National Accounts December 2002

Inventory of Sources and Methods

Price and Volume Measures in the Danish National Accounts

Statistics Denmark
National Accounts
Kirsten Balling

Contents

0 Introduction

This report describes how the functional part of the final Danish national accounts at constant prices is calculated.

A general introduction to constant price calculations as a concept is given in *Chapter 1*. Subsequently, the chapter is centred on the calculation methods, as the general calculation systems and procedures are described. Against the background of an alternative growth measure – in the form of chain indices – being introduced into the Danish national accounts from 2001, the chapter goes on to give an account of why chain indices are introduced, and of how the conventional fixed weight volume indices and the alternative chained volume indices are related to each other. Finally the chapter provides an overview of the publications and media where national accounts figures at constant prices can be found.

Chapter 2 provides a methodological starting point to going through individual deflators in chapter 3, as the chapter descripes the most frequently used methods for handling quality changes in estimating price indices and volume indicators and goes on to characterise the primary statistical data sources for deflating national accounts.

In *Chapter 3* specific attention is paid to the individual deflators for each product in the product balances

Chapter 4 goes through deflation methods for specific parts of the national accounts system, starting out with how economic aggregates are calculated in constant prices and moving on to looking at how taxes and subsidies on products is calculated.

Finally, a summarized characterization of the Danish deflation system is given.

1 General procedures

In this chapter a general description of the framework for calculating constant price figures in the Danish national accounts is given.

In section 1.1 a few general remarks are given concerning the calculation of constant price figures. Section 1.2 goes on to describe the general calculation procedures. In section 1.3 is dealt with the special questions arising from introducing chained volume indices in national accounts. Finally section 1.4 is focusing on the publication of constant price data.

1.1 Constant price calculations in general

Constant price calculations

The general purpose of estimating national accounts aggregates at constant prices is to describe the volume developments for economic aggregates: *The calculation of volume indices.* Determining the price development for these aggregates is of almost similar significance.

The availability of national accounts figures at constant prices is absolutely essential in conducting comparisons over time, where the effect of the price development has to be eliminated.

An estimation of national accounts figures at constant prices is fundamentally different from an estimate at current prices.

Generally speaking, the calculation of national accounts at current prices constitutes a linkage and aggregation of primary economic statistical data in the context of an accounting framework. The national accounts at current prices thus provide an overall picture of the national economy in a given year.

In contrast, the calculations of national accounts at constant prices describe an economic situation in a given year in the prices of another year (the base year). The description provided is thus a fictitious characteristic of the economic situation as the transactions of the year in question would not, in actual fact, have taken place in the same way, if prices had remained unchanged in comparison to the base year. Consequently, there is no separate economic interpretation of the absolute magnitude of aggregates in constant prices; a meaningful interpretation of the aggregates can only be given in relative terms.

The estimation at constant prices is based on the general assumption that a wide range of the concepts used in national accounts can be regarded as a value created as the outcome of a price multiplied by a volume. Thus, any changes in an aggregate can be divided into a price change and a volume change. As mentioned, the purpose of the constant price calculations is to isolate the development in volumes.

Quality changes

In connection with constant price calculations a special problem is associated with quality changes over time. A ton of sugar beets with high sugar content is not identical to a ton with low sugar content, and a black/white television set differs from a colour television set. Adjustments of changes in the quality of products are made as far as possible, so that the "pure" price development is reflected by the price indices used for deflation. Price changes for a given aggregated transaction can take place when prices change for individual products and when there are changes in the weighting of an aggregated transaction. Other changes have to result in changes in the volume component.

Consequently, changes in the quality of products over time have to be recorded as changes in the volume component and not in the price component. The same applies

to changes in the composition of an aggregated transaction, where the changes embrace changes in the quality of the products included.

Which aggregates are calculated at constant prices?

Calculations at constant prices can be performed in accordance with two principles that are fundamentally different. The first principle consists in an assessment of the flows of goods and services in the prices from a given base year. The second principle implies that the real purchasing power of, e.g. incomes or net lending is calculated. A typical example of the second principle is the calculations of changes in real income, which are frequently conducted by deflating the nominal incomes with the consumer price index. In this context, there is no unequivocal choice of deflator. When conducting real calculations of a payment from A to B, the choice of deflator will depend on the intention of the calculation; whether it is intended to calculate how much A has lost or how much B has received. Consequently, the choice of deflator in connection with calculating the purchasing power will be determined by the analytical requirements, which are to be fulfilled by the calculation.

As previously mentioned constant price calculations of national accounts, is an assessment of flows of goods and services in the prices from a given base year. This implies that values at constant prices are, as a main rule, only calculated for those aggregates of the national accounts that relate to real transactions. The calculation of real gross national disposable income is the only exception. In annex A of this paper the calculation of this aggregate is outlined.

Commodity flow system

Constant price calculations take place within a system of commodity flow balances. The relatively high level of detail (2,750 products) makes the need for corrections for changes in quality due to changes in the composition of national accounts products over time less central.

The supply and use framework also means that GDP-growth can be determined using either the production approach or the expenditure approach giving identical results. See chapter 4 for a more comprehensive description of how economic aggregates at constant prices e.g. GDP, is calculated.

Choice of base year

1995 is currently used as base year for the constant price calculations in national accounts. In connection with a change of the base year, which is traditionally undertaken every 5th to 10th year, the entire time series is rebased.

The fixed base volume indices are at present the official Danish national accounts volume indices.

Furthermore, using the calculations in 1995 prices as starting point, a constant price calculation in the prices of the previous years, forming the basis of the calculation of chain indices, is undertaken.

The choice of base year has an important bearing on the changes in values at constant prices. This is closely linked to the fact that the prices in the base year constitute the weights of the calculated volume indices. The discrepancies of the relative prices between the different years naturally imply that the calculation of volume indices is sensitive to the choice of base year. In general, it should be stated that a price structure as close as possible to the price structure of the year in question, will provide the best basis for compiling true and fair volume figures.

Economic theory gives rise to a prior assumption that the impact of bringing forward the base year will lead to a fall in the growth rate for the final demands, and thereby in an economy without any external trade for the gross domestic product over the period between the old and the new base year – the Gerschenkron effect. The argument in favour of this is that the final demands are derived as the sum of optimising economic agents' choices, and in consequence of this, a substitution over the period between the two base years must be assumed to have taken place away from prod-

ucts, which during the period have become relatively more expensive, tending towards products that have become relatively cheaper.

In an economy with external trade, the effect on the gross domestic product may as an ultimate consequence, where there is a considerable fall in the growth rate for imports and considerably greater than for exports, result in opposite signs.

1.2 Deflation method

By 'deflation method' is in this context to be understood the procedures and calculation systems forming the basis of calculating national accounts data at constant prices.

In order to be able to understand the description of the constant price calculations, a general insight into the calculation systems at current prices is essential. Consequently, a summary description of the framework for calculating the functionel part of the Danish national accounts is given in section 1.2.1, which is followed by an in-depth description of the deflation method. First, the general deflation method is outlined in section 1.2.2, and then section 1.2.3 gives a more detailed outline of areas where the calculation method differs from the general approach. Finally, section 1.2.4 gives a description of the manual checks that are performed, when the mainly automatic deflation calculation is completed.

1.2.1 Commodity flow balances at current prices

The final annual national accounts for Denmark are compiled within the framework of a system of commodity flow balances consisting of supply and use tables for about 2,750 products, see figure 1.1.

Figure 1.1 **Schematic diagram of commodity flow balances at basic prices**

	SUPPLY		USE				
	Danish prod. - 130 industr.	Imports	Inter. consump. - 130 industr.	Private consump. exp. -72 consump. groups	Govern. consump.expen. 21 consump. groups	Cap. form. - 10 groups	Exports
about 2,750 goods& services							

At the level of basic prices a given supply and use table contains information on:

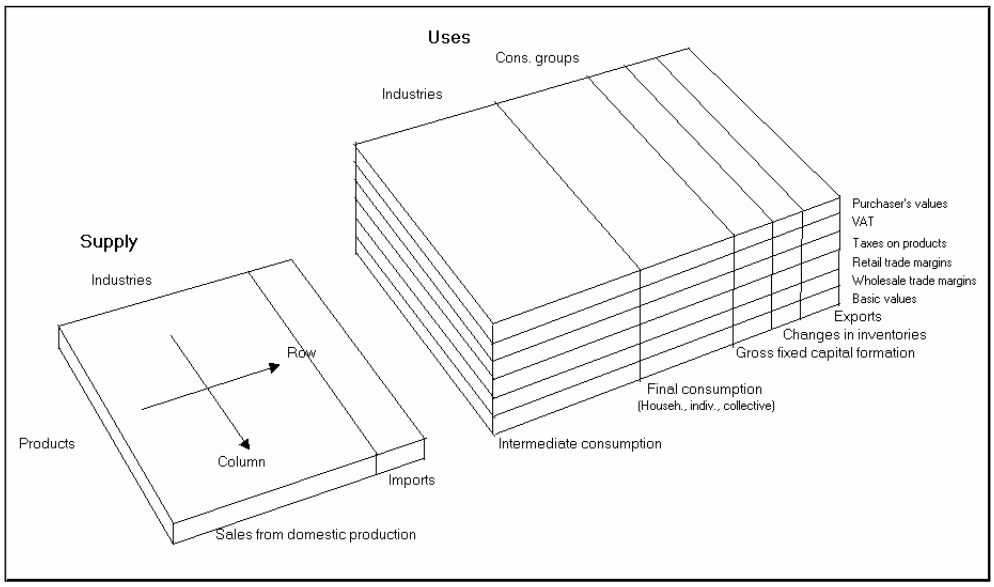
Supply

- Danish production by 130 industries
- imports CIF
- Customs and other import duties

Use

- intermediate consumption by 130 industries
- private consumption expenditure by 72 consumption groups
- government consumption expenditure by 21 consumption groups
- capital formation by 10 investment categories
- exports diveded between exports of Danish products and re-exports

Figure 1.2 **Commodity flow balances at purchasers' prices in national accounts**



The use side of the product balances is given at purchasers' prices from the level of basic prices by adding:

- trade margins (wholesale and retail)
- taxes less subsidies on products
- VAT

This multi-tier structure of the use side in the balances is illustrated in figure 1.2. A concrete example of a product balance is given in figure 1.3, which shows the supply and use table for the national accounts product (NA product) 'Stockings, socks and similar hosiery'.

Supply and use tables are characterised by an accounting balance between supply and use, calculated at basic prices.

This balance at current prices is achieved by conducting in principle an independent measurement of supply and use of the individual product. Subsequently a balancing utilising all types of information and a final central balancing are undertaken.

There is a similar balance at constant prices between supply and use, but this balance is achieved in a slightly different manner than the one at current prices, see section 1.2.2.2.

The balance between supply and use at constant prices in a system of supply and use tables requires that Laspeyres volume index and Paasche price index are used, where the volume estimates are additive. Additivity is not achieved using e.g. Fisher price and volume indices.

Figure 1.3 [1]

1998 **Current Prices**

* **Stockings, socks etc.**

NRNR: V611503 Supply:	**NRNR**	**ANVID**	**BRCH**	**Basic price**
Mfr. of textiles and textile products	V611503	1010	170000	71.451
Mfr. of wearing apparel, dressing etc. of fur	V611503	1010	180000	13.956
Import	V611503	1020		278.300
Custom duties	V611503	1021		9.876
Stockings, socks etc.	Total			373.583

NRNR: V611503 Use:	**NRNR**	**ANVID**	**BRCH**	**Basic price**	**Trade margin wholesale**	**Trade margin retail**	**Comm. Tax**	**Purch.ex. VAT**	**VAT**	**Purch.incl. VAT**
Mfr. of wearing apparel, dressing etc. of fur	V611503	2010	180000	25.600	2.551	0	0	28.151	0	28.151
Mfr. of leather and leatherproducts	V611503	2010	190000	455	0	0	0	455	0	455
General (overall) public service activities	V611503	2010	751100	1.244	18	0	0	1.262	307	1.569
Provision of services to the community	V611503	2010	752001	1.421	20	0	0	1.441	237	1.678
Primary education	V611503	2010	801000	160	25	0	0	185	45	230
Social institutions etc. for children	V611503	2010	853109	1.018	0	0	0	1.018	249	1.267
Social institutions etc. for adults	V611503	2010	853209	1.997	0	0	0	1.997	485	2.482
Garments and clothing materials etc.	V611503	2030	3110	241.151	47.380	123.515	0	412.046	95.254	507.300
Changes in stocks, raw materials	V611503	2060		620	50	0	0	670	0	670
Changes in stocks, wholesale trade	V611503	2061		1.846	0	0	0	1.846	0	1.846
Changes in stocks, retail trade	V611503	2062		3.062	608	0	0	3.670	0	3.670
Exports of Danish products	V611503	2081		67.389	571	0	0	67.960	0	67.960
Re-exports	V611503	2082		27.620	193	0	0	27.813	0	27.813
Stockings, socks etc.	Total			373.583	51.416	123.515	0	548.514	96.577	645.091

1.2.2 The general approach to deflation

The constant price calculations are centred on the commodity flow balances at current prices. For each cell in the supply and use tables at current prices, a corresponding at constant prices is calculated. The level of detail in the final commodity flow balances at constant prices is thus similar to the level of detail at current prices.

The initial deflation is undertaken at basic prices, and supply and use must balance at basic prices. Subsequently, trade margins, taxes less subsidies on products and VAT at constant prices are calculated as a supplement to the basic price in order to arrive at the purchaser's price at constant prices.

---

[1] The national accounts number of the good in question is given under NRNR in, figure 1.3. The codes under ANVID and BRCH are explained below.

ANVID
1010: Danish production
1020: Imports
1021: Customs
2010: Intermediate consumption
2030: Private consumption expenditure
2060: Changes in stocks, raw materials
2061: Changes in stocks, wholesale trade
2062: Changes in stocks, retail trade
2081: Exports of Danish products
2082: Re-exports

BRCH
For 1010 og 2010: Industry code in the national accounts
For 2030 : Consumption group code in the national accounts

Verification at current and constant prices

In principle deflation is not conducted until the functional national accounts are finished at current prices. However, there is an inherent procedure allowing for correction of any problems associated with the calculations at current prices, which are only revealed when the price component is specifically included in the assessment of the result.

An erroneous price index may account for a misleading volume development, but mistakes may also have been made in the calculations at current prices. If this is the case, the volume development will be wrong, although the price index is correct.

Against this background, calculations at current and constant prices are finally coordinated serving the purpose to ensure that the general results provide a true and fair overall picture.

1.2.2.1 Price indices

Goods

As previously mentioned, there are about 2,750 supply and use tables, which are separately deflated. However, with respect to goods the deflation is actually carried out at an even more detailed level. Below the product level in national accounts, there frequently is a sub grouping consisting of several HS-commodity items[2].

Table 1.2.1 **Deflator key**

Origin	HS commodity item	Deflator number
Danish production	611520	6115111
Danish production	611591	6115922
Danish production	611592	6115922
Danish production	611593	6115922
Danish production	611599	6115922
Imports	611520	6115111
Imports	611591	6115921
Imports	611592	6115921
Imports	611593	6115921
Imports	611599	6115921

Let us look again at the example of the NA product: 'Stockings, socks and similar hosiery', whose supply and use table at current prices for 1998 is shown in figure 1.3. This product in national accounts consists, in reality, of five domestically produced and five imported HS commodity items, comprising stockings and socks of different fabrics. A deflator key for the deflation system links a specific deflator to each of the HS commodity item, see table 1.2.1. In the case of stockings, the deflators are the producer price indices and import price indices from the wholesale price index.

However, the deflation is finally performed at the level of national accounts, which implies that one deflator only is needed for a given basic price cell in the supply and use table. Consequently, it is essential to conduct a weighting of the deflators for the basic HS commodity items. The weighting is conducted on the basis of the turnover values of the different HS commodities in the year under survey, derived from the statistics on manufacturers' sales of commodities and from external trade. The outcome of this weighting is that the calculated price indices to be used for the actual deflation become Paasche price indices and consequently the volume indices become Laspeyres indices.

The example of stocking and socks can be instrumental in specifying how the weighting is conducted. In the first instance, table 1.2.2 links index values to the deflator numbers in table 1.2.1.

[2] The HS nomenclature is the goods nomenclature used by the customs authorities: Harmonised System. The data reported for the statistics on manufacturers' sales of commodities and external trade are based on this nomenclature.

Table 1.2.2 **Price index**

Deflator number	Index value for 1998 1995=100
6115111	100.000
6115922	100.442
6115922	100.442
6115922	100.442
6115922	100.442
6115111	100.000
6115921	105.449
6115921	105.449
6115921	105.449
6115921	105.449

The statistics on manufacturers' sales of commodities and external trade show the following turnover values for the different types of stockings and socks in 1998:

Table 1.2.3 **The values in the statistics on manufacturers sales of commodities and external trade for 1998: Stocks, socks and similar hosiery**

NA. Product no.	Origin	HS product no.	Industry	Turnover at current prices
V611503	DK	611520	170000	6,102
V611503	DK	611591	170000	7,387
V611503	DK	611592	170000	57,475
V611503	DK	611593	170000	290
V611503	**DK**	**Total**	**170000**	**71,254**
V611503	DK	611520	180000	74
V611503	DK	611591	180000	230
V611503	DK	611592	180000	1,050
V611503	DK	611593	180000	12,738
V611503	**DK**	**Total**	**180000**	**14,092**
V611503	IM	611520	-	33,173
V611503	IM	611591	-	21,050
V611503	IM	611592	-	190,272
V611503	IM	611593	-	33,500
V611503	IM	611599	-	1,667
V611503	**IM**	**Total**	**-**	**279,662**

The basis for conducting the weighting is thus ready. The weighting is conducted by deflating the turnover values of the statistics on manufacturers sales of commodities and external trade with the associated indices, thereby achieving values at constant prices for all values in table 1.2.3. Subsequently, implicit industry and import price indices for the NA product can be calculated by dividing values at current prices by the corresponding values at constant prices. Similarly, the combined implicit price index for Danish production, corresponding to a weighted average of all the industry price indices, is determined. Table 1.2.4 shows the way in which the weighting is conducted:

Table 1.2.4 **Calculation of price indices for NA-product**[3]

NA. Product no.	Origin	HS product no.	Industry	Current prices	Price index	Constant prices
V611503	DK	611520	170000	6,102	100	6,102
V611503	DK	611591	170000	7,387	100.442	7,354
V611503	DK	611592	170000	57,475	100.442	57,222
V611503	DK	611593	170000	290	100.442	289
V611503	**DK**	**Total**	**170000**	**71,254**	**100.404**	**70,967**
V611503	DK	611520	180000	74	100	74
V611503	DK	611591	180000	230	100.442	229
V611503	DK	611592	180000	1,050	100.442	1045
V611503	DK	611593	180000	12,738	100.442	12,682
V611503	**DK**	**Total**	**180000**	**14,092**	**100.442**	**14,030**
V611503	**DK**	**Total**	**-**	**85,346**	**100.411**	**84,997**
V611503	IM	611520	-	33,173	100	33,173
V611503	IM	611591	-	21,050	105.449	19,962
V611503	IM	611592	-	190,272	105.449	180,440
V611503	IM	611593	-	33,500	105.449	31,769
V611503	IM	611599	-	1,667	105.449	1,581
V611503	**IM**	**Total**	**-**	**279,662**	**104.772**	**266,925**

Services, etc. For services and goods, which are not covered by the statistics on manufacturers' sales of commodities or by external trade statistics, the deflators are linked directly to the national accounts product in the deflator key. There is for each of these products one deflator for total Danish production and one deflator for imports.

1.2.2.2 Deflating basic prices

When the price indices for all goods in the commodity flow balances have been calculated, the deflation of basic price values in the balances is conducted. Separate calculations are performed for each commodity flow balance.

Supply is deflated The *Danish production by industries* is deflated first using the calculated industry price indices. The circumstance that Danish production is deflated with industry-specific indices forms the basis for a true and fair calculation of gross value added in each industry, see section 4.1.1. *Imports* are deflated with the calculated import price index. *Customs duties* at constant prices are calculated by applying the customs rate of the base year to the calculated import value at constant prices.

Total supply at constant prices has thus been calculated. It should be noted that the value of total use at constant prices is simultaneously calculated, as it is assumed that supply and use at constant prices are to balance.

Use is deflated *Exports* are deflated on the basis of the assumption that the price development of exports of goods produced in Denmark is generally in line with the price development of the total Danish production of the goods in question, and that the price development of re-exports of imported goods is in line with the price development of total imports of the goods in question. Against this background, exports of goods produced in Denmark are deflated with the calculated index for total Danish production and re-exports with the import price index.

On the basis of the constant price values of exports and of supply at constant prices, the constant price value of domestic use can now be calculated; given that balance at basic prices must be achieved. A residual of a total price index for domestic use is calculated on the basis of the value of domestic use at current and at constant prices. This total price index is used for deflating all domestic uses.

[3] The grey-shaded figures are the calculated implicit price indices.

Automatic balancing Simultaneously, an automatic balancing of the supply and use table in question is also achieved.

1.2.2.3 Deflation of trade margins, taxes less subsidies on products and VAT

When the basic prices in the supply and use tables have been deflated and balanced, a constant price calculation is conducted of trade margins, taxes less subsidies on products and VAT, with the purpose of calculating purchasers' prices at constant prices.

The general method here is to use the percentages in the base year – at the cell level in the supply and use tables – on the basic price values at constant prices. This corresponds to the method recommended for trade margins in ESA95[4], paragraph 10.38 and for taxes and subsidies on products in paragraphs 10.50-10.52. A detailed outline of the method used for trade margins is given in section 3.6 and for taxes and subsidies on products in section 4.2.

1.2.3 Deviations from the general approach to deflating

The general approach to deflation described above is used for a majority of the supply and use tables. However, for some products the approach differs, and these are dealt with below.

1.2.3.1 Energy products

The commodity flow balances for energy products are compiled directly on the basis of volume data.

They mainly concern gas, coal, oil products, electricity and district heating.

The most important sources on the supply side are the statistics on manufacturers sales of commodities and external trade, supplemented by questionnaire-based surveys analysing the products oil and natural gas. The source with respect to renewable energy is the Danish Energy Agency.

Energy consumption by the manufacturing industry is analysed on the use side by conducting a questionnaire-based survey, while the converting[5] sectors are covered by statistics compiled by the Danish Energy Agency. Exports are covered by the external trade statistics. The remaining uses are calculated from reimbursements of energy taxes or are determined residually.

In conducting the calculation at constant prices, the estimated physical quantities are multiplied by the corresponding unit prices from the base year. Where these are not available, the calculation is instead conducted on the basis of the average price for total use of the product in the base year.

Subsequently, balance between supply and use is achieved, usually by adjusting the supply side.

1.2.3.2 Construction

The commodity flow balances for products in the construction industry are calculated at current and at constant prices in a separate system, which supplies largely ready-made supply and use tables. Although the constant price calculation is conducted in a separate system, it is not essentially different from the general calculation method used in deflating.

However, one of the reasons why the constant price calculations must be conducted in a separate system is due to the circumstance that implicit price indices, which are

---

[4] "The European System of Accounts ESA 1995"

[5] Converting sectors are sectors transforming one form of energy into another, e.g. power and district heating stations.

calculated on the basis of other supply and use tables at current and at constant prices, are used in deflating some of the construction products.
A more detailed outline of the deflation of construction products is given in section 3.5.

1.2.3.3 General government

In the national accounts public non-market activities at current prices are compiled from the cost side by summing up the associated costs: Compensation of employees, intermediate consumption, consumption of fixed capital and other taxes less subsidies on production.

The compilation of non-market activities at constant prices is similarly conducted, as each cost element is deflated separately. In other words, a deflation is conducted from the input side.

A description of the deflation method for each of the four cost elements is given below.

1.2.3.3.1 Compensation of employees

The ideal earnings index

The payroll costs, which are included in measuring the activity, ideally contain all costs incurred by the employers in employing the employees. This implies that not only the wages or salaries paid to the employee but also other employer's cost, e.g. employer's contributions to pension schemes and social schemes, are ideally included.

The earnings index used in deflating wages or salaries must naturally cover the same concept of earnings.

In the context of the national accounts an increase in average wage or salary costs is not necessarily considered an increase in wages or salaries. A distinction is made between the changes in wages or salaries due to alterations in the quality of the labour force, and the direct increases in average wage or salary costs in order to have the same quantity and quality of labour available.

In the context of the national accounts the ideal earnings index is intended only to provide a description of the increases in average wage or salary costs in order to have the same quantity and quality of labour available (the price component).

It appears clearly from this principle that general increases in wages or salaries, which are due to collective agreements, including e.g. the wage-regulating scheme, should result in increases in the earnings index. Furthermore, it also implies that changes in hours of work, which do not lead to any fall or increase in wages or salaries, should result in a change in the earnings index.

In connection with working overtime an extraordinary remuneration is frequently paid. Changes in average wages or salaries due to this extraordinary remuneration should result in a change in the earnings index.

Conversely, changes in average wages or salaries, which are due to changes in the composition of the labour force with respect to function, seniority as well as classifications should not in a context of national accounts result in changes in the earnings index. They reflect changes in the quality of the labour force, and should therefore result in a change in the quantity of public non-market activities (the volume component)

Operationalization in the national accounts up to and including 1995

Up to and including 1995 the earnings deflator in the final national accounts was calculated as follows:

Earnings indices by final purpose are compiled for the central and the local government respectively.

Local government
The concept of earnings used excludes any supplements for working overtime, night shifts, etc.
The data on earnings reported for the local government sector have been stratified by category of pay and by seniority. The concept of earnings comprises average hourly earnings for persons paid by the hour and monthly earnings for persons paid by the month.

Central government
The concept of earnings used excludes any supplements for working overtime, night shifts, etc. (fixed earnings). The data on earnings reported for central government employees have been stratified by occupation and category of pay. The concept of earnings is average monthly earnings per person.

If changes in working time are made in accordance with the collective agreements without any corresponding compensation, e.g. by changing the normal weekly working time or by introducing so-called special holidays; adjustments of average monthly earnings, corresponding to the pay effect of the change in working time, are made for persons paid monthly.

When overtime payments are excluded from average earnings, which forms the basis for calculating earnings indices, changes in the frequency of overtime imply that public non-market activities will be overstated by the extent to which extraordinary payments are made in connection with working overtime.

Subsequently, the two earnings indices for the local government and the central government are being weighted together to form an overall earnings index by purpose.

Operationalisation in the national accounts after 1995

In connection with adjustments made to Statistics Denmark's earnings statistics, some of the data used for stratification in calculating the earnings indices in national accounts were temporarily removed. As from 2000, it is expected that these data will be included in the earnings statistics again. Furthermore as a new thing, for central government employees the earnings statistics are expected to include data on seniority. This implies that a calculation of the earnings index for 2001, is expected to be undertaken with full stratification in accordance with the ideal earnings index.

Until then the operationalization of the earnings index after 1995 is very similar to the one used in the quarterly national accounts. This means that the earnings index is fundamentally based on generally agreed percentages for pay increases, supplemented by the agreed constituents of the development in wages and salaries excluded from the agreed percentages. This concerns, e.g. changes in working time, expansion of pension schemes, special pay allocations and special terms with respect to overtime and changes in social contributions paid by the employer.

The representativity of the index is the most important difference in quality between the earnings index calculated until 1995 and the index calculated after 1995. As the earnings index until 1995 provides almost complete coverage, the representativity for the development of wages and salaries will naturally be greater within public non-market activites than for an earnings index based on more general elements in the formation of wages and salaries. A more systematic presentation of how the different pay elements are treated in the two different operationalizations, is shown in diagram 1.3.1.

Diagram 1.3.1 **Elements resulting in changes in the earnings deflator**

	National accounts (until 1995)	National accounts (after 1995)
Agreed pay increases	Yes	Yes
Wage-regulating scheme	Yes	Yes
Seniority	Central govern.: Yes Local govern.: No	Central govern.: No Local govern.: No
Changes in agreed working time	Yes	Yes
Changed frequency for part-time	No	No
Reclassification	No	No
Regrouping	No	No
Composition	No	No

1.2.3.3.2 Intermediate consumption

Intermediate consumption by general government is deflated by price indices broken down by industries.

The major part of intermediate consumption by general government takes place in industries that are only engaged in public non-market activities. For industries engaged in both public and private activities, it is assumed to apply to intermediate consumption that the price development in the public constituents of the industry in question is in line with the price development for the industry in question as a whole.

Consequently, implicit price indices for the purchase of goods in the respective industries are calculated on the basis of the balanced and verified commodity balances and the price indices are used in deflating intermediate consumption by general government.

1.2.3.3.3 Consumption of fixed capital

Consumption of fixed capital by the general government is deflated with a price index for total capital formation in the economy, excluding investments in software.

Consequently, the implicit price index for total capital formation is calculated on the basis of the balanced and verified commodity balances and is used in deflating consumption of fixed capital by the general government.

As from the year 1999 the calculations of capital goods will supply the constant price calculations with price indices by industry for the consumption of fixed capital in general government. These indices will by then replace the present summary price index.

1.2.3.3.4 Other taxes less subsidies on production

Other taxes less subsidies on production at constant prices should ideally develop in line with the volume development in the items that are subject to taxation/subsidisation.

Real property taxation/land tax and motor vehicle excise duty are the two most important taxes on production that are levied on the general government.

However, there is no available information that makes it possible at the level of industry to determine the actual development in land ownership and the fleet of cars of the public sector. Against this background, it is assumed, when the deflation of other

taxes less subsidies on production is conducted that possessions of items subject to taxation/subsidisation remain unchanged in each individual industry. In other words, other taxes less subsidies on production broken down by industry are kept constant in relation to the base year.

This assumption naturally requires that adjustments are made in the case of substantial changes in the possession of tax items by general government. This could, e.g. apply to comprehensive sales of land by general government. In such cases, adjustments must be made with regard to the overall assumption, and another measurement of the volume change in the tax-bearing items must be estimated.

Up to now such an alternative estimation has not been conducted in practice.

1.2.3.4 Wholesale and retail trades

For the wholesale and retail trades the production value at constant prices is not calculated by deflating the production values at current prices, but is calculated as the constant price sum of trade margins on the products sold by the industries. A detailed description of the calculation of trade margins in the commodity flow balances is given in section 3.6.

Consequently, the production values at constant prices of the wholesale and retail trades are exclusively calculated from the use side. The supply of trade margins at constant prices is not estimated separately.

1.2.3.5 Other deviations from the general method

Special export price indices

Considerable differences in the development of prices for exports and the domestic market respectively have been recorded for some special commodities. Against this background, the following commodity groups are deflated with special export price indices:

- Processed cheese
- Rapeseeds
- Sausages
- Processed meat products
- Sugar

The export price indices used here are based on unit value indices for exports.
The list is updated as required.

Deflation from the use side

The wholesale price index frequently shows major differences in the price development of Danish produced butter and of imported butter. Imported butter is generally used for inputs in the industry. In the light of this, the commodity flow balance for butter is deflated so that the price index for Danish produced butter is applied to consumption.

1.2.4 Results are checked against other sources

Considerable parts of the deflation process are conducted in a comparatively automated way within the framework of a computerised system. Checklists are continuously run through out this process and before the process continues they are processed manually. Subsequently, manual checks of the results are conducted by comparisons with other statistical sources until the results are considered to be final. The manual checks undertaken are outlined in this section.

1.2.4.1 Automatic adjustment of trade margins as regards consumption

The structure of the constant price calculation system implies that at the cell level in the commodity flow balances, the same trade-margin percentages are used as in the

base year. In practice, the trade margin percentages of the previous year are used whereby any manual changes in the trade margin percentages in the intervening years are taken into account.

In the case of changes in the trade-margin percentages at current prices, the implicit price indices at the level of purchasers' prices are influenced. This is generally a desired effect, but it may also lead to results that are unintentional.

A system has been designed, which automatically makes adjustments for changes in the trade margin percentages at current prices, provided that such an adjustment leads to results that come closer to the development in the consumer price index. The underlying idea behind these adjustments is that some of the changes in the trade margin percentages at current prices are due to changes in quality of the services in the wholesale and retail trades, which should be reflected in the constant price value of the trade margin.

A consumption group is considered as a whole by the system. The implicit price index for the consumption group is calculated on the assumption that all trade margin percentages at constant prices were changed for the products in the consumption group, corresponding to half of the change in the current trade margin percentages for the consumption group as a whole.

An example is that the wholesale trade margin at current prices for the consumption group in question increases from 20 to 30 per cent. That is an increase of 50 per cent. In this case the wholesale trade margin at constant prices will be increased by 25 per cent (half of the increase at current prices). If the development in the implicit price index for the consumption group is hereby coming closer to the development in the consumer price index for the consumption group in question, the change in the trade margin at constant prices is implemented.

Three scenarios are calculated:

- only wholesale trade margins are adjusted
- only retail trade margins are adjusted
- both wholesale and retail trade margins are adjusted

The scenario bringing the development in the implicit price index for the consumption group closest to the development in the consumer price index for the consumption group is selected.

When the consumption groups are manually reviewed the automatic adjustment of the trade margins is specifically considered against the background that the consumer price index is a Laspeyres price index, whereas the price indices for deflation are Paasche price indices.

1.2.4.2 Implicit indices for consumer groups vs. corresponding ones from the consumer price index

The rate of growth in the consumer price index aggregated to the consumption groups in national accounts are compared to the implicit price indices for consumption groups in national accounts. If there is a significant deviation, it is considered whether any changes in the deflation should be made.

The reason for the deviation can frequently be ascribed to trade margins, see section 1.2.4.1, or to excise duties. Any changes in trade margin/excise duty percentages at current prices will have an impact on the price index. This may imply that constant price trade margin/excise duty percentages are adjusted to provide a more reliable result. This applies especially where changes have been made to the trade margin/excise duty percentages, as new data on the level of trade margin/excise duty at

current prices have proved to be erroneous. In such cases, it is frequently necessary at constant prices to adjust trade margin/excise duty percentages correspondingly.

The deflation at basic prices is also assessed and changes are made if necessary.

1.2.4.3 Implicit import and export price indices aggregated to SITC vs. unit value indices from the external trade statistics

Unit value indices are calculated for imports and exports broken down by SITC divisions[6] in the external trade statistics. These unit value indices are used for checking the development of the implicit import and export price indices in national accounts.

The unit value index is primarily used for raw material and slightly manufactured goods whereas they are not suitable for, e.g. electronic goods.

1.2.4.4 Implicit industrial indices vs. price indices for manufacturers' turnover

A price index for turnover in the manufacturing industries is calculated as part of the industrial statistics. The wholesale price index is the main source for this calculation.

In conducting checks of the constant price calculation in national accounts, the implicit industrial indices in national accounts are compared to the corresponding ones from the industrial statistics. As the wholesale price index is the primary data source for both statistics, the checks are mainly conducted to reveal any errors in the computerised deflation processes.

1.2.4.5 General "common sense" assessment of the volume development

In addition to the checks above, against other sources, a general review of the main results for each industrial group and each consumption group is also conducted.

The volume and price developments in each industry are reviewed for both production and intermediate consumption. As a main rule, the development of the two aggregates should be more or less similar. If this is not the case, the reason for this is analysed and any errors are corrected.

The consumption groups are reviewed for the purpose of conducting probability checks of the development in the quantities consumed and of the price development. In addition to undertaking a general assessment, comparisons with other data sources are also made, e.g. quantities of heavily taxed goods assessed from tax revenues.

1.3 Chain indices

Chain indices were incorporated into the Danish national accounts in 2001. When an alternative growth measure is introduced it is natural to consider why there is a need for an alternative to the existing measure, and to identify the differences between the two measures.

This section goes into further details with the theoretical qualities of a volume index with fixed weights and a chain index, respectively. The reasons why the two types of indices generate different results as to growth in volumes are also discussed.

The section goes on to give a description of how chain indices are compiled in the Danish national accounts.

---

[6] SITC nomenclature: Standard International Trade Classification, is a UN commodity classification based on the HS nomenclature. The principle of classifying the commodities is the degree of processing.

1.3.1 Why compile an alternative volume index and what are the reasons for differences between the two indices?

What is a chain index?

In a constant price calculation, where the weights of the volume index are similar over the entire period of observation (fixed weights), the constant price values for all years are calculated at prices from the fixed base year. This enables a direct calculation of growth between two arbitrary years. The direct Laspeyres volume index describing growth from period 0 to t is given by:

$$Laspeyres\ volume\ index\ Q^{L}_{0,t} = \frac{\sum q^{t}\ p^{0}}{\sum q^{0}\ p^{0}}$$

An alternative to this volume index is a chain Laspeyres volume index. Each link of the chain is a direct Laspeyres volume index describing period-to-period growth:

$$Link\ of\ the\ chain: Q^{L}_{t-1,t} = \frac{\sum q^{t}\ p^{t-1}}{\sum q_{t-1}\ p_{t-1}}$$

The chain index, which describes growth from period 0 to t, is subsequently defined as the product of a chain of such links:

$$Chain\ Laspeyres\ volume\ index: \overline{Q}^{L}_{0,t} = Q^{L}_{0,1} \times Q^{L}_{1,2} \times ..... \times Q^{L}_{t-1,t} = \prod_{\tau=1}^{\tau=t} Q^{L}_{\tau-1,\tau}$$

Common to all types of chain indices, irrespective of whether they are based on the Laspeyres index formula or any other type of index, is that a binary comparison of two periods 0 and t, which are two or several periods apart, is achieved by multiplying a number of links which are volume indices for the period-to-period growth. The chain index has thus no fixed weighting structure, but multiple weights.

Measurement by chain index of the volume change between two periods, which are more than two periods apart, is thus dependent on all intervening period-to-period growth rates. In other words, the volume index becomes "path-dependent", meaning dependent on the path pursued by the volume changes during the intervening period. This forms a contrast to a direct volume index, which with respect to calculations is only dependent on the two periods that are compared.

Which is the best growth estimate?

On the basis of theoretical considerations alone, an unambiguous reply cannot be made as to whether a chain index or an index with fixed weights generally generates the best estimate of growth. There are advantages and disadvantages associated with both types of index, and dependent on the circumstances it can be shown which of the two growth measures is the most appropriate. However, there is general agreement that the chain index generates the best result for the period-to-period growth.

The idea behind a chain index where the weighting of each individual growth link is frequently switched is to ensure a weigthing structure that is as relevant as possible, and thereby to be able to generate a better result for the period-to-period growth rates and presumably also for the development of the total growth.

One disadvantage of the chain index (i.e. when chaining has taken place) is that additivity is no longer maintained. The problem is discussed in detail in section 1.3.3. To this is added that it is more difficult to interpret precisely the chain index, as the estimated growth is, of course, dependent on the changes in the volume of transactions, but it is also dependent on the changed weighting in the processes of calculating each individual link of the chain index.

Conversely, one advantage of a conventional Laspeyres fixed weights volume index is the ease with which the index is interpreted, as the value of the transaction calculated

at fixed base-year prices. Furthermore, the values at fixed prices are additive, implying that the sum of, e.g. the output of each individual industry, corresponds to total output at fixed prices.

However, the relevance of the fixed weighting structure is diminished over time, which reduces the reliability with respect to data comparisons over long periods of time. The problem is of particular relevance in periods with considerable shifts in the relative prices; and in cases where there are frequent shifts this problem can also have an impact on comparisons over short periods of time.

Whether the conventional Laspeyres volume index with fixed weights or the chain Laspeyres index provide the best description of volume changes over long periods of time depends, to a great extent, on the relative trend in the price development during the period over which the comparison is made. This is illustrated by two numerical examples[7]:

Example 1: The same tendency in the development of prices throughout the period

The substitution will usually in this case tend towards the same development throughout the period, and it therefore becomes gradually more unrealistic to use prices from period 0 as weights.

Data:

	Price for product		Quantities purchased	
	A	B	A	B
Period 0	20	10	0.30	1.40
Period 1	15	10	0.50	1.25
Period 2	10	10	1.00	1.00

Calculation of volume index:

	Laspeyres index with fixed weights	Chain Laspeyres index
Index period 1	112.5	112.5
Index period 2	150	140.6

Using the index with fixed weights the development in quantities tends to be overestimated, as the relatively high prices for product A in period 0 are incorporated into the weights in the calculation. Here, the chain index with shifting weights is to be preferred.

Example 2: The relative prices fluctuate around a constant.

Here, a substitution also takes place, but with varying tendencies, and the ratio between the quantities purchased remains unchanged considered over the entire period.

[7] This example is inspired by 'Indeksteori' by Erik Gørtz and Jørgen Drud Hansen, Odense Universitetsforlag, 1977
.

Data:

	Price for product		Quantities purchased	
	A	B	A	B
Period 0	10	10	1.00	1.00
Period 1	15	10	0.50	1.25
Period 2	5	10	3.00	0.50
Period 3	20	20	0.50	0.50
Period 4	10	10	1.00	1.00

Calculation of volume index:

	Laspeyres index with fixed weights	Chain Laspeyres-index
Index for period 0	100.00	100.00
Index for period 1	87.50	87.50
Index for period 2	175.00	218.75
Index for period 3	50.00	82.03
Index for period 4	100.00	164.06

Conducting direct calculations between period 0 and 4 will, of course, not generate any differences. However, the fluctuations are cumulated by the chain index that does not end up at the same level, as it was first based, despite the circumstance that the final situation is entirely equal to the initial situation. In this special situation, there are obvious advantages of the index with fixed weights, compared to the chain index.

Subsequently, whether chain indices are more or less appropriate as growth measures, compared to indices with fixed weights, depend on the actual movements of relative prices.

In the case of annual national accounts figures, there are no seasonal fluctuations in prices, and the most obvious reason for expecting relative prices to fluctuate around a constant does not apply.

However, there are strong arguments – based on, e.g. the technological development – in favour of expecting relative prices, in practice, to move in the same direction in the long term. The chain index will then provide the most appropriate figures on growth.

When conducting comparisons of the economic situation over two consecutive years, it is obviously more expedient to conduct a comparison of the two years by using information only from the two years under survey, than to add information into the comparison from a base year, which differs from the two years. In the light of this, the year-to-year growth rates of the chain index provide a more representative picture than the year-to-year growth rates from the volume index with a fixed base year.

For these reasons, among others, the use of chain indices for measuring year-to-year volume changes is recommended by the ESA 95. The best possible measurement of volume changes is thus achieved, while the disadvantages are non-additivity and reduction in the direct interpretation of the constant price figures.

1.3.2 Calculation of chain Laspeyres volume index

In the following, a description is given of how the calculation of chain Laspeyres volume indices is conducted in the Danish national accounts.

In practice, calculating a chain volume index involves two sub-processes:

- the calculation of transactions using prices from the previous year
- chaining the year-to-year growth rates of each transaction on the level of value from the base year for compiling chain index values.

1.3.2.1 Calculation in prices from the previous year

The first and most comprehensive element in the process is to calculate the transactions using prices from the previous year.

Methods

Fundamentally there are two methods for calculating transaction values using prices from the previous year:

The first method consists in deflating current price values for the year under survey with price indices having the previous year as base year. The deflation is thus undertaken analogous with the deflation in connection with calculating the traditional Laspeyres volume index with fixed base year, see chapter 1, the only difference is the base year for the price indices used.

Alternatively, the current price values from the previous years can be extrapolated with the volume development from the previous to the present year for the transaction in question.

In theory, the two methods will lead to the same result.

Data

The data on changes from the previous to the present year in prices and volumes, respectively, are derived from the calculations already conducted in connection with compiling the conventional Laspeyres volume index with fixed base year.

It is worthwhile to note that the same development in price and volume is thus achieved for each single transaction in both the calculation at 1995 prices and the calculation using prices from the previous year[8]. The reason why, the result at the aggregated level ultimately differ, is due to differences in the weighting when aggregations of single transactions are undertaken. The differences in the weighting that occur can be explained as follows:

The constant price changes in the national accounts are Laspeyres volume indices having turnover shares in the year of comparison calculated at base-year prices as weights when the volume indices for components in a given aggregate are weighed together. This is analogous to using the base-year prices as weights, when quantities are weighed together, see the formula below.

$$Q_{0,1}{}^{L} = \frac{\sum_{i=1}^{n} p_i^b q_i^1}{\sum_{i=1}^{n} p_i^b q_i^o} = \frac{\sum_{i=1}^{n} p_i^b q_i^o \frac{q_i^1}{q_i^o}}{\sum_{i=1}^{n} p_i^b q_i^o}$$

[8] As a result of balancing the supply and use tables, there are small differences between the changes in prices and quantities for the domestic uses in the calculation using 1995 prices and the calculation using prices from the previous year, respectively.

$$= \sum_{i=1}^{n} \frac{p_i^b q_i^o}{\sum_{i=1}^{n} p_i^b q_i^o} \frac{q_i^1}{q_i^o}$$

where

p_i^b = the price for product i in the base year

q_i^o = quantities of product i in the year of comparison

q_i^1 = quantities of product i in the current year

The last expression in the formula shows that in connection with weighing the volume indices for the components in a given aggregate, the weights are changed if the base year prices are shifted. When looking at the development between two consecutive years, 0 and 1 the year of comparison is year 0. Consequently, when the base year is 1995 the volume indices[9] are weighed with the turnover share in year 0 calculated at 1995 prices, and when the base year is t-1 the volume indices are weighted with the turnover share in year 0 calculated in the prices for year 0.

It can be seen that switching the base year leads to greater changes in the weights of the volume index, and subsequently in the size of the index the greater the development in relative prices has been over the period between the two base years.

Product groups whose price development has been below average will, due to substitution, be given smaller weight when the base year is changed, whereas product groups whose price development has been above average, will be given greater weight.

It should again be noted that through out both calculations the volume development for the single transactions: q_i^1 / q_i^0, is the same only the weights undergo a change.

1.3.2.2 Chaining

When the transactions in t have been calculated using the prices from t-1, growth rates from t-1 to t can be estimated for single transactions as well as for aggregations of these. Subsequently, it is possible to chain the individual year-to-year growth rate thereby compiling a combined chain index, covering an arbitrarily long period of time.

In the Danish national accounts it has been decided – in line with the EU recommendations – to publish the chain index with the value at current prices in 1995 as the reference period on which the growth rates are chained.

As the chained values are no longer additive, see section 1.3.3, it is necessary to chain all series that are to be published separately.

1.3.3 The non-additivity problem

In the context of national accounts analyses it is a useful quality that the basic national accounts identities valid at current prices also apply to volumes. As already mentioned, this quality does not apply to volumes based on chain indices.

This is ultimately based on a choice, as it is impossible to chain separately aggregates and sub-components, thereby achieving the real growth for sub-components as well as aggregates, while at the same time maintaining the accounting relations. This is illustrated by the numerical example below:

---

[9] The volume indices being the relative quantities in year 0 and year 1, q_i^1 / q_i^0.

The aggregate A+B is formed by the products A and B. Over the periods 0 and 1, period 0 is base year and over the periods 1 and 2, period 1 is base year. In other words, the calculation is conducted using prices from the previous year.

Table 1.

Product	Period 0			Period 1			Period 2		
	p_0	q_0	v_0	p_1	q_1	v_1	p_2	q_2	v_2
A	6	5	30	9	12	108	11	15	165
B	4	8	32	10	11	110	14	11	154
A+B	-	-	62	-	-	218	-	-	319

If chain Laspeyres volume indices are calculated on the basis of these figures, we achieve:

Table 2.

	Base year 0		**Base year 1**	
	Period 0	Period 1	Period 1	Period 2
	$p_0 \cdot q_0$	$p_0 \cdot q_1$	$p_1 q_1$	$p_1 q_2$
A	30	72	108	135
B	32	44	110	110
A+B	62	116	218	245
Index (A+B)	100.0	187.1	100.0	112.4
Chained index	100.0	187.1	187.1	210.3

Scaling

When we need a cohesive number of time series from period 0 to period 2, it can be achieved in more than one way. We can either scale indices from periods 1 and 2, based on period 1, down to the level of period 0, or we can scale indices from periods 0 and 1, based on period 0, up to the level of period 1. The two ways of scaling are not methodologically different. Let us take a closer look at the example, where we scale down to the level of period 0 with a constant equal to $\frac{\sum_{i=1}^{I} p_{0i} q_{1i}}{\sum_{i=1}^{I} p_{1i} q_{1i}} = \frac{72+44}{108+110} = \frac{116}{218}$, the following is thus achieved:

Table 3.

Product	Current value		Scaled to price level of period 0	
	$p_0 q_0$	$p_0 q_1$	$p_1 q_1$	$p_1 q_2$
A	30	72	57.5	71.8
B	32	44	58.5	58.5
A+B	62	116	116	130.4
Chained index	100	187.1	187.1	210.3

Let us look further at the outcome of this exercise. When we look at product A it appears that the ratio between the value in period 2 and the value in period 0, is equal to 71.8/30=2.4. According to table 1 the actual volume change is 15/5 = 3. Conse-

quently, the underlying volume movement is not represented in this way. However, the constant price values are additive.

Consequently, there are problems associated with maintaining volume movements in the sub-components when a method of scaling is used here.

Chaining sub-elements and aggregates

Let us instead chain each individual sub-element and aggregate.

Tabel 4.

Product	p_0q_0	p_0q_1	p_0q_2 (chained)
A	30	72	$\frac{15}{5}\cdot 30 = 90$
B	32	44	$\frac{11}{8}\cdot 32 = 44$
A+B	62	116	130.4
Chained index	100	187.1	210.3

Consequently, A, B and A+B have been chained separately, implying that the values of A and B do not sum up to the value of the aggregate A+B.

Chaining each individual sub-component and aggregate separately, the right volume movements are maintained in the chained indices of the sub-components, whereas the values at constant prices are no longer additive.

The problem actually consists in an old rule of arithmetic, which interferes with the achievement of an ideal result. The problem is that the same result is not achieved, when figures are divided first and then added up, as when figures are first added up and then divided.

As the purpose of calculating volume indices is to provide a reasonable growth measure at all levels, it is generally recommended to give way to additivity. This is recommended by the SNA93[10] as well as the ESA95.

1.3.4 Summing up the Danish practice

In the Danish national accounts chained volume indices are calculated from a basis of supply and use tables in the prices of the previous year having a level of detail similar to the one in the calculation of traditional fixed weight Laspeyres indices, see section 1.2 above.

Chaining is done on each individual sub-component and aggregate separately having 1995 as the reference year. In this way the correct developments in volumes is maintained but as a consequence we give way to additivity.

When publishing chain indices in the Danish national accounts the non-additive indices are published directly.

Chained volume indices are published only electronically as an alternative to the official Danish volume measure at present being the fixed weight Laspeyres indices. It has not yet been decided when the fixed weight Laspeyres indices will be replaced by the chained volume indices, as the official volume measure.

[10] "System of National Accounts 1993", Commission of the European Communities, IMF, OECD, UN and World Bank, 1993.

1.4 Publication

National accounts figures in constant prices are almost exclusively published in the form of volume data. In some of the summary tables the volume data are supplemented by growth rates.

Data is published at different levels of detail and on various media, i.e. on paper, electronically, etc. Below, an outline is given of where constant price figures for a given year are available.

1.4.1 Figures at constant 1995 prices

First publication
Following a normal rhythm of production, the process of deflation is concluded some 34 months after the end of the year. Subsequently, the constant price figures appear in the series *Statistiske Efterretninger* (Statistical News): *National Accounts and Balance of Payments*, National Accounts December version. Figures at constant 1995 prices are accessible from the following tables in the December version:

Table 1	Goods and services
Table 2	Production, generation of income, etc.
Table 4	Real gross national disposable income, etc.
Table 8	Output by kind of activity
Table 9	Gross value added by kind of activity
Table 14	Private consumption expenditure by purpose and duration
Table 15	Capital information by type of goods

Other publications

Statbank Denmark

Simultaneously with publishing the December version the completely detailed figures at constant 1995 prices are accessible from the database *Statbank Denmark*, which contains constant price data for the period from 1966 onwards.

Statistical Yearbook

Data at constant 1995 prices appear in the *Statistical Yearbook:* Demand and supply, gross value added by kind of activity, private consumption expenditure and gross capital formation. Figures are published at a summary level of detail.

Statistical Ten-Year Review

Constant price data appear in the *Statistical Ten-Year Review*: Demand and supply, goods and services account, production and gross value added by kind of activity, private consumption by purpose and duration, public-sector consumption and capital formation. The figures are again published at a level of detail lower than the level in Statbank Denmark.

Annual publication

In the *Annual publication: National Accounts,* the scope of publication of figures at constant prices is similar to that which appears in the December version, but with a complete level of detail.

1.4.2 Chain indices

Simultaneously with the publication of the National Accounts December version, chain indices with reference year 1995 are accessible from Statbank Denmark. At present, chain indices are not published on paper, they are only available electronically.

The chain indices in Statbank Denmark are available under: 14. National Accounts and Balance of Payments; Annually National Accounts, ESA 95. Chain indices are available for the following accounts:

- Full sequence of accounts by account and price unit
- Capital formation by type and price unit
- Private consumption by classification of individual consumption and price unit
- Production, etc. by kind of activity and price unit

2 General information on main sources used

In this chapter we look into the price data sources from which deflators are taken for conducting calculations of constant price data. In this connection is also focused on the way, in which corrections for changes in quality is done.

Section 2.1. serve as an overview of the most frequently used methods for treating quality changes in connection with calculating price and quantity indices.
Subsequently, *section 2.2* gives brief descriptions of the most important price data sources used for deflation.

2.1 Handling quality changes in calculating price indices and volume indicators

Generally speaking, a value at constant prices can be calculated in two ways: By deflating the value at current prices with a price index equal to 100 in the base year of the constant price calculations, or by carrying forward the value in the base year with the relevant volume development. In principle, the same result is achieved by the two methods.

However, it is in practice frequently preferable to use price indices, as the representativity of a price index is generally broader than that of a volume indicator. In practice, deflation with price indices is the most frequently used method, but in fact both methods are being used.

2.1.1 Price index

There are two significant problems related to calculating a price index that are relevant when the price indices are used for deflation:

- handling changes in the quality of the products,
- discontinuity in the price observations

Different methods to handle these problems are described below.

2.1.1.1 Quality changes

If the quality of the product for which a price index is to be calculated has changed from one price observation to the next observation there are problems involved in determining the price changes over the period. In such cases, the observed price change will be the result of a change in the quality of the product as well as a change in the price itself.

When only a pure price change is to be reflected in a price index, it is essential to eliminate the part of the price change due to changes in quality when conducting the calculation of the price indices. That part of the price change resulting from a change in the quality, will then instead be reflected in the volume effect when the constant price calculation is conducted.

An alternative formulation of this demand is to determine that it must be (completely) the same product that is being priced in two consecutive periods.

There is a number of methods whose purpose is to solve this problem of quality changes over time. The suitability of the various methods depends on the market conditions for the product in question. A brief outline of the methods will be given below:

For this purpose the following question will be answered in view of the method described:

"Product A in the price index for a given product group disappears from the market and is replaced by product B with a changed quality. How is the price change over time measured?"

Overlapping
Given the situation where the new and the old quality of a product is simultaneously available in the market for a least one period; this period can be called *t*. Let the change in price up to the period *t* be based on product A and after period *t* on product B. It is thus implicitly assumed that the price difference between product A and product B in the period *t* is a measurement of the value of the difference in quality.

Unadjusted price comparisons
The price difference between product A in the period *t-1* and product B in the period *t* is incorporated without any adjustment into the price index. It is thus implicitly assumed that there is no difference in quality between A and B.

Automatic linking
This method is the second extreme in relation to the unadjusted price comparison. The two products are here said to be incomparable and the level of the price index remains unchanged. Consequently, the entire price difference is ascribed to quality changes.

Matched models only
Only products, which are available in the two periods that are compared, are included in calculating the price index. In this way, product A as well as product B will be excluded from the calculation of the price index for the product group in question. It is thus assumed that the price development of the matching models is also similar to that of the non-matching models.

Option prices
It is relevant to use this method when the price difference between product A and B is entirely due to the inclusion of new facilities in B, which were not contained in A. Provided that the consumer's price for the new facilities can be determined separately, the price for B can be reduced with the price for the new facility, thereby achieving comparable prices between A and B.

Production costs
The same relevance applies to that given above in "option prices". Provided that the consumer's price for a new facility cannot be determined, information on the production costs involved in producing the new facility can be obtained from the producer. These costs can be used instead of the consumer's price, see above "option prices".

Judgmental approach
The basis of the quality adjustment is here to ask an expert in the field about an estimate of the value of the difference in quality between A and B, and thus make a corresponding adjustment of the price observation

Hedonic adjustment
The hedonic method is based on a regression analysis investigating which characteristics of various models are the determinants of the price differences between the models. This makes it possible to determine which part of a price difference between two models that can be ascribed to quality changes - and is not to be comprised by the price index - and which part of the price change that is then not due to quality changes, and therefore can be regarded as the pure price change, - which is to be described by the price index.

When using this method it is essential to have knowledge of the qualities of the products, which have an impact on the price formation. These qualities are continuously

changed, and it is therefore imperative that the regression model is continually updated. Similarly, the results are influenced by how the regression is specifically modelled. Furthermore, there are comprehensive data requirements. The method is generally rather resource intensive.

Resampling
The method can also be described as: Continual renewal of the sample.
A new representative sample of the products is priced in each period. The calculation of the price index is based on the products that are included in the sample over two consecutive periods. The price index finally calculated is constructed by chaining period-to-period growth rates. If the sample is frequently renewed and chained, e.g. monthly, preliminary tests show that indices based on this method provide results that are similar to those achieved when hedonic methods are used.

2.1.1.2 Discontinuity in the price observations

The issue here is that the product, for which a price index is to be compiled, is only produced once. This may concern a ship or another major unique product. A ship, which is completely identical to the one produced in a given period will probably never be produced again. Next time a somewhat similar ship is produced it will probably differ substantially, and there may be several periods in which a ship of a similar type is not being produced at all. In cases like this, how is a price index calculated for use in the periods when a ship is actually being produced?

In this context, two methods can be mentioned: Model prices and Specification prices.

Model prices
A unique product is frequently only unique in its entirety. If the product is divided into constituents, these are frequently not so unique. In the light of this, the method used here implies that – in the case of a ship – the shipbuilding yards are asked to assist in putting together a "model ship" containing the most representative constituents of a ship. Subsequently, data on fictitious market prices for the "model ship" are collected. These prices are then used for calculating a more general price index for ships.

In obtaining high-quality model prices it is essential that the model is representative, both over time and with respect to geography. Furthermore, it must be ensured that the stated prices reflect the actual output prices. This means that, e.g. discounts and profit margins are also taken into account.

Specification prices
This method also implies that the unique products are divided into their constituents. Subsequently, the constituents are priced in the different periods. The prices are actual output prices for the constituents.

It is crucial that when the constituents are selected the unique quality-bearing elements of the products are taken into account. Calculating price indices for the actual unique product is conducted by weighting the indices for the constituents, which correspond to the composition of the constituents in the specific product for which a price index is requested.

2.1.2 Volume indicators

Similar to the way in which a price index is compiled, calculations of a volume indicator must also take into account that the product's quality changes over time. In this way, it is ensured that changes in the product's quality are reflected in a change in the volume element and not in the price element when constant price calculations are conducted.

2.1.2.1 Quality changes

In practice, it can be difficult to handle quality adjustments of volume indicators. First, an observable and measurable quality indicator must be identified. For example, if the number of houses sold is used as a volume indicator for trends in the constant price value of the production of services by estate agents, how is one to adjust for a quality change, showing itself in the form of houses being sold at a faster pace and at a higher price? If a measurable indicator, which is considered appropriate, is identified, how is the indicator subsequently quantified? If the average number of days used to get a house sold goes down from 100 to 50 days, is the quality then twice as high or what?

It is obvious that in undertaking this type of quality adjustment, there is a risk of making a number of subjective choices, which may be inappropriate.

One possible solution – at least theoretical – is to adjust the implicit price of the product, which is calculated by comparing turnover data and volume data.

2.2 Most important data sources

The data sources are gone through in order of importance to the constant price calculations. The detailed classifications of the price indices are outlined in annex B.

2.2.1 Wholesale price index

The wholesale price index is the primary supplier of price indices for deflating national accounts.

The purpose of the wholesale price index is to analyse trends in prices related to the first commercial transaction of each commodity in Denmark. This is in practice operationalized by analysing trends in producers' and importers' actual selling prices. However, data on importers' purchase prices are collected if the goods are used directly as raw materials in the importer's production. The price concept of the wholesale price index excludes taxes less subsidies on products and VAT, but includes any customs duties.

As a matter of fact, the wholesale price index consists of two price series: A *producer price index* showing the trends in prices for Danish manufactured goods and an *import price index* showing the trends in prices for imported goods.

As price representatives for a 6-digit HS commodity group were selected, all goods for which a turnover of more than DKK 40 Mio. was recorded in the base year (1990). Price data are collected for these so-called representative goods. The trends in prices for these representative goods are assumed to be representative of the entire HS commodity group.

For the time being the wholesale price index covers 853 import price series and 827 price series for Danish produced goods.

A few HS divisions are excluded from the wholesale price index. The most important ones are fur, rolling railway stock, aircraft, ships and arms.

Wholesale price indices as these are being used in national accounts are elementary price indices having 1990 as base year.

The preferred method to handle changes in quality in the wholesale price index is the overlapping method. In the cases, where no overlap exists, automatic linking is applied, see 2.1.1.1.

2.2.2 Consumer price index and net price index

The consumer price index and net price index show the trend in the actual prices charged to consumers for goods and services bought by private households in Denmark.

Approximately 25,000 prices are collected from some 1,800 respondents every month. This forms the basis for calculating price indices for about 500 different goods classified in accordance with the commodity divisions in COICOP[11].

The collection of data for the consumer price index and net price index is conducted jointly. The price concept used is the only difference between the two price series. The price concept of the consumer price index is consumer prices or purchasers' prices, i.e. inclusive of trade margins, taxes less subsidies on products and VAT, whereas the price concept of the net price index is consumer prices, exclusive of taxes less subsidies on products and VAT, but still inclusive of trade margins.

Trade margins are not relevant to services, implying that as far as services are concerned the net price index is really a consumer price index adjusted to the level of basic prices. The prices of goods usually also contain elements of wholesale and retail trade margins. Against this background, it must be assumed that similar conditions do not generally apply to the net price index for goods.

When it comes to corrections for changes in quality several approaches to this problem are being used.

When there is an overlap in models the overlapping method is used for quality correction. In most cases however it is assessed that the average price development of the other products in the product group in question are representative of the price development of the product with the new quality. This is tantamount to linking the product into the calculation in a way so that the inclusion of the product does not affect the price index for the product group – the matched models only' method, see 2.1.1.1. For products with rapid changes in quality, e.g. electronic equipment, the resampling method is used.

New products are linked into the calculation in such a way that the inclusion of the new product does not in itself affect the price index.

2.2.3 Price indices for agricultural sales

The price indices for the sales of products by agriculture show the trend in prices for both crop products and animal products.

The price concept for the indices is prices ex farm, exclusive of VAT. The price indices are calculated on the basis of definitions set out by the EU.

The indices are Lapeyres indices having 1995 as the base year.

The calculation of the indices is done on the basis of a representative number of prices for the product in question.

The calculations are normally done at such a disaggregated level that the problem of corrections for quality changes does not often occur. No specific correction for quality changes is done.

---

[11] COICOP is an international classification of consumption expenditure for households.

2.2.4 Unit value indices

Unit value indices can be calculated for manufacturer's sales of commodities as well as for imports and exports.

The detailed statistics on manufacturers' sales of commodities and external trade statistics form the basis of calculating the unit values by dividing values sold by the quantity, e.g. number of tons. Consequently, changes in the price of a commodity as well as changes in the composition of a commodity group result in a change of the unit value. The degree of homogeneity of a commodity group influences how well the unit value serves as an estimate of the price of the commodity. Unit value indices are usually calculated at the level of detail corresponding to the 8-digit CN-nomenclature.[12] For the same reason the unit value index should only be used in deflating raw materials or related commodity groups, whose composition is very similar and the degree of fabrication is low.

For goods that have been processed to a greater degree, the unit value index is considered unsuitable for reflecting the trends in prices.

2.2.5 Earnings index

Indices of earnings indicate the trends in prices for a central input in the production process, namely labour. Consequently, the earnings index is an input price index.

The earnings indices are used for deflating some services and serve as inputs into calculating deflators for compensation of employees in general government.

Earnings indices for the private sector is based on data reported to Statistics Denmark via sample surveys of employees in business enterprises in the private sector, whereas a full-scale survey of the public sector is conducted.

The concept of earnings is total earnings, including contributions to pension schemes paid by employees and employers. Average earnings are calculated on the basis of information on the total number of hours performed. This means that changes in quality of the labour force end up in the earnings indices.

The indices are available broken down by 26 industries.

[12] CN is EU's common classification of commodities – the Combined Nomenclature. At the 6-digit level it corresponds to the HS-nomenclature.

3 Methodologies by product

While chapter 1 gave a description of the general approach to constant price calculations in the Danish nation accounts, the present chapter gives an outline of the specific choice of deflator for each product.

The description of how each product is deflated is organised around the products nomenclature, CPA[13].

For each product group, attention is first focussed on the characteristics of the products that are of relevance to deflation. Subsequently, a description is given of how the actual deflation is undertaken. Finally, the applied methods of deflation are assessed against the background of the recommendations for deflating the different products in EU's handbook on constant price calculations "Handbook on price and volume measures in national accounts", Eurostat, 2001[14].

In accordance with the Commission Decision of 30 November 1998[15], the handbook classifies the methods into three categories:

A. Most appropriate methods
B. Methods which can be used in case an A method cannot be applied
C. Methods which shall not be used

3.1 CPA A and B - Products of agriculture, hunting and forestry; fish and other fishing products

Products of agriculture and fishing are frequently characterised by distinct seasonal price fluctuations and corresponding distinct variations in the quantities sold. This complicates the measurements of year-to-year trends in prices that are of relevance when the annual national accounts are deflated.

An example of a very seasonal product in Denmark is strawberries. The majority of strawberries consumed in Denmark are sold over the months June and July. A simple average of prices for strawberries over the entire year will thus result in a distorted view of the price for strawberries actually sold over the year in question. Instead, the average price for the year is to be calculated, thus ensuring that the prices in the months June and July are given sufficient weight in the calculation.

Another typical characteristic of agricultural and fishing products is the complex nature of general subsidies and subsidies on products. The frequent presence of subsidies imply, that it is particularly important to isolate the basic price when prices for these products are determined.

Factors similar to those mentioned above do not apply to forestry. This means that calculating a price index for forestry products is generally less complicated.

In the field of agriculture and fishing the data availability is generally very high. One reason for this is that the EU places heavy demands on the reporting of data for both price statistics and other statistics in this field.

---

[13] CPA 1996: Statistical Classification of Products by Activity in the European Economic Community, Eurostat, 1998.

[14] From now onwards named 'the handbook'.

[15] Commission Decision 98/715EEC, Official Journal of the European Communities L 340, p. 33.

How is deflation undertaken?
To achieve a more precise indication of trends in the annual average price, it is frequently decided to use unit value indices when agricultural and fishing products are deflated.

One advantage of the unit value indices is that the correct weight is automatically linked to the large turnover shares when average trends in prices are calculated. However, one precondition of good unit value indices is that there is a homogeneous definition of the product group for which the calculation is undertaken, as both price changes and changes in the composition of the product group in question will be reflected in the unit value index.

Agricultural products

Three types of indices are generally used for the Danish production of *crop products*: The highly seasonal products are deflated using unit value indices, which are calculated on the basis of the statistics on agriculture; other products are either deflated with relevant wholesale price indices or net price indices. The same pattern applies to imported goods. In the case of imports, the unit value indices are typically calculated on the basis of the external trade statistics, and if the wholesale price index is applied, it is typically import price index series that are being used.

Unit value indices calculated on the basis of statistics on agricultural products sold are widely used in deflating *animal products*. With respect to the major animal product groups, only eggs and honey are instead deflated with net price indices. The wholesale price index is used for some of the minor product groups, e.g. wool, beeswax and fur of rabbits. The same price indices are used when the domestic production and imports are deflated on the assumption of a competitive market, ensuring homogeneous price trends for Danish produced and imported goods.

Services of agricultural machine pools are deflated with an output price index calculated by the Danish Research Institute of Food Economics.

Forestry, etc.

Forestry products are almost exclusively deflated with wholesale price indices. The only major exception is timber of beech, where a price index from the statistics on agriculture is used. The same indices are again used for Danish production and imports.

Landscape gardeners are either engaged in market or non-market activities. The non-market activities are deflated from the input side as described in section 1.2.3.3. When the market activities are deflated the relevant net price index is applied.

Fish and fishing products

Unit value indices calculated on the basis of data reported by the Danish Ministry of Food, Agriculture and Fisheries are used for all major product groups. Deflation with wholesale price indices is only undertaken for minor product groups, such as mussels, eels, and pearls. The same indices are again used for Danish production and imports.

Classification into A-, B- and C-methods
An A-method recommended by the handbook is the use of data from the agricultural economic accounts, suitably adjusted for the minor methodological differences with national accounts. This implies that the predominant use of unit value indices from the statistics on agriculture and fishing, and to a smaller extent wholesale price indices qualify to A-methods.

3.2 CPA C - Products from mining and quarrying

Products from mining and quarrying are extracted from the underground in their finite form. There is no processing, but the products occur naturally as solids in different qualities. The Danish production of these products encompasses mainly, on the one hand, oil and natural gas and, on the other hand, products such as salt, sand,

gravel, lime and chalk. Some raw materials are also imported, e.g. metals, energy products and gravel.

A typical characteristic of the products is that they are not affected by seasonal fluctuations and are not, to any large extent, subject to quality changes over time. Consequently, it is a comparatively easy task to calculate the price indices for these products.

How is deflation undertaken?
Deflators for these products are predominantly extracted from the wholesale price index and from both the import price index series and the producer price index series. Energy products are an important exception to this main rule. As mentioned in section 1.2.3.1, the constant price values for these products are calculated on the basis of volume data.

Classification into A-, B- and C-methods
The A-methods recommended by the handbook are: Use of volume data, where these are collected in detail; deflation with appropriated producer price indices and use of unit value indices.

The methods used thus qualify for A-methods.

3.3 CPA D - Manufactured products

This section of products is very comprehensive and diverse, from nails to fashion clothes, computers to aeroplanes.

Special problems are related to two groups of products in determining a price index. Consequently, it has been deemed necessary to treat these products in a special manner. The first group is large equipment, e.g. ships and aeroplanes, which are only manufactured or imported occasionally, and where the quality differs widely from product item to product item. Against this background, it is difficult to calculate directly an actual price index. The second group concerns computers and related services, where the rapid quality changes imply that a normal comparison of prices between two years is not meaningful. These two groups are treated separately in sections 3.3.2 and 3.3.3.

3.3.1 Manufactured products

As already mentioned, this section on manufactured products includes a wide range of craftmen's products and manufactured products. It is a common feature of these products that great attention has historically been paid to this type of commodities, and in the light of this detailed classifications of the products have been undertaken. In Denmark, these product classifications have been reflected in the collection of producer and import price indices. Consequently, a well-established price basis for this product area is available.

For some products there are rapid changes in the quality, and the need to develop methods for quality adjustments is thus urgent. This applies especially to electrical products, such as e.g. mobile phones, but also to fashion goods, e.g. clothes. Dealing with this problem is essential when price indices for such products are calculated.

How is deflation undetaken?

The general deflators

The wholesale price index constitutes the predominant deflator source for manufactured products. The producer price index series for the Danish production, and the import price index series for imports.

It has been decided to use other deflators only in instances where the wholesale price index does not exist or has proved to have, e.g. an inexpedient weighting, compared to the delimitation in national accounts.

Commonly used alternative deflators are: The net price index, unit value index from external trade, unit value index from the statistics on manufacturers sales of commodities, international price quotations, e.g. for gold, price information from, e.g. the statistics on agriculture and fishing.

As mentioned in section 1.2.3.1 the constant price values for processed energy products are estimated from volume data.

Books ex publishers and publishing of daily newspapers, weekly and monthly magazines

The constant price value for books ex publishers is estimated on the basis of volume indicators for total book sales. With respect to the publishing of daily newspapers, weekly and monthly magazines where the activity is classified to on the one hand revenues from sales to non-subscribers/subscribers and on the other hand advertising revenues, the advertising revenues are deflated with an index for the price per column millimetre, while revenues from direct sales of magazines are deflated with the net price index for newspapers.

Contract work, Repair and installation work and Machinery and equipment, plants for own use

Finally, there are three product groups that must be separately mentioned. These are: Contract work, Repair and installation work and Machinery and equipment, plants for own use. For these three product groups the character of the finished product is unknown, only the way in which the product was manufactured is known.

Contract work in a given industry is deflated with the earnings index for the entire industry. Repair and installation work in a given industry is deflated with a combined index, where the earnings index accounts for 50 pct. and selected wholesale price indices account for the remaining 50 pct. Machinery and equipment, plants for own use, are deflated with a combined index, where the earnings index for the industry accounts for 25 pct. and selected wholesale price indices account for the remaining 75 pct.

Classification into A-, B- and C-methods
A-methods in the handbook are:

- the use of sufficiently disaggregated producer price indices representative of the product in question
- volume indicator where the product is sufficiently homogeneous and the volume indicator is fully representative

B methods constitute the use of detailed consumer price indices adjusted to basic prices corresponding to net price indices and the use of producer price indices, where there is incomplete product coverage.

The majority of the methods used are thus considered A-methods and the remaining methods are considered B-methods.

3.3.2 Large equipment

The group considered here covers major product items, such as ships, aircraft, oilrigs and machinery for special purposes (e.g. paper machinery).

A characteristic feature of such products is that only one specimen is produced, alternatively a series of uniform items which are successively delivered over a few number of years. When the order has been completed, there is an interruption and after a number of years a new order is placed. This time the product is available in a brand-new version that is difficult to compare with the previous order. New techniques and materials are applied in the process of production, and another generation of tech-

niques takes over, e.g. the Danish State Railway's change from trains driven by locomotive engines to self-propelled units (IC3 trains).

Second-hand ships and aeroplanes make up a considerable part of the import and export values. Trade in ships between two subsidiary companies located in two different countries, but owned by the same shipping company, is a special phenomenon. In such instances, the price reported, will not necessarily be the market price in force, but an internal price fixed by the shipping company. Additionally, it should be mentioned that change of flag without change of ownership is not included in the Danish external trade statistics.

How is deflation undertaken?

Ships, oil rigs and aircraft

Due to the modest Danish production of ships, it is impossible to obtain an adequate population from which a price index can be calculated.

The market for trade in ships is very international and most ships in the world are produced by shipbuilding yards in the Far East. The price trends in the world market are essentially determined by these shipbuilding yards. Against this background, price indices of shipbuilding yards in the Far East published in the magazine "Lloyds Shipping Economics" are used in deflating production as well as imports of ships.

These price indices are also used for oilrigs.

Aeroplanes are not produced in Denmark. Imports of aeroplanes are deflated with the American producer price index for "Complete civilian aircraft". The index is accessed from the web site of the Bureau of Labour Statistics.

The indices for both ships and aeroplanes are adjusted for changes in the exchange rate of the US dollars against DKK, and the indices are used for new as well as second-hand ships and aeroplanes. There is – by the way – no distinction between new and second-hand ships and aeroplanes in the present goods nomenclature.

Rolling stock

Output price indices for railway rolling stock in Denmark are not estimated. It has therefore been decided to apply the wholesale price index for lorries over 20 tons in deflating the production and imports of these products.

Special-purpose machinery

In the case of special-purpose machinery appearing only in one single year, followed by an interruption of a number of years in which no production takes place, it is a general rule to use a wholesale price index for machinery in a related industry.

Classification into A-, B- and C-methods

Model pricing and specification prices are recommended as A-methods in the handbook.

Use of international prices can be a B-method if there is a competitive market and a suitable adjustment of exchange rate movements.

Except for the deflation of rolling stock the methods used are thus B-methods.

3.3.3 Computers

As with other products, computers and related equipment are considered manufactured products. In the present context, there are after all some special problems associated with these products, i.e. the problem of taking into account quality changes over time is imperative in calculating a price index for these products. The rapid technological changes imply that if quality changes are not taken into account when data are collected for the price index, the results obtained will be misleading when the price indices are used for estimating the activity at constant prices.

There are various methods that can be applied when price indices are to be adjusted for changes in the underlying quality of the product, see section 2.1.1.1. The hedonic approaches are predominant with respect to computers and related equipment. As the hedonic approaches are immensely data and resource-intensive, it is a relatively complex matter to produce hedonic price indices, and for this reason indices of this type are not compiled in Denmark. However, production of such indices at the European level is already in the pipeline, and all EU Member States can thus benefit from the resource-intensive efforts. In lieu of using directly the overall price index for a complete computer, there is also the possibility of using the estimated prices of computer characteristics, and to use these to make explicit quality adjustments to price data collected domestically.

The supply of computers, etc. to the Danish market takes place primarily via imports.

How is deflation undertaken?
Four different US hedonic price indices for computers and computer accessories are applied in deflating these products. The indices are adjusted for exchange rate movements of the US dollars against DKK.
There are two prerequisites for the reasonability of this choice:

- that the market for computers and related equipment is internationally highly competitive, and in view of this that the price formation can be considered to be a joint characteristic of the entire market
- that the settling price on the international market is in US dollars, and consequently the relevant exchange rate to adjust for is the rate for US dollars.

Imports and Danish production are deflated with the same price index.

When it comes to trade margins for computers the general method of applying the trade margin percentages in the base year to the value at constant prices, effectively means that the same quality improvements are assumed to apply to the services provided by wholesale and retail traders as the quality improvements applying to the hardware. This does not seem plausible. For that reason trade margins for computers and accessories to computers are calculated by deflating trade margins at current prices with an earnings index for business services.

Classification into A-, B- and C-methods
The handbook recommends as an A-method a quality adjusted output price index. The quality adjustment method may, e.g. be a hedonic approach.

As a B-method the handbook mentions using information from the US hedonic price index, provided it can be shown that it is sufficiently representative for the domestic prices. An appropriate mechanism for taken into account general exchange rate changes should be constructed. The method used is thus considered a B-method.

All methods that do not take account of quality changes over time are considered C-methods.

The method actually applied is thus a B-method.

3.4 CPA E – Electrical energy, gas, steam and hot water

The major products in this section are electricity, district heating and water. Production/extraction as well as distribution of these products are at the moment combined in a single product. This is due to a business structure where the two activities are integrated in the same company. The production of the utility companies embraces total revenues from sales and distribution. No internal supplies between the production unit and the distribution unit are recorded. The revenues from distribution are

thus tantamount to a distribution margin, or in other words there is a net recording taking place.

It is characteristic of theses products that they are relatively homogeneous, so that quantity data can be used directly in measuring constant price output. Another advantage is that the market for these products is generally concentrated with a few utility companies, implying that data collection is relatively straightforward.

It should be noted that price discrimination is widespread within these markets. This is one of the reasons why a product supplied for various uses is considered to be different products in the context of national accounts.

To this is added quantity discounts, etc.

How is deflation undertaken?
As described in detail in section 1.2.3.1, the constant price values for electricity and district heating are, like other energy products, estimated on the basis of volume data.

The constant price values for water are also calculated on the basis of a volume indicator of water distributed.

Classification into A-, B- and C-methods
Deflating the output of these products by the use of a volume indicator approach is classified an A-method.

The use of a volume indicator approach in deflating the distribution of the products, when a net recording of distributions margins takes places, is in the handbook classified as a B-method.

The actual method used in which a combined deflation of production and distribution is undertaken on the basis of volume data, is thus at least a B-method.

3.5 CPA F – Construction work

This CPA section covers a wide range of products: residential buildings, industrial and commercial buildings, non-civil construction, civil and non-civil engineering projects and repair/maintenance of buildings and existing structures.

The construction output covers new buildings and major improvements of existing buildings. The product groups also covers work performed by craftsmen as own production .Construction work is performed by private as well as public contractors.

There is a broad mix of construction work, from minor repair work to civil engineering projects, involving the construction of bridges and roads.

It is characteristic of the industry that every building project can be considered unique when all characteristics of the work – e.g. location – are taken into account. As is well known, this makes it difficult to compare prices over time.

Output price indices for construction work are not compiled in Denmark, but a wide range of indices monitoring construction costs are collected.

How is deflation undertaken?
Broadly speaking two different types of deflators are applied:

For the construction of new residential buildings and major repair work and private construction of industrial and commercial buildings, volume indicators are used for

activity cubic metres constructed, which are stratified by type of building and main geographic region. It is thus implicitly assumed that there are no quality changes of cubic metres over time.

The implicit price index for residential buildings thus derived is used in deflating non-civil construction work for capital formation and in deflating the new building projects of the non-civil construction work for government consumption.

The remaining construction products are deflated with relevant cost indices.

Classification into A-, B- and C-methods
The use of actual quality-adjusted output price indices and model pricing is classified as A- methods by the handbook. Use of hedonic indices is classified as a B- method.

Applying pure cost indices classified as a C-method in line with the use of volume indicators.
The approaches presently applied can thus be found among the C-methods.

3.6 CPA G - Wholesale and retail trade services; repair services of motor vehicles, motorcycles and personal and household goods

The products in this section fall into two groups. The first group covers services related to wholesale and retail trade. These services have in common that earnings are achieved in the form of a trade margin arising when selling goods that are purchased with the purpose of being resold. The other product group, which is smaller, consists of repair services and maintenance of household consumer durables.

Trade margins at current prices are defined as the difference between the actual or imputed price realised on a product purchased for resale and the price that would have to be paid by the distributor to replace the product at the time it is sold or otherwise disposed of.[16] The next issue is how to measure trade margins at constant prices? Broadly speaking, wholesale and retail services can be said to make goods available at a place and at a time that is convenient to the purchaser. That is, elements such as the supply of goods, shop hours, parking facilities, quality of personal service of customers, etc. have an impact on the service that is offered. In other words, ideally to determining the volume of wholesale and retail services it is necessary that all the above-mentioned elements can be measured and that the quality of services can be defined and quantified. At the moment, there is to my knowledge, no country in which a measurement of this type is conducted.

Method 1 The ESA95 states that one approach to constant price calculation of trade margins is to base the calculation on current prices and to deflate the goods purchased separately and the goods sold separately. Estimates of trade margins at constant prices can therefore be made by difference, by subtracting the constant price value of goods bought for resale from the constant price value of goods resold.[17]

Method 2 The other method recommended by ESA95 is to undertake the valuation at constant prices by extrapolating the trade margins of the base year with the trends in either the volume sold or the volume purchased by the wholesale and retail trades. When using the alternative method, it has to be taken into account in order to achieve correct results that there are variations in the trade margins amongst the products and their uses. This problem is explicitly acknowledged in the supply and use tables.[18]

---

[16] ESA95 , 3.60

[17] A more detailed description of this method is given in Eurostat' s handbook on price and volume measures in national accounts.

[18] ESA95, 10.38

Repair work and maintenance of household consumer durables do not involve any major conceptual problems. There is a wide range of net price indices in this area. Repair work of motor vehicles is also covered by net price indices for the part involving households.

How is deflation undertaken?

Trade margins

In deflating trade margins method 2 is used in the Danish national accounts, as we apply the trade margin percentages from the base year on the basic price values at constant prices. This is tantamount to extrapolating each individual wholesale and retail trade margin in the base year with trends in the volume of goods purchased measured at basic prices. This appears from the calculation below, where BP is the basic price value, EA is the wholesale profit margin.

Calculation of trade margins

Year	Basic price	Wholesale margins at 1995 prices
1995 (basic)	BP	EA
1996	BP_{F96}	$EA * (BP_{F96} / BP) = (EA / BP) * BP_{F96}$

In terms of interpretation, what is calculated when the constant price value of a product is determined; is the price of the product in question if it had been purchased for the given purpose in the base year and if it had had the same quality as in the present year. The quality of a good is dependent on both the quality contained in the physical good and the quality linked to the service received in connection with trade of the product in question.

If the trade margin percentage from the base year is applied we estimate which margin – would have been linked to a service of the same quality as in the base year – if the good in the base year had been sold at that time.

Using the trade margin percentage from the base year will thus lead to the correct result, provided that the quality of the service offered by the wholesale and retail trade does not change over time. If there is a quality change, it will have to be reflected in a change in the trade margin percentage at constant prices.

An example of a quality change in the wholesale and retail services:

Trade in CD players is to a great extent transferred from the general retail shops to discount stores.

In physical terms the goods remain unchanged as regards to quality, but the quality of the service offered when the goods are traded, has decreased. This is to be reflected in a fall in the retail trade margin percentage for the goods in question calculated at constant prices.

When large differences in the trade margin percentage at current prices are observed, compared to the base year, it results in an assessment of:

1. whether larger/smaller trade margins on the goods in question, compared to the base year, are obtained by the industry due to the competitive structure
2. whether there have been any radical changes in the quality of the service provided by the wholesale and retail trade.

Re. 1. In this case the price of the service provided by the wholesale and retail trade has changed, and is not to be reflected in the constant prices. Against this background, we continue applying trade margin percentages from the base year.

Re. 2. In this situation it has been decided to – possibly only partly - follow current prices, which implies that we either use the trade margin percentage at current prices, based on the assumption that the entire change in the trade margin percentage between the present year and the base year is attributable to quality changes, or we let the trade margin percentage at constant price develop in the same direction as that of the trade margin percentage at current prices, but not fully, see section 1.2.4.1. The new trade margin percentage is maintained in the constant price calculations that are conducted over the forthcoming years.

The use of the so-called Canadian method, see section 1.2.4.1, where trends in the implicit price indices for a consumption group is tested in comparison with trends in the consumer price index, can be considered a test of the assumption that the volume of services in the wholesale and retail trade remains constant.

One advantage of estimating wholesale and retail trade margins by multiplying a fixed trade margin percentage from the base year with the basic price, is that the interpretation of the implicit price index – based on the price, including trade margins – can be maintained as being a Paasche price index.

Exceptions

There are a few exceptions from the general method, as some goods are characterised by the fact that it is meaningless to assume that there is a fixed ratio between the basic price and the trade margins. This is true for, e.g. scrap and second-hand consumer durables. In these instances, it has been decided to deflate trade margins with the index for the basic price, or the equivalent to this, to apply trade margin percentage at current prices to the basic prices at constant prices.

Repair work and maintenance of household durables and motor vehicles

Deflation is here generally undertaken with relevant net price indices.

Classification into A-, B- and C-methods
Assuming that the volume of margins follows the volume of sales applied within a supply and use framework, is classified a B-method by the handbook.

Using net price indices in undertaken the deflation of repair work and maintenance of household durables is considered A-methods by the handbook. For motor vehicles it is a B-method.

3.7 CPA H - Hotels and restaurant services

This CPA section covers restaurants, hotels, canteens and public houses. The section also covers work canteen subsidies, sub-declaration of restaurants and tips.

The coverage in the section is very broad, from five star hotels, youth hostels, Michelin-rated restaurants to pizza bars. Consequently, the price level and composition of customers are extremely differentiated.

Price discrimination is widespread, the most common examples being considerable discounts granted to groups of tourists and to business people frequently staying in the same hotels. Discounts and special offers, must be assumed to be made available across different groups.

The net price index provides appropriate coverage of the area, but the index does not specifically include services to the business community.

With respect to prices there is one product in the group that can be distinguished, namely canteen subsidies, whose value is approximately twice the value for canteens. The total payment for canteens comprises the part that is paid by the customers and the part paid by the employers in the form of grants to canteens operated by compa-

nies. For the purpose of deflation, the two products should be considered in overall terms, to ensure a correct breakdown between grants and direct payments. In line with this, the deflator to be applied should not be affected by changes in the percentage of subsidies.

How is deflation undertaken?
With respect to hotel and restaurant services relevant net price indices is used for both "bed nights" in accommodation and "meals served" in restaurants.

It has also been decided to use a net price index to deflate: sub-declaration, canteens and canteen subsidies. With regard to canteens and canteen subsidies, the net price index for restaurants, takeaways, etc. is used for both products. This index is not affected by changes in subsidy percentages.

Classification into A-, B- and C-methods
The handbook recommends as A-method to undertake deflation with the net price index if it can be shown that prices for business people and private consumers move in a similar way, and that the compositions of consumption are comparable. Where studies indicate that the price movements and compositions differ significantly, the use of net price indices will be considered a B-method.

The use of net price indices as the general approach represents an A- or a B-method, depending on whether the conditions of homogeneous composition and price movement for private consumption and business consumption are met.

3.8 CPA I - Transport, storage and communication services

Passenger transport is divided into transport via railways, by bus, by taxi, air transport and water transport. Several of these groups receive considerable public subsidies. The value at current prices is made up of the sum of revenues and subsidies.

The net price index collects information about trends in ticket prices and it is only appropriate from a conceptual point of view, provided that there are no changes in the share of subsidies in relation to total expenses.

Freight transport comprises transport via railways and by road haulage contractors, by shipping companies and air transport. Freight transport services are mainly provided to businesses, and most earnings are derived from abroad. There are only a few price indices covering this kind of activity.

This group also covers *expenditure abroad of Danish ships* which constitutes a high import amount.

Supporting and auxiliary transport services are predominantly made up by services provided by forwarding agents and travel agencies. Forwarding agents' services mainly cover purchases of transport. The same applies to travel agency services, where the output value is fixed as the entire price of the product, corresponding to the value of transport, accommodation and travel agency services. The groups also comprise ports, airports and bridge charges.

The CPA sub-section *Postal services* consists of services of the national post and those provided by couriers and delivery of newspapers. The area is dominated by the national post, whose services are still subject to regulations, implying that competition is not free. However, the market structure is breaking up, the services provided to business customers are widely based on contracts granting discounts, and other providers are gradually gaining market shares.

Telecommunication services is an area that has seen rapid changes and is still developing rapidly, with new products and fierce competition. The products cover fixed lines, mobile phones, data network services and Internet service provision.

The charges used are frequently divided into 3 groups: connection fee, regular rental charge and a usage (call) charge. However, there are other charging mechanisms, such as phone cards and fixed connection to the Internet, irrespective of usage.

How is deflation undertaken?

Passenger transport

Relevant net price indices adjusted for changes in public subsidies are here used for private consumption as well as consumption by the business sector.

Freight transport

The applied volume indices are estimated from tonne-kilometres for freight transport by railways and by air. Net price indices are used for furniture removals.

An output price index for earnings by shipping companies is used. This has up until now been compiled by the Ministry of Business and Industry. The index is based on price indices for freight rates prepared by the Danish Shipping Council. Furthermore, a price index for expenditure abroad of Danish ships is used. This has also up until now been prepared by the Ministry of Business and Industry and is mainly based on CPIs from the countries where most of the freight traffic is going to and from.

For haulage contractors an index for transport by lorries is used, which is collected as part of the cost index for engineering projects.

Supporting and auxiliary transport services. Travel agencies.

For forwarding agents an average of the earnings index for the industry and freight charges for transport by lorriy is used. Tour operator services are deflated with the net index for package tours, whereas for agencies engaged in sales of travel tickets an average of the net price index for the Danish State Railways and the net price index for air tickets, is used. The constant price calculations for ports and airports are based on volume indices – freight turnover in Danish ports and number of passengers in Danish airports, respectively. The net price index is applied for bridge charges.

Post services

Deflation for postage is undertaken with a net price index, covering the postage for letters of two weight classes and also the postage for packets over 3 kg.

Telecommunication services

The net price index is used, as it contains both connection, regular rental charge and call charge for fixed line telephones, in addition to mobile phones and the Internet.
For services provided by couriers and delivery of newspapers, the price index for road carriers is used.

Classification into A-, B- and C-methods

For *passenger transport* the use of producer price indices is considered an A-method.
The use of net price indices is a B-method assuming that the indices take appropriate account of quality changes. The methods used are thus B-methods.

The A-method for *freight transport* is using producer price indices, possibly based on model pricing. Among the A-methods are thus the methods used for furniture removals and shipping companies.
The handbook considers volume indicators based on tonne-kilometres to be a B-method. Consequently, the methods used for transport via railways and by air are B-methods.
The use of an index for freight charges of road carriers is among the A-methods.

For *supporting and auxiliary transport services* the handbook does not provide a listing of the recommendations by products, instead these are classified by the way in which prices are determined.

By usage (total time):
An approach measuring hourly charges is an A-method. An approach where the volume is measuring usage is a B-method.

By both usage and volume:
An A-method has to measure both the usage and the volume unit.

By volume:
To be considered an A-method quality has to be taken into account when using prices per unit. If quality changes are not taken into account the approach is a B-method.
Volume indicators are considered B-methods.
The use of volume indicators for ports, airports, etc. is subsequently a B- method.

By regular charges:
Using the developments in charges is considered an A-method, provided that quality changes are taken into account. If this is not the case the approach is considered a B-method.
In using volume indicator approaches it is assumed that a quality adjustment is undertaken in order to be considered a B-method.
Consequently, the use of net price indices for bridge charges is an A-method, while it is considered a B-method for package tours.

The use of earnings indices is a C-method.

The use of net price indices for *postal services* is only an A-method for those services consumed by households. Net price indices can be B-methods for services consumed by businesses if it can be shown that price developments are similar to the price development for households. Due to the dominant position of Post Danmark in this market, the use of the net price index for postal services is considered a B-method.

For *telecommunications* the handbook recommends the use of net price indices if the weighting take the rapid changes in the composition of consumption into account and all telecommunication products are included in the index. The use of net price indices is an A- method for services consumed by households and a B-method for services consumed by businesses, if it can be shown that price developments for households and businesses are similar. Against this background the general use of relevant net price indices in the deflation is considered B-methods.

3.9 CPA J - Financial intermediation services

3.9.1 Division 65: Financial intermediation services, except insurance and pension funding services

The major agents within this section are banks and mortgage credit institutions.

Most of the services produced by banks are not paid directly. These services are financed by banks via the interest margin, i.e. depositors in financial institutions receive a rate of return that is lower than the market rate of interest while borrowers pay a rate of interest that is higher than the market rate. Earnings from the interest margin are called 'Financial intermediation services indirectly measured' (FISIM). For example, the guidance provided by banks to their customers is frequently financed in this way.

Due to the nature of FISIM it cannot be specifically attributed to the services that are provided by banks to their customers free of charge. Consequently, a concrete price for these services cannot be recorded.

The calculation of FISIM at current and at constant prices is determined by convention.

The services paid directly have an increasing impact on earnings by banks. Fees are gradually being charged for a number of services provided by banks, which were previously free of charge. The fees are determined in different ways. Fees can take a number of forms, such as: a regular fee charged for, e.g. statements of account, provision of cheque books, transfer of funds to other banks and provision of credit cards. The fee charged may also cover a fee calculated as a percentage of the transaction in question.

The fees charged are actual prices for the services purchased from banks by consumers and businesses. However, in comparison with a parallel system of services financed via the interest margin, the way in which fees charged for directly paid services are determined is less obvious. In conjunction with a current transition to more direct financing by introducing new fees as well as by increasing existing fees, it is a rather difficult task to compile a price index for the area. To this is added that there may be great differences in the structure of fees charged to a private customer and to a business customer.

Consequently, from the point of view of payment, two groups of products are generated by banks. Widely different deflation methods are required for the two product groups, as the difficulties encountered in determining the output of these products at both current and constant prices differ entirely.

FISIM is not produced in connection with the activities performed by mortgage credit institutions. The greatest source of income is here the contributions to reserves and administration, which make up a fixed share of the amount of the loan. Furthermore, commission or fees are charged in connection with carrying out specific transactions, e.g. raising or restructuring of loans.

How is deflation undertaken?

FISIM

Deflation of FISIM is undertaken in accordance with the guidelines laid down in the Regulation on FISIM[19]:

If the reference rate from the base year is used on the volume of deposits and loans at constant prices in year t, we have according to the Regulation on FISIM arrived at a bid for FISIM at constant prices in year t.

Let the reference rate in the base year be defined as FISIM's share of the total volume of deposits and loans in the base year:

$$r_0 = \frac{FISIM_0}{A_0},$$

where r_0 is the reference rate in the base year and A_0 is the total volume of deposits and loans in the base year.

The method is subsequently materialised as:

$$FISIM_t^{FAST} = \frac{A_t}{P_{NP}} * r_0,$$

where P_{NP} is the total net price index, which is the general price index used to remove the impact of price changes from the volume of deposits and loans at constant prices.

A slight conversion of this relationship shows that such a calculation of FISIM at constant prices is tantamount to letting FISIM develop as the total volume of deposits and loans with banks estimated at constant prices:

---

[19] Council Regulation 98/448/EEC: Official Journal of the European Communities L58, p.1.

$$FISIM_t^{FAST} = \frac{A_t}{P_{NP}} * \frac{FISIM_0}{A_0} = \frac{\frac{A_t}{P_{NP}}}{A_0} * FISIM_0,$$

where $\frac{A_t / P_{NP}}{A_0}$ represents the development in the volume of deposits and loans at constant prices.

This is the recommendation in the Regulation on FISIM.

However, the volume indicator in the Regulation on FISIM does not take into account that fees make up an increasing part of earnings by banks. In the borderline case where total earnings by banks are accounted for by fees only, implying that FISIM at current prices is equal to zero, the recommendation of the Regulation on FISIM will still lead to FISIM at constant prices to prevail. In an attempt to adjust for this phenomenon a correction factor showing the development in the share of FISIM of total earnings is also included in the calculation, before FISIM at constant prices for year t appears:

$$FISIM_t^{FAST} = \frac{\frac{A_t}{P_{NP}}}{A_0} * FISIM_0 * \frac{I_t^{FISIM} / I_t^{TOTAL}}{I_0^{FISIM} / I_0^{TOTAL}}$$

where I^{FISIM} is earnings by banks via FISIM, whereas I^{TOTAL} is total earnings by banks.

Financial services paid directly

Banking services paid directly are deflated with a net price index for fees, which at the moment covers different forms of banking fees, but also other fees, e.g. fees charged for issuing passports and driving licences.

For services provided by mortgage credit institutions a weighted index of the total net price index and an earnings index for the industry, is applied.

Classification into A-, B- and C-methods

In the handbook there are two recommendations for FISIM that are considered B-methods[20]:

1. The use of a detailed volume indicator approach
2. The use of reference rate in the base period on the volume of deposits and loans at constant prices

The method used in the Danish national accounts corresponds essentially to method 2.

When separate prices exist for the services directly paid, it is recommended by the handbook to use quality-adjusted output price indices for a representative set of those services. Where the activities are highly heterogeneous, the set of services must be selected for each part of the market in order to be considered representative. Provided that these preconditions are met, the approach is considered an A-method. If the heterogeneous nature of the activities is not taken into account the approach is considered a B-method.

[20] At the moment, it is considered impossible to identify an A-method.

Deflating the directly paid banking services with the net price index for fees would generally be considered a B-method. However, it is inappropriate to mix banking fees with other forms of fees. As from January 2000 a separate index for banking fees will be compiled in the net price index, implying that this inappropriateness is subsequently removed.

The handbook recommends for ad valorem fees, such as administrative contributions charged by mortgage credit institutions that indices reflecting both changes in the percentage charged and the changes in the value of the underlying asset to which this percentage rate is applied. An A-method would thus be achieved. The use of earnings indices and general price indices are C-methods.

The current deflation of services provided by mortgage credit institutions is thus a C-method.

3.9.2 Division 66: Insurance and pension funding services, except compulsory social security services

The output of insurance services is determined by convention and is measured as[21]:

	total actual premiums earned
plus	total premium supplements (equal to the income from the investment of the insurance technical reserves)
minus	the total claims due
minus	the change in the actuarial reserves and reserves for with-profits insurance.

The output of pension funding services is measured as:

	total actual pension contributions
plus	total supplementary contributions (equal to the income from investment of the pension funds technical reserves)
minus	the benefits due
minus	the change in the actuarial reserves.

From the above definition, it can be seen that an indirect measure of the output value is conducted and the price of the service provided is therefore not observable.

The output of the insurance industry can be considered in two different ways:

If the output of the insurance industry is considered being the pooling and transfer of risk, then it is a measurement of the risk that constitutes the output of the insurance industry.

If the activity is instead considered being the acquisition and administration of policies and the administration of claims, then it is a measurement of these services that constitutes the output of the insurance industry.

How is deflation undertaken?
A volume indicator method forms the basis for calculating insurance services at constant prices. The constant price value of insurance services is projected with a volume indicator showing the development in employment within the insurance industry, adjusted for changes in productivity.

Due to the fact that it is not possible to estimate the productivity changes within an industry until its output at constant prices is determined, this productivity adjustment

[21] ESA95, 3.63.

has to be based on the assumption that the development in the productivity of the insurance industry is well estimated by the corresponding development in the banking sector.

Classification into A-, B- and C-methods
It is stated in the handbook that an A-method is impossible for this service.
The B-methods are two types of volume indicators, reflecting the two different ways of considering output of the insurance industry, see above.

Either a volume indicator reflecting provisions made in balance sheets adjusted for total claims, which are deflated with a general price index as a measurement of the volume of risks, or a volume indicator showing, at a very detailed level, the various activities linked to the output of services.

A volume indicator based on input of manpower would according to the general classification in the handbook be a C-method. However, when an adjustment is made for changes in productivity it is an estimate of the activity and is thus considered a B-method.

3.9.3 Division 67: Services auxiliary to financial intermediation

This division covers the Stock Exchange, security brooking, stockbrokers, consultancy services, transfer of payments by banks, the Danish Securities Centres, insurance agencies, etc.

The services provided here are frequently paid directly in the form of a regular fee or an ad valorem based charge.

How is deflation undertaken?
A weighting of the total net price index and an earnings index for the industry is applied.

Classification into A-, B- and C-methods
With respect to regular fees the handbook recommends the use of actual output price indices adjusted for changes in quality as an A-method. If an adjustment is not undertaken it is considered a B- method.
For ad valorem based charges volume indicators, at a detailed level, are considered B-methods.

The actual use of a general price index or an earnings index is regarded C-methods.

3.10 CPA K – Real estate, renting and business services

This section covers a wide range of heterogeneous services that are mainly provided to industries. The services offered differ from company to company, but are frequently tailor-made or subject to a contract. This implies that it is not straightforward to compile ordinary price indices, as there is a predominant need to undertake quality adjustments.

The statistics on the service industries are generally less well developed than those for the "goods-producing" industries. Only goods are included in the wholesale price index. And services are only included in the net price index, when these are provided to private customers.

Below, the various sub-headings of services within this CPA section will be discussed individually.

3.10.1 Division 70: Real estate services

The greatest production values in this group are for: dwelling services of owner-occupiers and letting of rental properties, holiday homes and non-residential buildings. Services provided by real estate agents are also included.

The output of dwelling services of owner-occupiers is estimated by linking the actual rents paid by those renting similar properties, taking into account the quality of the dwelling with respect to the existence of facilities, size and location. A price index for this product is then to reflect the development in rents for similar rental properties.

Net price indices are compiled for the rents derived from rental flats and letting of holiday homes. In other respects, only few price indices are available for this area. For example, there is no actual price index for the letting of non-residential buildings. There is a few price indices compiled by real estate agents and others engaged in the sector. However, these price indices only cover a narrow area, such as the development in the price of rents for office buildings in central Copenhagen. National accounts is to have a comprehensive coverage, from office buildings to factory buildings all across Denmark and consequently, a specific category of property in a single area cannot be regarded as representative of the general price development for rents.

How is deflation undertaken?

Dwellings

With regard to letting of rental properties, rent in the net price index are used. A price index is estimated for the imputed rent of owner-occupied dwellings, where the price development in the existing stock of dwellings is reflected by the net price index for rental properties, whereas new owner-occupied dwellings completed is reflected in the price development for new rental properties completed. The two are deflated separately.

Letting of non-residential buildings

Letting of non-residential buildings is deflated with a general price index being the total net price index.

Real estate agents

Price indices for real estate agents are estimated on the basis of a volume indicator for sales of properties in ordinary free trade.

Classification into A-, B- and C-methods

The use of net price indices for *letting of flats* and *imputed rents* of owner-occupied dwelling is considered A-methods in the handbook.

For *letting of non-residential buildings,* a quadrennial survey of the developments in rents for privately rented dwellings and non-residential buildings, is conducted by the Danish Ministry of Business and Industry. The surveys have hitherto shown that developments in rents for letting of non-residential buildings are very close to the development in the total net price index. One reason for this could be that in many rental contracts it is agreed to regulate rents in line with the development in the net price index. Against this background, the use of the net price index in deflating the letting of non-residential buildings is considered at least a B-method.

The handbook recommends as a B-method for *real estate agents* the use of a volume indicator calculated from the number of sales if these are broken down by type of buildings, e.g. by size. The approach used is thereby a B-method.

3.10.2 Division 71: Renting services of machinery and equipment without operator

This group covers both renting services supplied to private customers and businesses. The main groups, for the business sector is the renting of transport equipment, trac-

tors and office machinery. Services supplied to private customers are dominated by the renting of cars, TV sets and video films.

How is deflation undertaken?
Regarding renting services of machinery and equipment supplied to businesses, the price index covering the actual equipment rented, is used. For example, when rented agricultural equipment is deflated, the producer price index for agricultural machinery is applied. The underlying assumption being that the development in the rental price follows the development in the price of the item.

With respect to renting services of passenger cars, videotapes, TV sets, tables and chairs, which are supplied to private households, net price indices for these services are used.

Classification into A-, B- and C-methods
Regarding renting services supplied to private households, deflation with net price indices are considered A-methods. Where the renting services are supplied to both private households and businesses, the use of net price indices is considered a B-method. The applied methods are thus A- and B-methods, respectively.

If no price index for the renting service exists, the use of price indices applicable to the actual product itself is considered a B-method. The approaches for renting services of machinery, etc. are thus B-methods.

3.10.3 Division 72: Computer and related services

There is here a wide range of products: Hardware and software consultancy services, maintenance of computer systems, repair services of office machinery and actual software, including both packaged and customised software.

Software can roughly speaking be divided into two types: Packaged software, such as Office packages and customised software, meeting specific needs of each individual customer, and perhaps developed internally by the customer in question. The problems associated with major quality changes over time that apply to hardware also generally apply to software, although there may not be any relationship between the two rhythms of quality changes.

In principle, the price of packaged software can be observed in the market, but the price differs for a private customer and a business customer, and the quality of the software is rarely the same over two consecutive periods. The characteristics of customised software are frequently unique, which complicates the compilation of a price index because prices for the product do not exist for two consecutive periods. With respect to own-account software there is no actual price. There are thus theoretical as well as practical problems associated with compiling price indices for software, and such indices are not at present compiled for the Danish market.

There are no wide distinctions between *Consultancy services and maintenance* and other types of consulting services. The problems linked to compiling price indices for these types of services are similar to those for other consulting services.

How is deflation undertaken?
Software, both packaged and customised/own-account software, is deflated with an index calculated as the geometric average of 75 per cent earnings index for the sector and 25 per cent the index for PC hardware. This implies that a weighted input price index is used. The reason behind the weighting of an earnings index and an index for hardware is based on an assumption that quality changes in hardware lead to a productivity increase in connection with developing software, which is reflected in the development of the prices for software.

Systems services and data consultancy services are deflated with an index, which is weighted from three different price indices for specific data processing services. This implies that a weighted output price index is used.

Maintenance and repair services of machinery are deflated with a net price index for repair services of radios and TV sets.

Classification into A-, B- and C-methods
For *packaged software* the handbook recommends as an A-method the use of an output price index adjusted for quality changes, e.g. based on hedonics. The use of the US index for packaged software, adjusted for exchange rate effects, is among the methods classified as B-methods.

A possible change to applying the US index for packaged software in the Danish national accounts will have to be undertaken on the basis of an observed price development in the US market, which is parallel to that in the Danish market. Such parallelism has not been observed. The reason for this could partly be the circumstance that packaged software for the Danish market is frequently translated into Danish. As the Danish-speaking area is very small, the price development will for that reason alone be dependent on other factors than those determining the price development for software in the US market. To some extent, a parallel can be drawn to customised software, which is also the reason why the same deflator is used for packaged software and customised software.

An example of an A method for *customised software/own-account software* is the use of model pricing. Applying a weighted input index is classified as a C-method. It should be noted that thorough studies of selecting a deflator for these products in the US national accounts have resulted in the use of weighted input indices.

The use of "representative pricing" as a potential A method is mentioned with respect to *maintenance and data consultancy services*. In this context, it is also a condition that quality changes over time are handled in a suitable manner, but the magnitude of the changes in the quality of services is not the same as is the case for e.g. software and hardware. The use of weighted prices for a number of central services constitutes an A-method, which is also the case if the net price index for repair and maintenance services is used.

3.10.4 Division 73: Research and development services

The productive activity of research and development is by nature a unique activity that only takes place once. Next time the activity takes place it is, by definition, no longer research and development. In most cases this makes ordinary price comparisons over time impossible. A result deriving from research and development activities is a product of knowledge, and once this knowledge has been achieved the price of achieving it again in the next period is nought.

The output of the production process is correspondingly difficult to identify in advance. The outcome of a research project is rarely known in advance.

These factors are complicating the construction of both price indices and volume indicators for undertaking deflation of research and development services.

How deflation is undertaken?
Both the market production and the non-market production are deflated with the earnings index linked to the industry.

Classification into A-, B- and C-methods
Due to the conceptual difficulties described above, the handbook underlines that an A method does not exist in this case.

In view of the difficulties present, the use of input methods for the non-market part of output is classified as a B-method.

With respect to the market part of research and development, the handbook is inclined to hold the view that it can be expected that the prevailing pricing mechanism is concentrated on fixing a price for the hours worked on the research and development project. That means that a price index reflecting the development in charge out rates or hourly fees can be used. For the market activity this would constitute a B-method. The use of an input method, such as an earnings index is in principle classified as a C-method.

3.10.5 Division 74: Other business services

For some of the services in this division the consumers can be both companies and households. This applies to, e.g. services provided by lawyers and accountants. However, most of these services are in fact provided to companies. Services of consulting engineers, business consultants, advertising agencies, and cleaning companies are exclusively provided to companies.

It is characteristic of this area that services can be either standardized and measurable, e.g. the drawing up of contracts for buying houses or of a more unique character, such as consultancy services provided to a company in connection with a specific project. The issues linked to unique products are similar to those described for unique machinery in section 3.3.2.

How is deflation undertaken?
Net price indices are used for deflating services that are supplied to both households and companies. This applies to legal and accounting services, chimney cleaning, window cleaning and photographic services. It is thus implicitly assumed that the price development is similar for both purchases made by companies and by households.

Other activities are deflated using earnings indices for the industry. However, for advertising services it has been decided to use a weighting of the earnings index and a price index for newspaper and TV advertising.

Classification into A-, B- and C-methods
Actual output price indices, adjusted for changes in the product/contract content, are generally classified by the handbook as A-methods. It is, in practice, a relative resource-intensive task to collect actual output price indices, as it is a prerequisite that the content of a specific contract is carefully examined and constitutes a representative sampling unit of such contracts in the sample. Only few countries have attempted to compile this type of price indices.

Furthermore, model prices are generally classified as an A-method in analogy with the recommendation for large units, and for the same reasons.

The use of so-called charge out rates for services on a fee-per-hour basis is classified in the group of B-methods. Charge out rates for services comprise the hourly remuneration that are charged for service activities when contract prices are calculated. The charge out rates thus include remuneration of manpower as well as miscellaneous overheads. In classifying the method as a B-method, it is naturally assumed that the development in the hourly service fees reflects the price development for the service as a whole.

The use of net price indices constitutes an A-method for the part that is aimed at private consumption, and a B-method for the part aimed at companies.

The use of the net price index for services aimed at both consumption by the household sector and the corporate sector constitutes a B-method.

The handbook gives other recommendations with respect to some specific areas:

For *advertising agencies* there is a distinction in the handbook between "placement" of the advertisement and the process in which the advertisement is created. Regarding the creative process the recommendations are in keeping with the general recommendations. With respect to "placement" the collection of contract prices constitutes an A-method, such as price per second for TV advertising or the price of column millimetres in newspapers. Another A-method would be the use of volume indices with a high level of detail and with adjustments for quality changes.

In the Danish national accounts the products from *advertising agencies* are not broken down by placement and creation. Consequently, the two indices selected for the two processes are weighted, ratio 50/50. The use of the price index for newspaper as well as TV advertising constitutes an A-method for the part related to placement.

For *recruitment agencies* the use of an earnings index for personnel hired out would be a B-method.

Using earnings indices is generally a C-method.

3.11 CPA L – Public administration and defence services, compulsory social security

This section consists of the provision of collective goods, such as police, law courts, foreign affairs, administration services of the general government and compulsory social security services, e.g. the Danish Labour Market Supplementary Pension Fund. Most of these are mainly non-market services. Consequently, market prices, which can be used for calculating a price index, do not exist.

A public good is always consumed in equal quantity by the community as a whole and one person's use of it does not deprive others from using it. National defence is a public good of this sort. All inhabitants in a country may make use of national defence in the quantities that are offered, and an increase in the number of inhabitants does not imply that each individual receives less defence or is deprived of a national defence.

It is extremely difficult to define the output of services with respect to public goods. Is the output of police services increased if the number of arrests increases and what about preventive work? Is output of national defence higher if, e.g. more military exercises are carried out, flying hours for fighters are increased, or are there other aspects that have to be taken into account?

In view of these two characteristics for this type of products, the use of a volume indicator method for deflating collective goods is meaningless.

Without the existence of price indices and with no possibilities of using a volume indicator, the only appropriate method is to apply an input deflation for collective goods.

How is deflation undertaken?
Collective non-market products are deflated from the input side, see section 1.2.3.3.

The only market service that is classified to this CPA division is for emergency services, where subscriptions are offered in an actual market. Here the net price index for emergency services is used.

Classification into A-, B- and C-methods
In view of the conceptual problems associated with defining output, the use of input approaches for deflating public non-market collective products is, according to the handbook, a B-method.

Using a net price index for emergency services is an A-method.

3.12 CPA M – Education services

Non-market education

Education in Denmark is mainly a non-market service produced by the general government, more precisely by the 277 municipalities in Denmark. As these education services are not offered for sale in a market there is no observable price and subsequently no possibility for calculating a traditional price index. Unlike the products under CPA L education services are primarily provided on an "individual" basis. In principle, this enables the collection of volume indicators for the output. If this is to succeed, three ingredients have to be there:

- a definition of the output from education which can handle quality changes, e.g. by undertaking an appropriate stratification of the products
- determination of cost-based weights for the various types of output, so that they can be weighted in order to achieve a measure for total production
- dealing with quality changes within strata

How is deflation undertaken?
The non-market education services are deflated from the input side, see section 1.2.3.3.

Classification into A-, B- and C-methods
The use of volume indicators are the only A- and B-methods in the handbook. It is an A-method if quality adjustments are made, otherwise, it is a B-method.

Input methods are C-methods.

The handbook's recommendations for a volume indicator in this area can be summarised on the basis of the following statements:

- the volume indicator should be "student-hours" or number of students, provided it can be shown that the hours of tuition that an average student receives remain broadly stable
- the volume indicator should essentially cover the entire area
- stratification should be made to at least 6 levels of education (categories)
- the indicators should be weighted by using unit costs (per student-hour or per student) in the base year.

By means of six cases it can be illustrated why it is necessary to impose high demands with respect to a volume indicator for this area in order to achieve a better volume index than the one achieved by using an input method, which is for the time being the general method used in Denmark as well as in most other countries.

Case 1: Change in input and output: If there is a proportional change in outputs and inputs, the two methods provide the same result.

Case 2: Change in the composition of output: Let us assume there is a change in the composition of output between the 6 strata and let us also assume, e.g. that there

is an increase in the number of student-hours within further education, which corresponds precisely to a fall in the number of student-hours with respect to in-schooling, so that the total number of student-hours remain unchanged. Output will increase if the volume indicator method is used (provided that there are higher unit costs within further education, compared to in-schooling), and the increase will depend directly on the difference in unit costs in the base year, which is applied as weights. The input method will generally lead to the same result, namely an increase in output that depends directly on the difference in unit costs.

If the same type of change takes place within one of the 6 strata, e.g. between university students in English and Medicine, this change in output will not be reflected by the volume indicator recommended, whereas a detailed input method will reflect this change, if costs differ. The input method is in this case better than the volume indicator method.

Case 3: Change in intermediate consumption: Let us assume that there is an increase in intermediate consumption, while the number of student-hours and their distribution remain unchanged. This would be the case if more and better educational materials were being used. It will normally be assumed that the quality of education had hereby increased. No increase in output would be reflected by the volume indicator but an input method would record an increase. Also here the input method seems to be more appropriate than the volume indicator method.

Case 4: Change in capital-intensity: Let us assume that more computers for educational purposes are being purchased by schools. The number of student-hours and their distribution remain unchanged again. Normally, it will also in this case be assumed that the quality of education will increase. No increase in output will be recorded by the volume indicator method, whereas the input method will, via the increase in the consumption of fixed capital. Also here the input method is more appropriate than the volume indicator method.

Case 5: Change in input of labour: Let us first assume that more skilled but also more expensive teachers are appointed, but the number of appointments are the same as before. Let the number of student-hours and their distribution remain unchanged again. Normally, it will again be assumed that the quality of education will hereby increase. No increase in output will be recorded by the volume indicator method, whereas the input method will, via the increase in compensation of employees. Also here the input method is more appropriate than the volume indicator method.

Let us subsequently assume that the number of teacher-hours increase, the number of student-hours and their distribution still remain unchanged. This is the conventional example where the student/teacher ratio is changed. No increase in output will be recorded by the volume indicator method, whereas the input method will, via the increase in compensation of employees. The outcomes of the two methods thus represent the two extremes as to whether a change in the student/teacher ratio has an impact on the quality of education. There is no indication of a quality change when the volume indicator method is applied, whereas the input method indicates that changes in costs completely reflect the quality change.

Case 6: Change in output without any change in input: If the change in output is entirely due to a change in the quality of output, this change will not be reflected by any of the two methods. If the change in output is instead due to a change in the number of student-hours, this will be reflected by the volume indicator method but not by the input method. In this case the volume indicator method is more appropriate than the input method.

Theoretically, it is clear that an appropriate volume indicator method, where thorough adjustments for quality changes are made, is better than an input method. In practice, it is however very difficult to carry out quality adjustments without using the

differences in costs as a proxy. And when these differences in costs are used as a proxy for quality changes, it is fundamentally speaking the same principle, as the one applied in the input method.

Consequently, it is obvious that the use of a detailed input method will lead to results that are at least as good as those achieved by using an unadjusted volume indicator method, which is recommended as a B-method by the handbook. A well-founded justification is, of course, needed to explain why the unadjusted volume indicator method is classified as a B-method, whereas the detailed input method is classified as a C-method.

Market education

Market education takes place to a small extent outside public institutions of education, e.g. by driving schools, music schools, etc. Here, there is no direct obstacle to collecting price data and to calculating price indices in an ordinary manner. In these cases, relevant net price indices are applied as recommended by the handbook.

3.13 CPA N – Health and social work services

This CPA section covers individual health services, such as hospital services, medical and dental practice services, as well as other types of treatment provided by, e.g. physiotherapists. The output of social institutions is also included here.

In Denmark the majority of these services are produced by the public non-market part of the economy, but market services are also provided by, e.g. private general practitioners and dentists.

Market services are mainly aimed at private consumption and are consequently covered by the collection of price data for the consumer and net price indices.

Price data are by definition not available for the non-market services, as they are not sold in a market. Volume indices for the service output can only be obtained by applying volume indicator methods.

However, an exact definition of the output of, e.g. hospital services is required in order to apply a volume indicator method. Which measurement unit is to be used, e.g. a specific treatment or a bundle of services constituting a complete treatment? This is just one of the major problems, which have a great impact on the final result.

If the measurements are to be reliable it is also required that the output measure cannot be affected by changes in administrative procedures. Imagine for example that the number of discharges from a hospital is used as measurement of the output of hospitals. If hospitals were then to change their administrative procedure, implying that patients were technically discharged when they were moved from one hospital department to another, and then again registered by the new department as being admitted to the hospital. Such a change in the administrative procedure would thus lead to an increase in the number of discharges. The design of a good volume indicator must be able to deal with such an administrative change without this changing the calculated output at constant prices.

However, the most important problem associated with the use of a volume indicator method for health services is to be able to make adjustments for quality changes of the composition of the services produced and for the quality changes of each specific service over time. Firstly very detailed information on the output of services is required so that stratification can take place in a way so that differences in quality and costs are reflected by the stratification. Furthermore, information on unit costs for the various strata is needed, in order to weigh together the various volume measurements to one volume indicator for the entire output of this service. Secondly, a method is also required, which enables us to quantify the quality improvement – estimated in money terms. It could e.g. be how to put value to the quality improvement

of e.g. an out-patient treatment provided under local anaesthetic, compared to a corresponding treatment requiring hospitalisation for a week and operation under a general anaesthetic.

It is obvious that a number of problems have to be solved until an appropriate volume indicator method for hospital services can be implemented.

How is deflation undertaken?
The non-market output is deflated, using an input method, see section 1.2.3.3.

The market output, e.g. private hospitals, general practitioners, dentists and veterinarians is deflated with corresponding net price indices.

Finally, the output of social institutions managed by NPISH's[22] is deflated by an earnings index for the industry.

Classification into A-, B- and C-methods
For market output the use of a consumer price index adjusted for changes in public price subsidies constitutes an A-method, which corresponds to the use of the net price index as compiled for these market services.

For the non-market output, where there is by definition no available price data, the only accepted methods are volume indicator methods. Input-based methods are C-methods.

3.14 CPA O – Other community, social and personal services

This section comprises a wide range of heterogeneous services, representing membership organisations of all types, refuse disposal, radio, TV, theatres, hairdressers, etc.

How is deflation undertaken?
Activities used by individuals are generally deflated with a relevant net price index, such as hairdressing, sporting events, music lessons and theatres.

Other market activities are deflated with earnings indices.

A few non-market activities are included. The national church accounts for the greatest activity. These activities are deflated from the input side, see section 1.2.3.3.

Duty on water drainage

An important product within this group is the duty on water drainage, which constitutes a rate per unit consumed, the rate being determined by each individual municipality. The receipts from this duty were originally intended to cover the costs of operating and maintaining water purifying plants. The duty on water drainage is comprised in the net price index, and this index is consequently used for deflation.

Sewage service are deflated with the price index for water.

Lotto and lottery activities

Lotto and lottery activities constitute another special service. There is some analogy with non-life insurance services, in the sense that here there is a chance for making future gains in wealth. The price index used is compiled as the development in the price of a lotto row adjusted for the development in the repayment percentage.

Classification into A-, B- and C-methods
As A-methods for *refuse disposal* the handbook classifies producer price indices or volume indices adjusted for certain quality features of the services, such as a change in the regularity of refuse collection.

---

[22] "Non-profit institutions serving households".

For *membership organisation services* the use of a volume indicator for the services supplied to the members, broken down into a fine detail and weighted by the costs of provision, is considered an A-method. However, it should be noted that this kind of data collection imposes a substantial burden on the respondents. The B-method would be to use the number of members as a proxy for output.

For *cinemas, theatres and sports events* the use of the net price index is considered an A- method for services provided to households and a B-method when the net price index is also used for services provided to businesses. The greatest part of these services is accounted for by households.

For *libraries* the handbook recommends as an A-method to combine output data on lending (broken down by major item type) with data on visits, adjusted for quality factors. This is best achieved using a cost-weighted approach. The B-method would be to use data on lending (broken down by major item) as an indicator of the overall output of the library.

For *gambling and betting services* the use of a price index for the charge to participate, is an A-method. The B-method for betting is to use the number of bets made as a volume indicator. However, each different type of games should be distinguished, with weighting provided by the proportion of total amount bet for the individual lottery.

For *production of films and TV programmes* the use of a price index for, e.g. an hour of domestically produced TV series would be a B-method. Another B-method is to use a volume index for hours of programming broken down by major categories of programme and weighted by the share of viewers.

For *News agencies* the handbook classifies the use of model prices as an A-method. The B-method for news agencies is to use quantity and quality indicators employed by the firms themselves to measure output. It is assumed that output is reasonably comparable and is stable in definition from one period to the next.

The product division *other services* covers, e.g. sports centres, laundries, hairdressers and undertakers. Here, the use of net price indices is generally accepted as an A-method.

According to these classifications the use of net price indices for services primarily provided to households, is considered A-methods. Similarly the way the deflation of lotteries is carried out is also considered an A-method.

The use of input methods for deflating the services not provided to households, are C-methods.

3.15 CPA P - Private households with employed persons

This product category covers housemaids, cleaning ladies and gardeners directly employed by a household. The scope of this area is very limited in Denmark. In practice the greatest value is an amount concerning undeclared work by housemaids.

This category excludes the temporary employment of occasional cooks and babysitters.

How is deflation undertaken?
The net price index for housemaids is used.

Classification into A-, B- and C-methods
The use of a net price indices is considered a B-method by the handbook.

4 Methods for other parts of the system

This chapter covers the deflation methodologies used in the Danish national accounts for some very important transaction categories in national accounts. Thus in section 4.1 the calculation of economic aggregates at constant prices is descriped and in section 4.2 the methods for calculating taxes and subsidies on products at constant prices is accounted for.

4.1 Economic aggregates at constant prices

The system of commodity flow balances is based on two accounting relationships:

- It applies to each product that: *supply = use,* i.e. *production + imports = intermediate consumption + private consumption + public consumption + gross capital formation + exports*

- It applies to each product that: *output by industry = input by industry*, which can alternatively be worded as: *production = intermediate consumption + gross value added*

The first accounting relationship, is used in calculating each commodity flow balance at current and at constant prices, see above. To achieve additive volume estimates, the calculation of commodity flow balances at constant prices is based on Laspeyres volume indices and Paasche price indices.

As described, the constant price calculations in national accounts are conducted at the level of products, and against this background the economic aggregates at constant prices are calculated on the basis of the above-mentioned accounting relationships and the additive quality of the volume estimates.

For example, total private consumption at constant prices is calculated in this way by summing private consumption across all commodity flow balances. This also applies to other economic totals.

Two important economic aggregates are not calculated by means of a simple summation. It concerns gross value added (GVA) and gross domestic product (GDP) calculated from the production side.

The same applies to the calculation of gross national income in real terms. However, a description of how this aggregate is calculated is not given here but can be found in Annex A of this paper.

4.1.1 Gross value added

Double deflation

It is a precondition that gross value added at constant prices is calculated before a calculation of GDP at constant prices is undertaken from the production side. However, gross value added at current prices is not an aggregate that can be conceptually divided into a price and a volume component, due to the fact that it is an income aggregate. For this reason, gross value added at constant prices is conventionally calculated on the basis of the above-mentioned second accounting relationship, as production is compiled at basic prices, whereas intermediate consumption is compiled at purchasers' prices.

The production in a given industry is calculated as the sum of the constant price values of the production of different goods and services – primary as well as secondary ones - which are produced by the industry in question.

Intermediate consumption is similarly calculated as the sum of the constant price values of the intermediate consumption of different goods and services, which are applied to input to production in the industry in question.

Gross value added (GVA) is subsequently calculated residually as the difference between production (calculated at basic prices) and intermediate consumption (calculated at purchasers' prices). In this way, gross value added at constant prices is calculated by double deflation.

The concept of *double deflation* embraces the circumstance that production and intermediate consumption are deflated separately. Subsequently, gross value added is calculated residually as opposed to a direct deflation of gross value added, using one single price index – single deflation. Double deflation is a direct consequence of deflation being carried out in a supply and use framework.

The price indices available conceptually measure the price development of actual transactions, e.g. production or consumption. There are no available price indices measuring the price development for any balance, for example, gross value added. Consequently, it is clear that the price indices are used in a more concrete manner by applying double deflation instead of single deflation of gross value added.

As it is not meaningful from a conceptual perspective to split up gross value added at current prices into a price and a volume component, one could ask how the development of gross valued added at constant prices can be interpreted, considering the way in which it is calculated in national accounts.

Gross value added by industry

Gross value added at constant prices by industry reflects the industys' product in real terms. It reflects the gross value added that the industry would have achieved in the base year provided that it had produced the output combination of the year under survey, with the input composition of the year under survey. Changes in relative prices imply that the development of gross value added at constant prices cannot be considered to reflect the development in real incomes in each industry. Any changes in the composition of input as well as output imply that the development of gross value added at constant prices will differ from the development of the production value at constant prices. Consequently, these factors should be taken into account when interpreting gross values added at constant prices by industry.

In calculating GVA at constant prices for a given industry using double deflation it is conceptually possible that it will become negative. This is the case when intermediate consumption accounts for a comparatively large share of production and when there is a considerable distinction between the price development of intermediate consumption and price development of production. However, this is to a larger extent more a theoretical possibility than a practical problem.

Implicit price and volume indices

One consequence resulting from the calculation method of gross value added at constant prices is subsequently that there is ex ante no specific deflator for gross value added. However, the implicit price index of gross value added can subsequently be calculated when GVA has been calculated at both current and constant prices.

It can be demonstrated that one characteristic feature of the implicit price index for GVA is that it is always outside the interval delimited by the price index for production and the price index for intermediate consumption. A similar characteristic feature applies to the volume index for GVA.

Classification into A-, B- and C-methods

The A-method for deflating gross value added is the double deflation.

4.1.2 Gross domestic product

On the basis of gross value added at constant prices and the use of the additive quality of the volume estimates at constant prices, the gross domestic product (GDP) at constant prices can be calculated from the production side by adding net product taxes to gross value added.

The additive quality is also necessary in enabling a calculation of gross domestic product at constant prices from the use side by calculating the sum of the final domestic uses, i.e. public as well as private consumption, capital formation and net exports.[23]

GDP deflator

When the calculation of GDP at current and constant prices is completed, the implicit price index for GDP can be determined. This index is referred to as the *GDP deflator* and is commonly regarded as one of several measurements of inflation. It should be underlined that the GDP deflator is not known until the entire deflation process is concluded. Consequently, the GDP deflator is not used for direct deflation, but is an aggregate that is implicitly estimated when the deflation process is finished.

4.2 Taxes and subsidies on products

Taxes less subsidies at constant prices is calculated within the system of supply and use tables. For each individual use of each of the 2,750 products the volume of taxation is determined by applying to the value of output, revalued at the prices of the base year, the tax rate of the base year. In this way attention is paid to the fact that taxation prices differ among different uses.

VAT at constant prices is also calculated within the system of supply and use tables on a net basis. For each individual use of each of the 2,750 products the VAT rate in force in the base year is applied to the value of output, revalued at the prices of the base year. Any change in the rate of VAT for the current year will therefore be reflected in the price index and not in the volume index of VAT.

In the case of a new product being introduced the VAT rates in the base year for the various uses of the new product are applied, meaning a possible rise in the volume of VAT.

Classification into A-, B- and C-methods
Constant price calculations for taxes and subsidies on products are conducted according to the principles in ESA95 paragraphs 10.50-10.52. This means that the applied method is an A-method according to the classifications in the handbook.

[23] Net exports are exports less imports.

5 Summary

Constant price calculations

A wide number of the concepts used in national accounts can be considered a value consisting of the product between a price and a quantity. When constant price calculations (deflation) are conducted, that part of the development in the value, which can be ascribed to the price development, is eliminated, whereas the remaining part - the values at constant prices - reflects the volume development. The national accounts at constant prices constitute an important tool for undertaking several forms of analyses.

Principles for undertaking deflation

Calculations at constant prices can be conducted in accordance with two fundamentally different principles. The first principle consists in assessing the flows of goods and services at prices from a given base year. The second aims at calculating the real purchasing power of, e.g. incomes or net lending. A typical example of the latter principle is calculations of the trends in real disposable incomes, which are frequently conducted by deflating nominal incomes with the consumer price index. In this context, there is no unambiguous choice of deflator. When a real calculation of a payment from A to B is conducted, the choice of deflator will depend on whether the calculation aims at establishing how much A has lost or how much B has received. Consequently, the choice of deflator in connection with calculations of purchasing power will depend on the analytical requirements that are to be served by the calculations.

Constant price calculations of transactions in real terms

Constant price calculations in national accounts estimate the flows of goods and services at prices from a given base year. As a general rule, this implies that values at constant prices are only calculated for those parts of national accounts that relate to real transactions. The applied method implies that the volume indices, which are compiled, become Laspeyres indices; whereas the implicit price indices, which can be derived from the national accounts, become Paasche indices.

Quality changes

In connection with constant price calculations a special problem is associated with quality changes over time. A ton of sugar beets with high sugar content is not identical to a ton with low sugar content, and a black/white television set differs from a colour television set. Adjustments of changes in the quality of products are made as far as possible, so that the "pure" price development is reflected by the price indices. Quality changes will thus have an impact on changes in the values at constant prices.

Choice of base year

The development in values at constant prices will also be dependent on the base year, as the price development differs from product to product, whereby the relative prices are changed.

1995 is at present the base year for the constant price calculations. Adopting the calculations at 1995 prices as starting point, constant price calculations are also conducted using prices from the previous year, which form the basis for calculating Laspeyres chain indices.

Deflation of commodity flow balances

The core of the constant price calculations is the deflation of the total number of some 2,750 commodity flow balances at current prices. The calculations are first conducted at the level of basic prices, and subsequently the remaining components, i.e. trade margins and net taxes and VAT on products, are calculated as supplements, applying the percentages from the base year.

Price data

When the domestic output of agricultural and horticultural products is deflated, information on average sales prices ex farmer is used, whereas the wholesale price index is used mainly for industrial products.

The net price index is used for deflating the output of market services, especially for personal use, such as expenses on restaurant food and beverages, personal transport,

and hairdressing. Services mainly supplied to industries, such as transport of goods, data processing and consulting engineers are not covered by any official price statistics. Consequently, it has been necessary to compile special price series.

A characteristic feature of the output of non-market services exclusively provided by the general government is that they are not sold in a commercial market. These services are deflated with weighted cost indices.

The calculations of imports of goods at fixed prices are to a large extent based on data series from the wholesale price index. Indices for unit values are only used to a very limited extent. It has been necessary to compile a number of special price series for imports of services.

Export prices for calculating exports at constant prices are not collected at present. Consequently, export indices are compiled for each individual product and service by weighing indices for imports and Danish production at basic prices in relation to the share of re-exports and exports of Danish production, respectively. To this is added calculations of Danish trade margins and net taxes on products at constant prices, which are similar to the other uses.

A residual calculation of the value of each individual product's total domestic use at constant prices is undertaken. Subsequently, this value is distributed to categories of use proportionately with the corresponding distribution at current prices. This implies that the same price indices are used at the level of basic prices for all domestic uses of the product.

Excepted from the general system

Energy products and certain primary products, are excepted from this general system of calculation. The constant price calculations of energy products are based directly on physical balances.

Gross value added at constant prices

The value of gross value added at constant prices is calculated as the difference between the production value and the value of intermediate consumption estimated at constant prices. The gross value added at constant prices is estimated according to the so-called double deflation method, implying that deflation is separately undertaken for the production value and the value of intermediate consumption.

The gross value added at constant prices reflects the product in real terms. It gives an indication of the gross value added that would have been achieved by an industry in the base year, provided that the industry in question had produced the output combination of the survey year with the input composition of the survey year. Changes in the relative prices imply that trends in the gross value added at constant prices cannot be considered to reflect the development in real income of each individual industry. Any changes in both the input and output composition will imply that trends in the gross value added at constant prices will differ from the development in the production value at constant prices. These factors should be taken into account when the gross value added at constant prices broken down by kind of activity (industry), is interpreted.

Deflation from an international perspective

Against the background of the international recommendations for deflation expressed in Eurostat's handbook on price and volume measures in national accounts, the Danish national accounts is primarily using accepted methods. To this is added that the high level of detail in the deflation itself, is instrumental in ensuring a high quality of the constant price calculations, seen from an international perspective.

However, there are areas where some of the deflators – in the Danish as well as in quite a high number of other countries' national accounts – can be found in the group of non-accepted methods in Eurostat's handbook. The problem is particularly outspoken with respect to services supplied to businesses, where the lack of price indices has resulted in a widespread use of earnings indices when deflation is undertaken.

Annex A:

Calculating real gross national income

The prosperity of a country can be enhanced if the output is increased. However, another way of enhancing a country's prosperity is by improving the terms of trade, i.e. the relationship between export and import prices. If there is a greater increase in the prices for exported goods and services than in the prices for imported goods and services, it implies that the country is able to obtain a greater volume of imports for a given volume of exports. These aspects are monitored via calculations of real gross national income.

GDP as production

It is well known that gross domestic product (GDP) is identical with the final domestic uses plus net exports. This can be written as follows:

(1) GDP = Consumption
+ Capital formation
+ Exports
- Imports

This is traditionally interpreted as, *total production* of goods and services in Denmark being identical to the consumption of goods and services, capital formation of goods and services and net exports (exports – imports) of goods and services.

GDP as income

However, GDP can be regarded as the value of *total income* generated in Denmark. From this angle, the identity (1) can be regarded as:

(2) GDP = Income spent on consumption
+ Income spent on capital formation
+ Income surplus with rest of the world

Income surplus with rest of the world is the outcome of exports and imports of goods and services. The value corresponds to the surplus on the balance of goods and services (net exports), i.e. receipts from exports less expenditure on imports. The concept is distinguished from the actual financial savings with the rest of the world, net lending, in that no adjustments have been made for compensation of employees, income from foreign assets, taxes and other current transfers to and from the rest of the world.

Constant prices and real purchasing power

In conducting a traditional constant price calculation of GDP, the values of total production and use of goods and services are split up into a price and volume component. Subsequently, the values at constant price reflect the trends in the volume of goods and services that have been produced or used.

GDP at constant prices

Denoting consumption C, capital formation I, exports X and imports M, the identity at constant prices corresponding to (1) can be written as

$$(3)\ \mathrm{GDP}_{\text{constant prices}} = \frac{C}{P_C} + \frac{I}{P_I} + \left(\frac{X}{P_X} - \frac{M}{P_M}\right)$$

where P_J is the price index for the category of use J.

Real purchasing power of GDP

However, if GDP is regarded as the value of *total income* it is of interest to calculate the development in the *real purchasing power* of this income. The nature of such a calculation differs fundamentally from the general constant price calculations, where the choice of price index is, in principle, unambiguously determined as the price in-

dex for the goods or services in question. When real purchasing power is calculated the choice of price indices is not unambiguous, but depends on the use of income.

If the expression (2) is considered it seems reasonable to use P_C and P_I for those shares of income that are used for consumption and capital formation, respectively. Different problems are involved in choosing a deflator for income surplus with the rest of the world, as this income surplus is not actually used.

In the Danish national accounts it has been decided to use the import price index (P_M) for deflating income surplus with the rest of the world. The reason for this decision is that income from sales of goods and service abroad is used for financing imports.

The value of the real purchasing power of GDP corresponding to (2) can subsequently be written as

$$(4)\quad GDP_{real\ purch.power} = \frac{C}{P_C} + \frac{I}{P_I} + (\frac{X}{P_M} - \frac{M}{P_M})$$

Effect on the terms of trade

The difference between the value of GDP's real purchasing power (4) and the value of GDP at constant prices (3), is the real effect of changes in the terms of trade.

Real terms of trade gains

The real value of changes in the terms of trade in the Danish national accounts is written as

(5) Real value of changes in the terms of trade

$$= (4) - (3)$$
$$= GDP_{real\ purch.power} - GDP_{cons.prices}$$
$$= \frac{X}{P_M} - \frac{X}{P_X}$$

The real value of changes in the terms of trade is estimated as the difference between the value at current prices of exports deflated with the price index for imports (P_M) and the price index for exports (P_X), respectively. Furthermore, it also appears that if the import price index is greater than the export price index, the value is negative.

Real gross national income and real disposable national income

Gross national income, GNI

Gross national income (GNI) is estimated by adjusting GDP with the value of compensation of employees, income from foreign assets and taxes on production and imports less foreign subsidies. While GDP shows the value of total income generated in Denmark, the value of GNI shows total income available to Danish residents.

Disposable gross national income

Furthermore, if adjustments for current transfers (foreign aid, net receipts from the EU, etc.) are made, we arrive at the value of disposable gross national income (disposable GNI). Disposable GNI thus reflects the value of the disposable income that Danish residents are allowed to spent on consumption and capital formation, provided that the current account of total expenditure to rest of the world, is in equilibrium, i.e. balance = 0.

Real GNI

Real gross national income (real GNI) is calculated by adjusting $GDP_{real\ purchasing\ power}$ with the real value of net income, generated by compensation of employees, income from foreign assets and taxes on production and imports less foreign subsidies. If the import price index is used again for deflation, we have the following expression

$$(6)\ \text{Real BNI} = \text{GDP}_{real\ purch.power} + \frac{\text{Compensation of employees from abroad}}{P_M}$$

$$= \text{GDP}_{cons.prices} + \left(\frac{X}{PM} - \frac{X}{PX}\right) + \frac{\text{Compensation of employees from abroad}}{P_M}$$

Real disposable GNI

Furthermore, if current transfers, net from abroad are deflated with the import price index, real disposable gross national income can be expressed as follows

$$(7)\quad \text{Real disposable GNI} = \text{real GNI} + \frac{\text{current transfers from abroad}}{P_M}$$

Real disposable GNI is the value of the real purchasing power of the disposable income which Danish residents are allowed to spend on consumption and capital formation, provided that the current account of total expenditure to the rest of the world is in equilibrium.

Outline

The following outline can be presented

GDP, constant prices	(production at constant prices in Denmark)
+ $(X/P_M - X/P_X)$	(real value of the terms of trade gains)
= GDP, real purchasing power	(real purchasing power of the income generated in Denmark)
+ Compensation of employees from abroad/P_M	(real value of net income from compensation of employees, income and taxes, net from abroad)
= real GNI	(real purchasing power of the incomes of Danish residents)
+ current transfers from abroad/P_M	(real value of the current transfers from abroad)
= real disposable GNI	(real purchasing power of the disposable income of Danish residents)

Annex B:

Examples of classifications of main price indices used for deflation

Wholesale price index

Nomenclature: HS – harmonised System
Level: 6-digit
Codes: Origin-code: 1: Imports ; 2: Domestic production
Example: Chapter 25 consists of the following goods:

HS-no	Origin	Product
250100	1	Salt
250100	2	Salt
250310	1	Sulphur, crude or unrefined
250510	2	Quartz sands
280900	2	Chalk
251020	1	Calcium phosphates and phosphatic chalk
251200	2	Siliceoun fossil meals
251710	1	Pebbles, gravel, shingle and flint
251710	2	Pebbles, gravel, shingle and flint
252100	2	Limestone of a kind used for manufacture of lime or cement
252210	2	Quicklime
252321	2	Portland cement, white
252329	1	Portland cement, other
252329	2	Portland cement, other

Consumer price index and net price index

Nomenclature: COICOP
Level: 3-digit COICOP + national sub-division at 3 digits
Example: Code 8 consists of the following products:

COICOP	Product
08.1.1.00	Postal services
08.2.1.02	Purchases of telephone
08.2.1.03	Purchases of mobilphone
08.2.2.04	Telephone calls
08.2.2.05	Mobilphone, subscription
08.2.2.06	Internet, subscription

Earnings index for the private sector

Nomenclature: NACE-based
Level: 27 groups. 2 first digits from NACE + national sub-division in 2-digits
Coverage:

Industry code	Industry
0109	Agriculture, horticulture and forestry
0500	Fishing
1009	Mining and quarrying
1509	Mfr. of food, beverages and tobacco
1709	Mfr. of textiles, wearing apparel, leather
2009	Mfr. of wood products, printing and publ.
2309	Mfr. of chemicals, plastic products etc.
2600	Mfr. of other non-metallic mineral products
2709	Mfr. of basic metals and fabr. metal prod.
3600	Mfr. of furniture; manufacturing n.e.c.
4009	Electricity, gas and water supply
4500	Construction
5000	Sale and repair of motor vehicles etc.
5100	Ws. and commis. trade, exc. of m. vehicles
5200	Re. trade and repair work exc. of m. vehicles
5500	Hotels and restaurants
6009	Transport
6400	Post and telecommunications
6509	Financial intermediation and insurance etc.
7009	Real estate and renting activities
7209	Business activities etc.
7500	Public administration etc.
8000	Education
8519	Health care activities
8539	Social work activities
9009	Other community, social and personal act.
9800	Unknown

Price indices for agricultural sales

Coverage:

Crop products:
Barley
Wheat
Rye
Oats, mixed grains and triticale
Pulses, ripened, total
Oilseeds
Potatoes
Seeds for sowing
Seeds for manufacturing
Sugar beets
Flowers, cut
Potted plants
Nursery products
Chrismas trees
Vegetables, fruit and berries

Livestock products:
Natural milk
Eggs for human consumption
Meat and live animals, total
Cattle
Pigs
Poultry
Horses
Sheep
Furred animals
Game
Other livestock products