection with saving and voluntary transfers of wealth, the latter being recorded in the capital and financial accounts. It is divided into the other changes in volume of assets account and the revaluation account.
Other changes in the volume of assets (K.1-5)	The other changes in the volume of assets consist of the changes in assets, liabilities, and net worth between opening and closing balance sheets that are due neither to transactions between institutional units, as recorded in the capital and financial accounts, nor to nominal holding gains and losses as recorded in the revaluation account. For the case of inventories these might, for example, be changes in classification, or catastrophic losses.
Other changes in volume	See other changes in the volume of assets.

Other changes in volume not elsewhere classified (K.5)	Other changes in volume not elsewhere classified (K.5) are the effects of unexpected, irregular events on the economic value of assets; the impact of the events on the value of the inventories should be substantial. Some examples are losses from fire damage, from robberies, from insect infestation of grain stores, from an unusually high level of disease in livestock.
Other changes in volume of assets account (III.3.1)	The other changes in volume of assets account records the changes in assets, liabilities, and net worth between opening and closing balance sheets that are due neither to transactions between institutional units, as recorded in the capital and financial accounts, nor to nominal holding gains and losses as recorded in the revaluation account.
Other changes	See other changes in assets.
Other flows	See other changes (in assets).
Other work-in-progress (AN.1222)	Output other than cultivated assets that have been partially processed, fabricated or assembled by the producer but that are not usually sold, shipped or turned over to others without further processing.
Perpetual inventory method	A widely used method for estimating net capital stocks by accumulating past gross fixed capital formation and deducting accumulated consumption of fixed capital (depreciation) and the remaining value of assets that have reached the end of their service lives.
Price indices	Price indices describe price evolution between the current period and a base period. The producer price index measures price changes of output. Price indices of foreign trade describe price changes of exports and imports. Consumer price indices measure price development of final products purchased by households.
Price times quantity method	See direct estimation method.
PRODCOM	PRODCOM provides statistics on the production of manufactured goods. The term comes from the French 'PRODuction COMmunautaire ' (community production) for mining, quarrying and manufacturing: Sections B and C of the statistical classification of economic activities in the European Community (NACE Rev. 2).
Produced assets	See produced non-financial assets.
Produced non-financial assets (AN.1)	Non-financial assets that have come into existence as outputs from production processes that fall within the production boundary of the SNA 2008/ESA 2010. They consist of fixed assets, inventories and valuables.
Producer's price	The price receivable by the producer from the purchaser for a unit of a good or service produced as output minus any value added tax, or similar deductible tax, invoiced to the purchaser. It excludes any transport charges invoiced separately by the producer.
Production measure of GDP	The production measure of GDP is derived as the value of output less intermediate consumption plus any taxes less subsidies on products not already included in the value of output.
Purchaser's price	The price paid by the purchaser, excluding any value added tax or similar tax deductible by the purchaser, in order to take delivery of a unit of a good or service at the time and place required by the purchaser. It includes any transport charges paid separately by the purchaser to take delivery at the required time and place as well as deductions for any discounts for bulk or off-peak-purchases from standard prices or charges.
Recurrent losses	Recurrent losses to the stock of inventories arise from 'normal' or 'typical' physical deterioration, accidental damage, or pilfering. They are included in withdrawals and valued in the same way as withdrawals.
Residual approach	See indirect estimation method
Revaluation account (III.3.2)	The revaluation account records the nominal holding gains and losses accruing during the accounting period to the owners of financial and non-financial assets and liabilities.

Revaluations	See nominal holding gains and losses.
Size class	Breakdown of enterprises or other economic units into different categories according to their size as expressed in terms of persons employed.
SNA 2008	System of National Accounts. SNA 2008 is the internationally agreed standard set of recommendations on how to compile measures of economic activity according to strict accounting conventions based on economic principles. The accounting framework provides a comprehensive and detailed record of the complex economic activities taking place within an economy and the interaction between the different economic agents, and groups of agents, which takes place on markets or elsewhere.
Specific identification method	The specific identification method implies that specific costs are attributed to each item of inventories separately.
Statistical discrepancy	Difference between two (or more) calculation approaches that should theoretically lead to identical outcomes. An example is the difference that might exist between GDP calculations according to the production, expenditure and income approach.
Stock holding period	See turnover rate.
Stocks	Stocks are the holdings of assets and liabilities at a point in time. Stocks are usually recorded at the beginning and end of each accounting period. The accounts that show stocks are called balance sheets. Stocks result from the accumulation of prior transactions and other flows, and they are changed by future transactions and other flows. Thus stocks and flows are closely related.
Stock-to-sales ratio	See turnover rate.
Supply and use tables	Supply and use tables provide a detailed picture of the supply of goods and services by domestic production and import and the use of goods and services for intermediate consumption and final use (consumption, gross capital formation, export). They are a powerful tool for balancing and deflating GDP.
Survey	A survey is an investigation about the characteristics of a given population by means of collecting data from a sample of that population and estimating their characteristics through the systematic use of statistical methodology.
Tax data	Data coming from tax records.
Taxes (subsidies) on products	Taxes (subsidies) that are directly related to unit of a given good or service produced or transacted. They are specified as amount of money per unit or as percentage of price unit.
Time of recording	Time of recording refers to the point in time at which transactions between units are registered. The general principle in national accounting is that transactions between institutional units have to be recorded when claims and obligations arise, are transformed or are cancelled. This time of recording is called an accrual basis.
Top-down approach	The top-down approach breaks down a total into sub-components, when lower level data are unavailable. An example is a breakdown of data for the total economy into institutional sectors.
Trade margin	A trade margin is the difference between the actual or imputed sale price realised on a good purchased for resale, and the price that would have to be paid by the distributor to replace the good at the time it is sold or otherwise disposed of.
Transactions	A transaction is an economic flow that is an interaction between institutional units by mutual agreement or an action within an institutional unit that it is analytically useful to treat like a transaction, often because the unit is operating in two different capacities.
Turnover rate	The turnover rate — also called the stock holding period or the stock-to-sales ratio — is the stock of inventories divided by the sales per period (often monthly). This rate reflects the average time the good remains in inventory.

Uncompensated seizures (K.4)	Uncompensated seizures occur when governments or other institutional units take possession of the assets of other institutional units, including non-resident units, without full compensation, for reasons other than the payment of taxes, fines or similar levies. The seizure of property related to criminal activity is considered to be a fine. The uncompensated part of such unilateral seizures is recorded as other changes in volume.
Unincorporated enterprises	Unincorporated enterprises are units of which the productive activities cannot be separated from their other activities (for example: consumption).
Weighted-average cost method	The weighted-average cost method implies that withdrawals are valued at the average price of all inventory items in the stock. These weighted-average prices are either updated periodically or perpetually.
Work-in-progress (AN.122)	Output produced by an enterprise that is not yet sufficiently processed to be in a state in which it is normally supplied to other institutional units and for which the production process will be continued in a subsequent period by the same producer. Work-in-progress is broken down again into two sub-components: work-in-progress on cultivated biological assets and other work-in-progress.
Work-in-progress on cultivated biological assets (AN.1221)	Livestock raised for products yielded only on slaughter, such as fowl and fish raised commercially, trees and other vegetation yielding once-only products on destruction and immature cultivated assets yielding repeat products.
Write-down	A write-down occurs if current market prices for the goods held in inventory are lower than the costs. Write-downs may occur as recurrent losses through 'normal' or 'typical' physical deterioration or accidental damage. Write-downs may also result from exceptional losses, through natural disasters, fire damage, exceptional insect infestation of grains, and other irregular, non-recurring events.

Bibliography

Bloem, Adriaan M., Robert J. Dippelsman, Nils O. Maehle, *Quarterly National Accounts Manual — Concepts, Data Sources, and Compilation*, International Monetary Fund, 2001, p.60–63. Available at http://www.imf.org/external/pubs/ft/qna/2000/textbook/ch3.pdf

Bureau of Economic Analysis, *NIPA Handbook: Concepts and Methods of the U.S. National Income and Product Accounts*, 2016, Chapter 7: Change in Private Inventories. Available at http://www.bea.gov/national/pdf/chapter7.pdf

European Commission, 'International Accounting Standard 2 Inventories', EC staff consolidated version as of 16 September 2009, 2009. Available at http://ec.europa.eu/internal_market/accounting/docs/consolidated/ias2_en.pdf

European Commission, Commission Regulation (EC) No 2602/2000 of 17 November 2000 laying down detailed rules for the implementation of Council Regulation (EC) No 2494/95 as regards minimum standards for the treatment of price reductions in the Harmonised Index of Consumer Prices, Official Journal of the European Communities, 2000. Available at http://eur-lex.europa.eu/eli/reg/2000/2602/oj

European Commission/Eurostat, *European system of accounts — Transmission programme of data*, European Union, 2014, p.107. Available at http://ec.europa.eu/eurostat/web/products-manuals-and-guidelines/-/KS-01-13-429-3A-C

European Commission/Eurostat, *European system of accounts (ESA) 2010*, Publications Office of the European Union, Luxembourg, 2013. Available at http://ec.europa.eu/eurostat/web/products-manuals-and-guidelines/-/KS-02-13-269

European Commission/Eurostat, *Eurostat Manual of Supply, Use and Input-Output Tables*, Office for Official Publications of the European Communities, Luxembourg, 2008. Available at: http://ec.europa.eu/eurostat/documents/3859598/5902113/KS-RA-07-013-EN.PDF/b0b3d71e-3930-4442-94be-70b36cea9b39?version=1.0

European Commission/Eurostat, *Manual on sources and methods for the compilation of COFOG Statistics – Classification of the Functions of Government (COFOG)*, Luxembourg, 2011. Available at http://ec.europa.eu/eurostat/en/web/products-manuals-and-guidelines/-/KS-RA-11-013

European Commission/Eurostat, *Manual on the economic accounts for Agriculture and Forestry EAA/EAF 97 (Rev.1.1)*, Office for Official Publications of the European Communities, Luxembourg, 2000. Available at http://bookshop.europa.eu/en/manual-on-the-economic-accounts-for-agriculture-and-forestry-eaa-eaf-97-rev.1.1--pbKS2700782/

European Commission/Eurostat, *NACE Rev. 2 — Statistical classification of economic activities in the European Community, Rev. 2*, Office for Official Publications of the European Communities, 2008. Available at: http://ec.europa.eu/eurostat/documents/3859598/5902521/KS-RA-07-015-EN.PDF

European Commission/Eurostat, *Statistical Classification of Products by Activity, Version 2.1 (CPA 2.1)*, Official Journal of the European Union, 2014. Available at http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014R1209&from=EN or http://ec.europa.eu/eurostat/ramon/nomenclatures/index.cfm?TargetUrl=LST_NOM_DTL&StrNom=CPA_2_1&StrLanguageCode=EN&IntPcKey=&StrLayoutCode=HIERARCHIC

European Commission/Eurostat, *The European Framework for Integrated Environmental and Economic Accounting for Forests — IEEAF*, Office for Official Publications of the European Communities, Luxembourg, 2002. Available at http://ec.europa.eu/eurostat/documents/39314/44178/Handbook-IEEAF-2002.pdf/c7b2aeaa-c4dd-49ce-bf25-05740d90e043

European Union/Eurostat, *Essential SNA: Building the basics*, Publications Office of the European Union, Luxembourg, 2014. Available at http://ec.europa.eu/eurostat/web/products-manuals-and-guidelines/-/KS-GQ-14-008

Eurostat, 'Building the System of National Accounts — supply and use tables', *Statistics Explained*. Available at http://ec.europa.eu/eurostat/statistics-explained/index.php/Building_the_System_of_National_Accounts_-_supply_and_use_tables

Eurostat, *Handbook on prices and volume measures in national accounts*, Publications Office of the European Union, Luxembourg, 2016. Available at http://ec.europa.eu/eurostat/documents/3859598/7152852/KS-GQ-14-005-EN-N.pdf/839297d1-3456-487b-8788-24e47b7d98b2

Eurostat, *Manual on Government Deficit and Debt*, Publications Office of the European Union, Luxembourg, 2016. Available at http://ec.europa.eu/eurostat/web/products-manuals-and-guidelines/-/KS-GQ-16-001

Eurostat/Organisation for Economic Co-operation and Development, *The Eurostat-OECD compilation guide on land estimation*, Publication Office of the European Union, Luxembourg, 2015. Available at http://ec.europa.eu/eurostat/documents/3859598/6893405/KS-GQ-14-012-EN-N.pdf

Food and Agriculture Organization, *A System of Economic Accounts for Food and Agriculture*, United Nations, Rome, 1996. Available at http://www.fao.org/docrep/W0010E/W0010E00.htm

Gittins, Peter, 'Transition to ESA2010: Capitalising Government Spending on Military Weapons', Office for National Statistics — United Kingdom, 10 June 2014. Available at http://webarchive.nationalarchives.gov.uk/20160105160709/http://www.ons.gov.uk/ons/rel/naa1-rd/national-accounts-articles/transition-to-esa10--capitalising-government-spending-on-military-weapons/index.html

International Monetary Fund website, 'Templates for Minimum and Encouraged Set of Internationally Comparable Sectoral Accounts and Balance Sheets', 11 July 2012. Available at http://www.imf.org/external/np/sta/templates/sectacct/index.htm

International Monetary Fund, *Balance of Payments and International Investment Position Manual, Sixth Edition*, Washington D.C., 2009. Available at http://www.imf.org/external/pubs/ft/bop/2007/pdf/bpm6.pdf

International Monetary Fund, *Government Finance Statistics Manual 2014*, IMF Publication Services, Washington, 2014. Available at https://www.imf.org/external/Pubs/FT/GFS/Manual/2014/gfsfinal.pdf

Lequiller, F. and D. Blades, *Understanding National Accounts*: *Second Edition*, OECD Publishing, 2014, Chapter 5. Available at https://www.oecd.org/std/UNA-2014.pdf

Moulton, Brent R., US. Bureau of Economic Analysis, 'Canberra II Group's Recommendations to Treat Military Weapon Systems as Fixed Assets',13 December 2003 (revised 10 March 2004). Available at http://unstats.un.org/unsd/nationalaccount/AEG/papers/m1(p)military-revised.pdf

Organisation for Economic Co-operation and Development, *Handbook on Deriving Capital Measures of Intellectual Property Products*, Paris, 2010. Available at http://www.oecd.org/std/na/44312350.pdf

Organisation for Economic Co-operation and Development, *Measuring Capital: OECD Manual, Second edition,* Paris, 2009. Available at www.oecd.org/dataoecd/16/16/43734711.pdf.

Peleg, S. and D. Finzi, 'Measuring Inventories under High Inflation', March/April 2000. Available at http://www.unece.org/fileadmin/DAM/stats/documents/ces/ac.68/2000/24.e.pdf

Shrestha, M., and S. Fassler, 'Changes in Inventories in the National Accounts', IMF Working Paper, WP/03/120, June 2003. Available at https://www.imf.org/external/pubs/ft/wp/2003/wp03120.pdf

Udenio, M., J.C. Fransoo, R. Peels, R., 'Destocking, the bullwhip effect, and the credit crisis: empirical modelling of supply chain dynamics', *International Journal of Production Economics*, 160, February 2015, p.34–46. Available at https://pure.tue.nl/ws/files/3820044/585164889591905.pdf

United Nations Economic Commission for Europe, *Guide on Impact of Globalization on National Accounts*, Geneva, 2011. Available at http://www.unece.org/fileadmin/DAM/stats/groups/wggna/Guide_on_Impact_of_globalization_on_national_accounts_FINAL21122011.pdf

United Nations Economic Commission for Europe, *Guide to Measuring Global Production*, Geneva, 2015. Available at https://www.unece.org/fileadmin/DAM/stats/publications/2015/Guide_to_Measuring_Global_Production__2015_.pdf

United Nations, Central Product Classification (CPC), Version 2.1, New York, 2015. Available at http://unstats.un.org/unsd/cr/downloads/CPCv2.1_complete%28PDF%29_English.pdf

United Nations, European Commission, Food and Agriculture Organization of the United Nations, Organisation for Economic Co-operation and Development, World Bank Group, *System of Environmental-Economic Accounting 2012 — Experimental Ecosystem Accounting*, New York, 2014. Available at http://unstats.un.org/unsd/envaccounting/seeaRev/eea_final_en.pdf

United Nations, European Commission, International Monetary Fund, Organisation for Economic Co-operation and Development, World Bank, *System of National Accounts (SNA) 2008*, New York, 2009. Available at http://unstats.un.org/unsd/nationalaccount/docs/SNA2008.pdf

United Nations, *International Standard Industrial Classification of All Economic Activities (ISIC), Rev. 4*, United Nation Publications, New York, 2008. Available at: http://unstats.un.org/unsd/cr/registry/isic-4.asp

United States' Census Bureau website, *North American Industry Classification System*. Available at https://www.census.gov/eos/www/naics/

World Bank web site, 'What is the difference between purchaser prices, producer prices (VAP), and basic prices (VAB)?' Available at https://datahelpdesk.worldbank.org/knowledgebase/articles/114947-what-is-the-difference-between-purchaser-prices-p

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Eurostat-OECD compilation guide on inventories

The Eurostat-OECD compilation guide on inventories represents the first comprehensive overview of conceptual and practical issues related to the compilation of the balance-sheet item 'inventories' in the national accounts.

The estimation of inventories and changes in inventories in national accounts is often very difficult. Therefore it is the aim of this compilation guide to provide conceptual and practical guidance to statisticians on the estimation and valuation of inventories in mutual coherence with the transaction changes in inventories, and by doing so, to increase international comparability for these items. The guide clarifies theoretical concepts and possible data sources. It elaborates several estimation methods for both the asset inventories and the transaction changes in inventories, including their breakdowns into products, industries and institutional sectors. The compilation guide also addresses several special estimation cases and provides the results of a questionnaire — completed by 34 countries — on country practices regarding the estimation of inventories.

The Eurostat-OECD compilation guide on inventories was prepared by the Task Force on Land and other non-financial assets under the joint leadership of Eurostat and the OECD. Representatives from various European Union (EU) and non-EU OECD countries were represented as well as the European Central Bank.

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