General Government Output and Productivity

2008-2014

STATISTICS DENMARK

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Symbols

-	Nil or less than half the final digit shown
0	Less than 0.5 than the final digit show
0.0	Less than 0.05 than the final digit show
•	Not applicable
..	Available information not conclusive or not disclosable
...	Data not available
*	Provisional or estimated figures
|	Horizontal or vertical line indicates break in series, which means that data before and after break in series are not fully comparable

Due to rounding, the figures given for individual items do not necessarily add up to the corresponding totals shown.

Preface

This publication describes the way the volume of general government production is compiled in the Danish National Accounts and how this can begin to form a basis for calculating productivity in general government.

The volume growth in the production of public individual services is calculated using a variety of volume indicators (the output method). Some of these are the number of treatments carried out by the healthcare authorities, the number of students in various educational institutions, the number of children in pre-schools, the number of elderly in day care centers and residential homes for the elderly.

The output method was introduced in the Danish National Accounts with the major revision published in September 2014 and is applied for the years 2008 onwards.

The volume growth in public collective services, as for example public administration and police, is still calculated by deflating the value of the inputs used in production by relevant cost indices (the input method).

The introduction of the output method in national accounts is the first necessary step towards calculating productivity in some parts of general government and some results are presented in this publication.

Volume based calculations are highly dependent on whether quality changes of the services can be measured and how the different quality indicators can be weighted together. Some illustrative examples of how it is possible to make quality adjustments are shown in this publication as well as the implications of such adjustments. However, explicit quality adjustments of volume indicators is a field of expertise under ongoing development in both the EU and in Statistics Denmark.

The publication is prepared by Statistics Denmark in collaboration with The Danish Ministry of Finance and is the 7th in the series on general government output and productivity. This publication is a milestone in the sense that it provides documentation on how the volume indicator method has been implemented in the national accounts and the economic growth in GDP. The publication has been prepared in the National Accounts Division by Nura Deveci, Lill Andersen, Lars Gustafsson and Mette Ferslev. The publication is also published in Danish.

Statistics Denmark, February 2016

Jørgen Elmeskov, Director General
Kirsten Balling, Head of Division

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Executive summary

Overview

This publication describes the way the volume of general government production is compiled in the Danish National Accounts and how this can form a basis for calculating productivity in general government.

General government production – an important part of the economy

The economic activities of the general government contribute significantly to gross domestic product (GDP) and overall productivity simply because of its size. The production of general government in Denmark makes up more than 15 per cent of the whole economy, and about 30 per cent of the total employment is within the general government sector.

Measuring the volume of general government output

In the Danish National Accounts the real growth of general government output is based on volumes calculated using two different methods. For non-market services provided to individuals, volumes are compiled using the so-called output method. This method implies that the volume of production used for individual non-market consumption is calculated based on counting the services that the users (primarily households) receive and weighting them together using unit costs for each service. For collective services, the volume of production is calculated by deflating the value of the inputs used in production by relevant cost indices.

Productivity in non-market production

While the output method is the first necessary step towards calculating productivity in non-market production, the input method implies that part of the productivity changes for government-provided services is ignored because the volume of output is assumed to follow the same pattern as the volume of inputs.

The volume of general government services

To calculate the volume of general government non-market individual services in national accounts, Statistics Denmark collects and analyses a large number of quantity indicators and corresponding cost shares. The outcome of this process is 18 volume indicators which are weighted together to calculate the volume of general government non-market production used for individual non-market consumption.

The quality aspects of the volume indicators

Volume indicators ought, in principle, to reflect the quality of the services provided as well as the quantities. The detailed level of the volume indicators that are applied ensures that compositional changes in the volumes of output to some extent capture quality adjustments (implicit quality adjustments). The volume indicators applied for general government non-market individual services in the Danish National Accounts, however, are not explicitly adjusted for quality change in the volumes measured. Hereby, the compilation method meets the legal EU requirements in this field. Consequently the Danish real growth of general government output is comparable with those compiled for other member states of the EU.

Methods for explicit quality adjustment are being developed

Making explicit quality adjustments is complex and depends on subjective assessments and decisions. To avoid heterogeneous adjustments being applied across member states The European Commission does not presently allow countries to perform explicit quality adjustments. However, in order to be able to incorporate explicit quality adjustments to general government output in the future, work on developing methods for explicit quality adjustments is going on both in a working group in Eurostat and in Statistics Denmark. Chapter 7 reports on this work.

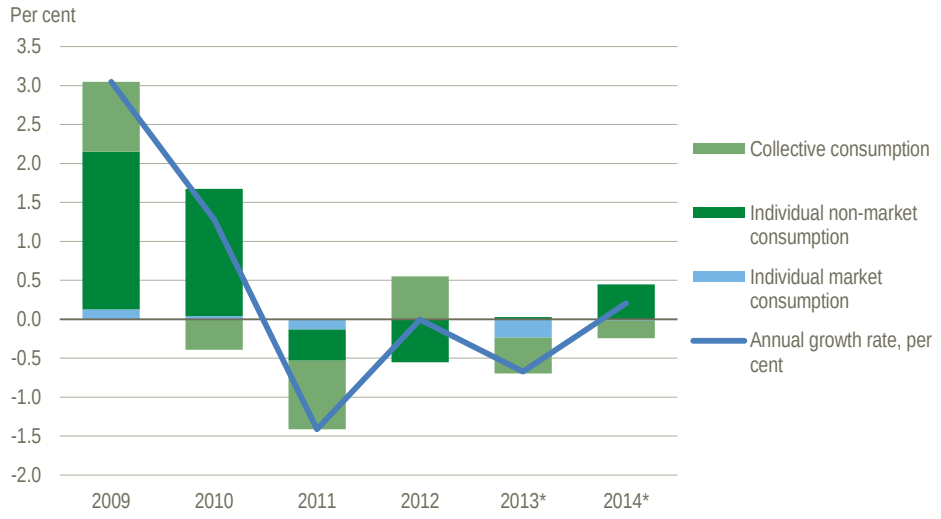
General government consumption

Figure A illustrates the real growth of general government final consumption since 2008 when the financial crisis hit Denmark. It also shows how this development is attributed to changes in individual market consumption, individual non-market consumption and collective consumption.

Positive contribution from individual non-market consumption

Individual non-market consumption as a whole has contributed positively to the overall development in the period, while individual market and collective consumption have contributed negatively.

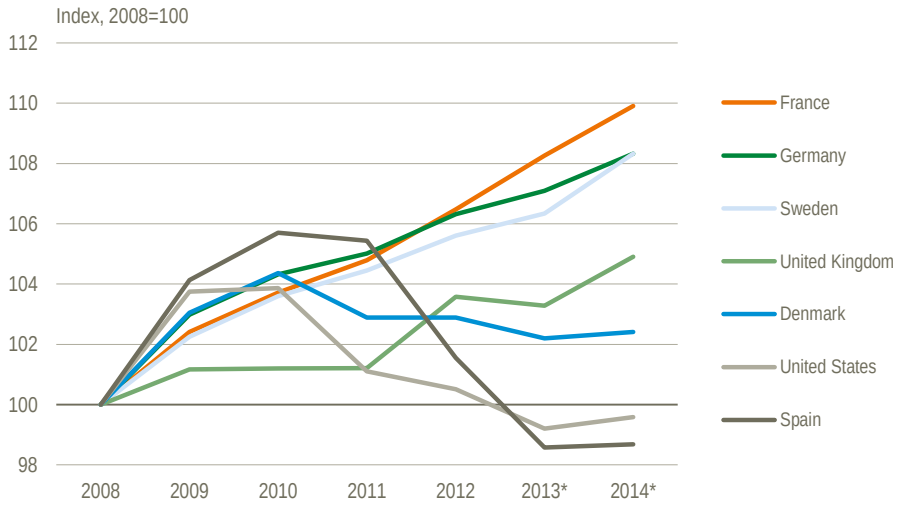
Figure A Annual growth rate of general government final consumption. Chained values



General government final consumption in an international context

Most other countries also experienced fast real growth of government consumption in 2009, cf. figure B. In France, Germany and Sweden the increase continued throughout 2010-2014. Since 2008, government consumption in the three largest European countries, France, Germany and United Kingdom has increased more rapidly than in Denmark. In the European Union (28 countries) the total real growth rate of government final consumption was 4.2 per cent from 2008 to 2014, which is a more rapid growth than the total growth of 2.4 per cent in Denmark in that period.

Figure B General government final consumption. Chained values

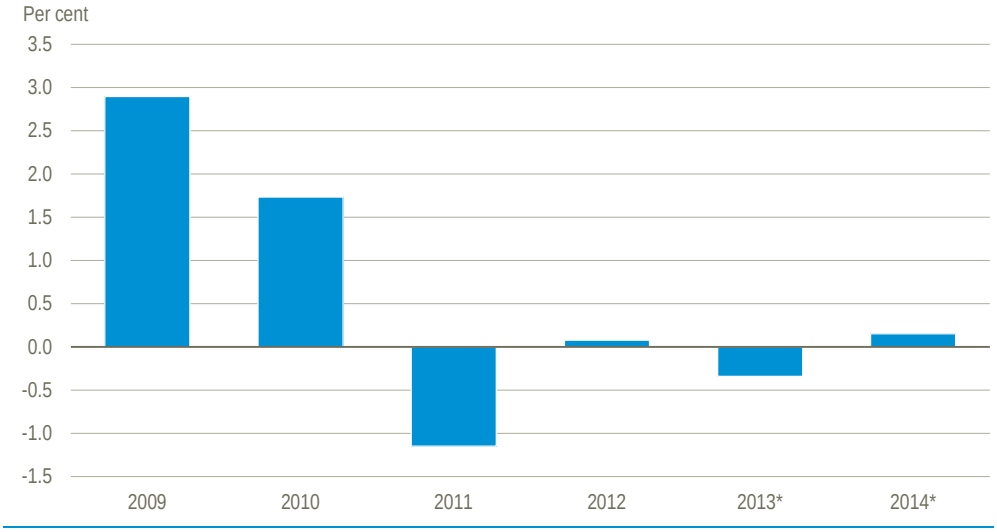


Source: Eurostat and www.statistikbanken.dk.

General government output

Figure C illustrates the growth of general government output during the years 2009 to 2014.

Figure C Annual growth rate of general government output. Chained values



In the years 2009 and 2010 the real general government output increased in total by 4.7 per cent. In 2011 when there was a real reduction in the government's final consumption expenditures, real output also decreased. During the last three years the real general government output remained more or less constant. The total growth rate of general government output from 2008 to 2014 was 3.4 per cent, while the annual average growth rate during the same period was 0.6 per cent.

Productivity in general government

Having applied the output method for calculating the volume of general government non-market individual production in national accounts, a first step is taken toward a meaningful calculation of productivity in general government.

In interpreting the results it should be kept in mind that explicit quality adjustments of the volume indicators are not applied, and it is still possible to improve the indicators.

When comparing general government and market production it should be done keeping in mind that one-fourth of general government output is calculated according to the input method, which rules out productivity growth in the absence of a change in the capital-labor split. Also, there may be less opportunity to substitute labor with capital in the labor-intensive service production of the general government than in, e.g., manufacturing.

Relatively slow productivity growth in general government 2008 to 2014

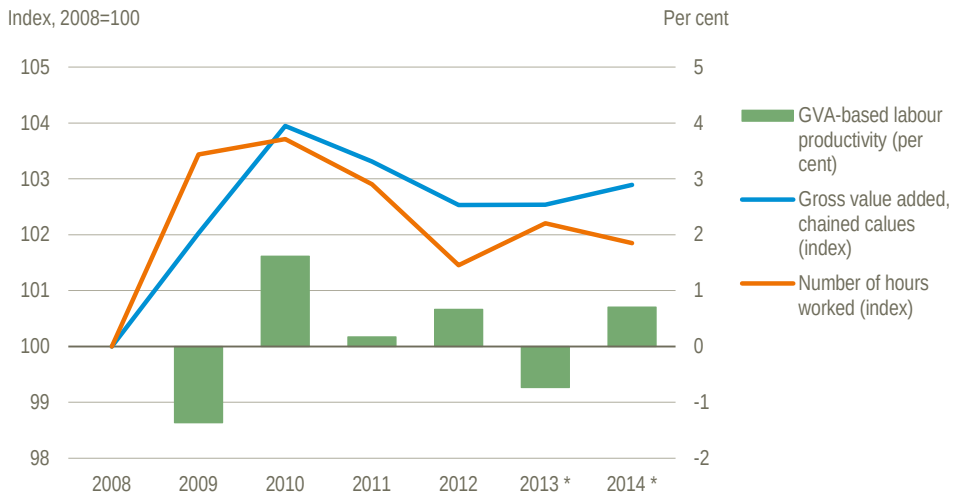
GVA[1]-based labor productivity in general government production increased 1.03 per cent from 2008 to 2014, corresponding to an average annual rate of growth of 0.17 per cent. The productivity growth reflects that gross value added grew at a slightly faster rate than the number of hours worked in general government during that period (Figure D).

[1] Gross Value Added.

Turbulent economic development in recent years

Many aspects of the economy have been turbulent in recent years. Since 2008 when the world economy was first impacted by the financial crisis a wide range of economic policies and instruments have been in use. This is the case both at a national level in Denmark as well as in the EU and internationally. Figure D reflects some aspects of this turbulence, especially in the years 2009 and 2010 where the year-to-year GVA-based labor productivity fluctuates more than would normally be expected.

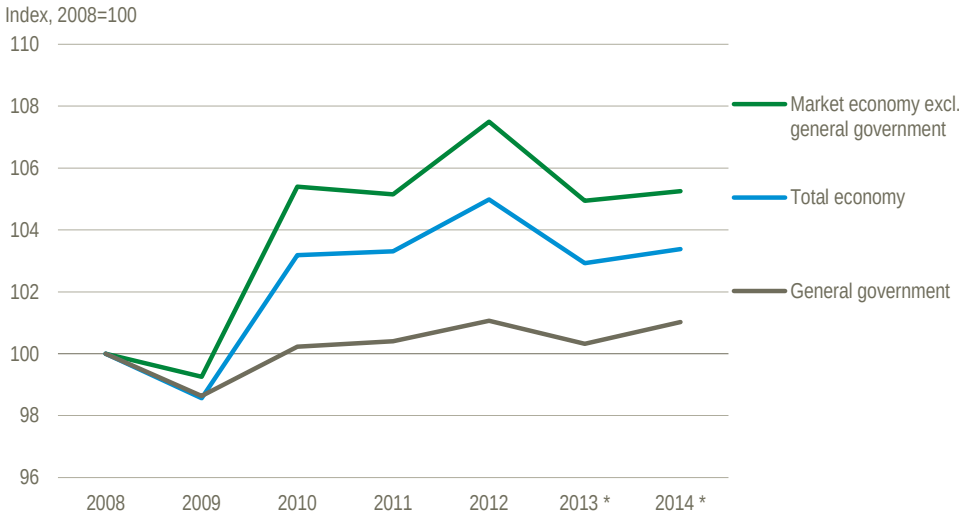
Figure D Annual growth rate of general government GVA-based labor productivity



Faster productivity growth in the market economy

Figure E illustrates the development in GVA-based labor productivity of the general government, market production (excl. general government), and the total economy from 2008 to 2014. For the entire period, labor productivity has been increasing 3.4 per cent for the total economy. Productivity in the market economy increased 5.2 per cent which is much faster than the 1.03 per cent in general government. This difference is almost entirely due to different development paths in the years immediately after the crisis.

Figure E GVA-based labor productivity



1. Introduction

This publication describes the way the volume of general government production is compiled in the Danish National Accounts and how this can form a basis for calculating productivity in general government. Some characteristics of the economic activities of the general government are presented, and we illustrate the development since the financial crisis that began in 2008 and the impact for the economy as a whole. The economic activities of general government contribute significantly to GDP and overall productivity simply because of its size. General government production constituted 16.3 per cent of the total production in Denmark in 2014, and 29.5 per cent of total employment was within the general government sector.

Relevant information

The development in general government output and productivity is of interest to the tax payers, the users of public services and the government. The tax payers finance the economic activities of the general government so they need to know how efficient the revenue is used to generate output. To the users (primarily households) the quality of the public services they are being offered is vital. The government needs detailed information about output and productivity to assess the impact of its policy.

No market prices complicates valuation

General government production has certain characteristics that complicate valuation and productivity calculations. First, there is no market price on most of general government production because the main part is free of charge or sold at a reduced price. This makes valuation difficult. Moreover, the general government covers activities in areas of the economy where the market is insufficient and there is a political preference to stimulate production, and the government activities are in general highly regulated through the economic policy. Also, the production structure of the general government differs from the private sector in terms of both output and input. It produces primarily services and the production process is rather labor intensive. These characteristics require carefulness when assessing and comparing output and productivity in the general government sector with private sector activities. The description of general government output and productivity is, therefore, supplemented with a comprehensive documentation of sources and methods used for calculating these items.

Quality

The development of output depends on a quantity development as well as changes in the quality of the services supplied. Hence, in order to correctly measure the development of output we need to take quality aspects into account. This is a complex process which Statistics Denmark has gradually started. In this publication we present some experimental estimates that include explicit quality adjustment of health and educational output.

Publication structure

The publication is structured in the following way. In chapter 2 the general government sector is described. Focus is on general government production and consumption and their special characteristics as well as some of the main challenges involved in measuring output and productivity of the general government sector. Chapter 3 describes the implementation of volume indicators into chain-linked constant price values in the national accounts. Chapter 4 focuses on the issue of quality and is an initial introduction to explicit quality adjustment of volume indicators. In chapter 5 the focus is on productivity. The chapter outlines various aspects of productivity measurements in general government. The area is at large still at a relatively early state in terms of experience with data collection, for a limited number of years, as well as optimizing methods for using the data in the best possible way. In chapter 6 the sources and methods used for calculating output volume indicators are documented and discussed. Furthermore, the development of the different service areas within general government is described. Focus is on the three main areas, health care, social security and education. Chapter 7 addresses explicit quality adjustment of volume indicators, which is of essence in the en-

hancement of the output-method. The chapter takes a theoretical and practical look at what can be done in the various areas where volume indicators are in use. Chapter 8 takes a look at the output method in contrast to the input method when valuing general government output in volumes. Moreover, the recent developments in general government output, consumption and productivity are presented. Chapter 9 puts Denmark into international perspective by comparing the development in general government output and productivity across a range of western countries. Chapter 10 takes a step back and looks at the topic from a national perspective. The economic impact of the general government on the economy as a whole is assessed.

2. General government economic activities

This chapter provides an overview of general government activities and central concepts associated with measuring general government output.

The general government sector

In the national accounts, the general government sector is defined as the sector that (i) is non-market producer of output intended for individual and collective consumption, and (ii) is engaged in the redistribution of national income. In Denmark, the general government sector includes the central government, 98 municipalities, 5 regions and social security funds (unemployment funds and the Employees' Guarantee Fund). The term public sector refers to the general government and public corporations. Corporations are considered public or non-market if the sales revenue covers less than half of the production costs incl. interest rates, and the general government exerts a certain degree of control regarding the firm's daily operations. Examples of public corporations are: Sund & Bælt, Statens Serum Institut, Bane Danmark and Danish Broadcasting Corporation.

General government expenditure

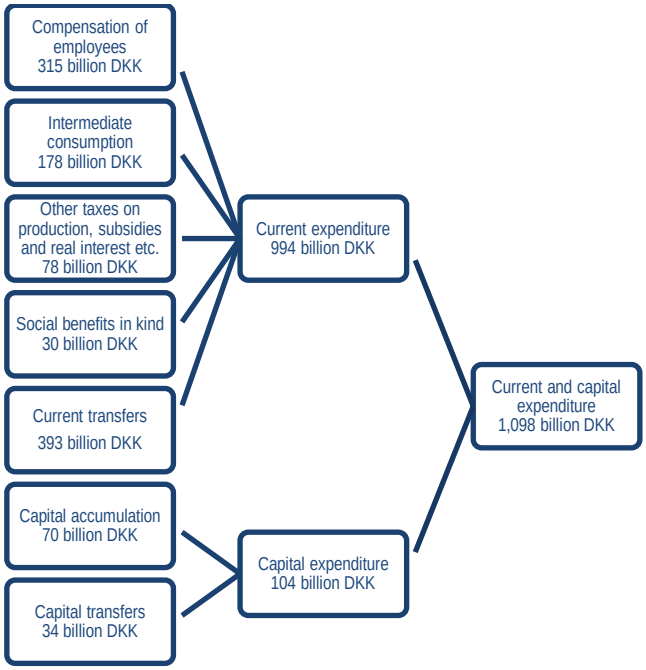
Total general government expenditure was 1,098 billion DKK or 58 per cent of GDP in 2012. The expenditure primarily covers costs related to production of goods and services that are supplied to households and firms, and income transfers to households.

The production costs primarily consist of wages to employees and purchases of goods and services that are used in production (intermediate consumption). In addition it consists of consumption of fixed capital and other production taxes less subsidies.

The income transfers to households include, e.g., pensions, unemployment benefits, social assistance, education subsidies, and family allowances.

The structure of general government expenditure is shown in figure 2.1 below.

Figure 2.1 **General government expenditure. 2012**



2.1 Production value

Non-market services

The general government produces services that are mainly supplied to households. The majority of these services are supplied free of charge or at a reduced price. The services include, e.g., health care (hospitals, doctors, medical products, etc.), care of children and elderly people (nursery homes, preschool, etc.), education (primary school, high school, universities, etc.), public administration, defense, public order and safety, and environmental protection. There is no market price on major parts of the production since only 13.5 per cent of general government production is sold at the market. Hence, the current production value cannot be calculated as the market price multiplied by the quantity sold. Instead, the current production value

Table 2.1 General government production. 2012

	Billion DKK
Compensation of employees	314.6
Consumption of fixed capital	55.9
Intermediate consumption	178.0
Other taxes less subsidies	-3.7
General government production	544.9

Costs of production

Compensation of employees and intermediate consumption measures the current value of the flow of services from labor inputs and inputs of goods and services in production[2]. Consumption of fixed capital refers to the deterioration and technical obsolescence of the stock of fixed assets (incl. research and development). Hence, it does *not* measure the flow of capital services in production. Other production taxes are taxes that the government pays as a result of engaging in production, independent of the quantity or value of the goods and service that are produced (e.g., property taxes and vehicle taxes). By including production taxes less subsidies, the production is valued at the costs that the producers incur (basic prices). As can be seen from table 2.1, compensation of employees is by far the largest cost item reflecting that the general government production is labor intensive.

Gross value added

In 2012, the production value of general government was 545 billion DKK or 16 per cent of the total production value at current prices in Denmark. An alternative, often used, measure of productive activity is gross value added, which is defined as production value less intermediate consumption[3]. The share of gross value added produced by the general government is higher than the production share due to a relatively low intermediate input share in general government production. In 2012 the share of total economy gross value added produced by the general government was 23 per cent. This is much more than the manufacturing (13 per cent), trade (12 per cent), transport (5 per cent) and construction industries (5 per cent).

Zero return on capital

When calculating general government production by summing production costs, the return to the invested capital is assumed to be zero. This is different from the method used for calculating private firms' production where the net operating surplus and mixed income (which may include a return on capital) is *not* assumed to be zero. This difference may imply that the general government production is systematically undervalued compared to private production, everything else being equal. Special characteristics of general government production, e.g. lack of competition, may, however, have the opposite effect, so it is not possible to determine whether general government production is under- or overvalued compared to private production based on the available information.

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[2] Provided that the production factors are paid their marginal products.

[3] For the economy as a whole, gross value added may be calculated as GDP less product taxes, net. Product taxes are taxes that depend on the quantity or value of the goods and services that are produced, e.g., VAT.

Production in different industries

General government production takes place in 19 different industries, cf. table 2.2. The industries from number 84202 to 87880 make up industry OPQ called public administration, education and health. The majority of general government production takes place within these industries. For each of the industries public administration, education and residential care, the general government production value was more than 100 billion DKK in 2012.

The government is the sole provider of public administration. Furthermore, the government is the primary provider of education, human health activities and residential care. General government production constitutes between 76 and 95 per cent of the total production values in these industries. In total, in the OPQ industry general government production covers almost 90 per cent of the total production value in 2012.

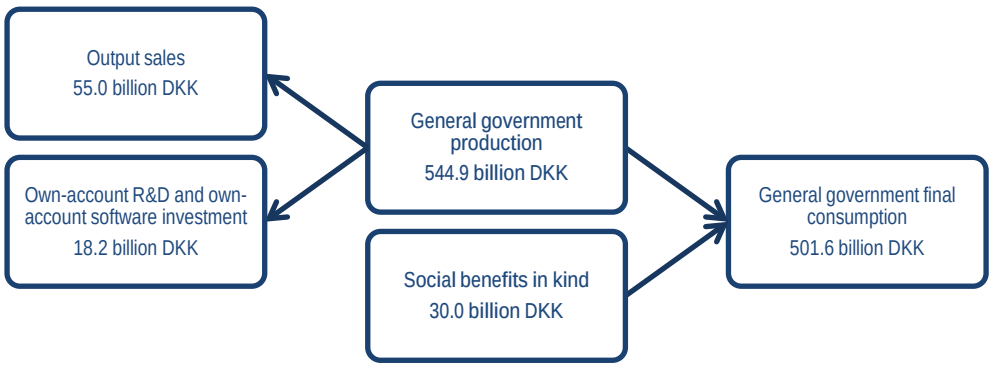
Table 2.2 General government production. 2012

Industry (69 classification)	Production, billion DKK	Share of total production, per cent
02000 Forestry	0.7	15.9
41430 Construction	9.0	4.4
50000 Water transport	0.3	0.2
52000 Support activities for transportation	5.1	11.2
59600 Motion picture and television pgm. prod., sound recording; radio and tv	3.7	15.8
68300 Renting of non-residential buildings	1.9	2.8
71000 Architectural and engineering activities	1.3	2.5
72001-72002 Scientific research and development	3.8	18.9
78000 Employment activities	11.6	53.4
79000 Travel agent activities	0.4	2.5
80820 Security and invest.; services to buildings and landscape; other business services	1.3	3.1
84202 Public administration etc.	139.5	100.0
85101-85202 Education	124.6	86.7
86000 Human health activities	96.8	76.0
87880 Residential care	122.9	95.2
90920 Arts and entertainment; libraries, museums and other cultural activities; gambling	10.8	38.3
93000 Sports activities and amusement and recreation activities	3.8	27.6
94000 Activities of membership organizations	7.3	27.9
96000 Other personal service activities	0.1	0.5
Total general government production	544.9	16.2

2.2 Government final consumption

The links between general government production and general government final consumption are illustrated in the figure below.

Figure 2.2 From general government production to general government final consumption. 2012



Social benefits in kind

The services produced by the general government supplied to households and firms free of charge or at a reduced price together with social benefits in kind, make up general government final consumption. Social benefits in kind are general government purchases of goods and services from market producers. The majority relates to health services, e.g., medical practice which is purchased by the government from general practitioners, and medicine which may be purchased directly by the government or by the households with financial support from the government.

Output sales

The current value of general government final consumption is calculated by adding social benefits in kind to the production value and deducting own account research and development and output sales of goods and services. The output sales component typically consists of services where a small part of the expenditure is paid for by households, for example user payment for child care and payment for official documents. The majority of the value of this sale is part of household consumption.

Own account R&D

Own account research and development (R&D) is output that general government has produced and invested in the sector itself. Hence, it is investment and not final consumption.

Transfers to households

Transfers to households are *not* part of general government final consumption. Transfers to households are income in the household sector and may thus be used for household consumption.

Close relationship between production and consumption

There is a close relationship between general government production and consumption. The vast majority of general government consumption is produced by the government itself. Moreover, the majority of general government production is used for final government consumption. In 2012 this share was 86.6 per cent.

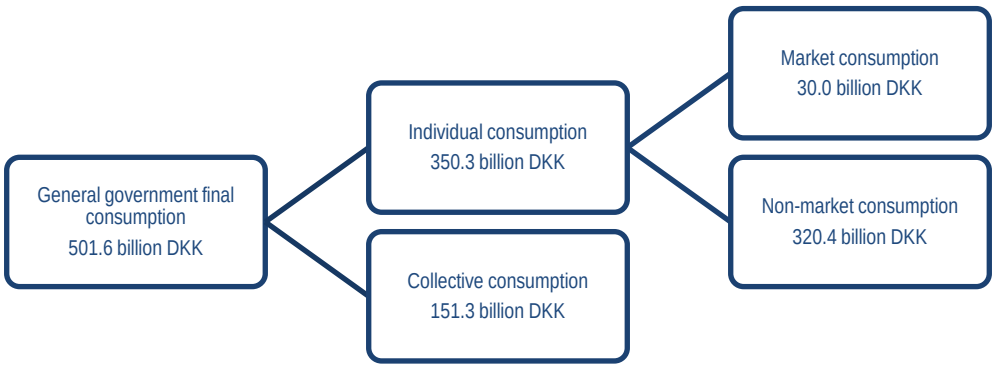
Government consumption is 26.6 per cent of GDP

General government final consumption was 501.6 billion DKK in 2012. It constituted 26.6 per cent of GDP and 18.0 per cent of total final demand. In comparison, household's final consumption was 31.5 per cent of total final demand while investment's share was 12.8 per cent.

Individual and collective consumption

General government consumption is categorized as either individual or collective. Individual consumption covers services for which a relationship to certain individuals, households or groups of these can be identified. Collective consumption is services provided to the society as a whole. Collective consumption includes, e.g., administration, defense, public order and safety, and environmental protection. In 2012, 69.8 per cent of general government consumption was individual, while 30.2 per cent was collective.

Figure 2.3 General government consumption. 2012



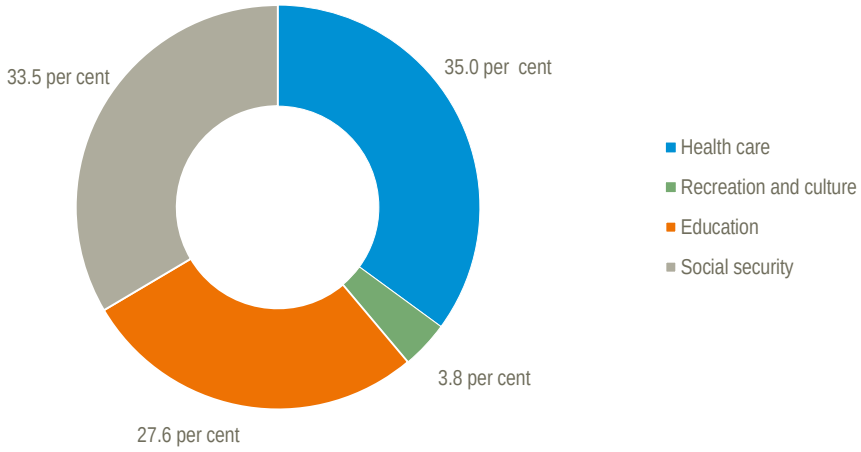
General government individual consumption consists of market as well as non-market services

General government individual consumption consists of market consumption as well as non-market consumption. Figure 2.3 illustrates that less than 10 per cent of the total individual consumption is market consumption (30.0 billion DKK). While non-market consumption consists of services produced by the general government itself, market consumption consists of market based services purchased by the general government and provided free of charge to the public. An example of non-market consumption is primary education in public schools, while an example of market consumption is the services of the general practitioner in primary health care. The primary education in public schools is produced by the general government while the primary health care is a market service produced by the general practitioners. However, both services are provided free of charge to the public, paid for by the general government.

Individual non-market consumption

Individual non-market consumption consists of social security (33.5 per cent), education (27.6 per cent) and health care (35.0 per cent) while only 3.8 per cent is recreation and culture. Social security relates to, e.g., care activities due to sickness, disability and old age, unemployment, and family and children's needs. Education relates to primary, secondary, higher and adult education but does not include private primary schools.[4] Health care mainly relates to treatments at public hospitals and public dental services.

Figure 2.4 General government individual non-market consumption. 2012



2.3 The volume of general government services

Approaches to measure volumes

In order to calculate the real development of general government production and consumption, we need to separate price changes from volume changes. For the part of general government consumption which is purchased at the market, the real development is calculated by deflating the production value at current prices with observed market prices. For non-market production, it is not possible to calculate the real development by deflation since there are no observable market prices. Instead, Eurostat lists four approaches to measure the volume of general government non-market production[5]:

- The input method: deflating the production value at current prices with a price index of the costs involved in production.

[4] Private primary schools are considered as Non Profit Institutions Serving Households (NPISH) consumption in the national accounts.

[5] Handbook on Price and Volume Measures in National Accounts, 2001.

- The output method: counting the services the users receive (for example the number of health treatments or pupils attending school lessons).
- The activity method: counting activities, i.e., what the government is doing with the inputs (for example operations offered at hospitals and school lessons offered in schools).
- The outcome method: the results of public service output (for example higher life expectancy or better job prospects).

The input method

Until September 2014 the input method was used to calculate all volume developments in general government non-market production and consumption. There was no distinction whether the production was for individual or collective consumption. After September 2014 all general government *individual* non-market consumption, from 2008 onwards, is calculated in volumes using the output method. It is the official mandatory Eurostat method due to a European Commission resolution[6]. However, general government non-market production for *collective* consumption is still calculated in volumes using the input method. Hence, the real growth of collective consumption is calculated by deflating the wages with a wage index, the intermediate consumption with an industry specific good and services deflator and the consumption of fixed capital with a suitable deflator. The reason behind the input method still being used for collective consumption in volumes is the non-excludability and non-rivalry of collective consumption. Both of which complicates the establishment of a link between volumes and activities of general benefit to society. In turn using the input method for collective consumption in volumes implies that, in the absence of a change in the split between labor and capital, there are by definition no productivity changes.

The output method

The essence of the method is counting the services the users receive. An appealing property is that it's ideally consistent with the measurement of household market consumption. Since individual non-market consumption consists of many heterogeneous products, in principle a volume measure for each product exists, and to construct an overall measure of the volume of output, each volume indicator is weighted by its unit cost:

$$Volume\ of\ output = \sum_{i=1}^{N} Unit\ cost(i) * Quantity(i) \qquad (2.1)$$

In the equation above, the volume of output may be the volume of hospital services. N is the number of different treatments offered in hospitals. For each of these treatments, the unit costs and the number of treatments carried out during a year are estimated. To calculate the total volume of health care services in the national accounts, the volume of hospital services is weighted together with volume indicators of other health care services, where the weights are the cost-share of each service.

18 volume indicators

Statistics Denmark collects and analyses a large number of quantity indicators. Within health care for example more than 1,300 indicators are used. The outcome of this process is 18 volume indicators which are weighted together to calculate the volume of general government non-market production used for individual consumption in the national accounts. The volume indicators cover most of the total costs of producing output for individual non-market consumption. The rest is calculated by assuming that the price development is similar in areas of production close to a specific volume indicator. There is also uncertainty regarding the unit costs. For details about data and method, see chapter 6.

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[6] Commission resolution of 17 December, 2002. Official Journal of the European Union 20.12.2002. Initially, Denmark was granted a temporary exception to this method. Therefore, the new method was only incorporated into the Danish national accounts in November 2014.

Quality changes

The volume measures based on the output method may be improved. First, more basic information may be incorporated into the calculation to improve the exactness and coverage of the indicators. Second, explicit quality adjustment of the volumes may be incorporated, see chapters 4 and 7. However, when judging the quality of the volume measures it is worth remembering that perfect information is not available about the development of prices and quantities sold at the market either. The Danish Productivity Commission identified several problems related to measuring prices of market service transactions, and assessed that half of the turnover in private service industries is deflated with price indices which do not adequately take quality changes into account. Statistics Denmark is continuously working on improving the price and volume estimates of market as well as non-market production.

The activity method

Eurostat does not recommend using the activity method because activities do not directly relate to the output of the government service. If for example the number of a certain type of operations decreases due to new and more effective drugs, then the activity method would measure a decline in output but from the patient's point of view this is actually an improvement in output. Instead, activity measures how the government is using its inputs.[7]

The outcome method

Even though the outcome method measures the ultimate objectives of the general government and individuals when consuming the government services, Eurostat does not recommend using this method. This is because the outcome is affected by external factors that have nothing to do with the service provided, and this makes it difficult to establish the link between the output of the service and the outcome. The link between health treatments and life expectancy is a good example. The treatment may improve life expectancy but the exact effect depends on the individual's general health condition and life style.

[7] This example is from the Atkinson Review, page 31.

3. Volume indicators in the national accounts

This chapter describes how the volume indicators in practice are implemented in the national accounts.

Supply and use tables

The 18 volume indicators of general government production of services are incorporated into the national accounts from 2008 onwards, and the indicators are an integrated part of the detailed supply and use tables (SUT), which consists of more than 2,300 goods and services, including the non-market services.

Volume indicator calculation

Price and volume data exist for j non-market services which covers a specific area, such as hospitals. It is assumed that the j services (e.g. treatment types) are comparable between two periods. The volume indicators are calculated as Laspeyres quantity indices $I_{t-1,t}$ between periods t-1 and t:

$$I_{t-1,t} = \frac{\sum_j P_{t-1,j} * Q_{t,j}}{\sum_j P_{t-1,j} * Q_{t-1,j}} \qquad (3.1)$$

Below an example, realistic in principle, that illustrates how the volume indicators are applied inside the framework of the SUT-system, calculating the non-market product balances in constant prices.

Example

Application of volume indicator in SUT

Example: A non-market health sector supplies the economy with two services for individuals. Hip replacements and appendectomy. The price (DKK) and production structure is as follows.

$P_t^{hip} = 100.\ P_t^{app} = 200$
$Q_t^{hip} = 1{,}500.\quad Q_t^{app} = 500$
$Q_{t+1}^{hip} = 1{,}500.\ Q_{t+1}^{app} = 500$

The price for a hip replacement in period t is DKK 100 and the price for an appendectomy is DKK 200. The Q's refer to the number of operations performed in period t and t+1.
On this basis a Laspeyres' quantity index is calculated:

$$QIDX_{t,t+1}^{Laspeyres} = \frac{100 * 1{,}500 + 200 * 500}{100 * 1{,}500 + 200 * 500} * 100 = 100$$

Not surprisingly the development in quantity (and volume) is zero per cent from period t to t+1. This volume indicator, named M2, is now applied to all cost components attributable to industry classification 860010 Hospitals activities.

The table below illustrates how M2 is used to calculate the corresponding deflator MIPI2 which is used to price deflate all non-market cost elements related to public hospitals.

(continues)

(continued)

Cost component	Industry	*t* (current prices)	*t+1* (current prices)	*t+1* (constant prices)
		DKK 1,000		
Compensation of employees	860010	150	200	150
Intermediate consumption	860010	70	100	70
Other production taxes, net	860010	6	10	6
Consumption of fixed capital	860010	30	40	30
Total		256	350	256

In period t the salary at current prices paid to employees working in public hospitals is DKK 150,000. In the following period t+1 it is DKK 200,000. In period t the sum of the costs is DKK 256,000 and in period t+1 it is DKK 350,000. Prior to introducing the non-market volume indicator, the four cost components would have been calculated in constant (previous year) prices using the input method. By applying the output method the constant prices in period t+1 is calculated using the volume indicator M2. Since M2 has an index of 100 corresponding to a zero per cent development in volume, each of the cost components in period t+1 (constant prices) is equal to the value of the cost component in period t, measured in current prices.

Finally, the volume indicator-based implicit deflator MIPI2 can be calculated as:

$$\text{MIPI2} = \frac{350{,}000}{256{,}000} * 100 = 136.7 \text{ per cent}$$

The deflator illustrates that the price of non-market hospital services has increased by 36.7 per cent from period t to t+1. The MIPI2 can now be used in the non-market volume indicator subsystem to price deflate all cost components most appropriately associated to the volume indicator, M2.

Proximate volume indicators

In the example the volume indicator-based deflator MIPI2 is used to deflate general hospital services. It could also be used to deflate closely related non-market individual services provided by non-market agents – services to which a specific tailor made volume indicator is not calculated at present time. The underlying assumption is that the development in prices in the two closely related areas is the same. In this way all non-market services provided for individuals are covered by the best suitable volume indicator, either by a volume indicator which is a perfect match (in 2010 around 90 per cent), or by a volume indicator, which after close examination reasonably can be used as a proxy (in 2010 around 10 per cent).

Full incorporation of volume indicators

The example is a realistic illustration of the non-market volume indicator production system which is fully incorporated into the annual national accounts production system. An appealing property of the chosen methodology is that the national accounts at constant prices to a high degree reflects the actual volumes of services provided, as observable in official statistics other than the national accounts.

Detailed level of calculation

The general government activities at constant prices are calculated at a quite detailed level. The four cost components at current prices covering all general government activity are attributable to around 75 public industries and about 85 functions of government (COFOG). A subset of around 50 functions of government is attributable to non-market individual services provided by general government. All of these are calculated at constant prices using volume indicators as illustrated in the example. In total 18 volume indicators corresponding to MIPI2 are used. They cover all areas of individual non-market services provided to the public by the general government.

4. Quality

This chapter provides an initial introduction to explicit quality adjustment of volume indicators.

The volume of output depends on the quality of the service as well as the quantity. In terms of the different hospital treatments from the last chapter, the quality adjusted volume of hospital services can in theory be measured as follows.

$$Volume\ of\ output = \sum_{i=1}^{N} Unit\ cost(i) * Quantity\ (i) * \mathbf{v_{quality}} \qquad (4.1)$$

In this equation each of the N different treatments are multiplied by an M-dimensional vector of quality characteristics, $\mathbf{v_{quality}}$. The quality parameter is multidimensional because each of the N treatments may be differentiated according to a host of quality characteristics, for example waiting time before an operation, pain suffered during the treatment and drugs needed. For a sufficiently detailed set of quality characteristics (a sufficiently large dimension of the vector, M), compositional changes in the volume of output reflect both quantity and quality changes.

Implicit quality adjustment

In reality, we distinguish between implicit and explicit quality adjustment. The detailed set of volume indicators that we have identified ensures that compositional changes in the volume of output to some extent reflect quality adjustments (implicit quality adjustment). This is for example the case when one current treatment is substituted with a new and better treatment of the same illness. The level of details is, however, not sufficient for compositional changes to reflect all quality adjustments relevant to suppliers and users. Therefore, we make experimental explicit quality adjustments.

Measuring quality

Quality is related to the intended outcome of the service – both from suppliers' and user's points of view. For example, quality relates to the extent to which the non-market service succeeds in delivering the outcome that is intended by the general government. It also relates to the extent to which the service corresponds to the user's request. As explained in the preceding subsection, if the outcome depends on the user of the service it is difficult to measure the service's contribution to the outcome. If, on the other hand, the outcome is largely attributable to the supplier then a measure of the user before and after may reflect the outcome of the service.

Explicit quality adjustment

In order to make explicit quality adjustments (i) we have to know the desired outcome from supplier's and user's point of view, i.e., which quality characteristics do they value; (ii) we must be able to measure the part of the outcome that is attributable to the service; and (iii) we must also weight the different dimensions of quality into an overall quality adjustment. As this is quite complicated, the European Commission does not presently allow countries to perform explicit quality adjustments for use in the national accounts. However, in order to incorporate explicit quality adjustment of the general government's output in the future, the work concerning quality adjustment continues in a working group in Eurostat. Denmark takes part in this working group, and the development of explicit quality adjustment methods is an ongoing work at Statistics Denmark. For more information on the progress and preliminary results, see chapter 7.

5. Productivity

This chapter outlines various aspects of productivity measurements in general government. The area is at large still at a relatively early state in terms of experience with data collection, for a limited number of years, as well as optimizing methods for using the data in the best possible way. The work is in progress.

Productivity measures

Productivity is usually understood as the ratio between a volume measure of output and a volume measure of input. There are, however, different ways to measure output (gross output or gross value added) and input (labor or capital or an index of different types of inputs). In this publication we apply two different productivity measures:

- Output-based labor productivity = (gross output-other production taxes, net)/number of hours worked
- GVA-based labor productivity = (gross value added-other production taxes, net)/number of hours worked.

Gross value added less other production taxes, net is gross domestic product at factor costs. It is calculated as

production value
- intermediate consumption
= gross value added
- other production taxes, net
= GDP at factor costs

It measures the income generated by production which is available for remuneration of the productive inputs, i.e., compensation of employees, consumption of fixed capital, mixed income and net operating surplus, where the latter two items are zero in general government production. Gross output less other production taxes, net and gross value added less other production taxes, net are chain-linked 2010-price values.

Labor productivity

The two productivity measures show how productive labor hours are to generate output and gross value added, respectively. The measures only partially reflect the personal capacities of workers or the intensity of their effort because they depend on the joint influence of other inputs, which may affect the personal capacities or intensity of efforts. We will for example expect that capital deepening (an increase in capital input per hour) or an increase in the quality of the work force will have a positive impact on labor productivity. Likewise, disembodied technical change (advances in technology which is not embodied in the inputs), e.g., diffusion of general knowledge about for example organizational structure, management and capacity utilization may affect labor productivity.

Outsourcing

While the output-based labor productivity measure relates to both primary inputs (labor and capital) and intermediate inputs, the GVA-based measure relates only to primary inputs. Hence, the former depends on how the ratio of intermediate input to labor changes, and the latter is less dependent on changes in this ratio. This is relevant if the government outsources the production of some of the services that it supplies, for example parts of the elder care. In that case, labor is substituted with intermediate inputs (service input bought from private firms), and it is assumed that gross value added and labor decrease while output remains the same. These effects translate into an increase in output-based labor productivity since labor decreases, but since both gross value added and labor decrease, the GVA-based productivity measure is less sensitive to this substitution.

Growth accounting

We use growth accounting based on a theoretical production function with output-augmenting (or Hicks-neutral) technical change to calculate multifactor productivity (MFP)[8]. Output-based labor productivity growth is decomposed into contributions from capital deepening, labor quality changes, changes in intermediate inputs per hour and MFP growth (the Solow residual). The contribution from capital deepening is calculated as capital's cost share multiplied by the growth rate of capital input per hour worked. Likewise, the contribution from labor quality changes is calculated as labor's cost share multiplied by the growth rate of labor quality per hour worked, and the contribution from changes in intermediate inputs per hour is calculated as intermediate input's cost share times the growth rate of intermediate inputs per hour worked. The MFP growth is residually calculated.

Costs of capital

The cost of capital covers only consumption of fixed capital since the return to capital in general government production is assumed to be zero. This is consistent with the measurement of general government production based on the sum of the costs involved in production. It is, however, different from market production where the costs of capital include a return to capital. For this reason, we have to be careful when comparing productivity contributions in non-market production with market production.

Output-based MFP

When inputs (both primary and intermediate) are adequately differentiated and each is correctly measured, effects of embodied technical changes are picked up by the capital and intermediate inputs terms such that MFP growth can be interpreted as disembodied technical change. The MFP term also picks up spillover effects from primary and intermediate inputs, i.e., effects on overall productivity which is not valued in the input factor's remuneration. However, since the MFP term is residually calculated, in reality it also captures (i) embodied effects of technical change which are not covered by the measures of capital and intermediate inputs; (ii) skill composition of labor input which is not covered by the measure of labor quality; (iii) non-technology effects which are ruled out by the simplified assumptions of the growth accounting framework though present in reality. For example adjustment costs and economies of scale, and (iv) measurement error in data.[9]

GVA-based MFP

In the case of GVA-based labor productivity, productivity growth is decomposed into contributions from capital deepening, labor quality changes and MFP growth, where the MFP term is again residually calculated. In this case, MFP growth does *not* reflect technical change – not even from a purely theoretical perspective. It can, however, be shown that there is a direct relation between output-based MFP growth and GVA-based MFP growth: the growth rate of GVA-based MFP equals the growth rate of output-based MFP multiplied by the inverse of the share of gross value added to output (at current prices)[10]. Since GVA is the income generated by the primary factors, the GVA-based MFP measure may be interpreted as reflecting the general government's ability to translate technical change into income.

Calculating inputs

The sources and methods for calculating capital input and labor quality in general government production are the same as those applied to the productivity calculations for the market economy by Statistics Denmark. The inputs of primary factors are calculated according to the direct method that counts the volume of inputs (as opposed to the indirect method where wages and prices are used to deflate current expenditure). Based on detailed information about the government's capital stock and hours worked in the general government, we may calculate the services from

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[8] The approach relies on a number of simplifying assumptions, e.g., perfect competition, profit maximizing firms, and constant returns to scale.

[9] For a good thorough description of the interpretation of the multifactor productivity term, see OECD's productivity manual (2001).

[10] Brown (1978) – see OECD's productivity manual (2001), chapter 3.

primary factors in the total government production as well as splitting it up into the 19 industries where the government activities take place.

Capital services

The flow of capital services in a certain year is calculated as the average of the general government's net stock of capital (chained values) at the start and the end of the year for 8 different types of capital. The rent of each capital type is calculated by multiplying the volume with its user cost. The user costs are assumed to be identical to the user costs of capital used in the market production of services excl. dwellings and non-residential buildings. The final calculation of the flow of capital services is based on a weighted sum of the growth factors of the 8 volume measures, where the weights are the calculated rent shares. This final calculation may be done for the entire general government or for general government production split up into 19 industries.

Labor quality

In the present productivity calculations, labor quality relates to education which is split up into 5 categories. We use information about the distribution of total hours worked in each industry on the 5 categories of education. The growth factor of these 5 x 19 volume measures are weighted together to a quality-adjusted measure of the development in total volume of labor input, based on their wage shares of either general government's total wage bill or general government's total wage bill in each industry.

Intermediate goods and services

The input of intermediate goods and services is calculated based on the growth rate of the general government's intermediate consumption at chained values. This is the same method as is used in the productivity calculations of the market economy.

KLEMS

The results of the GVA-based method for general government will be compared to the labor productivity measures of the market economy published by Statistics Denmark. Likewise, the output-based results will be compared to the KLEMS productivity figures for the market economy, which are also published by Statistics Denmark. In the KLEMS calculations the contribution from intermediate inputs is decomposed into contributions from energy, other goods and services, respectively.

6. Volume indicators – sources and methods

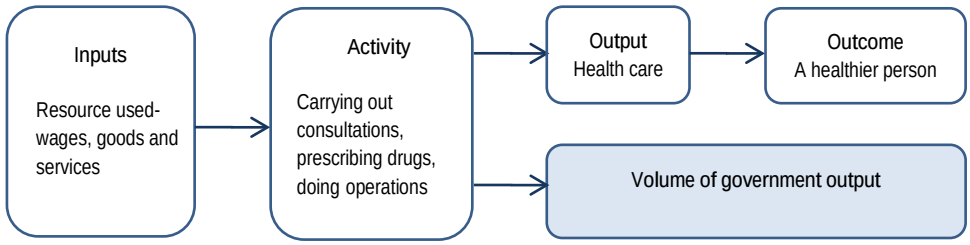
This chapter describes the theory behind the general method for compiling volume indicators. Furthermore, the compilation of volume indicators specific to each of the areas of human health, residential care, education and recreation and culture are described.

6.1 The method in general

Identification of general government output

To determine the volume of general government production two central questions need answering: What is the public output and how do we measure it? To answer the questions we need to distinguish between output, outcome and activity. Outcome and activity are influenced by the recipients of the public services, for instance the result of a treatment at hospital is influenced both by the health care authorities through consultations, drugs etc. and, also, by the individual, e.g. through lifestyle etc. The objective here is to identify relevant quantity and quality indicators for measuring volume of government output. Figure 6.1 shows the path undertaken by the government in order to improve the health of the population. The inputs into the process are the time of medical staff as well as goods and services. Combined, these inputs undertake certain activities such as prescribing drugs and carrying out operations. These activities constitute health care, the output of the government. An output (e.g., health care) leads to the desired outcome of a healthier person. However, individuals can contribute to being healthier, e.g., through diet and exercise, so the challenge is to capture only the government output that contributes to this outcome.

Figure 6.1 Path to improve the health of the population



Volume indicators

The volume growth of general government production is calculated using a variety of indicators. Some of these are the number of treatments carried out by the healthcare authorities, the number of students in various educational institutions (for primary school, number of pupil hours), the number of children in daycare, the number of people in elderly care centres and residential homes for the elderly, etc. The output-based method involves calculating the production value, using constant prices based on counting the number of representative activities in different categories and then weighting them together, using the unit cost for each activity. Unit costs are used as weights in the absence of unit market prices for non-market services.

The aim is that the output-based method should be analogous to the method used for the market economy. In order to be able to do this, information regarding prices and volumes in two consecutive periods is required.

Theory of output-based constant price calculation

The production value in period t is the multiplication of the price, P, and the volume, Q, in that period. To calculate chained values we also need to calculate the production value in period t at previous year's prices, i.e., the volume in period t multiplied by the price in period t-1.

Now bilateral Laspeyres volume indices (indicators) between periods *t-1* and *t*, can be calculated as:

$$I^{B}_{t-1,t} = \frac{\sum_{j} P_{t-1,j} * Q_{t,j}}{\sum_{j} P_{t-1,j} * Q_{t-1,j}} \tag{6.1}$$

When calculating chained volumes, a specific year is used as a reference, the base year. If period *t* is chosen as the base year, the equation for the Laspeyres chain index between periods *t* and *t+1* will be as follows:

$$V^{K}_{t,t+1} = \frac{\sum_{j} P_{t,j} * Q_{t+1,j}}{\sum_{j} P_{t,j} * Q_{t,j}} \tag{6.2}$$

6.2 Sources

In this section we describe the data sources applied to determine the general government output, and we discuss the quality of this data.

6.2.1 Health Care

The volume of output of health services should be measured as the quantity of health services provided to individuals adjusted for new products or services.

Danish Healthcare Services

The Public Danish Healthcare Services are extensive; therefore they are divided into various subsidiary areas. In this context, the relevant areas are:

- Hospital activity
- Treatment by dentists
- Social provisions with and without institutional care.

General hospital activity

Non-market production of hospital services is placed in industry 860010 Hospitals. Production in this industry is almost exclusively non-market: nearly the entire production value is generated from non-market producers; a minor share is produced by private hospitals. In 2012, the industries' total production value was almost DKK 85 billion, cf. table 6.1 below.

DRGs

The volume index for general hospitals is calculated on the basis of the Danish National Board of Health's Diagnosis Related Group database (DRG). In Denmark, this system is used as a tool for calculating fees to settle the accounts of patients treated in a different municipal area from the one in which they reside. The central health authorities and hospital owners also use the system to assess the correlation between activity and costs in hospital services. DRG's are increasingly used for budgeting and, particularly, as a tool for developing new methods of premises planning and management in administration and hospitals.

The DRGs were developed to create cost homogeneous groups in order to compare hospital activities. DRGs are good indicators of output volumes because they provide information on both (unit) costs per type of treatment and on the number of treatments. The DRG system includes a large number of categories (about 1,300) where each category denotes a rather homogenous service and thus, in principle, unit costs and volume indexes can be constructed at the most detailed level. Given cost weights and the number of treatments, a direct volume index can be con-

structed. The data is distributed according to a range of established main categories, known as MDC classification.

Table 6.1 Non-market production of human health. 2012

COFOG		Mill. DKK	Share, per cent
713	Therapeutic appliances and equipment	793	1
721	General medical services	1	0
723	Dental services	2 303	2
724	Paramedical services	4 840	4
731	General hospital services	84 416	66
732	Specialized hospital services	12	0
734	Nursing and convalescent home services	23 208	18
740	Public health services	1 904	1
750	R&D health	3 487	3
760	Health n.e.c.	61 430	5
70	Total health	127 393	100

Psychiatric hospitals

The National Board of Health made a DRG for psychological diseases from 2008 and we have included these treatments in the calculations.

Public dental services

The volume index of public dental services is estimated by the number of treatments distributed according to type of treatment and unit costs.

In industry 860020 Medical and dental practice activities, production mainly consists of market production. Less than a quarter of the total production value is generated by non-market producers. The non-market production is primarily derived from dental treatment and is associated with public dental services. Practicing doctors and veterinarians are considered to be market-based for the purpose of the national accounts.

A special extract from the Social Resource Statistics (Den Sociale Ressourcestatistik) provides details concerning the number of people receiving treatment. The number of people receiving treatment is distributed across dental services and orthodontic treatment. The data also indicates whether the treatment was provided as a public dental service or by a practicing dentist.

The data from the Social Resource Statistics does not specify whether the costs are associated with dental treatment or orthodontic treatment. This is problematic as orthodontic treatment requires more resources than dental care. The amount of resources devoted to the two types of treatment has been estimated, using accounts from the municipalities of Helsingør and Stevns. The studies show that two thirds of the costs are associated with dental care, while the rest goes to orthodontic treatment. Using this information, the total costs were distributed across dental care and orthodontic treatment, respectively.

Residential care

Industry 870000, Residential care activities shows data for care and social services for the elderly and other people at residential homes. This industry consists of two parts: The part that is considered as health care and the part that is considered as social services for adults and the elderly. The total production value in 2012 was approx. DKK 30 billion. Over 90 per cent of this total production is non-market and over half of the production is made up of health services for the elderly. Therefore the part that is considered as health care should be included in the calculations of volume indicators for health care. The output is calculated by applying the number of people receiving the care and unit costs.

The Social Resource Statistics provide details concerning the number of elderly people, who are residing in a nursing home, and the type of care involved. During the period considered, there was a steady decrease in the number of nursing home residences. This is due to reprioritizing, implying that nursing home residences have been converted or discontinued in favor of homes for the elderly. According to the Danish industry codes, homes for the elderly belong to an industry for adult social care.

6.2.2 Social protection

In this section we describe the sources used to calculate the output-based volume index for social protection services. The production value of social protection was 135 billion DKK in 2012 and it is, therefore, crucial to measure the real value of the services delivered correctly.

A small number of indicators

The number of indicators used for estimating the volume of social protection, are very limited – we have about 25 indicators to measure the whole sector. In comparison, human health and education are represented by almost 1,000 indicators each. However, some of the indicators on social protection are quite homogenous and robust, primary children and elderly institutions, for instance the number of children in daycare or preschools or the number of elderly in nursing homes/residences, which are some of the largest and most important areas of social protecttion. Social protection also comprehend other areas that are more heterogeneous and thus more difficult to measure; for instance services for people with mental- and physical disabilities, protected employment, special educational assistance, contact and companion arrangements. The existing data on these services are more inconsistent and difficult to compare over time, which is partly due to fact that the authorities change the grouping or classification of those services often, which makes it rather difficult to get time consistent data.

Unit costs

Another problem that arises when we compile volume indices for social protection services is the lack of unit costs. The authorities do not estimate unit costs for each of these services in a way that can be compared over time. In Statistics Denmark we compile unit cost by dividing the related total COFOG cost by the number of activities.

The area is under development and needs more systematic data collection to increase future indicator quality.

Practical description

The Danish social protection services are extensive and divided into several areas. The areas that will be evaluated here are:

- 870000 Residential care activities
- 880000 Social work activities without accommodation.

The accounts database for public accounts, DIOR (regarding the services classified as social protection-related according to COFOG) provides the source data for calculating the non-market production value in the national accounts.

Three COFOG groups are included in the non-market product number for social protection:

- 1012 Sickness and disability
- 1020 Old age
- 1040 Family and children.

Sickness and disability

In the case of sickness and disability, the number of people receiving services and care and the unit cost drawn from COFOG is applied to calculate Laspeyres volume index. The total number of people receiving care is used but at present there is no available information to make a distribution according to level of care.

Industry 870000 Residential care activities includes data for residential homes and centers, which includes care of the elderly, which is classified as a health service and social service, foster families, residential homes for children or youths, homeless, rehab centers and so on. Over 90 per cent of this total production is non-market and is made up primarily of health services (primary nursing homes). The part of this industry that is related to health care for the elderly is evaluated in chapter 6.2.1, and the present section only focus on volume indicators for the other part of this industry considering social services, which includes rehabilitation, foster families and homes for children or youths etc.

The Social Resource Statistics provides details concerning the number of people in different institutions and the number of individual assistance hours provided for care and help for practical purposes given to the elderly and disabled people in their homes.

At this moment, it is not possible to find any representative key fees for different types of institutions, therefore the costs for these services are given in the internal database. The detailed COFOG code 1012 Sickness and disability and 1040 Family and children include costs for non-market residential social services. The internal data specifies the cost at the detailed level, so it is possible to calculate a fee for different types of services. The detailed costs divided by number of places at different institutions produce the fee for the year. The weighted volume index for residential institutions is compiled by multiplying the calculated unit price by activity, weighted with their respective production values from the COFOG classifications.

Old age

The same is valid for old age. The number of people receiving services and the unit cost drawn from COFOG are applied to calculate the volume growth for the services.

Industry 880000, Social work activities without accommodation, consists primarily of non-market services for families and children and of institutions such as preschools and after-school activities for children and youths. This industry also includes offers for children and youths with special needs, for instance foster families and residential homes as well as preventive arrangements. The same applies for practical help to elderly and disabled people in their own home. The Social Resource Statistics provide details concerning the number of people in the different institutions without accommodation.

The detailed COFOG codes 1020 Old age and 1040 Family and children include costs of non-market social services for institutions without accommodation. The internal data specifies the costs at the detailed level, so it is possible to calculate a fee for different types of services. The detailed costs divided by number of places at different institutions produce the fee for the year.

Family and children

Regarding families and children, the number of people receiving services and the unit costs drawn from COFOG are applied to calculate the volume growth of these services.

Table 6.2 Non-market production of social protection. 2012

COFOC		Mill. DKK	Share, per cent
1012	Sickness and disability	26 144	19
1020	Old age	15 886	12
1040	Family and children	58 060	43
1050	Unemployment	16 490	13
1060	Housing	10	0
1070	Social exclusion i.e.	6 487	5
1090	R&D Social protection	10 808	8
1000	Total social protection	134 637	100

6.2.3 Education

Primary and secondary education

The system of national accounts considers primary and secondary education services as products that are consumed by households. The OECD Handbook (2010) recommendation for a quantity indicator for education is that a single unit of education service should be expressed as an hour of teaching received by a student at a particular level i.e. student-hours, that is the number of hours that students spend being taught. Alternatively, the number of students could be used.

The volume of primary education is estimated by student-hours; hence our indicator quality in the area meets the international recommendations (OECD, EU, etc.). There is no available data on student-hours for secondary education and for that reason, the number of students is used. Many issues remain; changes in education quality cannot be captured nor is number of students an accurate proxy for the quantity of services provided. However, using the number of students as a measure for the activity level explicitly requires quality adjustment for the services delivered.

This means that Denmark could improve the quality of volume indicators for secondary education by switching from measuring the number of students to the number of student-hours.

Higher and further education

Higher education is organized differently from primary and secondary education. The number of lessons provided to students is smaller. Compared to lower level education, attainments in higher education depend more on a student's own efforts. Thus student-hours are not as useful a measure of outputs as in primary education. It is in general more difficult to separate services provided by the educational institution and their quality from the input provided by the student him- or herself.

An indicator that is often used to measure output is the number of students. However, it is necessary that such a measure is based on full-time-equivalent students. As mentioned above many issues remain. Changes in quality cannot be captured and for that reason the student numbers are not a correct indicator for the quantity of services provided. Participation in studies varies significantly, and sometimes students may even have finished their studies but prefer to remain in the university register due to tough labor markets etc. (OECD Handbook (2010)).

Public non-market education is produced in four industries:

- 850010 Primary education
- 850020 Secondary vocational education
- 850030 Higher education
- 850042 Adult education etc. (other non-market).

Primary education

All areas producing educational services contain exclusively non-market services. Market-based educational services are placed in industry 850042 Adult education etc. (market). This includes, e.g. driving and music schools.

Industry 850010 Primary education includes general schools. The main objective of this section is to determine the output-based quantity index. Educational services in the national accounts are, as previously stated, placed in four industries covering the various educational levels available in the education system. All four industries exclusively contain non-market activity. In contrast to health services, where it was necessary to draw upon data in the DIOR database to define the individual services, the product divisions in the national accounts contain sufficient information to identify the relevant products. For the sake of clarity, we have provided a table showing non-market production of educational services.

Table 6.3 Non-market production of education. 2012

COFOG		Mill. DKK	Share, per cent
920	Primary and lower secondary education (0912 + 0921)	51 116	51
932	Post-secondary and other mid-length education, and preparatory schools for tertiary education	26 627	27
940	Tertiary education (0941 + 0942)	18 407	18
950	Education not definable by level	1 000	1
960	Subsidiary services to education	64	0
970	R&D education	1 236	1
980	Education n.e.c.	1 888	2
90	Total education	100 338	100

In the educational industry, non-market production is derived from five COFOG groups: 0920 Primary and lower secondary education, 0932 Post-secondary and other mid-length education, and preparatory schools for tertiary education, 0940 Tertiary education, 0950 Education not definable by level and 0980 Education n.e.c. There is a close correlation between the national accounts 130 industry classification and the COFOG classification of educational services.

Information will be used to distribute the calculated index so its scope corresponds to the above. The various volume indices calculated are as follows:

Volume index for primary and lower secondary education
Volume index for post-secondary education
Volume index for tertiary education
Volume index for adult education.

In contrast to the human health industry, in which a range of different sources were used to calculate the various volume indices, the education sector is much more homogeneous. The volume data for the four volume indices are all derived from one source. This source is Statistics Denmark's Education Register, which contains information about the number of students undertaking the various types of education.

Sources for calculation of prices

Market prices do not exist for educational services. However, the individual educational institutions are subsidized by the government according to the number of students passing the relevant course. This payment is made according to a detailed annual fee directory, which contains fees for many different courses. The fees are published each year in the annual Danish budget. These fees are the best indication of prices for educational services and will be used as weights for all types of education, except for public primary and lower secondary education.

Data on the number of students

In Statistics Denmark's databases each student is categorized according to the type of education in which they are currently enrolled. In the case of part-time study, the quantity is indicative of student years, i.e. data is compiled in terms of full-time study.

Alternative data on the number of hours taught.

In the case of primary, secondary and post-secondary education, a more accurate measurement of volume is the number of hours taught. For primary education, UNI-C has data for student-hours which means that the figures for 2010 are based on number of student-hours instead of number of students. The calculations for secondary education are still based on the less accurate measurement of volume, the number of students.

There are no educational codes in Statistics Denmark's Education Register or the annual Danish budget that enables these prices and volumes to be linked together. A comprehensive manual intervention was required to produce a link between the two sources. This provides information about prices and volumes for all types of education calculated according to fees in the annual Danish budget.

Special calculation for public primary and lower secondary education

The annual Danish budget does not contain fees for public primary and lower secondary education; hence the fee for this has been calculated on the basis of the total costs for primary and lower secondary education. This is available in the published accounts under COFOG classification 0920; cf. table 6.3. This figure is divided by the total number of students in primary and lower secondary schools, producing a fee for public primary and lower secondary education.

Calculation of growth rate

The data set, in which prices and volumes are linked, is now used to calculate the volume indices for the four different educational services. Based on the educational codes, it is possible to identify the indices in which individual observations should be included.

6.2.4 Recreation and culture

This section describes the sources used to calculate the output-based volume index for recreation, sports and cultural services and determines output-based volume indices.

Higher uncertainty

Within recreation and culture we have a higher uncertainty concerning the indicators for activity level as well as unit prices. However, it is not yet possible to find the actual activity level and representative key figures for different types of recreation, sporting activities and cultural services.

The accounts database for public accounts provides the source data for calculating the non-market production value in the national accounts. Since this data is aggregated and needs to be distributed in more detail, table 6.4 shows an extract from DIOR regarding the services classified as Recreation, culture and religion according to COFOG.

The following COFOG groups are included in the non-market product number for Recreation, culture and religion i.e. in practice, this division means that individual indices are calculated for:

- 0810 Recreational and sporting services
- 0820 Cultural services.

In the case of Industry 910002 Libraries and museums (non-market) the activity is assumed to be the number of visits to museums and libraries and the number of books and phonograms loaned. The unit cost is compiled by dividing the corresponding weighted COFOG cost by the activity level.

The activity level in Industry 930012 Sports activities (non-market) is measured by the number of individual memberships of sports clubs or any recreational activities. In Denmark sports clubs are given subventions depending on the number of members. For that reason, the numbers of memberships are chosen as one of the best indicators to measure sports activities, where the level of activity is compiled by the share of the population who are members of a sports club, based on a survey conducted in 2004. Statistics Denmark does not have any data on the actual number of members.

Table 6.4 Non-market production of recreation, culture and religion. 2012

COFOG		Mill. DKK	Share, per cent
810	Recreational and sporting services	4 601	18
820	Cultural services	10 160	39
830	Broadcasting and publishing services	3 671	14
840	Religious and other community services	7 252	28
860	Recreation, culture and religion n.e.c	491	2
800	Total Recreation, culture and religion	26 205	100

Generally, there are issues with systematic indicators for the activity level and indicators applied here are uncertain, i.e. collections of more systematic indicators are needed in order to compile a more accurate outcome for those industries.

7. Sources and methods for quality adjustment

Explicit quality adjustment of volume indicators is of essence in the current and future work of enhancing the output-method. This chapter takes a theoretical and practical look at what can be done in the various areas where volume indicators are in use.

The general government's non-market output adjusted for quality is given by

$$Volume\ of\ output = \sum_{i=1}^{N} Unit\ cost(i) * Quantity\ (i) * \mathbf{v_{quality}} \qquad (7.1)$$

where $\mathbf{v_{quality}}$ is a multi-dimensional vector of quality characteristics.

The quantity is defined as the number of units and the quality as the characteristic of different products. Hence, both the changes in quantity and quality should be taken into consideration in order to measure the correct volume changes of a given product. If the quality changes are not taken into consideration, some of the changes in the volume will be missing. Only in the case of completely homogeneous products (e.g. rice and oil, which do not change characteristic over time) the volume can be calculated based on the quantities alone, i.e. the number of units in the current period multiplied by unit costs in the basic period. Since most public services are heterogeneous and change over time, it is necessary to quality adjust the non-market individual services in order to reflect all changes in the products.

Measuring quality

Quality indicators should ideally reflect all changes in the general government output, i.e. they should reflect the marginal contribution from the public services to the outcome. In reality, the choice of indicator set is based on three main considerations: the importance of the indicator, the scientific and methodical reliability and the access to data. Measuring quality is very complex and depends on subjective assessments and decisions. In this chapter we will discuss quality aspects of human health and education output, and possible quality indicators will be introduced. It should be stressed that the quality-adjusted measures are not incorporated into the official national accounts statistics.

7.1 Health care

There are a number of desirable characteristics of indicators that could be used for quality adjustment of health care services. Our focus will be on the following two central quality aspects.

- The extent to which the public services succeed in delivering the intended outcome, and
- The extent to which the service corresponds to users' requests.

Since we are interested in health outcome improvements over time, the outcome indicators used for quality adjustment should be consistent over time and, if possible, updated annually. In health care services, new treatments and new drugs are constantly introduced whereby the outcome and quality of treatments change. Hence, an important question arises as to how we can compare the quantity of health services produced in a given year with those produced in the preceding year, if some services did not exist in the previous year or have changed?

Intended outcome

The following indicators will be considered when looking at the extent to which the health services succeed in delivering the intended outcome:

- Health gain as consequence of hospital treatment
- Reduced mortality rates/increased survival rate
- Health gain as a result of reduced waiting times
- Preventive arrangements
- Centralizing/specializing the hospitals.

Health gain due to hospital treatment

Health gain is the pattern of health status over the rest of the patient's life, compared with health status if the treatment had not been given. Health gain can be achieved even if patients do not get better if a less rapid decline in health status towards unavoidable death is the result. Furthermore, health care can relieve pain and other symptoms and extend life.

Reduced mortality rates/ survival adjustment

Data on deaths within 30 days of admission, by hospital procedure is generally accepted as a quality measure. Death from a condition from which a patient should recover is an important indicator of quality (or failure). For instance, the death rate of patients admitted with an acute disease, such as appendicitis, is considered to be a good quality indicator. Comparisons of death rates have to be adjusted for case mix – age of patient, severity of diagnosis, morbidity and other risk factors.

Health gain due to waiting time

The experience of waiting time for treatment plays a part in both the health gains and patient experience aspects of quality of health care. A longer waiting time for treatment may reduce health gains; patients defer the benefits of treatment, and may have pain, reduced mobility, concern and other damage to their health status while waiting, and in that way their health gain from the treatment will be reduced. Hence, a reduced waiting time is considered a health gain.

Preventive arrangements

Health gain from primary medical care is regarded as one of the most important preventive arrangements. The purpose of preventive health care services is to improve the overall health of the population, and it is considered a very important factor of the health care services. The medical/clinical outcome could be improved by controlling diseases as high blood pressure, hypertension, asthma, cholesterol, stroke and diabetes to avoid premature death. Most of these illnesses are chronic, i.e. long-term and many cannot be cured, but they can be controlled. At the primary health care level, the service is primarily based on prevention by informing patients about the benefits of a healthy lifestyle and by drugs.

Danish data on preventative arrangements

Only little data is available for preventive arrangements. The National Board of Health has data about the asthma mortality rates covering the analysis period. Also, the National Board of Health has started to register the data about the primary care of type-2 diabetes, but since this data is new, it does not cover the analysis period of this publication, but may be applied in later publications. The asthma mortality rate is the only quality indicator for preventive treatments that will be applied in this research.

Centralization

Denmark has experienced a centralization of hospitals. One of the main goals is to concentrate the expertise in a few, central hospitals. For instance, the small provincial hospitals no longer are allowed to perform complicated surgeries. At the moment, there are no scientific measurements of the effects of the centralization, but the general experience among experts is that it saves lives and results in more health-gain. A disadvantage of this policy is that some patients have a longer distance to the hospital. However, in Denmark we do not have any data for the centralization degree yet.

User's needs

The other aspect of quality is related to the use of health care services; does the service respond to the users' needs? The following quality indicators will be considered:

- Patient experience
- Waiting time.

Patient experience

Patient experience is usually measured through surveys. Survey questions are often grouped into different domains, including better information to the patients and their relatives, more choices, possibilities and safe, coordinated, high quality care. The collaboration between the health care system and the patients is also considered as an important quality factor. Surveys measure different areas of the health care services, for example; hospital inpatients, mental health, and primary care. The weight given to patient experience is assumed to vary across areas. The patient experience is assumed to be relatively more important for primary care and for mental health services than for hospital inpatient, outpatient and accident and emergency services.

Waiting times

The knowledge of the waiting time for treatment plays a part in both the health gains and patient experience aspects of quality of health care. Firstly, they may dislike waiting; waiting may be a bad experience for patients even when they are not in pain. Secondly, longer waiting time for treatment may reduce health gains; patients defer the benefits of treatment, and may have pain, reduced mobility, concern and other damage to their health status while waiting, and in that way their health gain from treatment will be reduced.

Quality indicators for Danish health care services

The example below demonstrates how we in practice can calculate quality adjusted health output volumes.

Example

Quality adjustment of human health service

We demonstrate an example from a non-market health sector that supplies the economy with surgery for herniated disk. The example shows actual figures from the Danish DRG's. Firstly, we illustrate the Laspeyres' volume index without explicitly quality adjustment and then show the volume index with quality adjustment. The price and production structure for herniated disk surgeries is:

$P_{14} = \text{DKK } 28{,}900 \qquad Q_{14} = 1690$

$P_{13} = \text{DKK } 34{,}879 \qquad Q_{13} = 1702$

Where the P's measure the prices in 2013 and 2014 and Q is the number of herniated disk surgeries.

The volume growth without explicit quality adjustment from year 2013 to 2014 is given by Laspeyres' quantity index:

$$I_{13,14} = \frac{34879 * 1690}{34879 * 1702} * 100 = 99.3$$

Laspeyres' volume index between 2013 and 2014 shows that the volume of herniated disk surgery has decreased by 0.7 per cent.

(continues)

(continued)

We have three quality indicators for herniated disk surgery that enable us to quality adjust the service. The indicators are the following:

- Reoperation after surgery for herniated disk (a reduction in the rate of reoperation is assumed to be a quality improvement)
- Waiting time for treatment (longer waiting time for treatment may reduce health gains; patients defer the benefits of treatment, and may have pain, reduced mobility, concern and other damage to their health status while waiting, and in that way their health gain from treatment will be reduced)
- Average lifetime in Denmark (an increase the average lifetime may partly be due to preventative health care arrangements. This indicator is a general indicator and may be used to quality adjust almost all DRG groups, while the first indicator is only related to surgeries for herniated disk and therefore we construct partially quality adjustment for this diagnose).

The results for herniated disk surgery with quality adjustment are the following:

	2013	2014	Change	Weight
			per cent	
Reoperation after surgery for herniated disk (per cent)	2.3	2.2	4.5	50
Average lifetime (years)	80	80.6	0.7	10
Average waiting time for hospital treatments (days)	60	59	1.7	20

The first two columns show the three indicators in 2013 and 2014. The third column shows the quality change from 2013 to 2014. It is seen that all factors contribute positively to the quality and then also contribute positively to the volume growth of the service. The last column shows the weight given to the three factors. The weights are based on subjective assessments, and they do not sum to 100 per cent reflecting that they do not measure all quality dimensions.

The weighted quality change from 2013 to 2014 is calculated as:

50 per cent*4.5 + 10 per cent*0.7 + 20 per cent*1.7 = 2.7 per cent.

Hence, the quality-adjusted volume growth for herniated disk is

$$I_{13,14}^{\text{Quality adjusted}} = (100 - 0.7) * \frac{102.7}{100} - 100 = 2.0 \text{ per cent.}$$

The example demonstrates that a quality increase implies higher volume growth of the health care services. The output decreases by 0.7 per cent without explicitly quality adjustment, but the 2.7 per cent increase in quality leads to an increase of 2.0 per cent in volume with explicit quality adjustment.

7.2 Education

In this section the quality aspect of education will be discussed and possible quality indicators will be introduced. Possible quality indices will be determined and then quality adjusted volume indices will be calculated.

The education output

The main quality component of the output of an education system is the sum of the expected transfers of knowledge and skills towards all students, i.e. the total transfer of knowledge and skills performed by education.

The aim of education is to improve knowledge and skills, i.e. put the student's potentials to maximum use. Education has a positive effect on the economic well-being of individuals and society as a whole, since there is a strong causal relationship between education, earnings and productivity. Educated (highly educated) citizens generate higher tax incomes for the government, because highly educated people earn a higher wage than people with lower education, and thus pay higher taxes during their lifetime.

In general, education outcome is considered to depend on three components:

- Natural abilities, knowledge and skills attributable to the socio-economic background
- Motivation and work effort from the student
- Knowledge and skills transferred by the education institutions.

Since the purpose is to measure the output of education services, the focus will be on the third component, i.e. measuring the educational contribution, independently of the two first components. As a starting point, the first two components are assumed constant.

The educational outcome for individuals is their education status, i.e. their level of knowledge and skills.

Class size (student/teacher ratio)

There are many factors creating a quality education environment, which maximizes each student's ability to learn. Class size is one of the most discussed factors of quality and a common belief is that small classes give more benefit than larger ones, and there are studies supporting this (Biddle, 2002). The logic behind this quality aspect is that if there are fewer students per teacher, then teachers will be able to devote more time and care to each student, i.e. it will be much easier for the students to get individual attention from the teacher. It is believed that students learn best in small environments and with a lot of discussions within the classroom. However, other studies confirm that class size does not have a statistically significant impact on learning (Wet stein and Mora, 2003).

We may measure class size we mean the student-teacher ratio, i.e. the number of students in a school divided by the number of qualified teachers (see definition below).

The teacher/ student time

The amount of time a student spends with the teacher is also an important indicator of quality, how much time is spent by the teachers with each student, how much feedback does the students get? Feedback is a form of input to the students' work from the teacher or supervisor. Receiving constructive feedback gives students a clearer idea of how well they are doing in their studies and how they could improve and get some useful advice. Feedback can improve results and strengthen the level of knowledge, since each source of feedback can provide a unique perspective that should be taken into consideration. Thus, it is essential for the quality of education that the teacher has enough time to give feedback, for instance, on assignments.

Teacher qualifications

The competence of the teacher in a classroom is supposed to make a huge difference as well, i.e., providing the teacher with the proper curriculum and tools to teach is important and so is the teacher's pedagogical knowledge. The rate of teachers with a relevant education could be applied as a quality indicator.

Projects/team work

The share of time students spend on projects and team work could be an indicator of quality, since projects are considered to improve the students' skills in terms of being creative, independent, responsible, and thus improve their ability to work in teams, given that collaborative learning is very beneficial, especially if the purpose is to enhance critical thinking and problem-solving skills or to introduce multiple perspectives on an issue.

Marks

Marks are usually supposed to measure the level of knowledge and skills. However, marks are subjective. Each teacher has a different subjective method of assessment. Educational attainment, as reflected in examination results, has been a main basis for discussions about quality; but one important question is whether exams can be compared over time; will examinations become easier if the educational institutions know that examination results are regarded as quality indicators?

PISA

The Programme for International Student Assessment (PISA) supplies data for the evaluation of 15-year-olds' competences in reading, math and science. This could be applied as a quality indicator for primary and lower secondary education. However, marks and PISA measure outcome rather than output, which is at present time not recommended by Eurostat (see section 2.3).

Drop-out rate

A reduction in the share of students, who fail to graduate and drop out of school at different levels of education, is regarded as an important quality indicator. Decreasing drop-out rates are regarded as indications of good education service and high quality. The drop-out rates are available for public primary and lower secondary educations in Denmark.

7.3 Social protection services

The output-based measures can be improved by adjusting output in a way that takes into account the quality changes of the service provided over time. Principle B of the Atkinson Review stated that 'the output of the government sector should be measured in a way that is adjusted for quality changes over time'.

Social care is currently measured in the National Accounts equating input used to provide the services with output. This publication uses a cost-weighted activity index, which weights together growth in prices. The limitations of this approach are that:

- A measure based on activity, fails to take into consideration, changes of quality in the service provided over time.

The social protection expenses constitute a significant part of the government spending in Denmark, hence it is important to be able to measure the value of the services correctly, i.e. the output of the public services.

Adult social care

The purpose of the adult social care is to meet the needs caused by old age and weakness by helping people with personal care and, to a certain extent, provide friendship for those who might be isolated, i.e. the main goal of social care is improvement of quality of life that people feel as a result of using the service. In Denmark, care for the elderly is primarily provided as home care and at nursing homes.

To measure the value of social care services correctly it is essential also to measure the changes over time, and measuring quality is not that simple; first, it is essential

to define the quality aspects for the diverse services and, second, to identify the crucial indicators for those services. The quality of services in the case of social care for adults can be divided in two areas, namely the basic needs and the needs at higher domains.

Basic needs as:

- Accommodation
- Cleanliness and comfort
- Food
- Safety
- Personal hygiene.

Needs at higher domains:

- Better quality of life, which includes involvement and control over daily life, dignity, activity and social participation
- Involvement of the home residents in decision making.

Quality adjustment requires a system of weighting all quality aspects together in order to combine the different components to form a single quality indicator. But weighting quality aspects together according to their relative importance is not straight forward. For instance, should one per cent change in quality imply one per cent change in quantity? And who is best to decide? (Providers, users, experts or general public and preference studies etc.) It is also vital that the weight given to the different indicators can change over time, the importance of a given service may not be constant over time, it may change according to the structure of the society and technically development etc.

Quality indictor for the elderly care

As part of a documentation project conducted in 2011, Statistics Denmark collected several indicators that can be used to quality adjust home care. The data is primarily collected from a consumer experience survey which measures the share of elderly who are satisfied with the services provided. The survey covers approximately 10.000 elderly people where about 75 per cent have fully or partially answered. Some of the collected indicators are as following:

- Quality of help
- The stability of help.

Children's social care

Daycares[11], preschools[12] and after school centers are the most common institutions, where children's social care services in Denmark are provided. This is related to the Danish labor market structure. Although it also includes plenty of special institutions for children and youths with special needs, for instance foster families and care homes.

One of the main goals for the high number of children's institutions is to provide child care for children whose parents both work outside the home. At the same time, it is expected that children and youths participate in a wide variety of high quality, positive activities developing their personal and social skills, which gives them a better sense of well-being; thereby reducing risky behaviors. Most im-

[11] For children approx. 10 months to 3 years of age.

[12] For children approx. 3 to 6 years of age.

portantly; children should be ready to start school with appropriate skills and confidence.

Since the unit cost we have for these activities does not reflect the quality of those services given, that unit cost is based on producer valuation and not consumer valuation and the fact that quality of services changes over time. One of the most important quality aspects in the case of child care is the number of children per present adult, i.e. adjusted for absenteeism, etc. The more time spent on one child, i.e. fewer children per adult, the higher the quality is considered to be. However at the moment we do not have any empirical research that shows the optimal number of children per adult. Therefore, quality adjustment is necessary to reflect the 'true' value of the service. Below is a list of quality indicators that could be used to adjust social institutions (for primary cares as daycares, preschools and after school centers) for quality over time:

- Child/teacher (adult) ratio
- Safety
- Personal, social, physical, emotional and behavioral development
- Creative development
- Personal care routines
- Language, communication and reasoning
- Knowledge and understanding the world
- Family and social background.

However, most of those indicators are difficult to measure in practice.

Another important part of child social care is fosters families, care homes and other special institutions for children with special needs, which are either related to their socioeconomic background or are congenital.

The quality changes for special institutions and homes could be measured by some of the indicators given below.

- Children per adult
- Children in foster care and orphanages and their highest obtained degree and their exam results over time. For instance the number of children who have graduated from the 9th grade, the number who have graduated upper secondary school/high school and the ones who have obtained a higher education
- Personal, social, physical, emotional and behavioral development over time
- Labor market commitment, how well are they performing in the labor market over time
- Socioeconomic and demographic development.

Measuring methods for social protection services

The mentioned quality indicators for social protection services are in general not easy to measure, it may require vast amounts of resources, but the most reasonable method may be observation by specialists and surveys. However, some aspects of quality are already reflected in the current method through the stratification of the different types of social protection services.

8. General government output, final consumption and productivity

This chapter covers the current developments in general government output and productivity. The area is at large still at a relatively early state in terms of experience with data collection, for a limited number of years, as well as optimizing methods for using data in the best possible way. In the coming years an important focus area is developing methods for explicit quality adjustment of the general government output. The work is in progress.

8.1 The input and output measurement methods

As described in section 2.3 there are two methods for measuring the real development of general government production and consumption. This section takes a general look at the methods in contrast to each other.

The input method is based on the inputs used to produce the non-market individual services provided by the government, while the output method is based on the actual output produced e.g. the number of treatments carried out by the healthcare authorities, the number of students in various educational institutions, the number of children in daycare, the number of people in elderly care centers and residential homes for the elderly, etc.

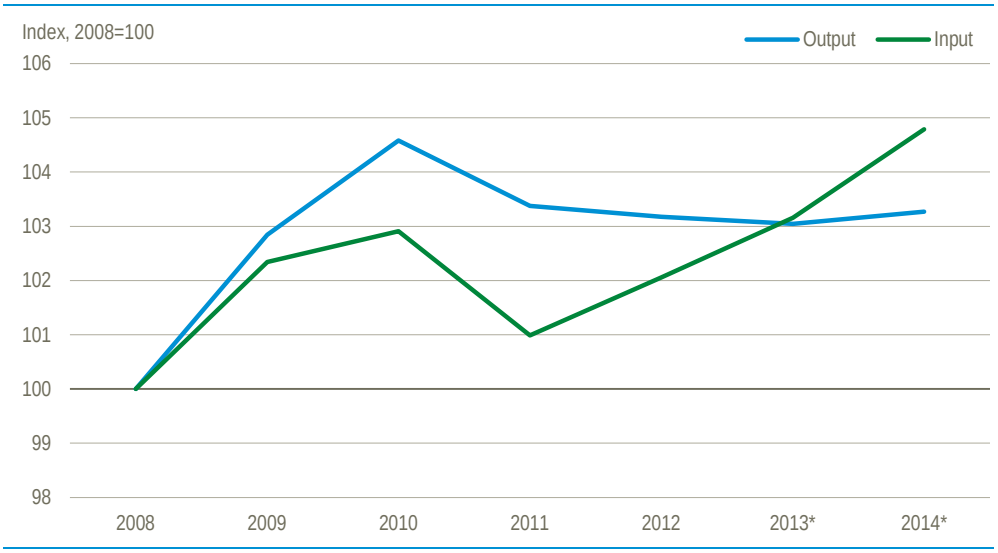
Caution is advised

In general when comparing the methods conclusions should only apply to trends observable over a longer period of time. Year-to-year or short term changes should always be interpreted with caution since they very well may be the result of more or less random fluctuations in e.g. capacity utilization. And these types of short term phenomenon do rarely represent the underlying production or productivity trends. Moreover, as mentioned before, the experiences with the output method are still fairly limited and under development, especially in the area of developing methods for explicit quality adjustment of the volume indicators.

The non-market individual services in total

The difference between the two methods is clearly reflected in the volume increase as illustrated on figure 8.1 below. The output calculated regarding to the output method is higher in five of the seven years, while the methods show equal growth in 2013. In 2014 the input-based method generates a higher volume growth. However, it should be noted that 2013 and 2014 are preliminary years and the results may change, when the data is final.

Figure 8.1 Volume increase for the non-market individual services in total



The relationship between the methods reflects the productivity trend in general government

If the volume increases faster when measured by the output method than the input method it reflects that the volume of services provided by the general government grows faster than the volume of resources consumed by the general government for that purpose. In the long run this means that the general government has become more efficient in providing services to the public – the productivity has increased. If the opposite development is the case, the productivity has decreased.

Can be misleading in the short run

However, in the short run such conclusions can be misleading, since phenomenon like capacity-utilization, continuous adjustments to socio-economic needs as well as changes in legislation can appear like productivity changes in the short run. For example, if a change in legislation results in a sudden drop in the number of students attending adult education this could, in the short run, appear as a decrease in productivity, since input-resources such as buildings and teachers typically would adapt slower than the production i.e. the number of students attending classes. Moreover, it should be emphasized again that the volume indicators aren't adjusted explicitly for quality which introduces a certain degree of uncertainty concerning the volume increases and thus the changes in productivity.

The period 2008-2014

As illustrated in figure 8.1 the data does not provide a picture of a clear trend in the period from 2008 to 2014. First the output method shows a higher volume increase[13] than the input method. Then in year 2011 the picture turns around and it's the input method that shows higher volume increase than the output method. The picture may however change in the future since the 2013 and 2014 data are preliminary.

The detailed underlying areas

The development illustrated in figure 8.1 is composed of the four underlying areas of health care, education, social protection as well as recreation, sports and culture.

Considered over the whole period from 2008-2014 the detailed preliminary analysis shows that in the cases of health care, education and recreation, sports and culture the input method shows higher volume increases than the output method[14]. Most significantly it's the case for health care. Only social protection differs from this picture i.e. the output method shows higher volume increases than the input method.

8.2 Output and final consumption

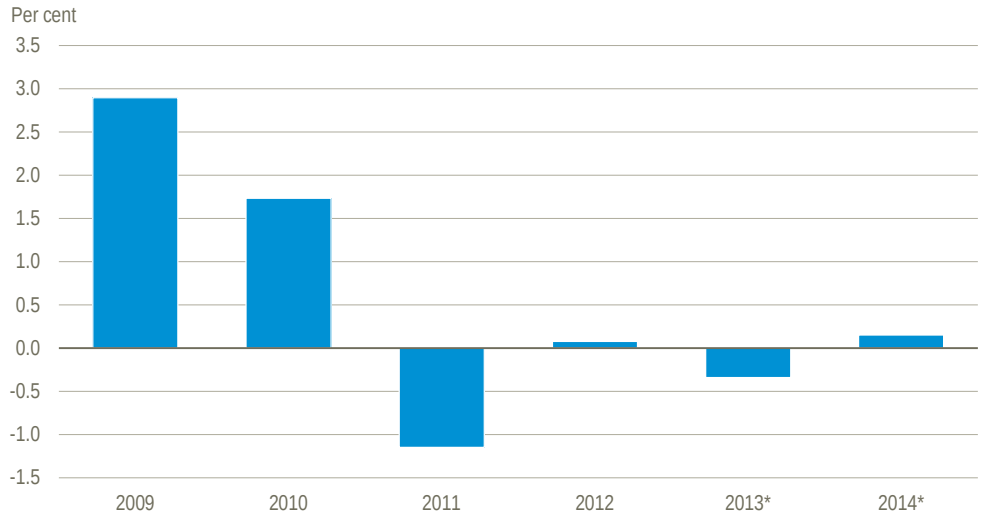
The global financial crisis hit Denmark in 2008 when real GDP decreased by 0.7 per cent accelerating to a decrease of 5.1 per cent in 2009. In both years the real general government final consumption increased substantially with 3.2 per cent in 2008 and 3.0 per cent in 2009. The expansion continued but at a slower pace in 2010 where the real increase was 1.3 per cent. In 2011 there was a reduction in the government's final consumption corresponding to -1.4 per cent in real terms. In 2012 the real development was zero, while the two preliminary years 2013-2014 showed growth rates in government's final consumption corresponding to -0.7 per cent and 0.2 per cent respectively.

Figure 8.2 illustrates how the development in real general government final consumption translates into the pattern of growth of general government output during 2009 to 2014.

[13] Or a lower volume decrease.

[14] Or lower volume decreases.

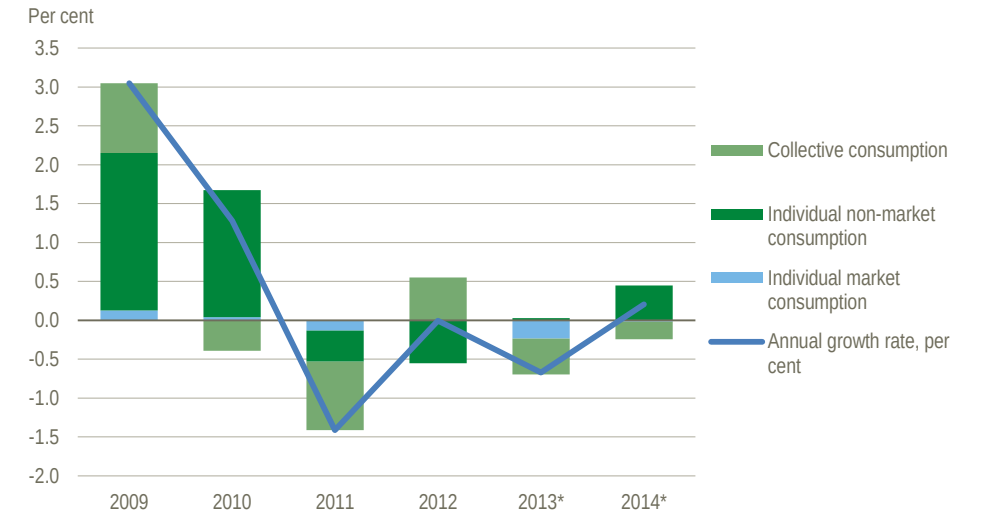
Figure 8.2 Annual growth rate of general government output. Chained values



Total growth rate of 3.4 per cent

In 2009 and 2010 the real general government output increased by a total of 4.7 per cent. In 2011 when there was a real reduction in the government's final consumption expenditures, real output also decreased. During the last three years the real general government output remained more or less constant. The total growth rate of general government output from 2008 to 2014 was 3.4 per cent, while the annual average growth rate during the same period was 0.6 per cent.

Figure 8.3 Annual growth rate of general government final consumption. Chained values



Similar development in government final consumption

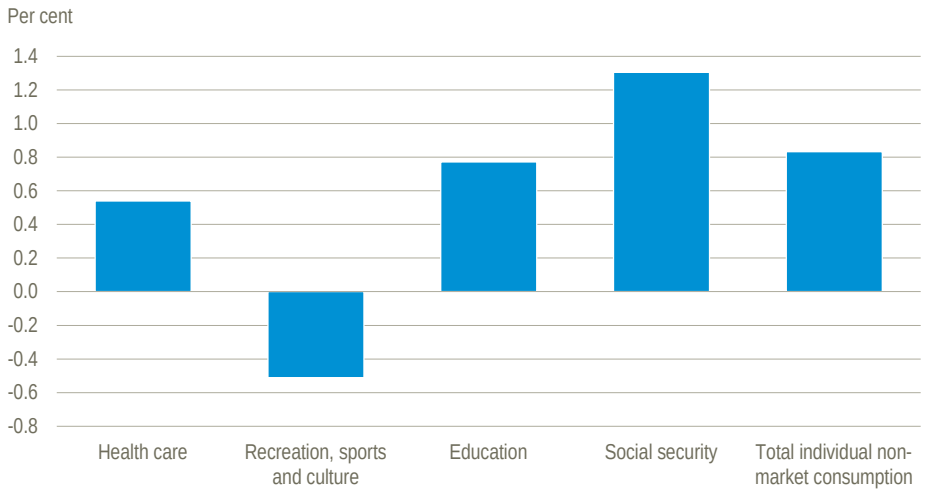
Figure 8.3 illustrates the real growth of the general government final consumption, as well as how this development is attributed to changes in the individual market consumption, the individual non-market consumption and the collective consumption. As expected, the overall real development pattern of the general government final consumption resembles that of the real general government output. The average annual growth rate was 0.4 per cent.

Positive contribution from individual non-market consumption

Individual non-market consumption has contributed positively to the overall development during the period, while the individual market and collective consumption have contributed negatively.

Individual non-market consumption consists of the four subcomponents: education, health care, social security, and recreation, sports and culture. The development in each of the subcomponents is illustrated in figure 8.4 (the bars).

Figure 8.4 Average annual growth rates of individual non-market consumption. 2008-2014*. Chained values



Positive contributions from all but one of the four subcomponents

Of the four subcomponents only recreation, sports and culture impacts the average growth rates of individual non-market consumption negatively. The impact is rather limited since recreation, sports and culture only constitutes around 5 per cent of the total individual non-market consumption. The three other subcomponents, constituting around 95 per cent, all contribute positively to the average annual total individual non-market consumption growth rate, which is 0.83 per cent.

8.3 Primary inputs

In 2012 current prices 58 per cent of the total government production cost is compensation of employees. This number reflects that the general government production is very labor intensive.

Figure 8.5 Employment, hours worked and labor quality

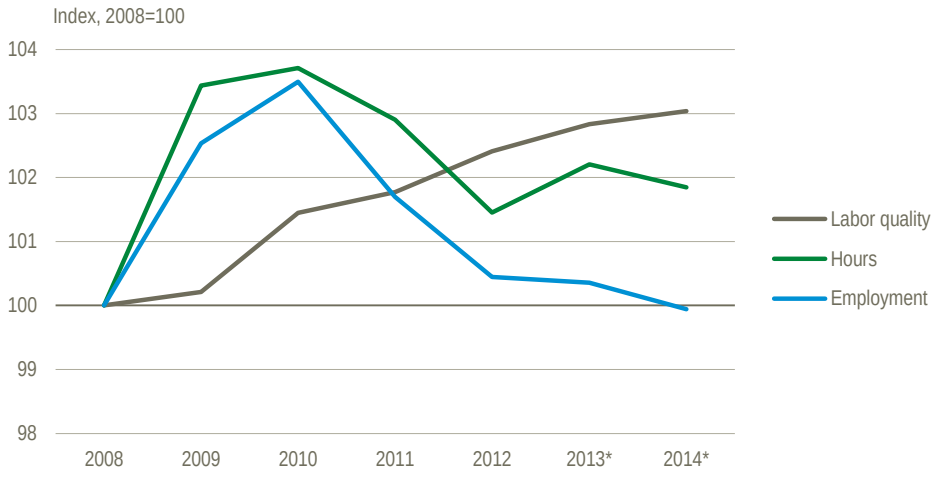


Figure 8.5 illustrates the development in employment, hours worked and labor quality in the general government production since 2008. Employment is the average number of persons employed in the course of the year, while hours are actual hours worked. Both are measured in the national accounts statistics. The labor quality reflects the composition of the employees in terms of educational attainment. It is calculated as a weighted sum of hours worked distributed on 5 categories of education. The categories are primary school, secondary school, short-cycle

higher education, medium-cycle higher education and long-cycle higher education. The weights are the education categories' shares of total compensation of employees in general government.

Hours worked has increased faster than employment

The figure shows that in 2009 employment and the number of hours worked increased significantly, whereas from 2010 to 2012 both have decreased. In 2014 the number of hours worked was 1.8 per cent higher than in 2008 while employment had decreased marginally by -0.1 per cent reflecting that the average working time has increased during the period.

Quality has increased faster than quantity

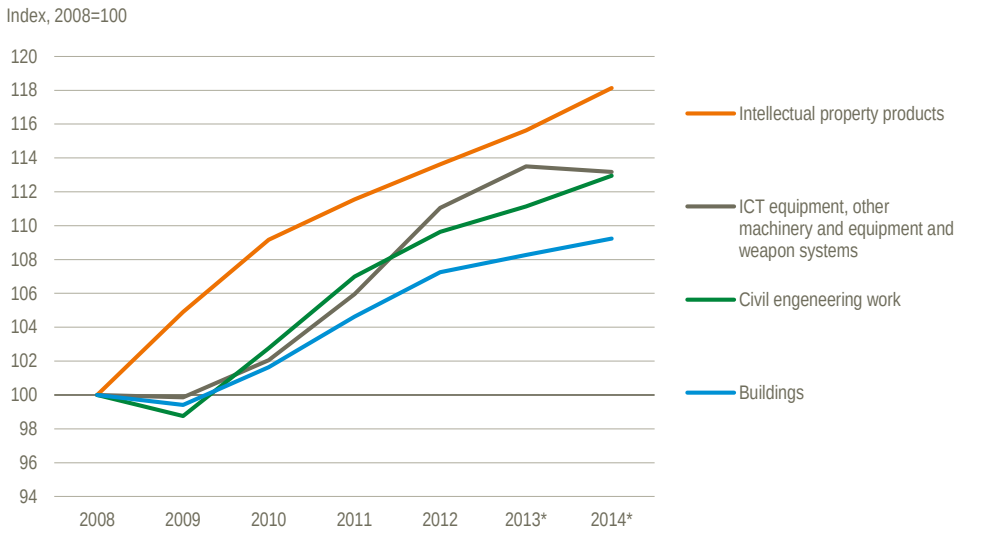
The quality measure develops slower than the two quantity measures in 2009. For the entire period, it has, however, increased faster due to a substitution away from employees with basic school and short higher education towards employees with long higher educations. In 2008 53 per cent of all hours worked were by employees with a higher education. This ratio has increased to 57 per cent in 2014.

The most labor intensive industry in the general government is residential care which contributed by 35 per cent of the total hours worked in 2014. Education activities contributed by 22 per cent, public administration 19 per cent and human health activities 16 per cent.

Capital input

In 2014 10.5 per cent of the general government's production costs were consumption of fixed capital. The most capital intensive activity was public administration – the output of which is mainly used for collective consumption.

Figure 8.6 Net stocks of gen. gov. capital, chained values end-period



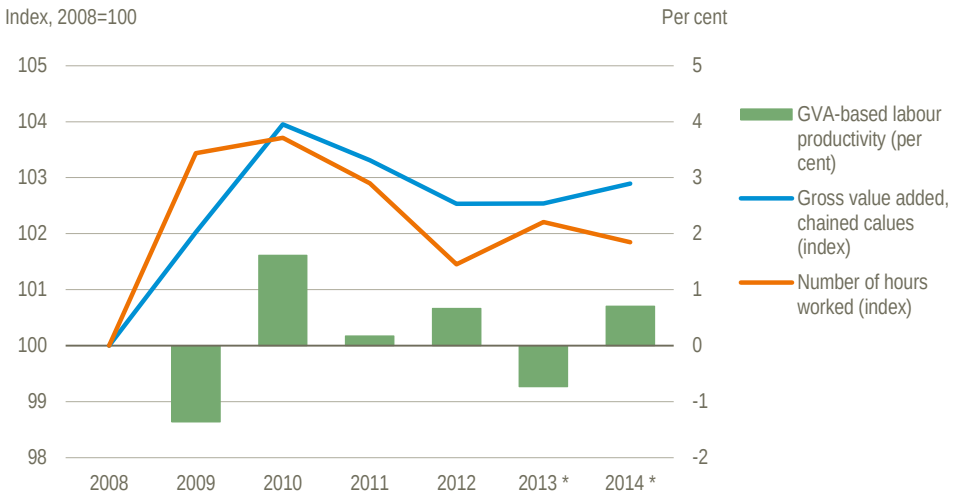
The development in the general government's stocks of different types of capital is shown in figure 8.6. ICT equipment, other machinery and equipment and weapon systems increased by 6.3 per cent during the period. This capital is primarily used in public administration etc. Education used 33 per cent of the building capital and 65 per cent of the intellectual property products.

8.4 Productivity

GVA-based labor productivity growth of 1.03 per cent

GVA-based labor productivity in general government production[15] increased 1.03 per cent from 2008 to 2014. It corresponds to an average annual rate of growth of 0.17 per cent. As shown in figure 8.7, gross value added grew at a faster rate than the number of hours worked in the general government.

Figure 8.7 Annual growth rate of general government GVA[16]-based labor productivity



Turbulent economic development in recent years

Many aspects of the economy have been turbulent in recent years. Since 2008 when the world economy was first impacted by the financial crisis a wide range of economic policies and instruments have been in use. This is the case both at a national level in Denmark as well as in the EU and internationally. Figure 8.7 reflects some aspects of this turbulence, especially in the years 2009 and 2010 where the year-to-year GVA-based labor productivity fluctuates more than would normally be expected. Furthermore, a substantial increase in hours worked is observed in the same period. In general, caution is advised when interpreting the year-to-year developments of labor productivity. These fluctuations do not necessarily reflect personal capacities or intensity of effort, but are sensitive to economic policies as well as for example capital deepening and changes in the quality of the work force. Furthermore, the year-to-year developments are very sensitive to time lags and leads in the production process.

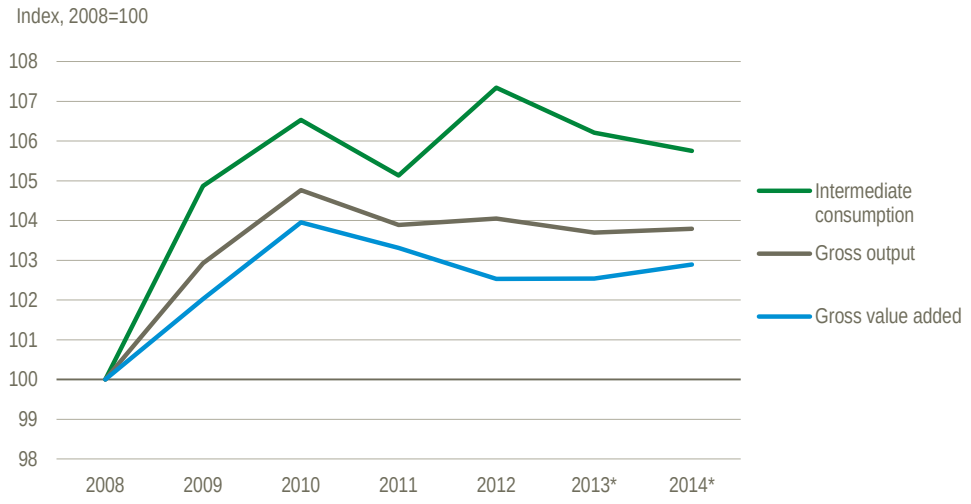
Output-based labor productivity

Output-based labor productivity increased 1.5 per cent from 2008 to 2014. The more rapid increase compared to the GVA-based measure reflects a relatively rapid increase of intermediate consumption during that period, cf. figure 8.8. The majority of the increased input of intermediate goods and services are used in employment activities and education.

[15] Again it should be noted that output- as well as productivity measures for general government are not explicitly adjusted for changes in output quality. Developing methods for this is a focus area in coming years.

[16] Excl. other taxes less subsidies on production.

Figure 8.8 General government gross output, intermediate consumption and GVA[17], chained values.



Slower productivity growth in general government than in market services

Labor productivity in the general government production has increased at a slower pace than labor productivity in the production of market services excl. dwellings and non-residential buildings. The total growth rate of GVA-based labor productivity of market services was 1.8 per cent from 2008 to 2014 while the output-based labor productivity measure increased 2.2 per cent from 2008 to 2013[18]. One of the reasons for the slower pace of the general government productivity growth is that more than one-fourth of the government output is calculated according to the input method (the part that is used for collective consumption), which rules out labor productivity growth in the absence of a change in the labor-capital split.

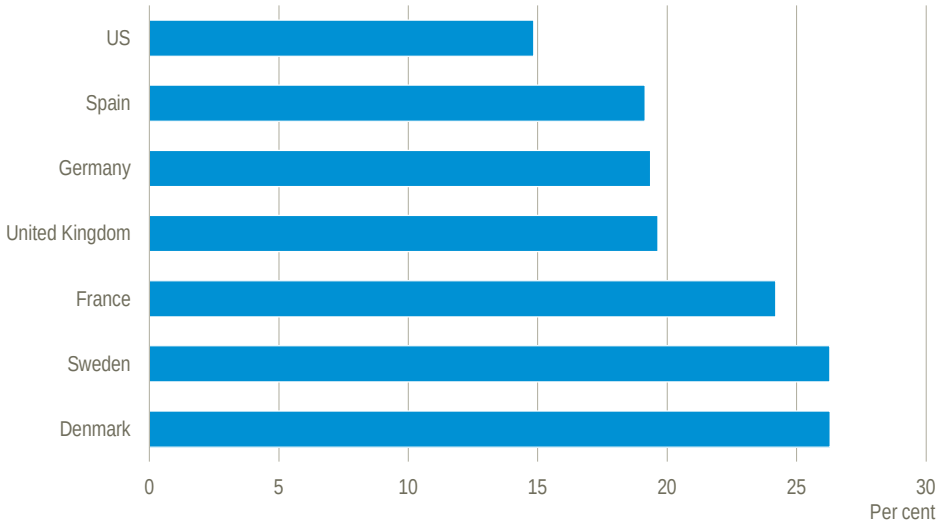
[17] Excl. other taxes less subsidies on production.

[18] Output-based labor productivity for 2014 will be published in March 2016.

9. International comparisons

This chapter puts Denmark into international perspective by comparing the development in general government output and productivity across a range of western countries. In general international comparisons should be treated with caution since there can be challenges in terms of differences in data and methodology from country to country.

Figure 9.1 Share of general government final consumption to GDP. 2014

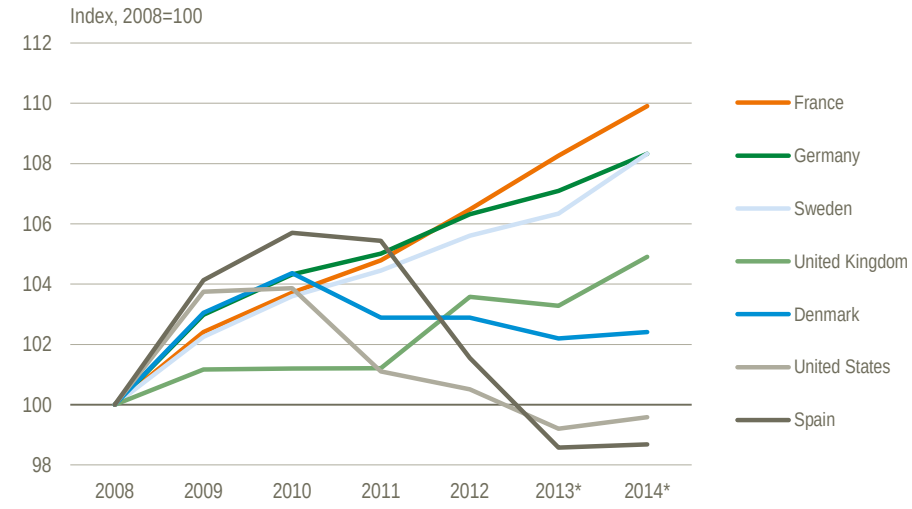


Source: Eurostat and www.statistikbanken.dk.

High share of government final consumption to GDP in international context

In 2014 only Denmark, Sweden and the Netherlands (not shown in the figure) had general government final consumption that constituted more than 25 per cent of GDP. On average, the share in the 28 EU countries was 20.9 per cent. In Denmark, the general government final consumption as a share of GDP rose from around 25 per cent in the preceding years to 28.1 per cent in 2009 where GDP decreased significantly due to the financial crisis and government consumption increased.

Figure 9.2 General government final consumption. Chained values



Source: Eurostat and www.statistikbanken.dk.

Slower growth since 2008

Figure 9.2 illustrates the real development of general government final consumption since 2008. It shows that also in real terms did the government consumption

increase in the seven selected countries in 2009. In France, Germany and Sweden the increase continued from 2010 to 2014. Since 2008, government consumption in the three largest European countries, France, Germany and United Kingdom has grown faster than in Denmark.

In Spain the volume of the general consumption today is lower than before the financial crisis due to public spending cuts in the wake of the financial crisis and large public deficits. We have seen a similar but much more extreme development in the volume of the general government consumption in Greece (a decrease of 20 per cent since 2008) and Ireland (a decrease of 10 per cent). In the European Union (28 countries) the total real growth rate of government final consumption was 4.2 per cent from 2008 to 2014.

10. General government economic impact

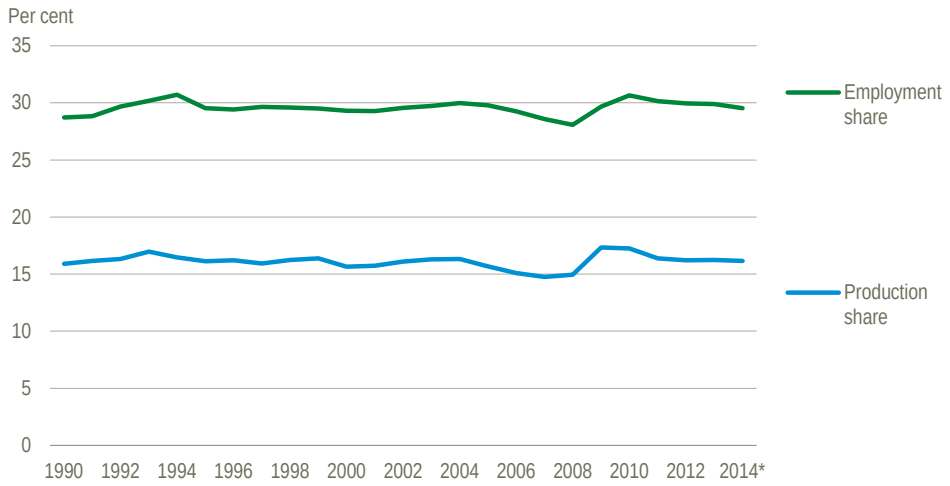
This chapter takes a closer look at the impact of general government activity on the economy as a whole, both in respect to production, productivity and employment.

10.1 Employment and production

General government production share peaked in 2009 and 2010

During the last 25 years, government production averaged 16.1 per cent of the total production. The General government's average share of employment was higher – that is, 29.6 per cent. In 2009 and 2010, the production share reached a historical peak of 17.3 per cent. It decreased again in 2011 and has since then been of the same size as the historical average share. Also, the employment share has fallen back into the historical level.

Figure 10.1 Government production and employment as shares of total production and employment. Current prices

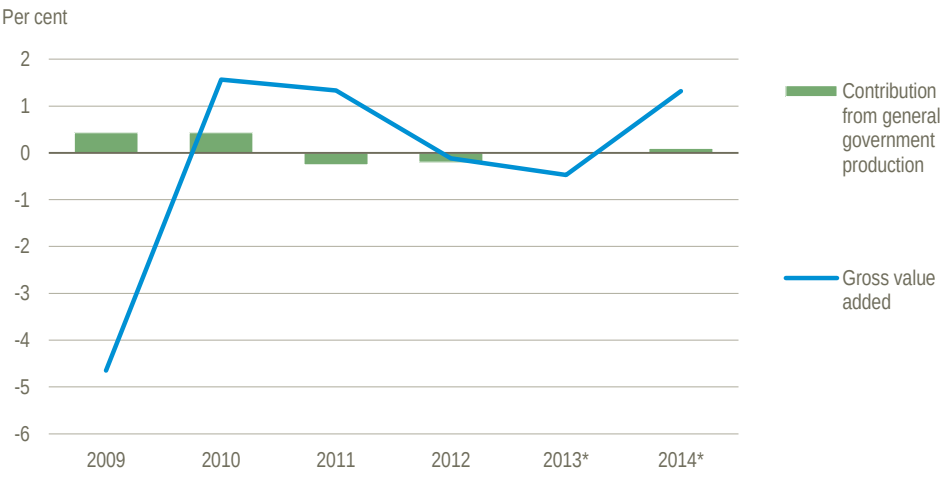


In this section we will see that the activities of the general government contribute significantly to the real economic development of the Danish economy.

10.2 Gross value added

Figure 10.2 illustrates the development of gross value added and the contribution from general government production activities.

Figure 10.2 Annual growth rate of gross value added, Chained values



Significant contributions to GVA

In 2009 and 2010 the general government contributed by 0.4 percentage point per year to the annual growth rate of gross value added. This means that in the absence of general government production, gross value added would have been growing 0.4 percentage points slower in both years. The following years general government contributed negatively to the development in gross value added meaning that gross value added would have been growing faster in the absence of the general government production. In 2013 and 2014 the contributions from the general government production activities were close to zero.

The total contribution from the general government to gross value added during the period from 2008 to 2014 was 0.5 percentage point. Public administration contributed negatively to this development, whereas especially education and human health activities contributed positive to the growth of gross value added.

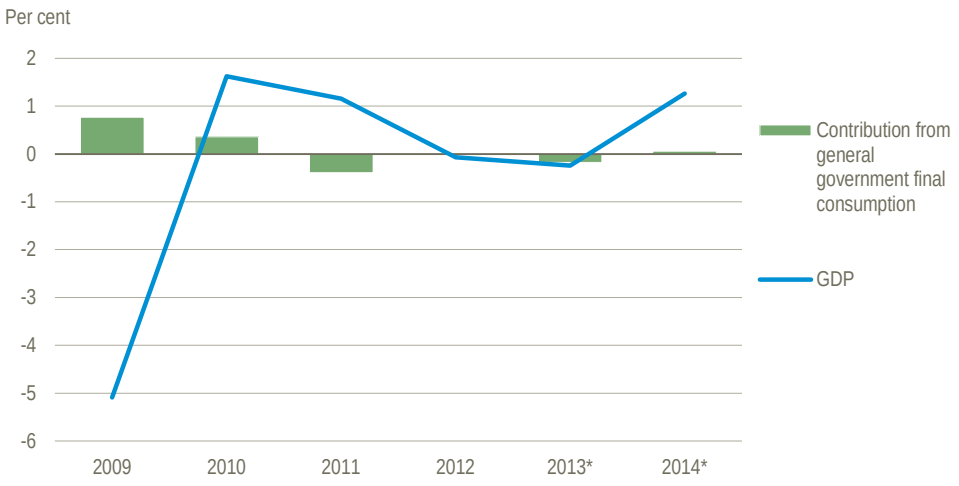
Negative contribution from private sector production

While the general government production activities contributed positively to gross value added during the period from 2008 to 2014, the total private sector production contributed with -1.5 percentage point. It is, however, important to remember that the considered time period includes 2009 which was the year when the financial crisis significantly affected the Danish economy, implying a decrease in gross value added of 4.6 per cent. Hence, the negative contribution from the private sector production activities primarily reflect the contraction of world trade and domestic demand in 2009 while the overall positive contribution from the general government production reflects the contra cyclical nature of the general government production. If we instead consider the general government and the private sector contributions to gross value added since 2009 then the general government production activities contributed with 0.1 percentage points while the private sector production contributed with 2.3 percentage points.

10.3 GDP and general government final consumption

Now consider the contributions to the economic development from the final consumption by the general government.

Figure 10.3 Annual growth rate of real GDP. Chained values



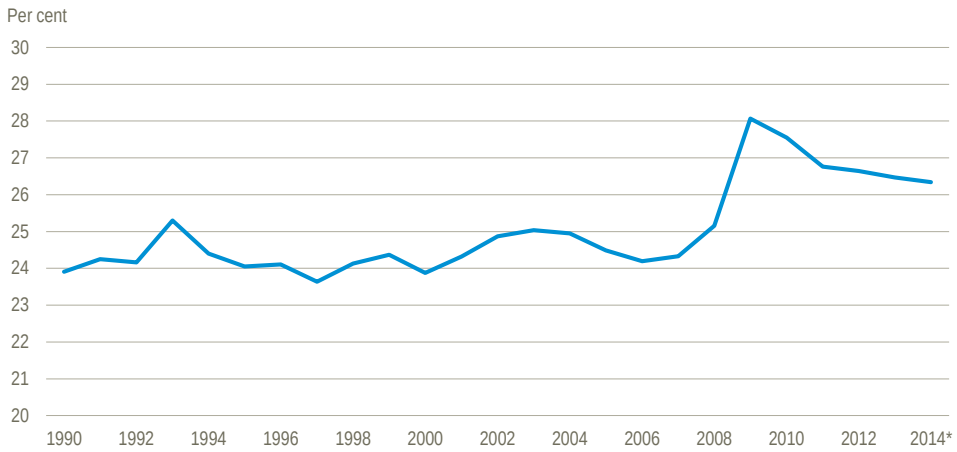
Positive contribution from government final consumption 2009-10

The stabilizing function of general government during the financial crisis did indeed dampen the real economic consequences. In 2009 the general government final consumption contributed by 0.8 percentage point to the development of GDP. Without this contribution real GDP would have decreased, all else equal, by almost 6 per cent. In 2010 general government consumption also contributed positive to

the development while in 2011 it contributed negatively. Since then the annual contributions have been close to zero.[19]

Figure 10.4 shows the evolution of the share of the general government final consumption to GDP (current prices) over a longer time period.

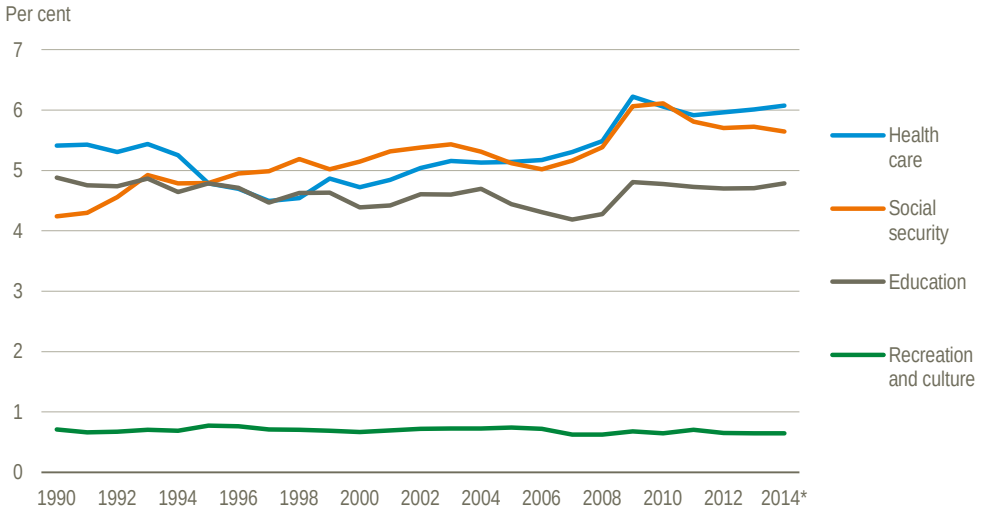
Figure 10.4 General government final consumption as share of GDP. Current prices



High share of government final consumption to GDP since 2009

The substantial decrease in GDP and the significant increase in general government final consumption in 2009, gave rise to a historically high share of government final consumption to GDP in that year. Since then the share has decreased but is still at a higher level than before the crisis.

Figure 10.5 General government individual non-market consumption of subcomponents. Shares of GDP



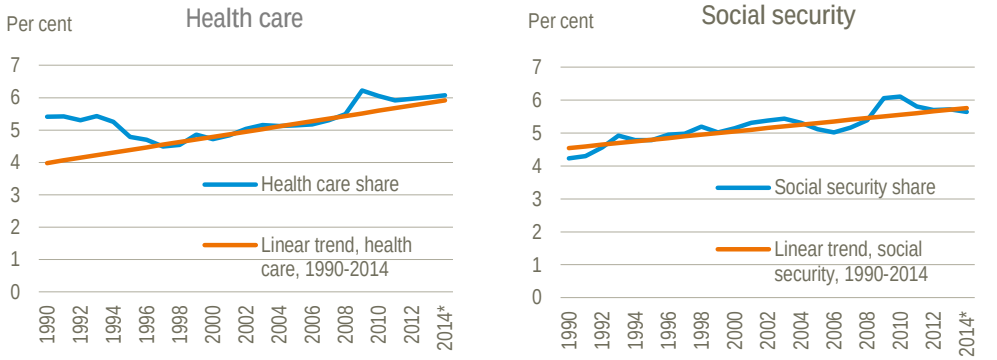
...due to health care and social security

It is especially the shares of individual non-market consumption of health care and social security to GDP that is still at rather high levels, cf. figure 10.5. However, the

[19] These contributions to GDP are not to be confused with the fiscal effects published by, e.g., the Ministry of Finance and the Economic Council, which are based on all discretionary fiscal policy interventions including changes related to taxes, social benefits and all other revenues and expenditures not included in the general government's final consumption. Contrary to the simple calculation of the general government final consumption's contribution to the real growth rate of GDP, the fiscal effects are calculated with the use of a macroeconomic model and also include derived effects, for example how an increase in the general government final consumption demand may affect employment in other industries and, hence, household's demand for goods and services for consumption.

high shares of health care and social security seem to be the result of a continuation of a trend starting several years ago rather than a lagged adjustment after the end of the crisis. In figure 10.6 we have plotted the actual shares of health care and social security, in together with their linear trends. Regarding health care, the trend is based on the development from 1997 to 2008 as 1997 was the year when the annual increases initiated. Regarding social security, the trend is estimated based on data from 1990 to 2008. As can be seen, the share of health care lies marginally above its linear trend in 2014 while social security is marginally below the trend level.

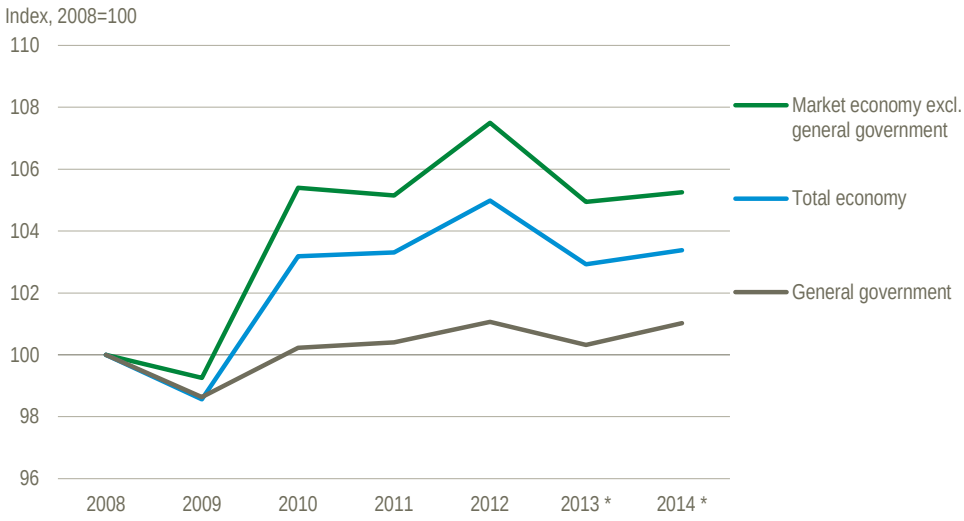
Figure 10.6 Individual non-market consumption of health care and social security as shares of GDP. Current prices. Actual levels and linear trends



10.4 Productivity

With the qualification in mind that the general government output is not directly comparable with market output, figure 10.7 shows the evolution of GVA-based labor productivity for the general government production, market production (excl. general government), and the economy as a whole (index 2008 = 100).

Figure 10.7 GVA-based labor productivity



Faster productivity growth in the market economy

During the entire period, labor productivity has been increasing by 3.4 per cent regarding the total economy. Productivity in the market economy increased by 5.2 per cent which is much faster than the 1.03 per cent in general government. During the years immediately after the financial crisis, adjustment of the work force implied that the market economy achieved much higher labor productivity than before the financial crisis. The government sector on the other hand, retained the level from before the financial crisis. In 2014 the labor productivity in the market economy and the general government was at the same level as in 2010. However,

when these productivity measures are assessed and compared it has to be taken into account that the period has been turbulent and that a rather limited number of years are represented.

Less scope for productivity growth in general government

In addition to the methodological differences between the calculations of output in the market economy and the government sector, the general government has some characteristics which complicate a comparison of the productivity development in the two sectors. The Productivity Commission mentions a number of such characteristics[20]. For example, in private firms the primary goal is to create profit. In the general government, the goal is more complex, as it is subject to political decisions based on short-term considerations, the general government will aim at treating all citizens equally, and there is no (or limited) competition. Moreover, there may be less possibilities of substituting labor with capital than in, e.g., the manufacturing industry. Hence, there may fewer possibilities of productivity growth in the general government production than in the market sector, and it may be more appropriate to compare productivity measures of the general government across countries.

[20] The Productivity Commission (2013) "Måling af produktivitet i den offentlige sektor".