12th Meeting of the Advisory Expert Group on National Accounts,
27 – 29 November 2018, Luxembourg

Agenda item: 3.b

Price and Volume Measures for Service Activities

Introduction

A Eurostat Task Force (TF) on "Price and Volume Measures for Services Activities" finalised its work in June 2018. The final report endorsed by the EU group of Directors of Macro-economic Statistic is attached to this note. The TF selected the following service areas as priority for its work and developed recommendations for each: construction, global production arrangements, digitalisation and non-marked services. The focus of this item lies on the digitalisation aspects.

Main issues to be discussed

The AEG is requested to take note of the report and provide feedback on the recommendations developed for price and volume measures for (see pg. 42 of the report):

- Online streaming,
- Cloud computing,
- Bundling of information and communication services and
- E-platforms

Comments on the non-digital part of the report are always welcome bilaterally after the meeting.

Furthermore, the AEG is invited to provide feedback on which specific areas it sees a need for further work on price and volume measures. This may be items already covered or new ones.

EUROPEAN COMMISSION
EUROSTAT

Directorate C: National Accounts, Prices and Key Indicators

DMES/2018/06-13- ANNEX

FINAL REPORT OF THE TASK FORCE "PRICE AND VOLUME MEASURES FOR SERVICE ACTIVITIES"

Task Force Price and Volume Measures for Services Activities

Final Report

Contents

1 Introduction

This Task Force (TF) received its mandate from the Directors of Macro-economic Statistics (DMES) Group in September 2016. It required the final report of the TF to be presented to the NAWG in May 2018 and to the DMES in June 2018. The TF had representatives from the following EU countries and organisations: Czech Republic, Germany, Denmark, Finland, the Netherlands, Norway, Romania, Sweden, Slovenia, the United Kingdom, ECB, OECD and Eurostat[1]. The group met four times in January, June and October 2017 and in February 2018.

The TF dealt with price and volume estimates for selected areas of market services and non-market services. The areas were selected after a discussion where a need and potential for further development was seen. In five chapters the following issues were analysed and recommendations were given:

Chapter 2 deals with construction and construction works. This is an important element of GDP where further improvements in price and volume measurement are considered necessary.

Chapter 3 is on global production arrangements. Globalisation poses a challenge to current price national accounts measurement but also to the measurement of prices and volumes.

Chapter 4 covers digitalisation issues. Inevitably the economic changes induced by ongoing digitalisation need to be reflected in price and volume measurement.

Chapter 5 deals with non-market services. The TF selected the particularly important areas of non-market education (chapter 5.2) and non-market health services (chapter 5.3) for further research. The work was supported by grants for research activities by a number of countries, with a specific focus on implicit and explicit quality adjustments for these non-market services.

Chapter 6 provides examples of good practices on how co-operation between different statistical domains can help to improve price and volume estimates.

Each chapter is concluded with a summary section with conclusions and recommendations.

[1] The list of participants can be found in the annex.

2 Construction and construction works

2.1 Introduction

Gross fixed capital formation in construction constitutes about 10% of EU28 GDP. The methods used for measuring prices and volumes for construction therefore have a significant impact on GDP growth rates. The Handbook on Price and Volume Measures in National Accounts (in short “HPVNA”) discusses the deflation of construction at length in section 4.6. It is noted that most countries collect input price indices and only a few collect output price indices, although the latter are considered superior.

The reason for the lack of output price indices is of course that they are more difficult to produce. However, given the important share of construction in GDP it is essential that research into improving the price measures for construction continues. This chapter will describe recent research in three countries (Netherlands, Denmark and the United Kingdom) that lead to methods that could be seen as benchmarks in this area.

2.2 Output price indices for construction in the Netherlands

This paragraph gives a brief description of the methodology behind the output price indexes for newly built dwellings resp. for newly built non-residential buildings in the Netherlands. For a more detailed description, the reader is referred to Statistics Netherlands (2009) and Meertens et al. (2016).

2.2.1 Price index for newly built dwellings

The output price index for newly built dwellings is calculated using a regression model, also known as a hedonic model. The hedonic method attempts to define the quality of a structure in terms of its characteristics, and regress them against price. One of the variants of the hedonic method is the so-called "characteristics price index method", which is used here. In this approach, the hedonic function coefficients are used as implicit prices for the characteristics and can be used to estimate a price for a reference model in different periods.

The index is based on information from municipal administrations (data from building permits). Building permits are issued on a project basis, i.e. more than one dwelling may be constructed with one licence. Data on prices and characteristics are obtained for all buildings with construction costs (ex. VAT) > €50000.-.

The following information is available:

- Type of building
  - Residential (‘normal’ dwelling, recreation dwelling, housing unit[2])
  - Non-residential (office, school, shop, stable,…)
- Number of dwellings in the project
- Type of commissioning party
  - Government and housing corporations
  - Commercial developers and corporate investors

[2] A housing unit is a dwelling without kitchen and/or bathroom; a shared kitchen/bathroom is available.

    - Private persons and others;
- Month when construction begins
- Gross volume in m^3
- Gross floor space in m^2
- Address/postal area code
- Construction costs ex. VAT, ex. costs of land, interior, fees of architects & surveillance, taxes
- Construction time
- Owner occupied/rental

For each quarter, a hedonic regression of the natural logarithm of the price of dwelling unit *i* in period *t* on its characteristics set Z_{ki}^t is estimated, using the equation:

$$\ln(P_i^t) = C^t + \sum_{k=1}^{2} \beta_k^t \ln(Z_{ki}^t) + \sum_{k=3}^{9} \beta_k^t Z_{ki}^t + \epsilon_i^t,$$

with

P_i^t is the price of dwelling i in period t;

C^t is the intercept term;

β_k^t are the regression coefficients of variable k in period t;

ϵ_i^t is the error term.

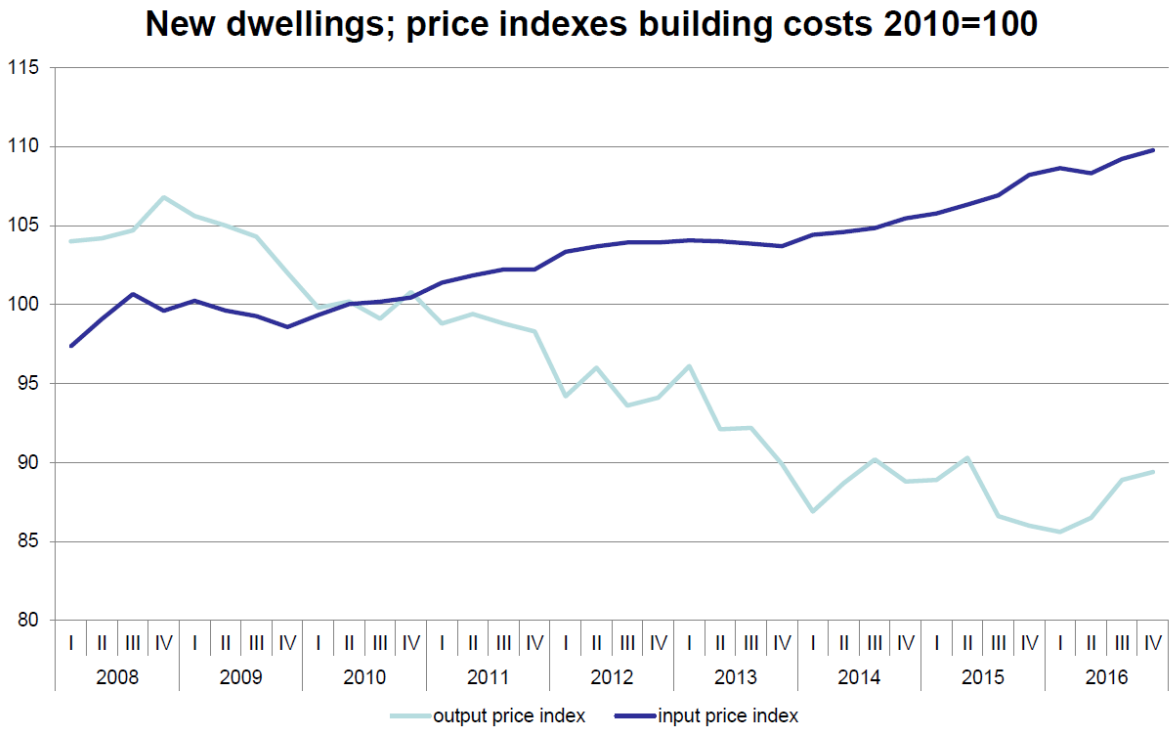
The following characteristics are used:

- Z_1 is the volume of the dwelling in m^3;
- Z_2 is the number of dwellings in the project;
- Z_3,…Z_6 are dummies for the type of soil[3];
- Z_7, Z_8, are dummies for the type of commissioning party;
- Z_9 is a dummy for owner occupied/rental.

- Figure 2.2.1 shows the development of the output price index of newly built dwellings in comparison with the input price index for new dwellings over the period 2008-2016. It is particularly interesting to see that in the period of the financial crisis the input method and the output method showed completely opposite developments. Because demand for new dwellings significantly slowed down, prices were under a lot of pressure. This underlines the limitations of an input index as a proxy of an output index and stresses the importance of having an output index for the deflation of construction output.

[3] The following types are distinguished: a) sand, Wadden sea, hills, dunes; b) fen land; c) river areas; d) sea clay soil and e) tidal areas, Zeeland and enclosed sea inlets. Information on soil type is not available in the dataset of building permits. The value of this variable is therefore approximated by the most common soil type per municipality.

Figure 2.2.1: Comparison output and input price indexes for new dwellings



2.2.2 Price index for newly built non-residential buildings

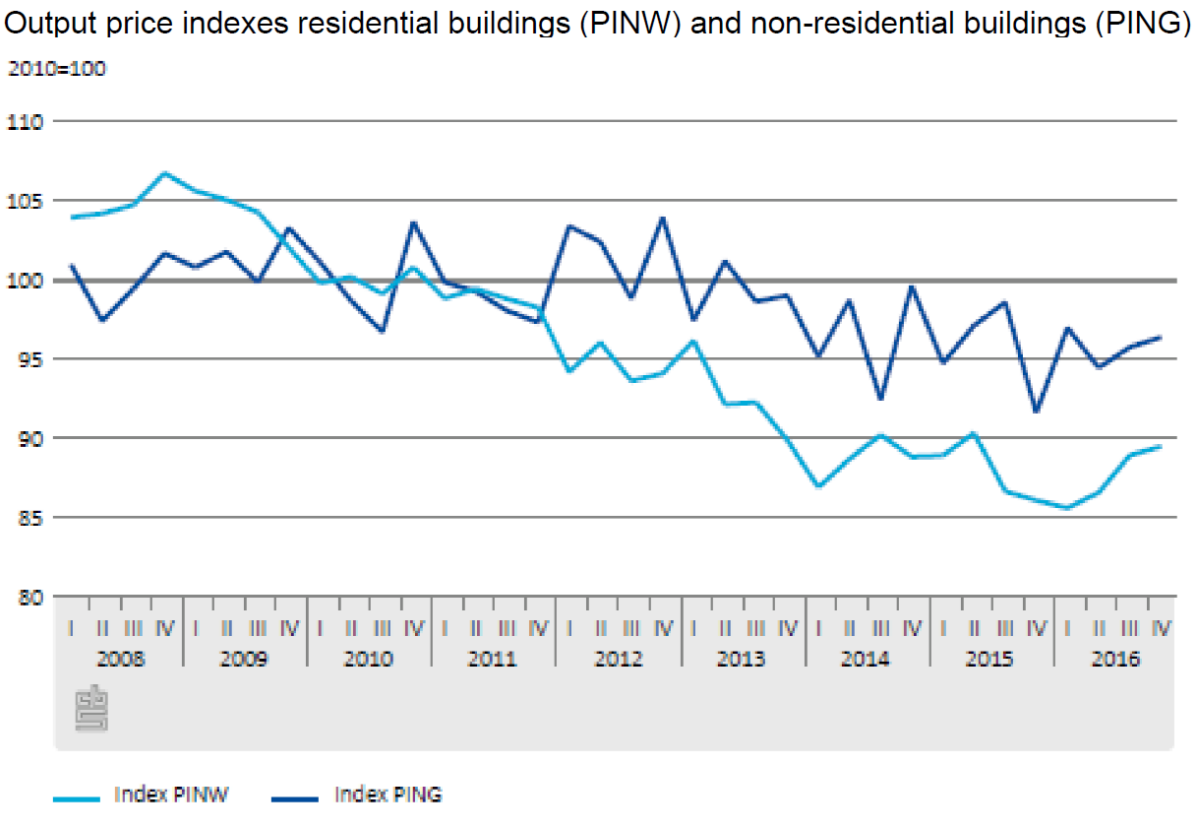
For non-residential buildings, Statistics Netherlands uses a hedonic approach as well. Contrary to the characteristics price index method that is used for dwellings, a time dummy model (with 5-year moving window) is used for non-residential buildings. By pooling data of several years, the regression analysis becomes more robust. The time dummy approach assumes that the parameters remain constant over the years. Over a longer period, this is a very strong assumption, which is why a moving window approach is used.

Separate models are estimated for different building types, such as office buildings, shops, schools and industrial buildings. The information set is the same as for dwellings, based on data on building permits from municipal administrations. The variables used are:

- Volume in m^3;
- Floor space in m^2;
- Dummies for type of soil;
- Dummies for urban density.

Figure 2.2.2 shows the development of the output price index of non-residential buildings in comparison with the output price index of newly built dwellings. The index for non-residential buildings shows only a minor decrease over the period 2008-2016 and is a bit more volatile than the index for dwellings, which can be attributed to the larger heterogeneity of non-residential buildings.

Figure 2.2.2: Comparison output price indexes residential and non-residential buildings



2.3 Redevelopment of construction estimates in Denmark

2.3.1 Background and current status

In a 2013 report[4] the Danish Productivity Commission concluded that the national account figures did not provide a true picture of the productivity developments in the construction industry. Consequently, Statistics Denmark, in consultation with major stakeholders, decided to improve the calculations.

The work took a convenient point of departure in a 2010 report[5] produced by Statistics Denmark in collaboration with Danish Industry and the Danish Construction Authority. The report included a description of how to improve the calculations of the construction industry in current and constant prices.

In 2014, a new Statistics Denmark project was set in motion, aiming at improving the calculations in current prices, and establishing a series of producer price indices for the construction industry (CPPIs) to improve the traditional deflation methods.

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[4] "Danmarks Produktivitet – Hvor er problemerne?" Analyserapport 1 (April 2013). Available in Danish language only.

[5] See https://www.dst.dk/da/Statistik/dokumentation/metode/produktivitetsberegning-for-bygge-og-anlaeg. Available in Danish language only.

In November 2017, the improved methods for measuring the construction industry were introduced in the national accounts - for the two provisional accounting years 2015 and 2016. In the coming years the improved methods will gradually replace the traditional methods.

2.3.2 The construction industry

Table 2.3.1 shows the structure of the construction industry in the Danish national accounts measured according to the traditional methods in current prices. The total output from construction was 205 billion DKK in 2013 corresponding to around 27 billion euros.

Table 2.3.1: The construction industry in the Danish national accounts (current prices)

Output by products, 2013.	Mill. DKK.	Percentage
Dwellings	55.297	27,0%
New construction	15.406	7,5%
Capital repair	28.329	13,8%
Current repair	11.563	5,6%
Non-residential buildings	58.324	28,5%
New construction	30.123	14,7%
Capital repair	10.267	5,0%
Current repair	17.934	8,8%
Other structures	50.991	24,9%
New structures/Capital repair	38.738	18,9%
Current repair	12.253	6,0%
Supplements (Own-account production)	40.267	19,7%
Total output, Construction industry	**204.880**	**100,0%**

2.3.3 The traditional methods in current and constant prices

In the traditional current price calculations, the output of each product from the construction industry is estimated separately and the total industry output is equal to the sum of products. The industry value added is recorded in the Structural Business Statistics (SBS[6]) and the intermediate consumption is calculated as the residual.

For construction of new dwellings and private non-residential buildings the current price calculations mainly rely on data on newly build square meters multiplied by a price per square meter, largely based on construction cost (input) indices.

For current and capital repair the method is similar and is in essence based on the number of employees multiplied by turnover per employee.

Constant prices are derived using two types of cost indices for deflation: (1) Construction cost index for residential buildings and (2) Construction cost index for civil engineering projects. However, since

[6] For final national accounting years the SBS contains information regarding GFCF of non-residential buildings and construction works. However, no such data is available for residential buildings.

these cost indices only measure price changes in wages and intermediate inputs and not the industry output these methods are far from optimal.

Summary: The traditional methods for estimating construction industry outputs are far from optimal in both current and constant prices. Notable weaknesses are that the cost indices used do not catch changes in margins nor productivity. Moreover, the quantity measures of constructed square meters and employment by kind do not catch changes in quality nor productivity. The next section addresses how these weaknesses have been addressed.

2.3.4 The improved methods in current and constant prices

The improved methods use three new data sources:

1. Data on turnover by products, produced by the construction industry[7].
2. Data on subcontracting within the construction industry.
3. Producer price indices for construction – the CPPIs.

Table 2.3.2 below shows the decomposition of turnover by products.

Table 2.3.2: Decomposition of turnover by products

Type	Product	Use
New constructions	Dwellings	GFCF
	Non-residential buildings	GFCF
	Other structures	GFCF
Capital repair	Dwellings	GFCF
	Non-residential buildings	GFCF
	Other structures	GFCF
Current repair	Dwellings	Intermediate consumption
	Non-residential buildings	Intermediate consumption
	Other structures	Intermediate consumption

The new data on turnover by products include the industry's use of subcontracting. Consequently, the subcontracting has to be subtracted. This is possible due to questions, regarding the use of subcontracting, added to the cost survey for the construction industry. In 2015 the cost survey revealed that the use of subcontracting is around 57 billion DKK corresponding to 8 billion euro.

The third of the new data sources are the newly developed producer price indices for construction (CPPI), which are used in the constant price calculations. The available CPPIs are listed in table 2.3.3.

Hedonic regression method: This method is used when estimating prices for one-family houses. Approximately 1,400 prices on new houses are reported to Statistics Denmark every year together with their address, which is used as the identifier. This information is merged with data from the Danish Building Register which contains information on characteristics for every building in Denmark (square metres, wall and roof materials, number of bathrooms etc.). Every quarter Statistics

[7] Data on GFCF of non-residential buildings and construction works are also included in the calculations and is evaluated against alternate data sources (turnover statistics).

Denmark performs a hedonic regression on the data using the above mentioned characteristics plus information on the construction companies and geographical data.

Table 2.3.3: CPPIs for different construction components

CPPI	Type
One family homes (new)	A hedonic deflator, based on characteristics for standard houses
Apartment blocks (new)	A deflator based on model pricing
Light industrial buildings (new)	A deflator based on model pricing
Office buildings (new)	A deflator based on model pricing
Refurbishment and maintenance	Deflators based on the standard component method
Highways and asphalt roads	Deflators based on model pricing

Model pricing: This method uses information from an independent construction company which re-price simple construction projects as defined under the PPP construction survey. The reason for using this is due to lack of information at the entities we first expected to get data from (the clients). The indices using this method are not published since their status is still experimental.

Standard component method: The standard component method uses reported prices from reporting units for well-defined types of services. That is, every period the reporting units transmit prices for refurbishment and maintenance service which are the same period after period (homogeneous products).

Not all products produced by the construction industry are covered by a perfect matching CPPI. In these cases the CPPI valued closest to the product in question will be used as a proxy – assuming a similar change in price.

Summary: The improvements of the methods in both current and constant prices are substantial. The industry output is now – product by product – based on actual business turnover and not just newly built square meters or number of employees inflated by benchmark prices taken forward by price indices representing production costs. The constant price calculations are now based on producer price indices and therefore measuring estimates on changes in output prices, not just changes in production costs. Consequently, the constant price calculations are now including much more changes in output quality.

2.3.5 The impact of the improved methods

The impacts of the improved methods are substantial in both current and constant prices, as will be demonstrated below. However, the analyses of the impacts of the method changes are still preliminary and must be interpreted with caution. To fully evaluate the method changes further investigations are necessary.

The preliminary results for the accounting year 2015 (still a provisional year) are:

- the real growth rate of the construction industry total output is 2.9 percent according to the improved methods – compared to 3.8 percent according to the traditional methods. The method change lowers real output substantially in 2015.

- the total output in current prices of the construction industry is 212 billion DKK (28 billion euros) according to the new method compared to 220 billion DKK (29 billion euros) according to the traditional method. The method change lowers the output in current prices by around 3.6 percent.
- The various areas of the construction industry are impacted very differently (in current prices) by the method improvements. See table 2.3.4 below.

Table 2.3.4: Impact of method improvements – output by products (current prices)

2015, Mill. DKK.,	Current NA	New sources	Difference
Dwellings	64.445	66.401	1.956
Non-residential buildings	63.012	49.747	-13.265
Other structures	50.089	42.784	-7.305
Other	0	10.641	10.641
Supplements	41.992	41.992	0
Total output	219.538	211.565	-7.973

Summary: The introduction of the improved methods has had substantial impact in the national account figures for construction in 2015. This is true in both current and constant prices. There's a need for further evaluation over a longer period[8], however, the assumption is that the improved methods will provide a more qualified picture of the structure and developments in the Danish construction industry. In constant prices the improved methods has meant a shift in the classification of deflation methods – from predominantly C-methods to predominantly A- or B-methods.

2.4 Construction output prices in the UK

2.4.1 Introduction

The UK Office for National Statistics (ONS) took responsibility for output price indices for construction in April 2015 – previously these price indices had been produced by the Department for Business, Innovation and Skills (BIS) but were suspended in December 2014. In the absence of any suitable price indices to deflate construction output, ONS developed an interim price index, based on a project cost approach and using existing ONS data, as a proxy to an output price index. This index was published for the first time in June 2015. Development work continued to produce a true output index with various alternative approaches investigated, including hedonics, but none proved successful (e.g. sample sizes were not sufficient for reliable hedonic estimations). The final approach settled upon was to take an improved version of the interim index and add a measurement of a mark-up to account for company profit margins to make the series a closer approximation of an output price index.

[8] In current prices the traditional methods will be continued.

2.4.2 The project cost index

Originally developed as the interim index and later improved, the project cost index assumes there are three components to a construction project: labour costs; construction plant costs; and material costs.

Labour costs are estimated using the Average Weekly Earnings (AWE) index for construction excluding bonuses. AWE measures money paid to employees in Great Britain for work done before tax and other deductions from pay. Since the AWE is not available at a more detailed level than all construction, the same index is used to represent labour costs for each of the sub-indices produced.

The Services Producer Price Index (SPPI) for construction plant hire is used to measure changes in the price of plant used in construction. This SPPI measures changes in the price received by UK plant hire companies when providing plant without an operator to other UK companies and government and includes items such as cranes, earth-moving equipment and site accommodation. Similarly to labour, the SPPI for construction plant hire is not available for specific construction work types so the same index is used for each of the sub-indices produced.

For materials, an aggregate of relevant individual Producer Price Indices (PPIs) is used to measure changes in costs. The selection of PPIs used is based on the data ONS submits to Eurostat as part of the Purchasing Power Parities (PPPs) programme. The approach taken is for each country to provide a price for a selection of fictitious but representative construction projects that are defined using Bills of Quantities (BoQs). For the project cost index, these BoQs have been used to define projects that are representative of UK construction and, by matching PPIs with the materials defined in the BoQs, to determine which selection of PPIs to use. The representative projects chosen for use in the index for each type of work, selected from those submitted for the PPPs as they are considered to be most reflective of the type of work undertaken in each category, are shown in table 2.4.1.

Table 2.4.1: Representative projects selected for each type of work

Type of work	Bill of quantity
New Housing	Detached house and apartment
Infrastructure	Roads/ Bridges
Public Other	New office
Private Industrial	Factory Building
Private Commercial	Factory Building or new office or combination of the two.

More detailed information about this project cost approach (ONS, 2015) as well as the subsequent improvements made (ONS, 2017) is available on the ONS website.

2.4.3 Estimating the profit margin mark-up

One of the key limitations of the project cost index is that it assumes that input costs move in the same way as output prices meaning that the margins of construction businesses are constant through time. To address this limitation, a method was developed to estimate a mark-up based on gross profit. The Fame dataset[9], from Bureau van Dijk, has been used to access the financial

[9] https://fame.bvdinfo.com/version-2018327/Home.serv?product=fameneo

information of construction businesses. Using this data, the mark-up is estimated using the following formula:

$$\textit{Mark-up} = \frac{\textit{Average Gross Profit}}{\textit{Average turnover} - \textit{Average gross profit}}$$

Where average gross profit and average turnover represent the arithmetic mean across all companies selected from the dataset. The mark-up calculated using this approach can be found in table 2.4.2.

Table 2.4.2: Annual mark-up figures, based on gross profit, Great Britain

Year	Mark-up (percent)
2011	13.321
2012	12.879
2013	12.307
2014	10.741
2015	11.092

2.5 Recommendations

On the basis of the above studies, the TF concludes that

- the importance of developing construction output price indices cannot be understated; the difference between output price indices and input price indices can be very significant;
- as described in the HPVNA, the hedonic approach and the model pricing approach are in principle good ways to develop proper output price measures;
- for both methods, the quality, detail and coverage of the underlying data will determine the usability of their results;
- if sample sizes are too small at a detailed level, price indices should be established at higher aggregate level (e.g. for non-residential buildings);
- If input prices have to be used, a mark-up for net operating surplus needs to be added. This should be based on actual data from construction enterprises.

The TF therefore recommends to all countries that have not yet developed output price indices for construction, to advance research into available data sources and methods.

3 Global production arrangements

3.1 Introduction

This chapter of the report discusses three types of global production arrangements: goods sent abroad for processing, merchanting and factoryless goods production. These three arrangements pose challenges for national accountants, both for the measurement of current price flows as well as for price and volume measures. The chapter aims to expand on the discussion in chapter 3.9 of the Eurostat Handbook on Price and Volume Measures in National Accounts (HPVNA) and will in particular describe actual practices of three countries. Numerical examples are used to illustrate.

3.2 Goods sent abroad for processing

3.2.1 Introduction

The conceptual treatment of goods sent abroad for processing underwent a fundamental change in SNA 2008 compared to SNA 1993 and consequently also in ESA 2010 compared to ESA95[10]. The strict application of the change of ownership principle[11] for exports and imports of goods[12] has led to new results in National Accounts. In an increasingly globalised world, goods sent abroad for processing play a major role in global value chains. While literature on the treatment of goods sent abroad for processing in volume terms gives helpful guidance[13], the discussion about the challenges in compiling price and volume measures for transactions related to global production have only just begun[14].

3.2.2 Recommendations of the Handbook on Price and Volume Measures in National Accounts

The HPVNA contains recommendations for deflating the processing fee. As previously mentioned, these global activities become increasingly important, but, nevertheless, estimating the price and volume components of this type of manufacturing service represents a challenge for national accounts.

Generally, it is necessary to differentiate between the export of processing services on physical inputs owned by others and the import of processing services on physical inputs owned by others.

The best way for estimating the volume in previous year's prices (A method) for both import and export would be the application of suitable service producer price indices (SPPIs). In reality, this information is mostly not available yet. Therefore, HPVNA provides alternatives for estimating the volume in previous year's prices[15], which include deflation of the import value and export value of

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[10] For a comparison of the treatment of goods sent abroad for processing in SNA 1993 and SNA 2008 see UNECE (2011), chapter 5.

[11] For a definition of the principle of economic ownership see ESA 2010, par. 1.90

[12] See ESA 2010, par. 3.162, par. 18.23 and par. 18.24

[13] See Eurostat (2014) and UNECE (2015)

[14] Price and volume measures for globalization phenomena were for example discussed at the UNECE Group of Experts on National Accounts in Geneva in 2017.

[15] See HPVNA, par. 3.9.3

the good under processing with their respective import and export prices, deflation of the processing fee with the price index of the goods being processed and the use of wage indices as a last resort.

3.2.3 Results of the questionnaire on current practices

In May 2017, a questionnaire on current practices for price and volume estimates for goods sent abroad for processing was distributed among the Task Force members. The goal of this questionnaire was to gain insight into how important outward and inward processing is in the Member States and which industries are mainly concerned by these activities. Additionally, information about the applied deflation approaches was collected.

It became obvious that the issue of goods sent abroad for processing is relevant in various countries. The number of industries in which these activities are relevant differs across countries.

Concerning the question on the deflation approach the responses of the questionnaire revealed that, when it comes to deflation of the service fee, A methods as described in the HPVNA are mostly not applied due to a lack of available data. In practice, import prices and wage indices are mainly applied.

3.2.4 Case study: goods sent abroad for processing in Germany

In Germany, foreign trade statistics represent the data source for information on goods exported and imported for processing purposes. Data on manufacturing services of physical inputs owned by others is provided separately within balance of payment statistics which are calculated by Deutsche Bundesbank.

Currently, an approach on a highly aggregated level is applied for estimating the prices and volumes of the processing fee. In the case of outward processing the imported processing fee, provided by Deutsche Bundesbank, is deflated with a weighted index composed of import prices for goods processed abroad. The exported processing fee is deflated with a weighted wage index[16].

For the revision in 2019 it is planned to change the approach for deflating the fee for goods sent abroad for processing. The intention is to apply the deflation approach at the detailed product level. In general, the approach can be described as follows.

The goods exported and imported for processing activities can be identified in foreign trade statistics due to the two-digit nature of transaction codes. In Germany, these codes provide reliable and well-founded information on goods sent abroad for processing (inward and outward processing). The following commodity groups (in accordance with statistical classification of products by activity in the European Economic Community (CPA)) are relevant in Germany for outward processing activities: CPA 13 Textiles, CPA 14 Wearing apparel, CPA 24 Basic metals, CPA 25 Fabricated metal products, except machinery and equipment, CPA 26 Computer, electronic and optical products, CPA 27 Electrical equipment, CPA 28 Machinery and equipment n.e.c. and CPA 29 Motor vehicles, trailers and semi-trailers. For inward processing, the commodity groups are constituted by CPA 20 Chemicals and chemical products, CPA 21 Basic pharmaceutical products and pharmaceutical preparations, CPA

[16] See: Statistisches Bundesamt (2017), par. 3.5.2.

24 Basic metals, CPA 25 Fabricated metal products, except machinery and equipment and CPA 28 Machinery and equipment n.e.c.

In a first step the aforementioned data are subdivided into the detailed product classification framework of supply and use tables. At this level of detail exports and imports assigned to processing activities are deducted from exports and imports to fulfil the requirements of national accounts.

For the deflation of the processing service the corresponding fees are assigned to the concerned products with the help of specific analyses for the processing fees for industries. Once this step is realised and cross-checked on the export side, the export price index of the concerned goods is applied on the exported processing service and on the import side the corresponding import price is applied on the imported processing service[17].

This approach comes with major challenges and issues which have to be tackled before final implementation. For the purposes of supply and use tables in current prices as well as in previous year's prices balancing issues represent a major issue. On the detailed product level it has to be assured that the used data (PRODCOM, Foreign Trade Statistics etc.) all follow the same concepts or are transformed into the concepts necessary for the desired purposes. Regarding the treatment of processing, the concepts have to be harmonised throughout the whole framework. If balancing adjustments are necessary, the effects have to be within justifiable boundaries.

3.3 Merchanting

3.3.1 Introduction

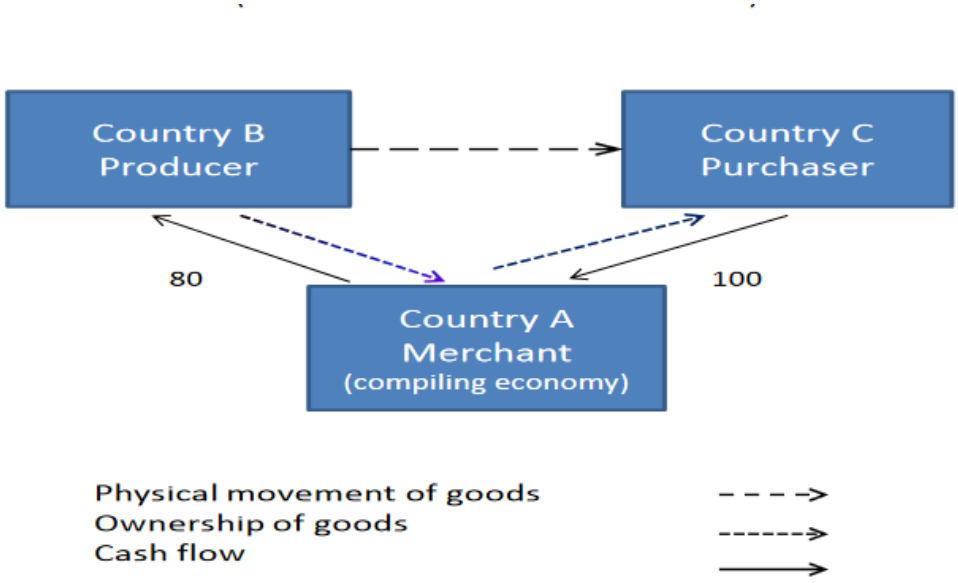
Merchanting is defined as purchases and sales of goods without these goods physically entering the domestic territory of the merchant's country. Goods under merchanting are subject to trading but the physical form of the goods does not change. Merchants trade in other countries without establishing local units in those countries. The activity is driven by free trade zones (e.g. the single market in European Union) that remove or at least reduce any obstacles of doing business abroad.

3.3.2 Compilation of merchanting at current prices

ESA 2010 (SNA 2008) and BPM 6 recognize merchanting as trade in goods even though it has the nature of a service (trade margin). It is a significant change to the previous approach based on ESA95 that recognized merchanting as export and import of services. As goods do not enter the merchant's economy, no export or import is recorded in the International Trade in Goods statistics. Merchanting is explained in Figure 3.3.1. Merchant (country A) purchases goods in country B that are physically moved to country C where the goods are sold to a customer. In fact country B and country C can be the same country i.e. without border crossing. A key point is that goods do not enter the territory of country A and purchase and sale is realized abroad.

[17] This approach is recommended by the HPVNA, see par. 3.9.3.

Figure 3.3.1: Merchanting



Source: Eurostat Manual on Goods sent abroad for processing, 2014

The above transactions are recorded in the supply and use tables of country A as follows:

	Output	Trade margin	**Resources**	Export	**Uses**
Goods		20	**20**	20 (=100-80)	**20**
Trade margin	20	-20	**0**		**0**
Total	**20**	**0**	**20**	**20**	**20**

It should be noted that import of merchanting, sometimes called negative or inverse merchanting, should be distinguished. Nevertheless, very little attention is paid to import of merchanting in various guidelines. Inverse merchanting refers to purchases and sales by non-residents without goods leaving the domestic territory. If these transactions are omitted it may cause an imbalance between supplies and uses. Consider the following example: a resident producer sells wood to a non-resident trader for a value of 100 (these revenues are reported by the resident producer in a statistical survey and the non-resident user reports the purchases in VAT statements). The non-resident trader sells it subsequently to a resident furniture producer for 120 (reported costs by the furniture producer in a statistical survey and reported revenues by the non-resident trader in VAT statements).

There are two options for the recording in supply and use tables. The first is to treat it as an import of trade margins:

CPA	Output	Import	Trade margin	**Resources**	IC	**Uses**
16	100		20	**120**	120	**120**
46		20	-20	**0**		**0**

However, ESA 2010, para. 18.41, states that "export sales to merchants and import purchases from merchants are included under general merchandise". This would lead to the second option:

CPA	Output	Import	Trade margin	**Resources**	IC	Export	**Uses**
16	100	120	0	**220**	120	100	**220**
46		0	0	**0**			**0**

This treatment is however not symmetrical to the recording by the country of the merchant (where the export and import flows are netted).

3.3.3 Compilation of merchanting at current prices (case study: the Czech Republic)

Export of merchanting is estimated using data of the International Trade in Services survey. Purchases and sales realized by residents abroad (merchants) are surveyed in a breakdown by country and industry. Using a transformation key purchases and sales are transformed to the product classification (CPA). Export of merchanting (margin) is derived as the difference between sales and purchases by products. Export of merchanting is recorded on a net basis, i.e. only the margin is shown. In the below example, energy (CPA 35) is traded abroad. The activity generates a margin of 100.

CPA	Output		Trade margin	**Resources**	Export	**Uses**
	NACE 35	NACE 46				
35			100	**100**	100	**100**
46	100		-100	**0**		**0**
Total	**100**	**0**	**0**	**100**	**100**	**100**

It should be noted that the export of energy (value of 100) is in fact the difference between the value of the export of the goods and the value of the import (registered as negative export). This requires that these merchanting flows of goods are broken down by product.

There is no survey on the import of merchanting in the Czech Republic. Inverse merchanting is estimated using data on purchases and sales of non-resident units recorded in VAT tax statements and data in Intrastat and Extrastat, if a non-resident company reports purchases and sales in the domestic territory without exporting and importing goods. These transactions must take place between resident and non-resident units in the domestic territory.

3.3.4 Compilation of merchanting at previous year's prices

In general trade margins may be deflated using several methods, see the HPVNA. The principles for the deflation of trade margins apply equally to merchanting. The HPVNA provides a comprehensive description of the deflation of merchanting. The double deflation method is recommended, however results may not be reliable if the margin is relatively small compared to the value of goods. As goods under merchanting are subject to international trade, price indices of countries where goods are purchased and sold should be used. If necessary an adjustment for changes in exchange rate is performed. Another approach would be deflation by wholesale trade margin index adjusted for exchange rate effects. In practice, trade margin price indices are often implicitly derived by assuming

that the volume of the trade service follows the volume of the traded goods. This is also an approach that can be applied to the deflation of merchanting margins.

Another issue is the deflation of import of merchanting which is mentioned but not discussed in the HPVNA. Import of merchanting can be deflated with the double deflation method using national import and export price indices, irrespective of the choice between the two approaches discussed in section 3.3.2.

3.3.5 Compilation of merchanting at previous years' prices (case study: the Czech Republic)

In the Czech Republic, trade margins are deflated within supply and use tables using ratios of margins to uses at basic prices from the previous year. These ratios are applied to the goods that are being traded. For this, one would have to make a link between the products traded and the trade margin to be deflated.

Another possible approach would be the use of merchanting (trade margin) to sales ratio from the previous year that is one of the proposed methods in the HPVNA. However, sales of goods under merchanting are not recorded within SUTs as merchanting is recorded on the net principle. It would cause technical difficulties within SUTs compilation. Therefore another approach has to be used.

If purchases and sales are estimated separately, the double deflation method can be used. Purchases are transformed to previous year's prices using producer price indices of countries where products are purchased. Similarly, sales are deflated by prices indices of countries where products are sold. In fact countries are divided into three groups (western, eastern, others) which are represented by Germany, Hungary and Russia (which are countries with the highest weight in each group). Price indices are adjusted for changes in the exchange rate.

Merchanting at previous year's prices (pyp) is calculated as the difference between sales and costs at pyp. Implicit deflators are calculated and used in the supply and use tables where merchanting is actually deflated. The advantage of the method is that the price evolution of countries where the products are purchased or sold is taken into account. Domestic price indices have no link to transactions occurring abroad. Moreover, price indices express changes in average prices but trading activities may be driven by changes in spot prices.

3.4 Factoryless goods production

3.4.1 Introduction

A factoryless goods producer (FGP) refers to an enterprise, which has no factories in its home country, but whose planning, research and product development, administration and marketing are located there. A significant part of the value added incorporated in the end product is due to the use of intangible assets owned by the enterprise. The FGP does not supply or own material inputs as it does in the case of processing abroad. There is usually no information available about the content of intermediate consumption used by the contract processor abroad.

3.4.2 Classification issues - goods or services?

The European System of Accounts ESA 2010 was adopted in summer 2014 and the new Balance of Payments Manual BPM6 – harmonized with ESA 2010 – introduced changes to the recording of global production of goods sent abroad for processing and merchanting. The manuals do not, however, discuss factoryless goods production. The Guide to Measuring Global Production compiled by the United Nations Economic Commission for Europe (UNECE) contains recommendations on recording factoryless goods production in national accounts, but no final international decision has been made. The guide recommends factoryless goods production to be recorded in foreign trade of goods as the FGP has the economic ownership of the final product (similar to processing). A principal's IPP is seen as a component of the final product.

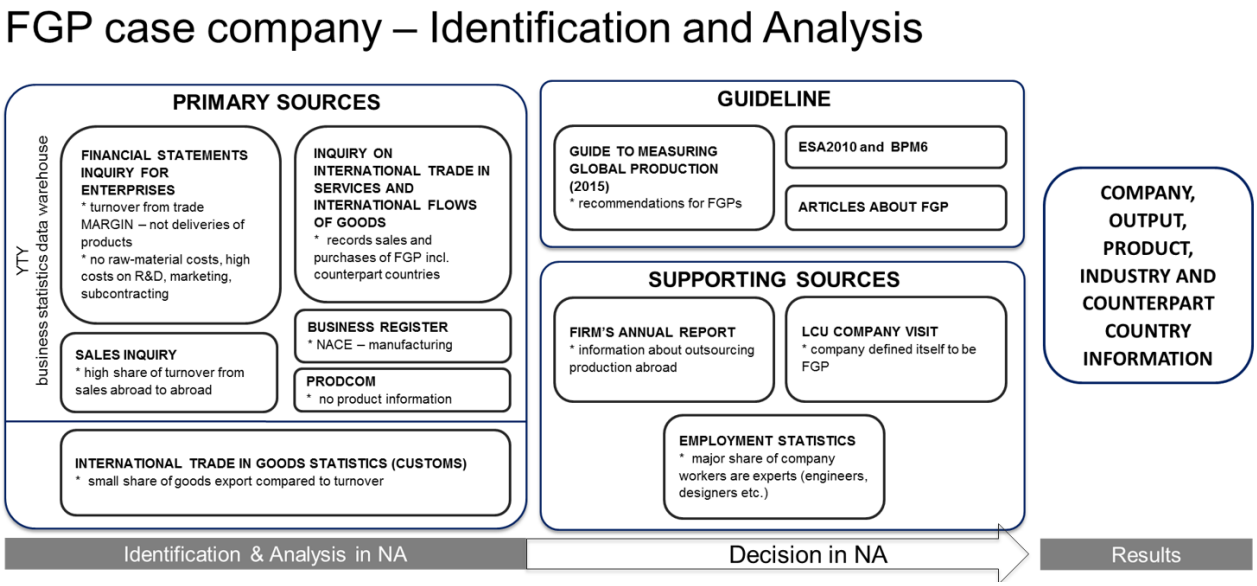
Previously, the margin from factoryless goods production, or net sales from abroad to abroad, was shown in Finnish service exports according to the activities of these companies that are carried out in Finland, i.e. R&D, head office and agency services. Starting from the statistical reference year 2014, the margin in question has been recorded as Finnish goods exports. In the supply and use tables, the recording by product changed from a service product to a good in accordance with the sold end product.

The treatment is similar in national accounts and balance of payments in Finland (their integrated information system has been in use since June 2017).

3.4.3 Identification process of FGP (case study: Finland)

The identification process of FGP is done by in-house cooperation with national accounts (NA) and other economic statistics. NA's global production coordinator leads the process and gives guidelines to all players. Active roles are played by NA Enterprise team, NA Supply and Use Tables (SUT) team, Balance of Payments team, NA senior advisers, Enterprise statistics, Large Cases Unit experts and Statistics Finland's Deflation team. From Figure 3.4.1 it is possible to see what kind of signs experts are looking for to identify a factoryless goods producer.

Figure 3.4.1: Identification of FGPs in Finland



3.4.4 FGP in supply and use tables (SUT) at current prices

Three options are identified for the possible recording of FGP in SUT. Assume an FGP (in NACE 28, producing machines) has a net output of 100, which is the difference between an export of goods (final products) of 300 and an import of (the same) goods of 200. These goods don't physically cross the border but are economically owned domestically.

The first option is the gross recording of these flows:

	NACE 28	import	trade margin	**total supply**	NACE 28	export	**total use**
machines	300	200	0	**500**	200	300	**500**
trade	0	0	0	**0**			**0**

A second option is the follow the same treatment as merchanting:

	NACE 46	import	trade margin	**total supply**	NACE 46	export	**total use**
machines	0	0	100	**100**	**0**	100	**100**
trade	100		-100	**0**			**0**

The producer is now seen as a trader so it is reclassified to NACE 46. (It is of course also possible to continue to include it under manufacturing.) The export of 100 is calculated as the difference between the 300 gross export and 200 import (treated as negative export).

The third option was adopted by Statistics Finland and is similar to the previous but splits the net output of the FGP in a goods part (90%) and a services part (10%):

	NACE 28	import	trade margin	**total supply**	NACE 28	export	**total use**
machines	90	0	10	**100**	0	100	**100**
trade	10	0	-10	**0**			**0**

When Finland made the decision to show the FGP output as goods instead of as services, studies of value chains showed that there is also a need to include wholesale trade services to the product basket of the FGP.

3.4.5 FGP at previous year's prices

The HPVNA doesn't provide a description of deflation of FGP like it does for merchanting. Statistics Finland has decided to use the merchanting guidelines also for FGP. Unfortunately export and import price indices of countries where goods are purchased and sold are not available at the moment.

When compiling FGP at previous year's prices, the quality of the results rely on the SUT product information and the availability of prices. In Finland the number of FGP firms is limited and it is possible to check the products of the enterprises individually for the compilation of SUT.

Finland deflates the net output of goods (the 90 in the example) with an export price index for the CPA concerned. For the deflation of the output of wholesale trade (the 10), only the domestic wholesale trade volume index is available. The export of goods (100) is then deflated by the combination of these two.

This section described the choices made by Statistics Finland in recording FGP. It is considered a pragmatic solution and Statistics Finland is still open to revise its practice when further agreement on the FGP recording is achieved at international level.

3.5 Recommendations

On the basis of the above discussions and country practices, the TF concludes that:

- data for all three types of production arrangements should be integrated at the most detailed level possible in supply and use tables;
- service payments, e.g. processing fees or merchanting margins, should be linked at this detailed level to the flows of goods concerned. This will enable the use of "double deflation", i.e. the deflation of imports and exports flows by price indices for the corresponding goods, or to use constant margin ratios;
- deflation of merchanting should follow the principles as described in the HPVNA (section 3.9.2), which are consistent with the principles for wholesale and retail trade margins;
- factoryless goods production is similar to merchanting, but with the difference that production is controlled domestically (because the IPP is owned domestically). Hence, the recording of the transactions should also reflect domestic output of goods.

4 Digitalisation

4.1 Introduction

Digitalisation is a broad term used to describe all kind of possible effects due to the use of digital information and communication technologies and its impact on products and processes. Most relevant for price and volume measures is that through digitalisation existing products have changed in some of their characteristics or new products emerged. The borderline between amended and new products is sometimes difficult to draw.

Given this background, firstly the effect of a possible substitution bias due to digitalisation is analysed. Next, as important examples of digitalisation, the treatment of online streaming, cloud computing and the bundling of information and communication services is investigated. In the last section new e-platforms are analysed, with a focus on the recording in national accounts of the two well-known platforms, Uber and Airbnb.

Thus, this chapter discusses only a selection of issues related to digitalisation. More discussion can be found in Ahmad, Ribarsky and Reinsdorf (2017).

4.2 Substitution bias

National accountants rely – to a large extent – for price and volume measurement on price statisticians to compile detailed and high quality Consumer Price Indices (CPIs), Producer Price Indices (PPIs) and others.

In European countries, CPIs[18] are generally constructed by following – each month – the prices of a representative basket of goods and services. The prices are observed, for the most part, by visiting outlets that sell those products. Great care is taken that the collected prices are for *the same* products as in the previous month, in order to compute pure price changes, i.e. not affected by any changes in the quality of the products followed. The indices are computed with a formula that also takes into account the importance of each product as indicated by its share in total consumption[19]. These shares are updated each year.

When a product in the sample disappears from the market, it will be replaced in the basket with an equivalent product, if that can be found. Fully new products are introduced in the sample once a year. Generally, the introduction of new products is carried out so that it has no impact on the price index.

CPI compilers also take care to properly reflect the shares of the different types of outlets (supermarkets, specialised shops, open markets, internet, …) at which consumers buy. A product can have quite different prices in different types of outlets. If certain outlets get higher market shares, more prices from those outlets will be collected or receive a higher weight. When new outlets appear and become important, they enter the sample at the same time that new products are introduced (once a year).

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[18] PPIs generally follow very similar procedures, except that the prices are collected directly from the producers.

[19] In practice, the shares are available only for groups of products.

The fundamental question is how to treat the price differences between different types of outlets. For lack of better information, statisticians traditionally assume that price differences between outlets, for the same product, are fully attributable to differences in quality of the services delivered by these outlets. Thus, the difference in price between a screwdriver bought in a DIY store and exactly the same screwdriver bought in a specialised shop is equal to the value of the difference in service quality between the DIY store and the specialised shop. In this classic example, most consumers would agree that the specialised shop provides the better service, as its staff is often more knowledgeable and can provide better advice on which screwdriver to buy, justifying the higher price. However, the DIY store can benefit from advantages of scale to be able to sell the screwdriver at a lesser price, which raises doubts about the assumption that the price difference is fully due to quality.

Thus, currently, most substitution between outlets is regarded as volume change. Also, the introduction of new outlets does not lead to a change in price. This methodology, which is rather standard, has often been criticised (see e.g. National Research Council (2002)). One reason for criticism is that new outlets are often cheaper than the old ones, which is automatically interpreted as meaning that they provide a lower quality service. The decline in expenditure caused by shifting to cheaper outlets is entirely treated as a decline in the quality of the services and thus leads to a reduction of the volume of GDP. The resulting bias ("outlet substitution bias") could be resolved if actual estimates could be made of the quality differences between outlets, but no satisfactory methods for this have been found so far, despite over 25 years of research.

Impact of the digitalisation of services

The internet is shifting an increasingly large share of transactions from traditional to on-line stores. Shopping on-line is a different experience from shopping in brick-and-mortar outlets. There are advantages and disadvantages to consumers. Currently, the above described methodology and the fact that products bought on the internet are often cheaper than products bought in traditional shops imply that the shift to on-line shopping results, *ceteris paribus*, in a decrease in the volume of GDP.

In some areas, traditional outlets are at risk of disappearing altogether, in favour of on-line purchases. An example may be airline tickets, for which one used to go to a travel agent, but nowadays are only a few clicks away. If one could agree that this represents a quality improvement for consumers, then the official statistics are underestimating the volume of consumption. On-line banking (and other electronic financial services) has virtually replaced visits to the bank for routine transactions. None of this change is picked up in the volume of GDP.

The internet, in combination with other technological innovations, such as the smartphone, broadband, GPS location services, etc., has also produced a host of new types of services. These fall in two categories:

- *fully new services*, like social media, Google search, Wikipedia, price comparison websites. Such services are often provided totally free (and thereby also excluded from CPIs). Consumers pay indirectly by either providing personal information and/or by accepting advertisements. Discussions are on-going in the national accounts community whether (and

if so, how) a value should be imputed for such free services, and, if so, how to measure their price and volume changes;

- *competitors for existing services*. A good example of this is Airbnb, which provides consumers with the possibility to rent out spare rooms or other living space to other consumers. Airbnb competes directly with traditional hotels, although they provide quite a different service. It is clear that an Airbnb service cannot be directly compared to a service provided by a hotel. In price statistics, the two will be seen as different products. The market share of Airbnb, at the moment, is still limited, reducing the need to introduce it into the CPI samples. So far, the ascent of Airbnb has an impact on the CPI only through the presumably downward effect its very existence has on hotel prices. The inclusion of Airbnb in the CPI would have no direct price impact, in line with the above described methodology, i.e. the presumably lower prices of Airbnb would be seen as a lower quality services than the traditional hotels, which is a contentious assumption.

There is one consistent issue in the above examples: through the internet and other technological advances new or alternative goods and services can be produced in a more efficient way than their traditional counterparts, i.e. at lower prices. These new products are often seen by consumers as improvements to the existing products on offer, at least in some of their characteristics. However, national accounts and price statistics generally assume that price differences can be taken to equal quality differences, i.e. a higher price must imply a higher quality. This fundamental assumption seems less and less appropriate in the modern digital economy.

Example: Uber vs traditional taxis

Uber provides individuals the possibility to use their private cars to provide taxi services. The rides are arranged through a smartphone app. Uber has become, where available, a significant competitor to traditional taxis. The question for statisticians is how to reflect the rise of Uber in GDP and price statistics? Apart from the practical question of getting complete data on Uber transactions, there is the conceptual question of what additional, if any, quality Uber brings to consumers. To determine this, one would theoretically:

- find out what are the characteristics of a taxi ride that people (on average) value most. Options are price, speed, comfort, safety, ease of use, payment options, etc...,
- find a way to measure or evaluate these characteristics, and
- assign a value to them in order to be able to quality-adjust the prices.

It is obvious that this would not be an easy task. Statisticians will have to find more approximate ways to make the comparison.

4.3 Online streaming, cloud computing and bundling of information and communication services

Relevant examples of the impact of digitalisation on emerging or changing products are online streaming, cloud computing and the bundling of information and communication services. These three will be discussed in this chapter.

4.3.1 Online streaming

Content (video, film, audio, music, pictures, text) is digitalised and digitally distributed and consumed. When speaking about online streaming in this report we refer to consumer services only. While the content may still be the same, digitalisation radically changes processes, supply and demand for this content. In addition, digitalisation also gave rise to new content that didn't exist before, for example blogs and YouTube channels. Online streaming means constantly receiving the requested data without, or with only temporarily or partly, storing the content on a local device. This is most relevant for motion picture, video, television programmes, music, audio content, and software (like online games or online applications).

When streaming the consumer does not become owner of the content. The relevant feature is that the provider (or distributor) of content acquires from the owner of the intellectual property rights the copyright for specific content (information products) or the reproduction and distribution rights for this content. The consumer acquires the right to use this content in a specific way, and sometimes also for a specified time span. Different business models are possible. Typically the remuneration of the copyright owners (royalty payments) is either determined as a fixed amount per piece downloaded or based on the number of streams for individual works, for example each time one specific song is listened to online. In the business to consumer relation the user usually pays per item (downloaded or streamed) or on a subscription basis (payment per month, per year, etc.). Sometimes a basic service is offered for free, on which the customer has to accept advertisement in return.

Classification

Online streaming of motion pictures, videos and television programmes is classified in CPA 2.1 class 59.11.25 (Streamed video content). Typical examples of these products are Netflix and Amazon Video. Sound recording and music streaming can be found in class 59.20.36 (Streamed audio content). Examples for this activity are Spotify or Apple Music.

Other online publishing activities, whether streaming or online reading or viewing, have to be classified in division 58 of CPA 2.1 (Publishing services). Online publishing of text, news, pictures should be classified in group 58.1 (Publishing services of books, periodicals and other publishing services). The distribution of audio books (for downloading or streaming) should also be included in this group. Online streaming of software (computer games and other software publishing) is classified in division 58.2.

The broadcasting of internet radio stations is included in CPA class 60.10 (Radio broadcasting services). The broadcasting of television channel programmes over the internet is classified in 60.20.1 (Television programming and broadcasting services). This includes also video-on-demand channels, as offered for example from Sky pay-tv broadcaster.

For consumer price indices, the ECOICOP classification is used in the EU. While the current ECOICOP is somewhat outdated, a revised version agreed at UN Statistical Commission in March 2018 will bring considerable improvements as concerns digitalisation issues.[20] The relevant categories, which are still subject to future implementation in ECOICOP, are:

08.3.9.2 Subscription to audio-visual content, streaming services and rentals of audio-visual content

Includes

- streaming services (film and music);
- rental, download or subscription of CDs, video tapes, DVDs, Blurays, software (excluding game software);
- subscription to cable TV, satellite TV, IPTV, and Pay-TV;
- VOD services;
- subscription to TV via decoder and rental of decoders;

09.4.3.1 Rental of game software and subscription to on-line games

Includes:

- rental of game software (games on CDs, DVDs, Blue-rays etc);
- Subscription to play online games (or streaming);

09.5.2.0 Audio-visual media

Includes inter alia:

- downloads of music and films;

09.7.1 Books

Includes inter alia:

- all electronic forms of books (e-books and audio-books);
- all electronic forms of educational books (e-books and audio-books);

Prices

The CPI: Online streaming services, for example Netflix, Spotify and video-on-demand, are currently included in ECOICOP 09.4.2.3 Television and radio licence fees, subscriptions. This means that in price statistics generally online streaming services are not separately identified.

In the 2017 OECD questionnaire on digitalisation some countries explained that online streaming is not included in the CPI. Consequently it will depend on the countries' individual survey sample plan if and how online streaming services are included in the aggregated index. Secondly, it seems that countries simply price the monthly subscription fee. Necessary data to make a quality adjustment for online streaming is usually not available.

[20] For further details please refer to the documents presented at the 49th Session of the UN Statistical Commission, available at https://unstats.un.org/unsd/class/revisions/coicop_revision.asp

The SPPI: Currently no SPPIs for divisions 58 Publishing activities, 59 Motion picture, video and television programme production, sound recording and music publishing activities and 60 Programming and broadcasting activities are available, following the STS Regulation. For the future it is foreseen to produce SPPIs also for these at two digit levels, but not in a more detailed breakdown.

Volume measures

The desirable A-method would be to deflate the current price output data at CPA class 4-digit level with suitable SPPIs. However, this is not feasible for the foreseeable future. A good alternative would be to use suitable CPIs, adjusted to basic prices. However, also the CPI currently available, for the ECOICOP "09.4.2.3 Television and radio licence fees, subscriptions", is an aggregate of numerous activities. Online streaming is only one of these, and the aggregates do not exactly match the CPA/NACE classes 58 to 60.

HFCE data should be deflated with suitable CPIs. As described above the CPIs available are composed of different products, and it is generally not clear if and how online streaming activities are included in the index. This will depend on each individual country's construction of the price index.

Quality changes in principle constitute a volume effect and should accordingly be taken into account in the price indices used for deflation. However, this does not mean adjusting for different qualities of the content itself; similarly as cinema tickets would not be adjusted for the quality of the film. In this context it should be taken into account that online content is in most cases dynamic and not static, i.e. it is part of the package purchased that for example a certain number of new films or songs are added every month or year, while others disappear. This would not constitute a change in quality. On the other hand a significant shift in the offer, for example the number of films or songs available is significantly increased or the speed or quality of streaming is significantly improved, should be considered a quality change. Up to now such CPIs or SPPIs have not been developed.

4.3.2 Cloud computing

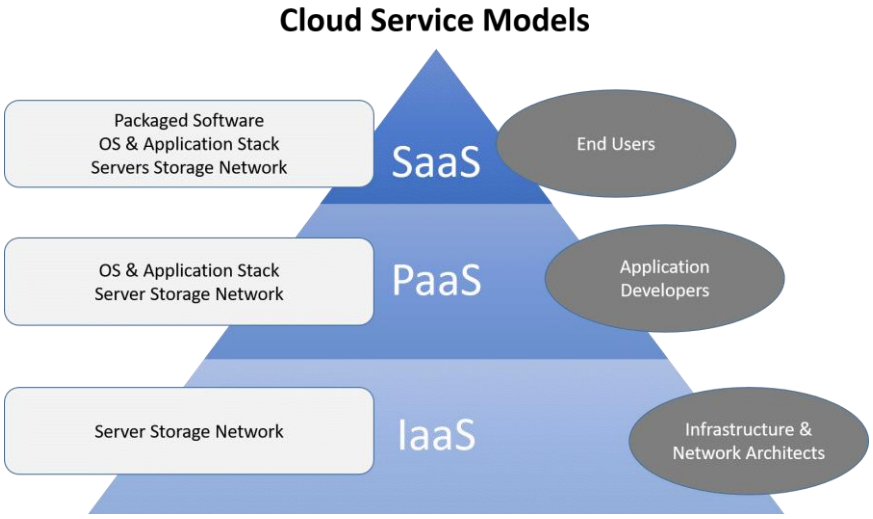
First of all it should be noted that there is no commonly agreed definition of cloud computing. It is a relatively new but rapidly growing service offered over the internet. Users of cloud computing services can be private households or corporations. For private households there is also an overlap with online streaming services treated in section 4.3.1, for example online access to a software package like Microsoft Office.

Three types of cloud computing can be distinguished:

- SaaS: software-as-a-service (email, applications for end users), e.g. Office 365;
- PaaS: platform-as-a-service (operating systems, application development, web servers), e.g. Google App Engine which allows users to build web and mobile applications; and
- IaaS: infrastructure-as-a-service (servers, networking, system management).

These services are hierarchical, as depicted in Figure 4.3.1. The contracts can vary much in duration and level of responsibility offered as a service. Examples of important suppliers of cloud computing services are Amazon, Google and Microsoft. An important aspect is that the supplier and user of the cloud service can easily be located in different countries; it may even not be exactly clear to the user which unit exactly provides the service and where the supplier is located (it is "in the cloud").

Figure 4.3.1: Cloud service models



Source: https://www.uniprint.net/en/7-types-cloud-computing-structures/

The Eurostat/OECD Task Force "Land and other non-financial assets – IPP" is currently discussing the treatment of cloud computing, in particular whether the use of these services are to be recorded as intermediate consumption or gross fixed capital formation. Software, when used in production for more than one year, is a capital asset. The question is thus whether expenditures on software provided as a cloud service should also qualify as capital formation. However, this does not affect the deflation of the output of these services.

Classification

The supply of SaaS should be classified with other software: CPA 58.2 (Software publishing services). PaaS is most likely CPA 62.01 (Computer programming services) while IaaS is CPA 63.11.1 (Data processing, hosting, application services and other IT infrastructure provisioning services).

Cloud services for consumers mainly consist of SaaS and data storage and hosting services which are probably IaaS. In the ECOICOP classification, SaaS will be in 09.1.3.3 (Software), whereas IaaS is currently recorded (by case law) in ECOICOP 12.7.0.4 'Other fees and services'. In the revised COICOP classification agreed at UN level in March 2018 this category is foreseen:

> ***08.3.3.0 Internet access provision services and net storage services (S)***
> Includes:
> - Internet access services provided by operators of wired, wireless or satellite infrastructure;
> - cloud storage, file hosting and web hosting services;
> - subscriptions for email services;
> Includes also
> - activation and installation fees and monthly rate;

Prices

CPI: CPIs for software (ECOICOP 09.1.3.3) should include cloud-provided software when this is important. However, for the IaaS-type services no separate indices will be available yet.

An improvement can be expected with the introduction of the updated ECOICOP. However, we cannot expect for the nearest future separate CPIs for IaaS-type cloud computing services consumed by households.

SPPI: SPPIs for NACE 62 and NACE 63 are available, as required by the STS Regulation. But more detailed breakdowns are generally not produced.

Price and volume measures

The output of cloud computing services should be deflated by appropriate producer price indices that cover the specific services provided. These may be different for the different types of cloud computing services:

- SaaS: existing price indices for packaged software (CPA 58.2 or COICOP 09.1.3.3) could be used
- PaaS and IaaS: as long as specific indices for these types of services are not available, producer price indices for computer programming services (CPA 62) and Information services (CPA 63) could be used as proxy.

For the use of IaaS-type cloud services by households (HFCE) the closest possible CPI should be used for deflation.

4.3.3 Bundling of information and communication services

Bundles of information and communication services are increasingly common in the market, while the market is very dynamic and also the bundles on offer change constantly. Bundles could combine different combinations of fixed line telephony, mobile telephony, fixed line internet access, mobile internet access, hardware (routers, mobiles, TV-sets) and access to content (film, video, music).

Classification

The provision of telecommunication services is classified in division 61 of CPA Ver. 2.1, with a breakdown into classes:

- 61.10 Wired telecommunications services (including provision of internet access),
- 61.20 Wireless telecommunications services (including provision of internet access),
- 61.30 Satellite telecommunication services (including provision of internet access) and
- 61.90 Other telecommunication services (including voice over internet protocol provision).

When bundles of telecommunication services are offered, for example wired and wireless telecommunication services in one package, the product should be classified in CPA 61.90.

On the consumer side the following ECOICOP classes are the relevant ones for telecommunication services:

- 08.3.0.1 Wired telephone services
- 08.3.0.2 Wireless telephone services
- 08.3.0.3 Internet access provision services
- 08.3.0.4 Bundled telecommunication services

In the revised COICOP classification agreed at UN level in March 2018 is very close to the existing one. These categories are foreseen:

- 08.3.1 Fixed communication services
- 08.3.2 Mobile communication services
- 08.3.3 Internet access provision services and net storage services
- 08.3.4 Bundled telecommunication services

The new COICOP also brings together telecommunication and information services into the same division 8.

Prices

CPI: The recommendation on the treatment of bundling of telecommunication services in the HICP, endorsed by the Directors of Macro-Economic Statistics in June 2015 (document DMES/2015/06-03), reads as follows:

> **Recommendation 6: Treatment of bundles**
>
> **Pure bundles** are bundles of services that are only available as a bundle and not sold separately. The expenditure should be allocated to the COICOP subclass according to the purpose of the main component.
>
> There are two exceptions. Mobile call plans often include mobile internet and these bundles are to be included in wireless telephone services, regardless of the importance or weight of the two components. This is also the case with call plans that include the cost of a mobile telephone; these are also to be included in wireless telephone services.
>
> **Mixed bundles are** products which are sold both in bundles and, separately, as stand-alone products. The expenditure on stand-alone products belongs in their respective COICOP subclasses.
>
> The expenditure of mixed bundles should be dealt with according to the Recommendation on the treatment of Bundles (2010): unless the constituent components can be weighed and itemised easily, the bundle should be allocated to the COICOP subclass according to the purpose of the main component.
>
> Mixed bundles that include combinations of telephony, internet and television are allocated to COICOP 08.3.0.4 'Bundled telecommunication services'.

An example of a pure bundle is a mobile call plan where calls and SMS are not available separately. An example of a mixed bundle is the purchase of a tablet (personal computers, ECOICOP 09.1.3.1) and internet data plan (telecommunication services) as a package for a single monthly fee, because both tablets and internet data plans can be bought separately. Two other commonly available mixed

bundles are the purchases of mobile phones with a mobile call plan and the triple play package consisting of fixed phone, internet and TV (see 'Recommendations on the treatment of telecommunication in the HICP', 2015, pg. 7).

SPPI: SPPIs are available at the level of NACE 61 Telecommunications, but not in a more detailed breakdown for groups or classes.

Volume measures

For the volume estimates an approach consistent to the current price data needs to be applied. This means that bundles should be classified according to the main component. If the bundle is itemized and expenditure can easily be split then the components can be allocated to the relevant ECOICOP or CPA class. In turn the value data should be deflated with the best suitable price indices.

Quality changes are treated in the HICP as follows, with a differentiation into horizontal and vertical changes: horizontal quality changes are changes that apply to all customers or affect the entire network. Often these changes cannot be taken into account on practical grounds, in which case the tariffs may be linked to show no price change. Vertical quality changes are changes in the characteristics between a replaced and a replacement tariff package. The following is recommended:

- For the tariff approach, such changes should be adjusted for. The tariff method takes prices from the tariff list in both periods as a matched pair.

For the other approaches vertical quality changes are implicitly included in the method.

4.4 E-platforms

4.4.1 Introduction

Currently there is no commonly accepted definition of e-platforms (also referred to as online platforms or digital platforms) but, as described by Martens (2016), from an economic perspective platforms are known as “two-sided” or “multi-sided” markets where two or more types of users are brought together by a platform to facilitate an exchange or a transaction. It becomes “online” when the platform is connected to the Internet and is reachable with any device capable of connecting to the Internet (e.g., computer or mobile phone).

According to the European Commission (2016) online platforms cover a wide range of activities including online advertising platforms, marketplaces, search engines, social media and creative content outlets, application distribution platforms, communications services, payment systems, and platforms for the collaborative economy.

The European Commission goes on to say that online platforms share some important and specific characteristics. In particular:

- they have the ability to create and shape new markets, to challenge traditional ones, and to organise new forms of participation or conducting business based on collecting, processing, and editing large amounts of data;

- they operate in multisided markets but with varying degrees of control over direct interactions between groups of users;
- they benefit from 'network effects', where, broadly speaking, the value of the service increases with the number of users;
- they often rely on information and communications technologies to reach their users, instantly and effortlessly;
- they play a key role in digital value creation, notably by capturing significant value (including through data accumulation), facilitating new business ventures, and creating new strategic dependencies.

It should be noted that merely having a presence on the Internet is not sufficient for a business to be classified as an e-platform.

Of much interest, especially in terms of recent criticisms regarding what is included or not included within GDP, are e-platforms that facilitate the sharing or collaborative economy. The sharing economy is defined in a report from the UK Office for National Statistics (ONS, 2016) as "*activity that is facilitated by digital platforms which enable people or business to share property, resources, time, or skills, allowing them to 'unlock' previously unused or under-used assets. An important function of the sharing economy is that it brings together or matches suppliers to customers*". The rest of this section will focus on collaborative economy e-platforms.

Verrinder (2016) discussed that existing studies on the collaborative economy have tended to draw a broad definition, to avoid "missing anything", but not to include on-line market places for goods. For example, a study by PwC for the European Commission, published in April 2016, identifies five key sectors (see PwC (2016)):

- Peer to peer accommodation services (households renting unused space, holiday homes)
- Peer to peer transportation (sharing a ride, car, etc)
- On-demand household services (household tasks, food delivery etc)
- On-demand professional services (consultancy, accountancy etc)
- Collaborative finance (crowd funding, peer-to-peer lending)

It appears that the business models of these platforms can differ: either transactions are recorded on a gross basis (booking the full price of the service provided and then taking part of the amount before remitting the remainder to the service provider) or a net basis (retaining a certain percentage of each transaction for their intermediation services). This creates the question of how to consistently record the consumption of the services provided – from the user perspective the cost of renting an apartment includes both the amount paid to the apartment's owner and (if relevant) the accompanying intermediation service fee. A more in-depth analysis of how to record Uber and Airbnb transactions within the national accounts will be discussed in the next sections.

The PwC analysis estimates that in the European Union in 2015, the transaction value of the services facilitated by collaborative economy e-platforms totalled 28.1 billion euros, equivalent to 0.2 percent of GDP (see Table 4.4.1). Although this seems comparatively small, the sector had a growth rate of 77 percent between 2014-2015. Also, the revenues received by the collaborative economy e-platforms amounted to 3.6 billion euros, with a growth rate of nearly 100 percent between 2014-2015.

Table 4.4.1: Revenues and transaction values facilitated by collaborative economy platforms in Europe, 2015, millions of Euros

Activity	Revenue of platform	Value of service provided
Peer-to-Peer Accommodation	1 150	15 100
Peer-to-peer Transportation	1 650	5 100
On-demand household services	450	1 950
On-demand professional services	100	750
Collaborative Finance	250	5 200
TOTAL	3 600	28 100

Source: PwC (2016), Figure 1.

4.4.2 Uber

This section elaborates on the recording of Uber in the national accounts, as an example to the general issues involved in the treatment of digital platforms. The aim is to develop guidance on price and volume measures, but, in order to be able to do that, the current price recording needs to be clarified first.

Hence, we'll discuss first the classification of Uber, before elaborating an example of the recording of Uber in supply and use tables, and then discuss possible deflators.

The classification issue

Uber presents itself as a technology platform enabling users of their apps or websites to arrange transportation services with independent third party transport providers. However, this will mostly differ from the perception of users, who will see Uber as a transportation service provider. Also, Uber competes with traditional taxis. Uber drivers, even if formally independent, may consider Uber to be their employer (as their source of income is generated by Uber). It is these different perceptions of the different actors involved in Uber transactions that complicate the classification of these transactions.

On 20 December 2017, the European Court of Justice settled the classification of Uber from a legal point of view. It ruled that Uber provides more than an intermediation service as the use of the app is indispensable for the service to take place and Uber exercises decisive influence over the conditions under which the drivers provide their services. It therefore finds that the "intermediation service must be regarded as forming an integral part of an overall service whose main component is a transport service and, accordingly, must be classified not as 'an information society service' but as 'a service in the field of transport'"[21].

It is this combination of providing an intermediation service and involvement in the provision of the transport service that stands Uber apart from e.g. travel agencies. In terms of CPA version 2.1, the

[21] https://curia.europa.eu/jcms/jcms/p1_653286/en/

service is a combination of 49.32.1 (Taxi operation services) and 79.11.1 (Travel agency services for transport reservations) or 79.90.3 (Other reservation services n.e.c.). The current CPA does not provide for precisely such a combination.

Hence, it needs to be decided in which of the current CPA classes Uber's services should be classified (and as a consequence in which NACE category Uber belongs). In this respect, it should be noted that in Europe, all Uber transactions appear to be invoiced by Uber BV, Netherlands, the European head office of the company. Uber has offices in other European countries but they appear to provide advertising services or programming services. Their classification should be in line with their main activity. So the main classification question only concerns the Dutch head office.

Below, we'll analyse the possible recording of Uber in supply and use tables following different classifications.

Recording of Uber in supply and use tables

Below some options for the recording of Uber payment flows in the supply and use tables are set out. It is assumed, for simplicity, that Uber is based in the same country as the consumer and the taxi driver. In reality, the service provided by Uber should in most cases be seen as an import.

A household buys a Uber ride for 50 euro. From this, Uber pays the taxi driver 30 euro, keeping 20 euro as the intermediation fee.

a1) Treat Uber as a taxi company with self-employed drivers

	Supply				Use		
	NACE 49				NACE 49		
	Driver	Uber			Driver	Uber	HFCE
CPA 49	30	50		CPA 49		30	50
				value added	30	20	

It is assumed that the taxi drivers are self-employed, providing a service to Uber. A small disadvantage of this treatment is that the total gross output of taxi services includes a double counting of the amount produced by the taxi driver (because taxi services are used as intermediate consumption to produce taxi services).

a2) Treat Uber as a taxi company with employees

If the taxi drivers are to be seen as employees of Uber, the recording would be:

	Supply				Use		
	NACE 49				NACE 49		
	Driver	Uber			Driver	Uber	HFCE
CPA 49		50		CPA 49			50
				value added		50	

b) Treat Uber as providing intermediation services to the taxi driver

	Supply			Use		
	NACE 49	NACE 79		NACE 49	NACE 79	
	Driver	Uber		Driver	Uber	HFCE
CPA 49	50		CPA 49			50
CPA 79		20	CPA 79	20		
			value added	30	20	

In this recording, the taxi driver is seen to purchase services from Uber. This does not correspond to the actual payment flows.

c) Treat Uber as providing intermediation services to households

	Supply			Use		
	NACE 49	NACE 79		NACE 49	NACE 79	
	Driver	Uber		Driver	Uber	HFCE
CPA 49	30		CPA 49		30	
CPA 79		50	CPA 79			50
			value added	30	20	

Here, the household pays Uber for intermediation services provided, who in turn purchases taxi services as intermediate consumption. The household expenses have to be reclassified from taxi services to intermediation services.

d) Split the transaction in two parts

	Supply			Use		
	NACE 49	NACE 79		NACE 49	NACE 79	
	Driver	Uber		Driver	Uber	HFCE
CPA 49	30		CPA 49			30
CPA 79		20	CPA 79			20
			value added	30	20	

Now, the household is seen to have two transactions: one directly with the taxi driver and one with Uber. It may be difficult in practice to reallocate household expenditures in this way.

Note that in these options we adhere to the NACE rule that the classification of a unit follows its dominant output. More options would be available if we allowed, for example, Uber to be classified as an intermediation company while still producing mainly taxi services:

e) Treat Uber as an intermediation company that produces taxi services

	Supply			Use		
	NACE 49	NACE 79		NACE 49	NACE 79	
	Driver	Uber		Driver	Uber	HFCE
CPA 49 CPA 79	30	50	CPA 49 CPA 79		30	50
			value added	30	20	

A final option is to see Uber as a trader of taxi services, producing a margin:

f) Treat Uber as merchanter of services

	Supply			Use		
	NACE 47	NACE 49	trade margin	NACE 47	NACE 49	
	Uber	Driver		Uber	Driver	HFCE
CPA 47	20		-20			
CPA 49		30	20			50
			value added	20	30	

However, opinions are divided on whether SNA 2008 would allow this option.

Price and volume measures

The choice between the options also impact on the choice of deflators. It should be noted first of all that Uber will likely be included in consumer price indices for taxi services. The HICP, for example, uses COICOP as classification and thus classifies transactions by purpose. COICOP does not have categories for reservation services. So for deflation of consumption using CPIs, it would be best to follow either options a) or b) above. (However, this does not answer the question how to deal with the substitution of traditional taxis by Uber – see the discussion in section 4.2.)

Producer price indices are based on NACE; it is likely that no countries have yet included Uber. However, if the Uber fee is a percentage of the trip fare, compiling a price index for this fee is conceptually not complicated (the difficulty is of course getting information on the actual percentage).

Conclusion

The TF prefers option b) from a statistical perspective[22], which considers that Uber provides an intermediation service to the taxi driver, while consumers purchase taxi services. This would provide a coherent deflation method for consumption, as well as for the output of taxi drivers. The intermediation service of Uber itself will need to be included in the service producer price indices.

[22] It should be clear that statistical recording is not to be seen as drawing into question judicial decisions such as the case cited above.

Option d) was considered a good alternative, provided data can be obtained to distribute household expenses over the taxi service and the intermediation service.

If, at some point, it is decided that Uber drivers are legally to be seen as employees of Uber, and thereby have all the rights and responsibilities of employees (e.g. for social contributions) then for consistency reasons option a2) seems to be only solution.

4.4.3 Airbnb

This section elaborates on the recording of Airbnb in the Dutch national accounts and focusses on the measurement aspects. Airbnb is an American company, which operates an online marketplace enabling people to lease or rent short-term lodging. The company was established in 2008 and is active in the Netherlands since 2009. The use of Airbnb services has grown fast in the Netherlands.

As regards the recording in supply and use tables, we treat Airbnb and similar platforms as a reservation service providing intermediation services to the home owner, resp. to the guests, corresponding to option d) in par. 4.4.2. This does not correspond to the actual payment flows. People who rent accommodation pay the price of the accommodation service to Airbnb, plus an intermediation fee (6 to 12 percent of the accommodation price, depending on the amount). Airbnb then pays the home owner the price of the accommodation service. The home owner pays Airbnb an intermediation fee as well (3 percent of the rent charged to the guests).

Besides the classification of Airbnb itself, it is also important to look at the classification of the services produced by households (as unincorporated enterprises). Statistics Netherlands classify these as accommodation services and reduces owner-occupied dwelling services to avoid double counting (as described below). This is in line with existing ECOICOP guidance. However, as e.g. employment related to Airbnb services is negligible, this has an impact on labour productivity measures for accommodation services. For this reason, Statistics Denmark has chosen to include these services under dwelling services. In principle, then only a mark-up is required to cover the surplus for households in renting out their residency. The classification discussion is GDP neutral, but may have an impact on the choice of deflators.

Available information

At the moment Statistics Netherlands does not directly collect information on the supply of lodging services by Airbnb. The information used is obtained from articles in the press and on the internet, studies and reports from universities, municipalities and so forth. See Hiemstra (2017) for an overview of the information sources used.

The usual problems occur when data from the different information types are used. A lot of information is qualitative, definitions differ between sources or are not specified, figures for different periods are given and so on. Nevertheless, by combining the available information, it is possible to arrive at an estimate for the number of rooms and the total value of rents. Although Airbnb is by far the biggest platform in the Netherlands in this field, it is not the only one. According to an estimate by the municipality of Amsterdam, about 75% of the houses in the Amsterdam area that are offered for short-term renting can be found on the Airbnb website. This does not necessarily mean that the market share of Airbnb is 75%. Many home owners advertise on more than one site. Moreover, the number of available houses does not necessarily reflect the number of bookings.

Estimation of the production value

Combining the several sources, estimates were made for the number of rented accommodations and the rent revenues for the period 2009-2016 for Airbnb. Table 4.4.2 shows that the use of Airbnb has grown very fast in this period.

Table 4.4.2: Airbnb rented accommodations and revenues, the Netherlands

Year	Number of nights (*1000)	Revenue (million €)
2009	0.0	0.0
2010	30.4	3.4
2011	30.4	3.4
2012	91.1	10.1
2013	284.8	31.5
2014	569.7	63.0
2015	1424.2	157.5
2016	1700.0	188.0

Estimation of other transactions

Most information that can be obtained from the sources mentioned is limited to the data presented above: the number of rooms and the total rental revenues. For national accounts purposes, additional information needs to be collected, such as:

- Intermediate consumption of Airbnb hosts. The use of goods and services purchased by house owners for their rental activities, such as costs for heating, electricity and water, food and drinks for breakfast, as well as the fees to be paid to Airbnb;
- Final consumption by the domestic consumers of the lodging services and of the fees paid to Airbnb;
- Export of lodging services (in case the guests are non-residents).

A complicating factor is that, as is the case in many applications of the sharing economy, that the traditional distinction between producer and consumer has become blurred. In national accounts, house owners are already seen as producers of services (self-produced housing services for their own final use). Renting out their house means that corrections have to be made on their own consumption of self-produced housing services in order to avoid double counting. The same is true for other transactions like intermediate consumption. Payments made by households for heating, electricity, water, food and drinks that are fully counted as final household consumption should be corrected for the part that is in fact intermediate consumption.

Overview

Table 4.4.3 shows the transactions that should be included in the national accounts. The estimates are based on a variety of sources, complemented by educated guesses where information is lacking. For details, see Hiemstra, 2017. Table 4.4.4 shows the corrections that are made in order to avoid double counting or misclassification of transactions.

Table 4.4.3: Airbnb-related transactions to be included, 2015

	Value (million €)	
Production		**215 *)**
Of which:		
Accommodation services	*215*	
Intermediate consumption		**50**
Of which:		
Several goods (cleaning products, toilet paper, food and drinks)	*40*	
Commission paid to Airbnb	*6*	
Electricity, gas	*4*	
Gross value added		**165**
Of which:		
Tourist taxes	*10*	
Gross operating surplus	*155*	
Imports of services		**10**
Of which:		
Commission paid to Airbnb by households and house owners	*10*	
Exports of services		**179**
Of which:		
Accommodation services to foreign tourists	*179*	
Consumption of households		**40**
Of which:		
Accommodation services to domestic tourists	*36*	
Commission paid to Airbnb	*4*	

***)** The value mentioned in table 1 is adjusted upwards in order to include other platforms as well.

Table 4.4.4: Corrections to be made, 2015

	Value (million €)	
Production		**-51**
Of which:		
Use of own house by owner occupier	*-51*	
Consumption of households		**-95**
Of which:		
Use of own house by owner occupier	*-51*	
Several goods	*-40*	
Electricity, gas	*-4*	

Price and volume measures

Until now, the issue of developing appropriate price and volume measures in this context has not been given much thought. Conceptually, the compilation of a price index for intermediation services by Airbnb is not complicated, as the fee charged is a percentage of the rent. Statistics Netherlands does not yet compile a specific price index for Airbnb accommodation, so for the time being the price index for hotel rooms is used as a proxy. In the short term this seems a reasonable approach, as the two are likely to experience the same seasonal pattern. Since Airbnb covers a range of different types of short term accommodation, a broader index covering holiday homes, caravan

parks etc. may be more representative. Presently, conclusive evidence whether this is a suitable proxy over the long term is lacking.

In order to calculate the volume change for the accommodation service and the service fee charged by platforms like Airbnb it needs to be taken into account that the fee is calculated as product of the value of the underlying accommodation service and the percentage fee. The calculation of prices and volumes can, in principle, follow the methods described for ad valorem taxes in chapter 3.10 or the description for real estate agents in chapter 4.12.1 of the HPVNA. That implies that a price index for the fee combines the change in the price of the accommodation service and the change in fee percentage.

The possibility of substitution bias may be a bigger problem. It is believed that an Airbnb rental is significantly cheaper than comparable hotel accommodation. If this is true, and if consumers have switched to the cheaper accommodation, conventional price and volume measures will miss this effect and the resulting price index will be upward biased and consequently, the volume index will be downward biased. Further research is necessary to determine how this potential bias could be captured. See also section 4.2 for a discussion.

4.5 Recommendations

This chapter discussed a variety of different aspects related to digitalisation. On the basis of these discussions, the TF concludes that:

- It is important to be aware of the risk of substitution bias related to the emergence of new products, the "digitalisation" of existing products or the increase in on-line shopping. In principle, in each case, an evaluation should be made whether new products or outlets constitute quality changes or not. One should be careful with the default assumption that a higher price implies a higher quality.
- Streaming services are becoming more important and will thus need to be reflected in price indices. Normal updates of the offered content are not to be seen as quality changes as they are deemed to be part of the service. On the other hand a significant shift in the offer, for example the number of films or songs available is significantly increased or the speed or quality of streaming is significantly improved, should be considered a quality change.
- Cloud computing services should, if possible, be separated in the three types described in section 4.3.2; the recording and deflation depends on the type of service.
- For the bundling of information and telecommunication services, the principles that were defined for telecommunication services in the HICP should be followed.
- Regarding e-platforms like Uber and Airbnb, the TF considered that they should be regarded as providing intermediation services between households as producers and households as consumers. These intermediation services should be deflated with price indices combining changes in the fee percentages charged and changes in the prices of the accommodation services. The services produced by the households should be deflated with dedicated price indices for these services (mostly still to be developed), or alternatively, with price indices for taxi and accommodations services, resp., as proxy. Compilers should be aware of the risk of substitution bias.

5 Non-market services

5.1 Introduction

The mandate of the TF is to continue research on explicit quality adjustments for education and health. Several TF member countries have undertaken such research during the lifetime of the TF and their outcomes and findings are summarised below.

The focus of the work is thus on quality changes, and the impact different quality adjustments may have on aggregate measures of growth in education and health. Thus, the TF did not conduct new studies on the difference between input and output methods. However, some discussion on the subject took place anyway, in particular in the context of impacts on productivity. It was noted that output methods can show lower growth than input methods, implying a slow-down in productivity. Indeed, output methods can and will give different results than input methods. These differences should be analysed and, where possible, explained. This analysis could lead to the identification of areas for improvement of the output methods.

5.2 Education

5.2.1 Quality indicators for education (project by Statistics Sweden)

Currently, no explicit quality adjustments are used in the volume measures for non-market services in national accounts. The main purpose of the Swedish project was to identify possible explicit quality indicators that are comparable between EU countries. The link to the full report is available in the references section at the end of this report; see Statistics Sweden, 2017(1).

The final report from the previous Task Force presented five possible quality indicators:

- Class size
- Examination results
- Student progression
- Student drop-out rates
- Student satisfaction (tertiary education)

A lot of research on quality in the area of education is focused on “value added” models, where the achievement level of a student is measured with a test before and a test after a period of time. The teacher or school effect on the student’s achievement can then be expressed as the difference between the two tests corrected for information on the students individual history and their family history. The required information for this kind of tests is often not available in European countries, especially not with full coverage and on an annual basis. However, the project has evaluated a similar model, developed originally as a resource allocation model for municipalities.

In this so-called “individual” model, a probability that a student who begins the last year in primary school will be qualified for upper secondary education is estimated based on a number of background variables using results from earlier years. The predicted results are compared with the actual results for the same students after the last year in primary school. If the number of students who are qualified for upper secondary school is higher than predicted, it is assumed to be due to an increase in quality and vice versa. The background variables are:

- Parents education level
- Immigration
- Parents income
- Gender
- Social assistance
- Family
- Number of siblings
- The school's socioeconomic status
- Socioeconomic status of the residential area

The opinion of the project group, supported by the experts, is that the individual model is theoretically the best quality indicator. However, studies of longer time series and similar studies in other countries are necessary. This is the preferable method both for domestic productivity analysis and for National Accounts if such detailed data are available. However, the investigation of data availability from the previous Task Force does not indicate this. Consequently, since comparisons between countries are important, another method is required.

Among the five indicators proposed by the previous Task Force, all experts recommended to use indicators of student's progression for comparison between countries. If progression can be made to different levels of education, the lowest level should be used, as this would be most comparable, according to the experts.

Class size may affects the student's achievements, but given that it does not have to be the case, and that class size is an input factor, we do not recommend this indicator.

Examination results could be a good quality indicator in some countries. However, this is not the case in Sweden. The main concern is that they are not comparable over time.

There are various reasons why students drop-out of school. Since there are many other possible reasons except for bad quality of education, we do not find it relevant as a quality indicator.

Surveys about student's satisfaction could be a good quality indicator, but since they often suffer from bad coverage, they are not suitable for this purpose.

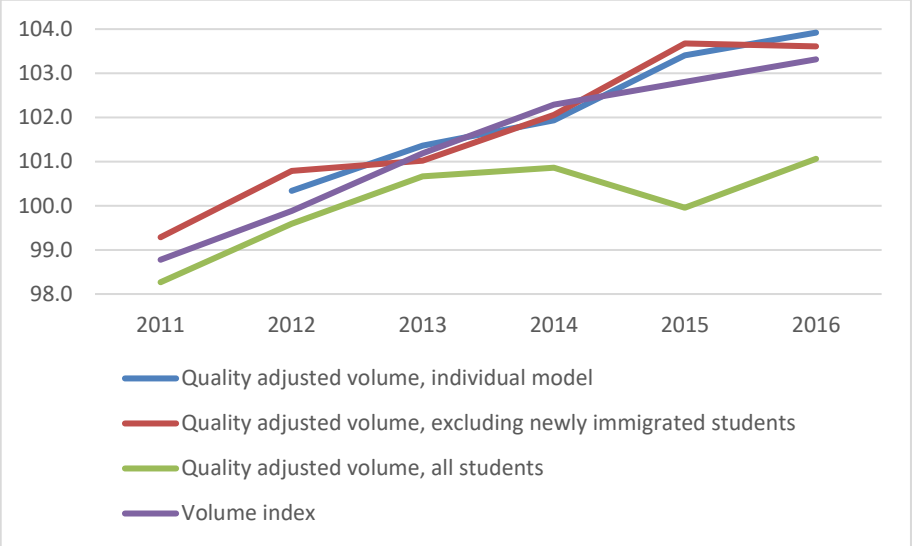
A requirement for any potential quality indicator is that it is not affected by any major external factors. If the preferred quality indicator is affected by external factors, this needs to be corrected for. However, any adjustments of this kind must be discussed with experts and users. Whether the quality indicator can be expected to reflect the quality for all school years, or only a few, needs further evaluation.

Figure 5.2.1 shows experimental tests with data for primary schools for the years 2011-2016. It compares the unadjusted volume index with the volume index adjusted with three different quality indicators: the individual model, students' progression for all students and student's progression for students who have been Swedish citizens more than four years.

From the experimental tests, it is clear that the large increase in number of asylum seekers in Sweden most certainly is the main reason for the decrease in number of students who are qualified for upper secondary education. After correcting the quality indicator for this by excluding newly

immigrated students, we see a completely different result in students' progression rates. The growth of the corrected qualification rates is then quite similar to the growth of the individual model. If we can assume that the individual model, which predicts the student's progression rate, is the best measure of quality in school, then the student's progression rate on a national level might be used as an approximation, as long any major change in external factors can be excluded.

Figure 5.2.1: Volume index and quality adjusted volume index using three methods, all school years adjusted



The theoretical discussion for primary schools is applicable also for upper secondary education. However, due to a major reform of upper secondary schools in 2011, we do not have suitable time series to be able to make appropriate test calculations. Hence, the project group has no further recommendations for upper secondary school.

To find a suitable quality indicator for higher education is difficult. According to the experts we have contacted, there are a few possible indicators available in Sweden. To what extent they reflect the quality of the education requires further research.

5.2.2 Quality indicators for education – UK experience

There are no explicit quality adjustments made within the UK National Accounts due to ESA2010 restrictions, quality is reflected only in the output measures within public service productivity estimates.

Education output consists of an estimate of quantity, which is then adjusted for quality. The reasons for quality-adjusting public service output are well documented and follow from recommendations made in the Atkinson Review (2005).

Quantity is the sum, weighted by cost of education, of full-time equivalent (FTE), publicly-funded pupil and student numbers within the following sectors:

• Pre-school education, including places funded in the private, voluntary and independent sector*.

• Government maintained primary, secondary and special schools. For England only, City Technology Colleges (CTCs) and (City) Academies (CAs) are included*.
**All of these figures are adjusted for attendance.*

From 1996 to 2007 output in Primary and Secondary schools, CTCs and CAs is adjusted using the average point score (APS) per student in GCSE level examinations which are normally taken during the student's eleventh year of schooling. Education output in Scotland, where the Standard exams are taken in place of GCSEs, is quality adjusted using the APS associated with these examinations.

Growing APS are deemed to reflect greater scholastic attainment arising from improvements in the quality of education delivered.

As exam performance varies across geographical areas, the APS quality-adjustment is applied to Primary and Secondary school, CTC and CA output in each country separately. The APS at GCSE level for England and Wales are provided by the Department for Education and the Welsh Government respectively, while the APS associated with the Standard exams in Scotland are provided by the Scottish Government. For reasons of data comparability and availability, the level of education quantity in Primary and Secondary schools in Northern Ireland is quality adjusted using the APS of English schools.

Table 5.2.1: Comparison of output quantity and quality indices and growth rates

Quantity and quality-adjusted output indices and growth rates for UK public service education, 1997 to 2015

United Kingdom	Index numbers (1997=100)			Percentage		
Year	Quantity output index	Quality index	Quality-adjusted output index	Quantity output growth	Quality growth	Quality-adjusted growth
1997	100.0	100.0	100.0			
1998	100.2	102.6	102.8	0.2	2.6	2.8
1999	101.0	104.7	105.7	0.8	2.1	2.8
2000	101.7	105.8	107.6	0.7	1.1	1.8
2001	102.5	107.0	109.6	0.8	1.1	1.9
2002	103.8	108.9	112.9	1.3	1.7	3.0
2003	104.8	109.8	115.0	1.0	0.9	1.9
2004	105.5	111.8	117.9	0.7	1.8	2.5
2005	105.0	114.7	120.4	-0.5	2.6	2.1
2006	103.5	117.1	121.2	-1.4	2.1	0.7
2007	102.5	120.0	122.9	-1.0	2.4	1.4
2008	101.7	123.6	125.7	-0.8	3.1	2.3
2009	101.6	128.5	130.6	-0.1	3.9	3.9
2010	101.5	132.2	134.3	-0.1	2.9	2.8
2011	102.9	134.3	138.2	1.4	1.6	2.9
2012	104.9	133.7	140.3	1.9	-0.4	1.5
2013	105.5	130.6	137.9	0.6	-2.3	-1.7
2014	107.0	127.6	136.6	1.4	-2.3	-0.9
2015	108.0	127.5	137.8	0.9	-0.1	0.9

Source: Office for National Statistics

1. The percentage growth rate shows the year-on-year growth in quantity output, quality adjustment and quality adjusted output

Estimates of quality-adjusted output are carried out in several steps:

1. Time-series data are compiled using (a) the number of students, (b) the level of expenditure in each educational service and (c) the APS at GCSE level for England and Wales and the APS for

Standard examinations in Scotland. Attendance at Primary, Secondary and Special schools, as well as CTCs and CAs is adjusted to account for student absence.

2. The quality-adjustment measures for schools is converted into indices such that:

$$q_{i,t}=q_{i,t-1}\cdot\left(\frac{APS_{i,j,t}-APS_{i,j,t-1}}{APS_{i,j,t-1}}\right)$$

3. A chain-linked Laspeyres volume index of quality-adjusted output is produced for each educational sector and aggregated to a UK level, such that:

$$I^{Q}_{i,t}=I^{Q}_{i,t-1}\cdot\left(\sum_{j}\left(\frac{a_{i,j,t}\cdot q_{i,t}-a_{i,j,t-1}\cdot q_{i,t-1}}{a_{i,j,t-1}\cdot q_{i,t-1}}\cdot\frac{x_{i,j,t-1}}{\sum_{j}x_{i,j,t-1}}\right)+1\right)$$

where:

- i, j and t index educational sectors, geographical areas and time respectively
- I^{Q}_{i} is a chain-linked Laspeyres index of quality-adjusted education output by sector
- $a_{i,j,t}$ is the number of students in each sector and country
- $q_{i,t}$ is the level of quality achieved in delivery
- $x_{i,j,t}$ is the level of expenditure in current price terms
- output in the initial period, t=0, is set equal to 100
- for educational sectors which are not quality-adjusted,

When education sectors are aggregated together using their relative cost weights, an overall UK level, chain-linked Laspeyres volume index of quality-adjusted output is calculated such that:

$$L^{Q}_{t}=L^{Q}_{t-1}\cdot\left(\sum_{i}\left(\frac{I^{Q}_{i,t}-I^{Q}_{i,t-1}}{I^{Q}_{i,t-1}}\cdot\frac{x_{i,t-1}}{\sum_{i}x_{i,t-1}}\right)+1\right)$$

where:

- i and t index educational sectors and time respectively
- L^{Q}_{t} is a chain-linked, aggregate UK, Laspeyres index of quality-adjusted education output
- $L^{Q}_{i,t}$ is a chain-linked Laspeyres index of quality-adjusted education output by sector
- $x_{i,t}$ is the level of expenditure in current price terms for each sector
- Output in the initial period, t=0, is set equal to 100

Further research and changes to quality adjustment from 2013

The quantity of education received is adjusted for the quality of education. Quality of education is challenging to measure as it encompasses many aspects of a child's education; therefore, due to the practicality of what is possible to consistently measure, exam performance is used as a proxy for quality. Research by ONS has found that significant increases in the APS in England between 2008/09 and 2011/12 can in part be attributed to increases in the number of non-GCSE examinations taken as a result of changes in the type of examinations which counted towards performance. The rise in the

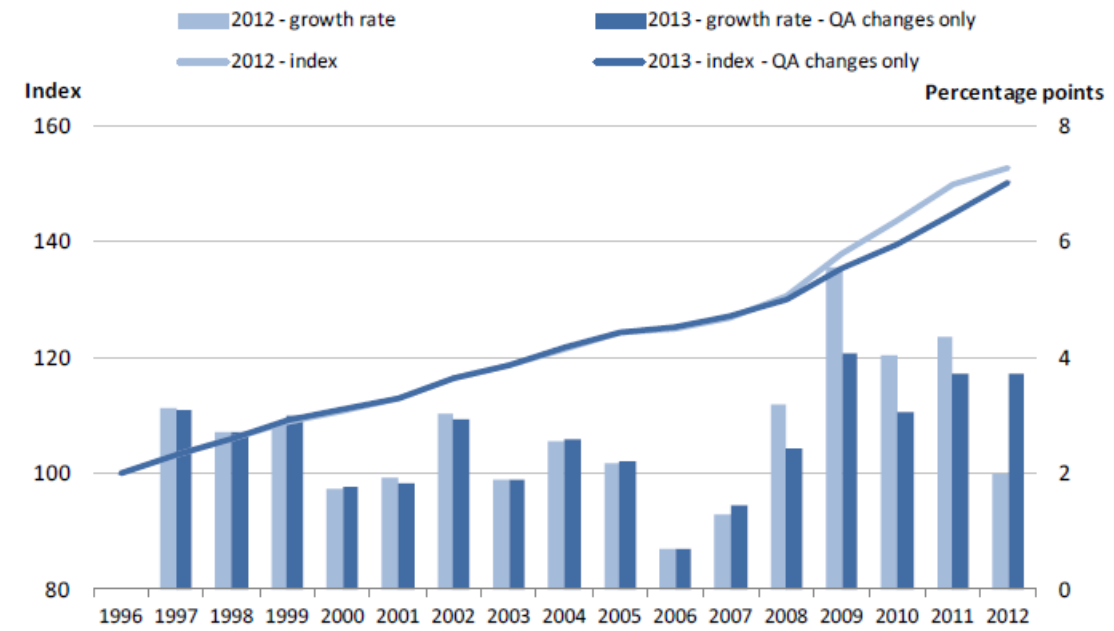
APS over this period therefore overstates the increase in education quality and consequently the rise in education productivity.

In 2011 the UK education department changed school performance tables limiting the number of non-GCSEs which counted towards performance. This led to a large fall in the APS in 2012/13 which cannot be directly attributed to changes in the quality of the education system.

As a result of reforms to the education system in England the suitability of the APS as a consistent measure of examination performance as a quality adjustment was deemed no longer fit for purpose. After a thorough consideration of all available attainment statistics was undertaken by ONS and the Department for Education the most suitable measure was deemed to be statistics on Level 2 attainment at age 16. Level 2 attainment equates to achievement of 5 or more GCSEs at grades A*-C or an eligible Level 2 vocational qualification of equivalent size. Level 2 attainment statistics are very similar to measures published in school performance tables on the percentage of students achieving 5+ A*-C GCSEs; however, the qualifications which count towards Level 2 are restricted and therefore are less likely to have been influenced by changes in the number of non-GCSE examinations taken.

Level 2 attainment statistics are used as the education quality adjustment from 2008/09 onwards, revising the previously published series (see figure 5.2.1).

Figure 5.2.1: Public service education outputs 1996-2012 using 2012 methodology and 2013 changes to the quality adjustment measure



Source: ONS

ONS will be looking again at the suitability of the quality adjustment on a long term basis once new statistics on pupil achievement such as 'Attainment 8' (the new headline measure of school performance from 2016)[23].

5.3 Health

5.3.1 Improving volume measures for health services in Sweden (project by Statistics Sweden)

In the last three years, the production volume for health services needed to be revised significantly each time estimates from the quarterly accounts were replaced with annual data. There has been a downward revision in constant prices of around 5 to 6 billion SEK each year for 2013-2015. In the quarterly accounts of health services, the production volume is calculated using the cost method. In the annual accounts, the production volume is calculated with volume measures based on number of treatments and the DRG system. The purpose of this part of the Swedish project was to improve the quarterly volume estimates for health services by creating a forecast model for the production volume. In order to do this, we also reviewed the volume measures for the annual accounts. A link to the full report is provided in the references section; see Statistics Sweden, 2017(2).

In the annual accounts, the number of health care contacts has, on average, increased by 2.0 per cent per year in 2012-2015. However, the weighted volume has only increased by 0.2 percent per year. The difference is mainly due to three reasons. First, nurses today to a greater extent provide the health care contacts instead of physicians. Second, other primary care (including advisory medical information) is not included in the calculations. Third, the number of expensive treatments tends to increase slowly or decrease.

After a review of the calculation methods, the following areas of improvements were found and have been implemented from 2015 onwards. Volume measures for 2012 to 2014 will be revised in 2019.

Annual accounts:

- Other primary care (including advisory medical information) and psychiatric care was not included in the calculations. These health care contacts have now been included. Both advisory medical information by phone and internet are included.
- The health care contacts, excluding DRGs, were weighted in two steps. First by using proxy weights by type of contact (e.g. nurse vs physician), and second by using the corresponding cost weights. The proxy weights have been removed from the calculations.
- Volume measures on hospital services were based on the number of treatments instead of weighted health care contacts (DRG points). These are now replaced with DRG points.

Quarterly accounts:

[23] See www.theexamsoffice.org/userfiles/.../Progress%208%20and%20Attainment%208.pdf.

- A forecast model for the quarterly production volume is implemented to replace the cost method. The forecast model is based on an ARIMA model of the production volume, the cost method and the population growth.

The improvements resulted in smaller revisions between the annual and the quarterly accounts. The volume method results in a considerably lower growth of production volume than the cost method, resulting in decreasing productivity. However, for health services there are still areas of improvements. Suggestions for further research are:

- The treatment of missing data, especially for outpatient care.
- Treatment of outliers due to new reporting methods for outpatient care.
- Investigate whether we have a problem with substitution bias due to matching at a detailed level.

5.3.2 Improving price and volume measures for health care services (project by Statistics Netherlands)

The Dutch healthcare system is a system of regulated competition in which most health care is insured through a basic health insurance package that is obliged for everyone. Medical specialist care is funded through a Diagnosis Related Groups (DRG)-like system with the Diagnosis-Treatment-Combination (DBC) as the central pricing unit. Statistics Netherlands has developed a basic method to calculate price volume trends in medical specialist care. According to this method, a Paasche price index is calculated using prices and numbers of DBC's from the DBC Information System (DIS) in a "matched items only" approach. A value index is calculated using the DBC-turnover from annual financial reports. The volume index is derived as the value index / price index. See table 5.3.2.1 for the year-on-year value, price and volume changes over the period 2012-2015.

Table 5.3.1: Value, price and volume changes for hospital care, based on the matched items only approach, year-on-year percentage changes

	Year	Value (% yoy)	Price (% yoy)	Volume (% yoy)
DBC's	2013	1.2	1.3	0
	2014	0.6	2.3	-1.7
	2015	-1.7	1.3	-3.0
Add-ons Intensive care	2013	11.8	11.9	-0.1
	2014	6.1	4.1	1.9
	2015	0	5.8	-5.5
Add-ons medicines	2013	28.8	0.7	28.0
	2014	10.5	-2.7	13.6
	2015	8.4	-3.1	11.8
Total	2013	3.3	1.8	1.5
	2014	1.6	2.0	-0.5
	2015	-0.9	1.2	-2.0

The method combines the advantage of timeliness of the annual financial reports with the advantage of a high level of detail of the DIS data. A particular challenge is that the two data sources use a different turnover definition. It is unclear to what extent the different turnover definitions in

the data sources affect calculated value indices, price indices, and thus the calculated volume indices. For the matched items only approach, the Eurostat Handbook on Price and Volume Measures in National Accounts (HPVNA) recommends to match at the highest possible level of detail. Choosing the right level of detail is not always straightforward because a higher level of detail may come at the expense of a higher risk of treatment substitution bias.

An exploration of the necessity of and possibilities for explicit quality adjustments suggests that, in the Netherlands, changes in the quality of healthcare occur at a rapid pace and may affect price and volume trends. In line with the recommendations of the HPVNA, for explicit quality adjustment, it is suggested to use quality indicators that have a direct link with treatment outcomes and are internationally comparable. For the Netherlands, the time-series standardized hospital mortality ratio (TSHSMR) and 'unexpectedly long hospitalizations' are general quality indicators that could be used. Furthermore, one could adjust for quality changes using diseases specific indicators, for example those developed within the OECD's Health Care Quality Indicators (HCQI) project. Quality adjustment using general quality indicators is the first choice option because this approach is not dependent on the availability of indicators per disease, is less time- and labour intensive, and requires to make decisions on how to value quality outcomes in terms of price and volume changes for a limited set of indicators only. The latter issue, of valuing quality changes in terms of price and volume changes is probably the biggest challenge when aiming to carry out explicit quality adjustments in healthcare. For the TSHSMR, one direction could be to convert mortality changes to changes in life years. The changes in life years could be valued in monetary terms, similar to what is done in cost-effectiveness studies in healthcare. A last step would be to discount the changes in monetary terms on the calculated price index. Another field of interest for explicit quality adjustment are the new medical products, such as new expensive medication. It is suggested to employ the change in quality adjusted life years (QALY) associated with the introduction of the new product to account for changes in the quality of care due to new products. Using the QALYs gained for the old and new product, one could calculate a price index for the price per QALY gained instead of a price index per product. It is concluded that, in the Netherlands, explicit quality adjustment in price and volume measurement in healthcare appears beneficial and feasible. Developing a comprehensive methodology, however, would require further effort and research.

Suggestions for further research are:

- Investigate the size and direction of potential upward bias (when new varieties that are of higher quality enter the market at similar or even lower prices) of the price index calculated using the matched-items only approach.
- Explore and quantify the effect of the different turnover definitions used in the microdata (DIS) and macro data (annual reports) used. Investigate potential solutions.
- Investigate to what extent budgetary ceilings set by insurers and hospitals are exceeded. Investigate how to adjust the price index for such exceeding of the budgetary ceiling.
- Investigate the size of and potential adjustment for treatment substitution bias due to matching at a detailed level.

- Develop a methodology for explicit quality adjustments using general quality indicators (TSHSMR and unexpectedly long hospitalizations) and the OECD disease specific indicators.
- Further develop the proposed method to account for quality changes related with the introduction of new medical products, such as expensive medication.

A link to the full report is provided in the references section; see Statistics Netherlands, 2017(1).

5.3.3 Now-casting models for health care services (project by Statistics Netherlands)

Flash estimates of quarterly GDP components are normally calculated on the basis of an incomplete information set. Health services are not an exception in this respect. Presently, a model-based approach is used to arrive at early quarterly estimates of volume growth for the health sector. The need for a model-based estimation emerges from the fact that a large part of the information needed is only available on an annual basis and becomes available at a considerable time lag as well.

Although the current model, that was introduced some years ago, was a considerable improvement compared to the existing estimation procedures at the time, it was felt that there was still room for further improvement. In the current model, there is no time dependency assumed for the relation between the target variable and its predictors. In the project, different time series methods were examined in order to improve the estimates. Another feature of the model that has been used until now is that a rather complex process is used to transform information on laws and regulations into value growth rates that are subsequently used in the model.

The main conclusion is that time series models can improve the quality of the flash estimates for health care services significantly and at the same time reduce the complexity of the current procedure. Several models that were examined clearly outperform the current model according to different accuracy measures. All these models rely on historical data of the target variable in combination with external information on laws and regulations. This eliminates the need for the complex estimation procedure mentioned earlier. A link to the full report is available in the references section; see Statistics Netherlands, 2017(2).

5.3.4 Explicit quality adjustments for hospital services (project by Statistics Denmark)

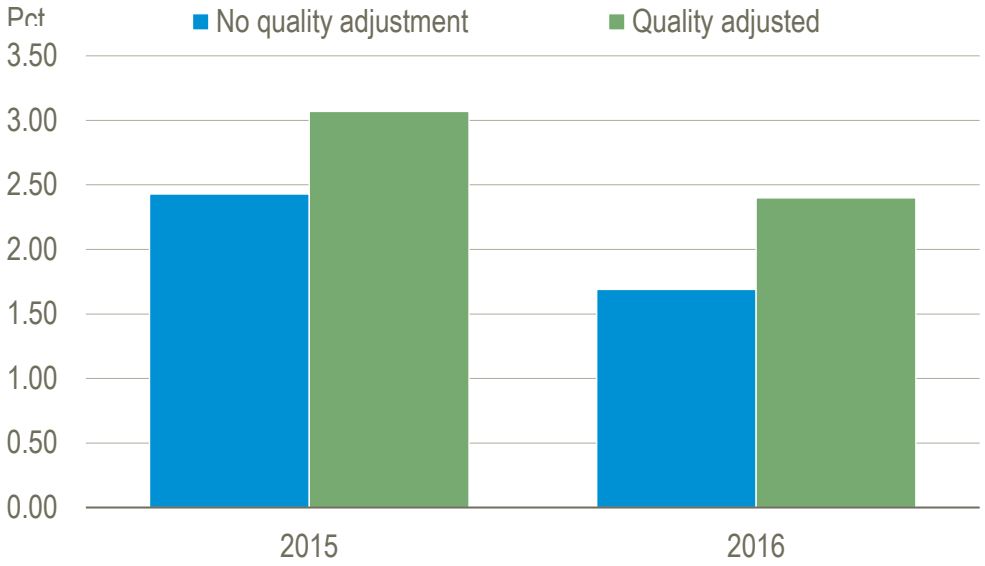
The overall aim of the project was to improve the output volume measurement for health care by investigating explicit quality adjustments for the volume indicator for hospital services. The volume indicator for hospitals is calculated as a Laspeyres volume index, based on the Diagnosis Related Groups (DRG) system. The objectives of the project have been to collect quantitative information on aspects of quality of health care, to experiment with different models of using this information to explicitly quality-adjust the volume indicator for hospitals and finally, to use the explicit quality-adjusted volume indicator for hospitals when performing constant price calculations on production of non-market services for individual consumption (the output measures).

Two types of explicit quality adjustment are used: a general and a treatment-specific adjustment. The general adjustment was applied to all treatment types. By reviewing the Ministry of Health's databank "eSundhed's" variables, we selected variables that were deemed useful and easy to implement for the general quality adjustment. The general quality adjustment for somatic patient treatments was based on variables pertaining to death during operations and for re-hospitalization within 30 days. Also, a satellite national account for non-market hospital services for individual

consumption in constant prices based on the general quality-adjusted volume indicator for hospitals has been calculated.

Figure 5.3.1 shows the volume indicator for hospitals with and without explicit general quality adjustment. The result of the explicit general quality adjustment of the volume indicator for hospitals was an increase in the volume indicator from 2.43 % to 3.07 % in 2015 and from 1.69 % to 2.40 % in 2016. The quality adjusted volume indicator for hospitals has also been applied in the calculation of a satellite national account. By applying explicit quality adjustment when deflating non-market health care services, the output growth for these services increased from 1.5 % to 2.0 % in 2015 and from 1.3% to 1.9 % in 2016. Consequently, explicit general quality adjustment of hospital treatments has a significant effect on the national accounts.

Figure 5.3.1: The volume indicator for hospital services



The general variables for health quality, such as death or re-admission, can be used as standardised quality indicators. However, this project has also another more nuanced approach to measuring health quality. The second type of explicit quality adjustment is the treatment-specific quality adjustment. This adjustment is based on the notion that for a specific type of patient treatment, the health care experts in the particular field are likely to have the best knowledge on quality of the treatment. Consequently, the selection of variables and the extent to which each quality variable should weigh on an index will be decided by the statistical office in collaboration with the doctors/clinicians for that respective type of patient treatment. This means that the patients' experiences and the treatments' long-term effect on a patient may also be included. Moreover, the outcome of a specific treatment in terms of quality is not only determined by treatment characteristics, but also by patient characteristics such as age, lifestyle factors and the health conditions of the patients, which are also taken into consideration.

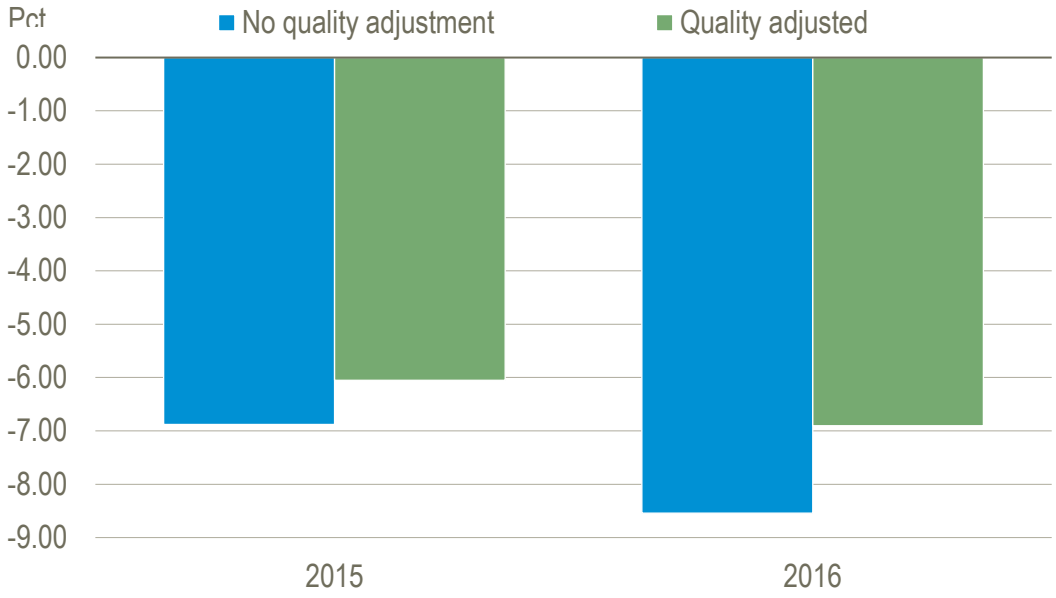
Overall, a quality function, which can capture the health professionals' valuation of a treatment, some standard quality indicators used for all patient treatments, the patient's assessment of the treatment and patient characteristics, seems most optimal to use as instrument for explicit quality adjustment of the volume indicator for hospital services. Although such a quality function can be

difficult to construct, in order to give a rightful valuation of the quality of a specific patient treatment, it is this challenge that this project has taken on.

To this end, we have developed a model of collaboration between health care quality experts and the statistical office in determining treatment-specific quality. The collaboration includes establishing contact and getting access to quality data from a range of patient treatments quality related databases, and for soliciting expert opinions from health care professionals. Based on the collaboration with health care quality experts, the construction of an advanced treatment specific quality adjusted volume indicator for one of the more complicated/expensive patient treatment groups has been achieved.

The treatment-specific quality adjusted volume indicator is based on a weighted index for quality of specific DRG treatments and control/correction variables for lifestyle, health conditions and age. The treatment specific indicator can be incorporated in the volume indicator for all hospital treatments. The results for the volume indicator for Hysterectomy operations (DHHD) with explicit quality adjustment showed that lifestyle, health conditions and age have a large effect on the success of an operation. The treatment-specific quality adjustment for Hysterectomy operations has a significant effect on the volume indicator for DHHD. The treatment-specific quality adjustment increased the DHHD volume indicator's growth with 0.83 percentage points in 2015, and 1.64 percentage points in 2016, as shown in figure 5.3.2.

Figure 5.3.2: The volume indicator for DHHD treatments



The project has been very successful in establishing contact and getting access to quality data from a range of patient treatments quality related databases and in the health community. Due to the amount of the collected data, it has not been possible to fully explore and experiment with all the data within the time and scope of this project. This provides a good platform for further research.

All in all, the comparability and quality of the experimental data used in the project is high. All the results from the many different types of explicit quality adjustment of patient treatments had a positive effect on the volume indicators. Consequently, this is a strong indication that the quality of

patient treatments in general has increased from 2014 to 2016 in Denmark. Moreover, including explicit quality adjustment in the output volume measurement of health care has a significant effect on the national accounts.

A link to the full report is available in the references section at the end of this report; see Statistics Denmark, 2017.

5.3.5 Improving volume estimates for residential care and social work activities (project by Statistics Finland)

Within the project, Statistics Finland improved its volume indicators for NACE Q Human health and Social work activities, more precisely NACE 87 Residential care activities and NACE 88 Social work activities without accommodation. These volume indicators are for the local government sector as the responsibility is mainly on the local government in these activities. As the main result, new, more detailed, output volume and cost data has been researched and gathered. The cost structure is more detailed and logical. It has gone from 12 to 14 services classes, but even greater improvement is in the quality inside each of the new services classes.

Output volume data has been researched to match as closely as possible the new cost data, and assessed for its quality. Unit costs have been researched to be able to weight different output volume components with each other.

Initial research has also been carried out on possible quality indicators to complement the various social activity data. This research included discussions with the experts of the National Institute for Health and Welfare, as well as a learning visit to Statistics Norway. Currently, the "Resource Utilization Group" (RUG) coefficient is being used as a quality indicator in some of our services classes. Other potential quality measures will be further researched in the future, especially as some of the main data sources are about to change significantly.

This work has produced volume indicators of better quality. This comes from a more detailed breakdown services classes, but also from more detailed output volume data, weighted with unit costs. A more transparent work flow was also developed. Simple work flow issues are important factors for the consistency and transparency of the ongoing production and future development.

A link to the full report is provided in the references section at the end of this report; see Statistics Finland, 2017.

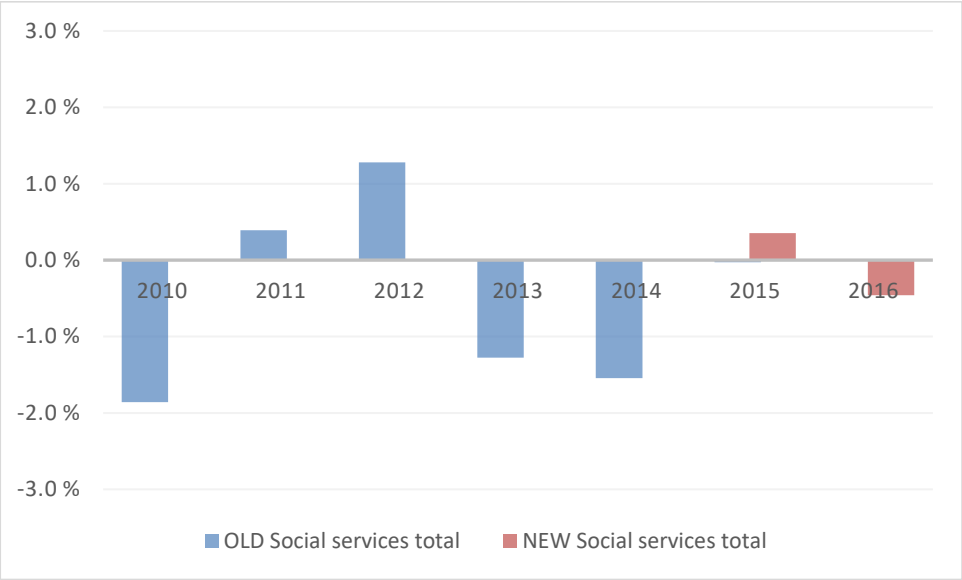
Key results of the test calculations

The detailed calculations can be found attached in the final report of Statistics Finland's grant project (reference/link needed). A quick look at the total level and the two social services products CPA 87 and CPA 88 shows, that the difference in the year 2015, which has been calculated with both the old and the new cost structure and activity data, is quite subtle. On the level of total social services the new indicator is 0.4 percentage point higher (Figure 5.3.3). Overall the time series shows that the total level has stayed fairly stable over the years, never moving in either direction more than 2 %.

For the product CPA 87 Residential care services, the new 2015 volume indicator is 1.7 percentage point higher than the result produced by the old calculation. For the second product CPA 88 Social

work activities without accommodation, the change is in the opposite direction with the new indicator being 1.0 percentage point lower. Thus, the impact of the new methodology is more noticeable at the more detailed level. However, even on the detailed product level the differences are small due to the high level of aggregation. The more interesting progress is inside the compilation of the indicators for the two products.

Figure 5.3.3: Social services total volume indicator, annual change (%)



Quality components in the volume calculations for the elderly care

In two of the services classes for elderly care we use RUG-coefficients as quality adjustments in the volume calculations. RUG-coefficients indicate how resource-intensive the produced care is. More resource-intensive care – with all other variables staying the same – is seen as higher volume. Table 5.3.2 shows that on the institutional side the intensity of the care has stayed the same from 2014 to 2016 thus the RUG-coefficient does not have any effect on the volume. Regarding housing services in around-the-clock care, however, the elderly have received more and more demanding care each year and it increases the volume slightly.

Table 5.3.2: Total volume indicator

	2014	2015	2016
Institutional care for the elderly			
RUG-coefficient	1,03	1,03	1,03
Volume change		-14,4%	-12,8%
RUG-weighted volume change		**-14,4%**	**-12,8%**
Housing services for the elderly in around-the-clock care			
RUG-coefficient	0,92	0,925	0,93
Volume change		10,0%	2,9%
RUG-weighted volume change		**10,6%**	**3,4%**

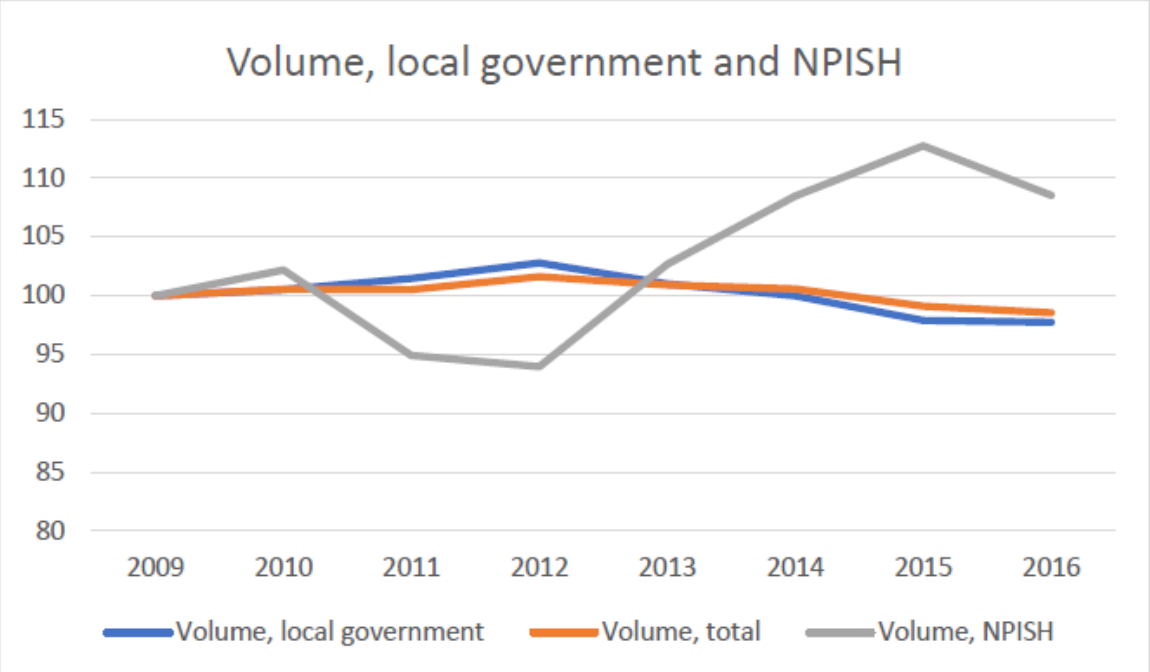
5.3.6 Improving volume estimates for nursing and health care services (project by Statistics Norway)

Statistics Norway's project aimed at improving the volume measurement for non-market nursing and social care in institutions and home-based health and social care services. The output for these services amounted to approximately NOK 98 000 million in 2015 and value added created by the providers contributed 2.7 per cent to GDP. The aim was to improve the volume measurement by developing a more detailed breakdown of the output. Originally, the plan was to use also explicit quality adjustments, but after analysing the available data it was concluded that it was better to improve accounting for quality indirectly by using more detailed data.

The total number of beds in institutions is currently used as a volume indicator for the institution services. One of the problems with this methodology is that the volume indicator does not distinguish between private non-market and public institutions. Another weakness with the methodology is that there is no split between different institution types such as nursing homes and old people's homes. It is reasonable to assume that a bed in a nursing home is more expensive than a bed in an old people's home.

The project showed that the volume estimates can be improved by separating the private non-market institutions and the public institutions. Figure 5.3.6.1 shows the change in volume for NPISH and local government separately. Using the number of bed-days instead of number of beds will also improve the estimates. The estimates can be improved further by carrying out the calculation at the most detailed level (by splitting nursing homes and old people's homes, and by type of service, e.g. long-term stay, short-term stay, rehabilitation). The detailed breakdown of the output is a way to indirectly take quality changes into account.

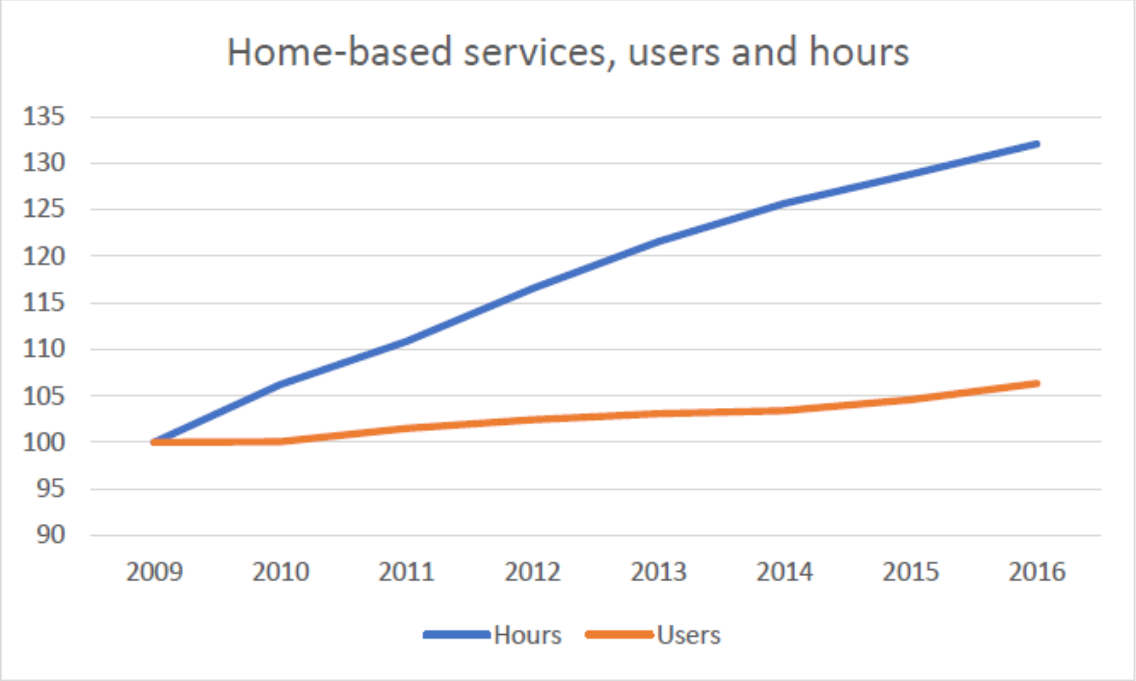
Figure 5.3.4: Nursing and social care in institutions. Volume, by sector. 2009=100.



For the home-based care services, the total number of recipients is currently used as a volume indicator. This methodology does not take into account that there are large variations in the recipients' need for assistance. There is also variation in what kind of service the user receives.

The project showed that the volume estimate can be improved by using the number of hours assigned to each user. Figure 5.3.5 shows the volume of home-based care services using the number of hours and using the number of users. The growth rate increases significantly when using the number of hours.

Figure 5.3.5: Home-based health and care services. Volume using number of assigned hours and number of users. 2009=100.



A breakdown by type of service could further improve the estimates. However, Statistics Norway concluded from the data that distinguishing between professional nurses and lower skilled workers is currently not bringing additional quality to the calculations. Furthermore, a split between non-market private providers and public providers is currently not possible with the data sets available. Further investigations are considered necessary to achieve a split between local government and NPISH data in the estimates.

The change in methodology will be implemented in the annual national accounts of Norway for 2016. The time series from 2009-2015 will be revised in the in the next benchmark revision (in 2019).

A link to the full report is provided in the references section at the end of this report; see Statistics Norway, 2017.

5.4 Recommendations

On the basis of the above described research, the TF concludes that:

- Improvements in methods to take into account quality change for health and education are possible. The research projects undertaken by TF countries describe various approaches that all would improve upon the existing measures. They vary from introducing further detail into the calculations and using new data sources to developing explicit quality adjustments. The impact of the improved measures on growth rates of education and health can be significant.
- For health services, a useful distinction between general quality adjustments, i.e. those that apply to all services provided, and treatment-specific adjustments, which are based on treatment-specific indicators, can be made.
- The experience in Denmark showed the benefit of working closely together with health organisations and experts; similar co-operation in Sweden led to a new and promising approach for education (labelled the "individual" model).
- While introducing increased levels of detail in the product breakdowns is generally recommended, one should again be aware of substitution bias: it may be that products are divided because of different costs, without them providing a different service to the user.
- A number of countries have also improved their methods to produce quarterly estimates for health services that are coherent with the annual estimates. This reduces the need for revisions to early quarterly estimates.

The TF considers that the work on methods to better reflect quality changes in education and health should continue, in order to prepare future discussions on their possible use in the next ESA.

6 Co-operation on price and volume measures

6.1 Statistics Finland's deflator group

Statistics Finland's deflator group has been operating now for almost two years. The cooperation between national accounts (NA), volume indices and price statistics has changed dramatically. Information exchange between statistics in the group works on a daily basis and numerous small development tasks are going on constantly. Also cooperation outside the group is now more structured. Together it is easier to stress important development wishes and to avoid asking for changes that would improve one statistic but could worsen another.

Background

The first steps towards the deflator group were made in the early 2010's when quarterly and monthly NA figures started to differ from the industrial production volume index. Soon, a large number of small methodological differences in volume calculations were discovered. The above mentioned statistics started to meet each other on a monthly basis. When the production system for volume indices was coming to the end of its life, discussions of a common deflator system for volume indices and NA started. IT work started in 2014 and all the small process steps of both NA and volume indices were studied in-depth. It became clear, that also NA's price and deflator process was not transparent enough. It was also too complicated and slow to use as a tool for interaction and development and to be connected to any new process of other statistics.

The new deflator tool, a browser-based application with a graphical user interface, has been in test use now for almost a year. With the deflator tool it is possible to define indices for each supply- and use table (SUT) product and it has direct connections to price index data bases. The SUT-team delivers SUTs to the same system. Deflators for NA and volume indices are combined with collected prices and SUT information. For NA's annual volume calculations, the deflators are extracted from the deflator tool but the application to the SUTs is done in NA's own system.

The deflator group was established to take care of this part of the compiling process for all volume statistics in Statistics Finland. The first and most important task for the deflator group is to ensure that the best SUT-price combinations are in use in all the volume statistics. Only with the cooperation between NA, volume indices and price statistics the best outcome can be accomplished.

Deflator group work in practice

The main responsibility of the quality of deflators is with national accountants. The chairman of the group is also from NA, more specifically from the annual volume calculations. Most of the difficult and controversial questions were already discussed during the project, where the need of common methods and deflators were first observed and then decided. Methodological questions concerning e.g. chain linked indices, or how we would benefit the most of new SPPIs (BtoB, BtoC or BtoAll), are now discussed together and the expertise of every statistics is welcomed.

The development of a common language and the increased understanding by experts of each other's statistics' purposes in the statistical system are big steps forward. It is also clear that the respect for each other's work and its special features has increased.

Role of national accounts and volume indices

In the near future both monthly and quarterly NA will get their deflators directly through the new deflator tool. The index of services production has started to use the tool in March 2018. In summer 2018, the annual NA will start to collect its prices through the new system.

All the methods concerning e.g. extrapolation and interpolation will be the same with NA and volume indices. At the moment, quarterly NA is evaluating industry-by-industry if they could increase the direct use of volume indices. On the other hand, the team producing short-term volume indices is evaluating if the best possible information is used and whether they should use value and price figures instead of direct volume information in some new industries.

The discussions within the deflator group also provide the SUT team with very valuable information about new products and knowledge about compiling price and volume indices. One of the biggest surprises has been that there is a need for more information and use of SUTs. In Statistics Finland, the compilation of the annual volume calculations is part of the responsibilities of the SUT team.

Role of price statistics

When the first links between SUT and price indices were defined with the help of the new deflator tool, there were a lot of discussions about the aggregation level at which the products should be linked. In some cases NA's old links were defined to combine price series from the most detailed level possible. E.g. CPI experts gave advice on the benefits of using always the most aggregated levels possible when linking CPIs to products.

NA has, together with the experts from PPI and SPPI, examined the old SUT and price index combinations and received new suggestions on how to link price indices with products of SUT. At the moment the project to establish base year 2015=100 for PPI and SPPI is almost completed. The new price index series will be implemented in the deflator tool and the links between PPI, SPPI and SUT will be updated in cooperation. In the deflator group meetings the matter will be discussed profoundly and information of the timeline of the coming changes will be given.

Close cooperation has also helped to make the most of other projects. During the work on the base year for PPI and SPPI and NA's SUT and deflator system , it has been possible to discuss the weights used in price indices in perspective of SUT deliveries and the use of common source data at more detailed levels (e.g. customs, PRODCOM, international trade in services, business services statistics). For example, the information at enterprise level of NA's special treatment of global production arrangements is valuable information for other statistics.

Summary

Statistics Finland established the so-called Deflation Group in spring 2016. This is a cross-cutting group bringing together different domains of prices and volumes compilations, in particular business statistics (volume indices), price statistics and national accounts. The work also comprises the development of a common statistical production environment. The aim of the group is to achieve a more coherent use of deflators.

6.2 Deflator team in the UK

Current management of deflators

Currently in the UK, as is the case in many NSIs, price indices are produced separately from the national accounts outputs that use them as deflators, with relatively little shared governance. This separation has led to price statisticians tending to place more emphasis on the use of price indices as measures of inflation for monitoring economic policy or for use in contract escalation and often overlooking their important role as deflators across the national accounts. Similarly, national accountants tend to see deflators as a fixed input that forms part of their production process and not an area to review, scrutinise or challenge. Furthermore, since the deflators actually used by national accounts are different from the price indices produced by the price statisticians, for example due to differences in aggregation methods and weighting, it is not clear where responsibility for deflators really lies. Over time this has led to a loss of transparency and understanding about the deflators that are used and the methods used to create them. It has also resulted in limited development of deflators meaning that they have failed to keep up with the changing economy – something that has resulted in recent external scrutiny.

Improving deflators

As part of a wider transformation programme at ONS, a development project has been established specifically to deliver improvements to the deflators used across the national accounts. This project aims to implement a series of quality improvements to existing price indices used to create deflators including improved sampling methods, increased sample sizes and more frequent updates of weights as well as the development of new deflators to capture changes in the economy, aiming to utilise external experts and academics wherever possible. This project will also deliver training to national accounts staff on how the deflators are produced as well as the publication of information about the deflators used across all national accounts outputs. The team in place to complete this development work does not sit with either national accounts or prices but works closely with them both.

Future deflator management

Work completed so far to improve deflators has highlighted the importance of managing deflators as a distinct entity with close co-operation between users in national accounts and the producers of the price indices used to compile the deflators used. As a result, ONS has committed to maintaining a permanently resourced ‘Deflator Team’ even after the current development project is complete. This team will be responsible for: the regular production of deflators; providing detailed briefing and explanations for deflator movements and trends; determining the methods (for example aggregation, forecasting, etc.) and data sources used to produce deflators; maintaining a programme of continuous improvement that meets the priorities of national accounts users; and negotiating with the producers of data sources, primarily prices, to deliver any quality improvements to better meet the needs of national accounts. It is anticipated that the existence of such a team will, for the first time, provide clear responsibility and accountability for the set of deflators used within the UK national accounts, as well as developing expertise, improving data quality and providing transparency to users about the deflators used and the methods used to create them.

6.3 Recommendations

The TF members confirmed that there is a strong need for better understanding and co-operation between the different domains working on price and volume measures. The initiatives taken in Finland and the UK can be seen as benchmarks. They will contribute to a co-ordinated approach to index production as well as methods developments.

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Annex

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