A new index method for price and volume of care for disabled patients in the Netherlands

Antonio G. Chessa[1]

---

[1] Statistics Netherlands, Division of Macro-economic Statistics and Dissemination (MSP), Development and support department (MOO), P.O. Box 24500, 2490 HA The Hague, The Netherlands.

Table of contents

A new index method for price and volume of care for disabled patients in the Netherlands

Antonio G. Chessa

Abstract. This paper describes a new index method for price and volume of care for disabled patients (disabled care) in the Netherlands. The old method used at Statistics Netherlands derives a volume index from a value and price index, where the latter is calculated as a weighted average of annual price changes for some types of disabled care. The new index method is part of a revision process, which aims at following the Eurostat guidelines. One of these guidelines is to develop explicit volume indices, by measuring quantities for as many products as possible. Product quantities and production values are supplied every year by the Dutch health authority (NZa). The data are differentiated according to patient age, type and severity of disability, resulting into about 200 health care products. The volume index is factorised into components that quantify contributions to volume change from existing products, new and disappearing products, and products for which only the production value is known. The results show that the volume of disabled care increased at an average annual rate of 5.9 percent, while prices increased with 2.7 percent per year in the period 2000-2007. The largest volume growth took place between 2000 and 2003, during which waiting lists were reduced considerably. The volume growth of extramural care (15.6 percent per year) is far superior to the growth of intramural care (2.6 percent per year). The rapid growth of extramural care was boosted by a policy change in 2004, which extended the range of extramural care products that could be offered by health care institutes. A striking result is that nursing days among young mentally disabled patients grow three times faster than for older patients. Nursing days for patients with behavioural disorders and short stays contribute significantly to the volume growth among young patients. The old and new volume indices show large differences for some years.

Keywords: Laspeyres volume index, Paasche price index, disabled care, intramural care, extramural care, Eurostat Handbook on price and volume measures.

1. Introduction

This paper presents the results of a study that is part of a revision of price and volume index measures at Statistics Netherlands. The revision was motivated by the publication of the Eurostat handbook on price and volume measurement (Eurostat, 2001). The handbook suggests the development of direct measures of volume change instead of deriving volume indices from price and production value indices. According to the Eurostat handbook, a volume index should be based on as many products as possible, for which the production quantities can be measured. The percentual quantity changes of the products should then be combined into an overall index of production volume ("B-method"). Ideally, the production quantity indices are adjusted by measures of product quality change ("A-method").

A part of the volume indices for the service sector at Statistics Netherlands are derived from a production value index –with value expressed in current prices– and a price index based on, for instance, the prices or tariffs of several main products. The volume index for care for disabled patients ('disabled care' for short) was calculated in this way (Statistics Netherlands, 2007, p.73). Although this method is classified as a B-method –because a distinction into different health services was made– there were possibilities to improve the method. Detailed data on production quantities and values were made available by the Nederlandse Zorgautoriteit (NZa), the Dutch health authority. Recently, new volume index methods were developed for care in nursing homes and homes for the elderly, homecare and mental health care (e.g., see Chessa and Okkerse-Ruitenberg, 2007).

This paper presents a new volume index method for the care of disabled persons. The method is similar to the index method described in Chessa and Okkerse-Ruitenberg (2007) for elderly care. The basis of the index method is a Laspeyres volume index, which is adjusted in order to account for different problems. In particular, it will be shown how entering and vanishing products are dealth with in the volume index. Adjustments of index methods are also needed when the content or definition of a product changes in time and when data are missing. The index method is described in Section 4. A technical description of the method is given in Appendix A.

A description of the disabled care sector is given in Section 2. Types and severities of disability are discussed and also the types of residential (intramural) and non-residential (extramural) care. Next, the financing system for these types of health care will be discussed and some of the changes in financing care since 1999.

Production data regarding the amount of health care provided on a yearly basis and the associated values in current tariffs for different health care products are supplied to Statistics Netherlands by the Dutch health authority NZa. The NZa sets (maximum) tariffs for a great part of the health sector. This authority supervises the negotiations between health care institutes and health insurers on the tariffs and the health care that is expected to be provided. The NZa uses the results of the negotiations to establish budgets for the health care institutes. The data for disabled care between 2000 and 2007 are described in Section 3.

The production values and health care provided are used to derive price and volume indices for every year by making use of the index method of Section 4. The results are presented in Section 5. This is done for the disabled care sector as a whole and also for intramural and extramural care separately. Separate volume indices are also derived for two age groups: young persons (children, adolescents) and adults. Sensitivity analyses are carried out in order to study effects of variations around the base values of unknown parameters on the volume indices.

The results are discussed in Section 6. Factors are identified that give a significant contribution to production volume growth. The results are compared with the old method used at Statistics Netherlands, but also with other methods, such as the Paasche volume index and methods used in other studies. Some remarks will be made about the application of the method in the future, in view of the changes in the financing system that will be introduced in 2009.

2. The disabled care sector

2.1 Types of care

Care for disabled patients can be subdivided into three main groups, as was also done with elderly care (Chessa and Okkerse-Ruitenberg, 2007):

1. *Care with residence and treatment*. Residence refers to 24-hours stay in a health care institute, while medical treatment involves nursing and behavioural treatment.
2. *Care with residence, but without treatment*. This refers to care in institutes with 24-hours stay, but without medical treatment. Examples are personal and household care.
3. *Care without residence*. This refers to care without 24-hours stay in an institute. This type of care comprises day-care centres and home health care. Day-care centres do not offer medical treatment, which, however, may be part of home health care.

Care with residence will also be denoted in this paper as *intramural care* and care without residence as *extramural care*.

The intramural care considered in this paper is confined to care offered by institutes for mentally, physically and sensory disabled patients.[2] A sensory disability may be visual or auditive, or

---

[2] Care for disabled patients that is offered by other health care institutes is not considered here. An example of care that is left out is care given to mentally disabled patients in nursing homes. These are patients who were previously treated in disabled care institutes. A part of extramural care offered by home health care institutes is also given to disabled patients. This care is

a combination of both types. The following description of disabled care types is largely based on a study of Woittiez et al. (2002).

Institutes for mental disabilities, with treatment
Institutes for mentally disabled patients offer a wide range of care for patients with mild to severe forms of mental disability in all age classes. Four levels of mental disability are distinguished, in accordance with the Diagnostic and Statistical Manual of Mental Disorders (fourth edition).[3] The classification is based on IQ:

- Mild mental disabilities refer to persons with an IQ between 50-55 and 70;
- Moderate mental disabilities refer to persons with an IQ between 35-40 and 50-55;
- Severe mental disabilities correspond to IQ-levels between 20-25 and 35-40;
- Profound mental disabilities refer to IQ-levels below 20-25.

The dividing line between categories is given as a range because IQ-scores may involve a measurement error of approximately 5 points.

In the Netherlands, the class of mild mental disabilities was extended several decades ago with a fifth group, although formally it falls outside the DSM-definition of mentally disabled. The additional group is denoted here as 'mentally subnormal' (in Dutch: zwakbegaafd), which consists of persons with an IQ between approximately 71 and 90. Some of these patients have severe behavioural disorders. Because of the combination of behavioural and mental disorders, these patients could not obtain adequate treatment in psychiatry or youth care. Special residential and treatment services have been created for this group in the disabled care sector (Woittiez et al., 2005; NZa, 2008). It is important to bear the extension of the definition of mental disabilities in mind, for instance, in view of international comparisons.

Most of the care for persons with mental disabilities is long-term care, which comprises protected stay with nursing, in combination with daily activities. There are also institutes specialised in the treatment of mentally disabled patients with additional disabilities, such as sensory disabilities or sensory-motor disorders. These institutes have specialised knowledge and experience with specific behavioural therapies and teaching methods that are not offered by other institutes. Institutes for young patients with mild mental disabilities offer care and behavioural treatment and support for patients between 6 and 21 years old, who have educational problems at home and whose chances of becoming successful in society are small.

Institutes for physical disabilities, with treatment
These institutes are referred to as "large housing structures" in the Netherlands. There are four of such housing structures for physically disabled patients. The care comprises housing support, personal care and nursing. The fully adapted houses are usually located in a district of a city and are supported by a central aid station. Assistance can be requested during 24 hours a day.

Institutes for sensory disabilities, with treatment
Health services for persons with visual and/or auditive disabilities comprise research, (para)medical treatment and education of patients, aimed at their integration within society. Care also consists of the support of patients with housing.

---

also left out here. The production value of care offered by nursing homes and home health care institutes to disabled patients was about 28 million Euro in 2007, which is less than 0.5 percent of the total value of disabled care. These health services are classified as nursing home care and home health care in the Dutch National Accounts and in the study by Chessa and Okkerse-Ruitenberg (2007).

[3] The Diagnostic and Statistical Manual (DSM) uses the term "mental retardation", which is replaced in this paper by "mental disability". This is done in order to relate the term quicker to the terminology used in non-English speaking countries. However, the meaning of mental disability is the same as in the DSM, which is characterised "by significantly subaverage intellectual functioning (an IQ of approximately 70 or below) with onset before age 18 years and concurrent deficits or impairments in adaptive functioning."

Institutes with residence, without treatment
These institutes consist of surrogate family homes for children and for patients of 18 years and older. There are surrogate family homes for patients with different types of disability and for patients with multiple disabilities. Care consists of personal and household care. Adults are assigned to a surrogate family home when they are able to handle things fairly well in daily life. The lesser dependent persons can be placed in an annex (in Dutch: "dependance"). Most children of surrogate family homes go to special schools.

Extramural care
Extramural care for disabled patients consists of activities in day-care centres and home health care. The range of these health care types has been extended significantly since the introduction of a new policy for extramural care by the Dutch health authority in 2004. According to this policy, health care institutes are allowed to offer extramural care across health care sectors. This means that institutes for disabled care may offer types of care that are not merely restricted to disabled care, but may also comprise elderly care and mental health care. This development is part of a shift in the Dutch health care system from supply-driven health care to demand-driven health care, that is, to a more consumer-oriented health care system. For instance, nowadays a patient has more choice in the location where health care can be received.

Day-care centres can be subdivided into institutes for children and adolescents and for persons of age 18 and older. Persons going to a day-care centre may live at home, in a surrogate family home or on their own. The activities are aimed at stimulating personal development, independence and social integration. Day-care centres offer a broad range of activities, from physical exercise and expression to work-related activities (creating products or services).

Home health care encompasses support and assistance, personal and household care, nursing, medical and behavioural treatment, and psychotherapy for patients at home.

2.2 The financing of disabled care

The greatest part of disabled care consists of long-term care. Almost all expenses associated with long-term care and the treatment of chronical diseases are covered by a social insurance according to the Exceptional Medical Expenses Act (AWBZ) in the Netherlands. The greatest part of elderly care also falls under the AWBZ. A smaller part of the expenses consists of payments by individuals and subsidies by the State.

The financing of health care in the Netherlands is determined by a set of laws and rules in order to control expenses, which have increased rapidly. For instance, the AWBZ-expenses for elderly care increased at an average annual rate of 7.4 percent in the period 2000-2006, which amounted to about 12 billion Euros in 2006 (Chessa and Okkerse-Ruitenberg, 2007). The expenses for hospital and specialist care increased with 7.8 percent per year in the same period to over 17 billion Euros in 2006.

In 1982, the Dutch law on tariffs for health care (WTG) was introduced by the government. This law contains procedures for setting up 'policy rules' ("beleidsregels" in Dutch) with regard to tariffs. The Dutch health authority NZa sets up the policy rules and tariffs. These are used as guidelines during negotiations between health care institutes and insurers, which involve tariffs and quantities for different types of health care that are expected to be offered during a year. The AWBZ-funds are distributed among health insurers, which compensate health care institutes for health care delivered.

Based on the policy rules and the results of negotiations, the NZa establishes a budget and the tariffs for each health care institute. There may be differences in the tariffs among institutes, which, however, appear to be small in practice. Budgets for intramural and extramural care are established in a different way. The budgets for intramural care consist of three main components:

- *Production-related costs*. This part of the budget covers expenses that are directly related to production levels, and include wages of medical and nursing personnel and material costs. The latter comprise costs of medication. Production-related costs thus vary with the product quantities

delivered by health care institutes. The policy rules of the NZa specify tariffs per unit of production, such as per day of care or nursing, and per hour of personal or household care.

- *Capacity-related costs.* This part of the budget covers expenses related to housing, such as nutrition and cleaning. These costs are set per unit of capacity, for instance per bed or room. The capacity-related tariffs are also made up of a wage-related part and a part that covers material costs.
- *User cost of capital ('capital costs').* These cover costs of buildings and equipment due to depreciation and interest. A part of these costs in the budget is established according to tariffs per bed or per square metre, while another part may be known because of approved investments.

Until 2000, health care institutes could only offer care within the limits of their budget. Additional care that would exceed the total budget was not refunded. From the year 2000, it became possible to provide care to persons on waiting lists by additional funds. The funding of additional care was integrated in 2004 with the regular funding. Institutes will receive extra funding only if they used their budget completely.

The funding of extramural care has been almost the same as for intramural care. The financing system underwent a change with the introduction of the new policy rule for extramural care in 2004 (Section 2.1). The budgets for extramural care now only consist of production-related costs. More precisely, the tariffs per unit of production not only consist of wages of health care personnel and costs of medication; capital costs are included in the tariffs as well. This means that all the costs must be covered by production in the case of extramural care.[4] This also holds for day-care centres. Before 2004, the composition of the budgets for day-care centres was the same as for intramural care.

Care funded according to the system described above is called "in natura" in the Netherlands. In this system, health care institutes are paid by health insurers. A part of the AWBZ-funds is reserved for personal care budgets (PGB's in Dutch). Health insurers pay the budgets to patients, who can choose where to purchase health care (from institutes or individuals). It is not possible to apply for a personal budget when a patient needs residential care, nursing or medical treatment. This means that only extramural care can be funded by personal budgets. Personal care budgets are included in this study, since these represented 11 percent of the total production value of disabled care in 2007.

3. The data

Data on production quantities and values are supplied to Statistics Netherlands by the NZa, with the exception of data on personal budgets. The NZa-data cover the period 1998-2007. Data on personal budgets were used in this study from the period 2000-2007. These data are supplied by a different institute, the College voor Zorgverzekeringen (CVZ; in English: the Health Care Insurance Board). The CVZ co-ordinates the implementation and funding of the AWBZ and the Dutch Cure Insurance Act (Zvw). The CVZ manages and distributes funds over health insurers.

Data differentiation
The NZa-data contain production quantities and values for more than 100 intramural health care types and over 80 extramural types of care. The data on intramural care are differentiated according to type of disability (mental, physical, sensory) and age groups. This holds for residential care with and without treatment. The age groups are defined in a different way for the various types of disabilities. Health care for mentally disabled persons is subdivided into age classes younger than 20, between 20 and 50, and 50 or older. Health care for persons with sensory disabilities is subdivided into care for children and adults. The same is done for care in surrogate family homes.

---

[4] It is worth pointing out that the share of capital costs in the production value for extramural care is smaller than for intramural care. The share of capital costs for extramural care, including day-care centres, was 7.3 percent in 2007, while the share was 12.8 percent for intramural care. In Euros, the capital costs in 2007 amounted to 91 million for extramural care and 504 million for intramural care.

Further differentiations of the production data are available for mental and sensory disabilities. The data for every age class regarding mental disabilities are subdivided into health care for each of the four IQ-groups in Section 2.1. The data for sensory disabilities are subdivided into auditive and visual disabilities. Even further refinements of these data are available: care for hard of hearing and deaf persons (auditive) and care for visually impaired and blind persons. Separate production data are also available for patients with multiple disabilities and with additional behavioural disorders. Examples are mentally disabled patients who are deaf or blind, and patients with a mild mental disability with severe behavioural disorders.

The data on care without residence, or extramural care, are differentiated according to the main types mentioned at the end of Section 2.1. Data are thus available on personal and household care, support and assistance, and medical and behavioural treatment at home. A part of the data is subdivided into type and severity of disability and age group, for example, for treatment and psychotherapeutic face-to-face contacts. Data on daily activities in day-care centres are available for children and adults.

Detailed data about health care financed with waiting list funds are available as well. Examples of types of health care in the data are: housing support and assistance for sensory and mentally disabled patients, and activities in day-care centres for mentally disabled children and adults.

Production quantities
The data on the amount of intramural care provided are mostly expressed in days. Volumetric units used for extramural care are hours of treatment, support, personal and household care, and face-to-face contacts in psychotherapy. Care in day-care centres is expressed as the number of days with daily activities. The amount of health care financed with waiting list funds is expressed as the number of clients that received health care (i.e., the number of persons who were taken from a waiting list and received health care).

Production values
The three cost components mentioned in Section 2.2, which make up the budgets of health care institutes, are available in the NZa-data. Production-related values are available for all the types of intramural and extramural care specified by the data. The values of the waiting list funds are specified for different health care types.

Missing data
Although the NZa-data offer a detailed description of the amount of disabled care delivered between 1998 and 2007 and the production values of the different types of care, several data could not be supplied by the NZa. Assumptions about the following missing data have to be made in order to calculate price and volume indices:

- The production-related tariffs per day of care in day-care centres and surrogate family homes are not available until 2003;
- The user cost of capital is not included in the different types of extramural care for the years 2004, 2005 and 2006. That is, the total cost is available, but it is not distributed over the extramural care types. True integral tariffs are available only for 2007;
- For some health care types, only the production values are known. Tariffs and quantities of health care delivered are not available for personal care budgets and several additional funds, from which short stays were financed (in Dutch: Zorg-Op-Maat, ZOM). Tariffs and quantities for personal budgets are missing for every year, while these data are missing for the ZOM-funds until 2003.

Table 3.1 summarises production quantities for different types of care.

Table 3.1 Days of care (x1000) in intramural institutes and day-care centres. Numbers of clients (x1000) helped from waiting lists are presented separately. Absolute values are given for 2000 and index numbers for subsequent years (2000 = 100). (Source: NZa)

	Days LMVG[1]	Days EZVG[2]	Days JLVG[3]	Days GVT[4]	Intramural [5] days	Days in day-care centres[6]	Clients from waiting lists[7]
2000 (abs.)	6447	5767	851	7384	21051	4628	1,35
2000	100,00	100,00	100,00	100,00	100,00	100,00	100,00
2001	99,84	103,87	106,77	101,18	101,62	104,39	386,56
2002	95,75	110,98	109,66	102,88	103,07	106,65	668,30
2003	95,33	113,79	114,63	105,56	104,91	111,03	910,88
2004	90,25	123,96	110,68	103,16	105,17	134,25	
2005	89,48	128,18	114,98	105,39	106,93	137,66	
2006	89,55	132,05	118,69	110,08	109,79	139,71	
2007	88,11	133,84	121,04	111,44	110,29	144,75	

1) LMVG: mild to moderate mental disabilities; 2) EZVG: severe to profound mental disabilities; 3) JLVG: institutes for young mentally disabled;

4) GVT: surrogate family homes; 5) all intramural care, except for care from waiting list funds; 6) both for children and adults;

7) number of mentally disabled clients who were taken from waiting lists and offered care.

The following observations can be drawn from the above table. Days in day-care centres show a much stronger increase than days in intramural institutes. The question is whether this picture will also emerge when taking into account the entire intramural and extramural care. In order to calculate the volume indices for intramural and extramural care, we have to take into account the contributions from personal care budgets and product differentiation. The indices in Table 3.1 apply to days summed over different types of care, so that the contribution from product differentiation is not quantified. Personal care budgets are not included in Table 3.1 either, as product quantities are not available.

Product differentiation is expected to have a positive effect on volume growth in this study. From Table 3.1 it follows that the number of days of care for mild to moderate mental disabilities decreases, while the number of days of care for severe to profound mental disabilities increases. The more severe types of health care have a larger contribution to volume growth in our method than milder types of care, which will be explained in the next sections.

In Table 3.1 it is also evident that the number of clients that received care from waiting list funds increased very fast. Another interesting question therefore is to what extent this increase contributes to the volume growth of the entire disabled care sector until 2004. The volume indices of disabled health care, and separate indices for intramural and extramural care will be presented in Section 5.

4. The index method

According to the Eurostat handbook on price and volume measurement, a volume index should satisfy the following criteria (Eurostat, 2001, pp. 33-35):

1. It should distinguish as many services or products as possible;
2. The produced quantities should be weighted by their costs in the base year;
3. The produced quantities should be quality-adjusted.

A volume index that satisfies the three criteria is called an "A-method". A volume index that does not take into account quality adjustments, but satisfies criteria 1 and 2, is called a "B-method". In fact, criteria 1 and 2 can be considered as the minimum set of requirements for a valid volume index. This paper does not address quality adjustments, as they require a separate study. The focus therefore is on developing a B-method.

The set of products in the case of disabled care are the types of care specified in the data set provided by the Dutch health authority NZa and the care funded by personal care budgets (Section 3). We have to answer the following questions in order to set up a volume index that meets the requirements for a B-method:

- What quantity measures should be used for the types of disabled care? Do the product quantities specified in the data sets, which are described in Section 3, provide adequate measures?
- How should the budget components be used in order to develop cost weights?

Quantity measures
For the health care sector, the quantity of health care received by patients should be measured in terms of complete treatments (Eurostat, 2001, p.117). This measure can be used for day treatments, face-to-face contacts in ambulatory services and day activities in day-care centres. These data can be obtained directly from the NZa-data. However, a substantial part of disabled care consists of long-term care. Treatments received by patients often cover periods longer than one year. In these cases it is not appropriate to count treatments, as they may not be completed within a year. An alternative could be the number of patients. However, if the amount of health care received per patient increases from year to year, then yearly changes in the number of patients would underestimate the volume index. This is the case in elderly care (Chessa and Okkerse-Ruitenberg, 2007). We therefore decided to take the number of nursing days or days of care during a year as a quantity measure for long-term disabled care. The choices for disabled care thus coincide with those made previously for elderly care.

Cost weights
The cost weights of the quantities are derived from the composition of the budgets. As was described in Section 2.2, the tariffs of extramural care are supposed to be integral tariffs from the year 2004. However, integral tariffs were introduced only in 2007. Until then, the tariffs did not include the user cost of capital. In this study, the capital cost component was derived from the composition of the tariffs in 2007.[5] It is assumed that the ratio between the tariff components for capital costs on the one hand and for the sum of wages and material costs on the other hand is the same in 2004, 2005 and 2006. The integral tariffs thus obtained are used as cost weights for the product quantities of extramural care.

The financing of intramural care is organised in a different, more traditional way. The budgets of institutes are composed of three main parts, as we saw in Section 2.2: (1) a production-related part, (2) a capacity-related part, and (3) a part that should cover the costs due to capital depreciation. The production-related part of the budget is obtained by multiplying the tariffs per day of care with the produced quantities for each type of care. This is the part of the budget that varies with the amount of care. The tariffs constitute a part of the cost weights of the intramural care types.

The other two budget components do not vary with the amount of care. They are included in the cost weights of the health care types as follows. The capacity-related costs are based on tariffs per unit of capacity, that is, per bed or room. These tariffs are converted into tariffs per day of care. This is done for every type of institute separately. For example, there is a capacity-related tariff for institutes for mentally disabled care and another tariff for surrogate family homes. The tariffs are assumed to be equal for every health care type per type of institute. The converted tariffs are added to the production-related tariffs.

The costs of capital depreciation are not uniformly distributed over days of care, but are added to the product tariffs according to the share of the products in the sum of the production-related and capacity-related costs. This distribution comes close to the way in which the NZa includes capital costs in the tariffs of extramural care.[5] This approach will be compared with the uniform distribution method used for capacity-related costs, as part of a sensitivity analysis in Section 5.

---

[5] The decomposition of the tariffs of extramural care types in 2007 into a wage part, material costs, energy costs and costs of capital goods and inventory is given in an Excel-file on the website of the NZa, which can be accessed at: http://www.nza.nl/9156/13600/1164093890_25c-b3.xls.

Index method

Now that the production quantity measures and their tariff structure are specified, we can proceed with the development of an index method. A technical outline of the index method that is developed for disabled care is given in Appendix A. The point of departure is the index of the total production value in year t with respect to year $t – 1$, which is denoted in the appendix by expression (A1). The value index has to be decomposed into a price index and a volume index. The convention at Statistics Netherlands is to use a Paasche price index and a Laspeyres volume index.

The Paasche price index uses the product quantities in year t as weights for the prices in years t and $t – 1$; the Laspeyres volume index uses the prices in year $t – 1$ as weights for the quantities in years t and $t – 1$. The price and volume index cannot be readily calculated because:

- The product sets in two successive years are not necessarily identical;
- For a part of the products only the production values are known, but not the tariffs and produced quantities (Section 3).

The first characteristic refers to the fact that products may not be offered in year t, while they still were in the preceding year ('old products'), and that other products may be introduced in year t ('new products'). There is no information about the prices in year $t – 1$ of new products, so that the Paasche price index and Laspeyres volume index cannot be calculated. Old products do not give problems of calculation: their quantities in year t are zero, so that these products do not influence the Paasche price index. The Laspeyres volume index uses prices in year $t – 1$, which are available for old products. Their contribution to the Laspeyres volume index can thus be calculated.[6] Products of which only the production values are known cannot be readily used to calculate price and volume indices, because product quantities in year t cannot be linked to prices in year $t – 1$.

The index method described in Appendix A resolves the problems with new products and products with merely known production values by introducing two parameters that link the price indices of these two subsets of products to the price index of the products that are offered both in year t and in year $t – 1$ ('product match'). The relations between the three price indices are represented by expressions (A3)-(A5). These relationships are used to rewrite the Paasche price index and the Laspeyres volume index. The Paasche price index has the following form (see expression (A6)):

(1) $P_{\text{match}} \, p(r,s).$

P_{match} denotes the Paasche price index of the product match in year t with respect to year $t – 1$ and p is a function of the two linking parameters, which are denoted by r and s. The parameter r denotes the ratio of the price index of the set of new products and the price index of the product match (expression (A4)). The parameter s has the same function for the set of products in year t of which only the production values are known (expression (A5)). The function p is equal to 1 when $r = s = 1$, in which case the price index is equal to the price index of the product match. The function p thus describes contributions to the price index from products outside the product match, like old and new products. The total price index increases when r and s increase, since the price indices of new products and of products, for which only the production values are known, increase.

The values of r and s are the only unknown factors in price index (1). These parameters can be assigned different values for intramural and extramural care. The parameters r and s are also used in a sensitivity analysis in the next section to quantify the effects of variations in these parameters on the total price and volume indices. A factor that influences the variation in the price and volume indices is the share of the product match in the total production value. If this value share is close to 100 percent, then the effects of variations in r and s will be small, as can also be deduced from the limit behaviour of the price and volume indices (expressions (A11) and (A21)).

---

[6] Notice that the opposite holds for the Paasche volume index and the Laspeyres price index. That is, there is no problem to account for new products in these price and volume indices, while old products do give problems of calculation.

The Laspeyres volume index can be written in the following form:

$$(2) \quad V_{\text{match}} V_{\text{old}} V_{\text{new}}(r) V_{\text{rest}}(r, s),$$

which is a shortened notation for the full expression (A18) derived in Appendix A. The Laspeyres volume index of the product match is denoted by V_{match}. The contributions of old and new products to the volume index are represented by V_{old} and V_{new} respectively. V_{rest} represents the contribution of the products of which only the production values are known. When setting $r = s = 1$, the volume index simplifies to expression (A20).

Variations in r and s have opposite effects on the volume index with respect to the price index. The volume index decreases when r and s increase. In that case, the production values of for instance new products, with values measured in prices of the preceding year, decrease, so that the total volume index also decreases. For more details, see Appendix A, in particular the discussion with regard to the limit result (A21).

Price index (1) and volume index (2) are calculated for intramural and extramural care in Section 5. The volume index for the whole disabled care sector is obtained by weighting the volume indices for intramural and extramural care by their shares in the total production value in year $t - 1$.

5. Results

*5.1 Volume and price indices of disabled care*

In order to calculate price and volume indices, assumptions have to be made about the missing data listed in Section 3 and the linking parameters r and s in the expressions for the price and volume indices in Section 4. The following ('base') values were used in the results:

- The price index for care financed with personal care budgets is set equal to the price index for extramural care, as calculated from the NZa-data on extramural care. This assumption is made for every year. Care funded by personal budgets does not include care with residence, so that patients can only receive extramural care.
- The parameters r and s are both set to 1 for every year, both for intramural and extramural care. These parameters are applied only to products in the NZa dataset. Personal care budgets, for which only production values are available, are treated in the way as described in the previous point.
- The production-related tariffs of day-care centres and surrogate family homes are assumed to increase with four percent every year until 2003. This price increase is in line with the average annual price increase of the entire disabled care in the period 2000-2003.

A consequence of the first two assumptions is that the price indices of intramural and extramural care are equal to the price indices of their product matches.

Figure 5.1 shows the decomposition of the production value index into a price and volume index. The indices shown are chained indices, with values set at 100 for the year 2000 throughout this paper. The production value increased at an average annual rate of 8.7 percent, while the production volume of the entire disabled care sector increased with 5.9 percent per year on average. This means that the tariffs increased with almost 3 percent per year on average. The figures of the chained and year-to-year indices that correspond with Figure 5.1 are given in Table 5.1 From this table it follows that the volume growth has become smaller during the period considered. The rest of Section 5 will be devoted to the analysis of the volume growth.

Figure 5.1 Chain indices for production value, volume and price of disabled care, 2000 = 100.
(Source: Statistics Netherlands, NZa, CVZ)
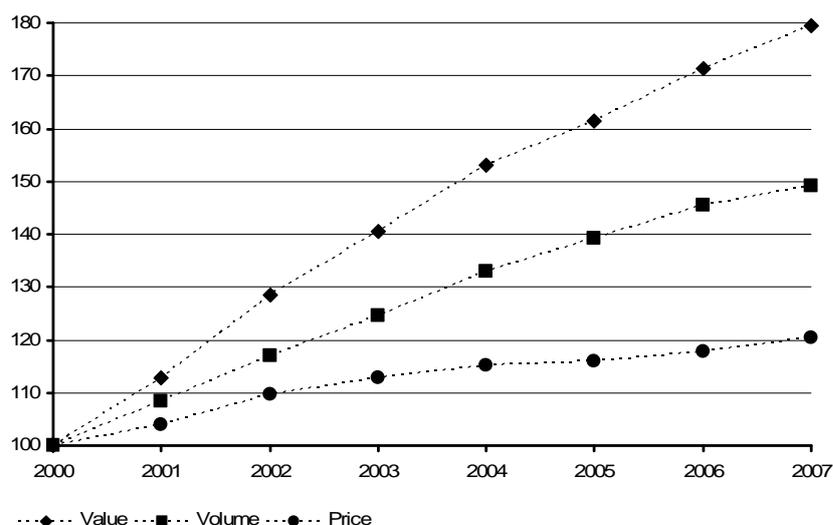
The strong increase of the expenses on personal care budgets (PGB's) [7] has contributed significantly to the total volume growth. The yearly volume growth without PGB's in the period 2000-2007 is 4.3 percent, which is 1.6 percentage point lower than the total volume growth. The contribution of PGB's to the total volume growth becomes stronger after 2003 (Figure 5.2). This development can partly be explained by the introduction of the new policy for extramural care in 2004, which allowed health care institutes to offer a broader range of extramural care. Personal budgets can only be used to finance extramural care.

Table 5.1 Chained and year-to-year indices for production value, volume and price of disabled care.
(Source: Statistics Netherlands, NZa, CVZ)

	2000	2001	2002	2003	2004	2005	2006	2007
Chained								
Value	100	112,81	128,50	140,56	153,15	161,54	171,32	179,52
Volume	100	108,46	117,10	124,46	132,90	139,32	145,50	149,11
Price	100	104,02	109,74	112,93	115,24	115,95	117,74	120,39
Year-to-year								
Value		112,81	113,91	109,38	108,95	105,48	106,05	104,78
Volume		108,46	107,97	106,29	106,77	104,83	104,44	102,48
Price		104,02	105,50	102,91	102,04	100,62	101,55	102,25

---

[7] All expenditures on PGB's for disabled care are included in the calculations. That is, care purchased by budget holders at health care institutes and also from individuals is taken into account here. The PGB-expenditures for disabled care increased from 56.5 million Euros in 2000 to 637 million Euros in 2007. A small part of disabled care is not considered in this study (which has a value of about 30 million Euros in 2007, among which health care delivered on behalf of third parties).

Figure 5.2 Volume growth with and without personal care budgets, 2000 = 100. (Source: Statistics Netherlands, NZa, CVZ)

········■···· Volume with personal budgets   ····□··· Volume without personal budgets
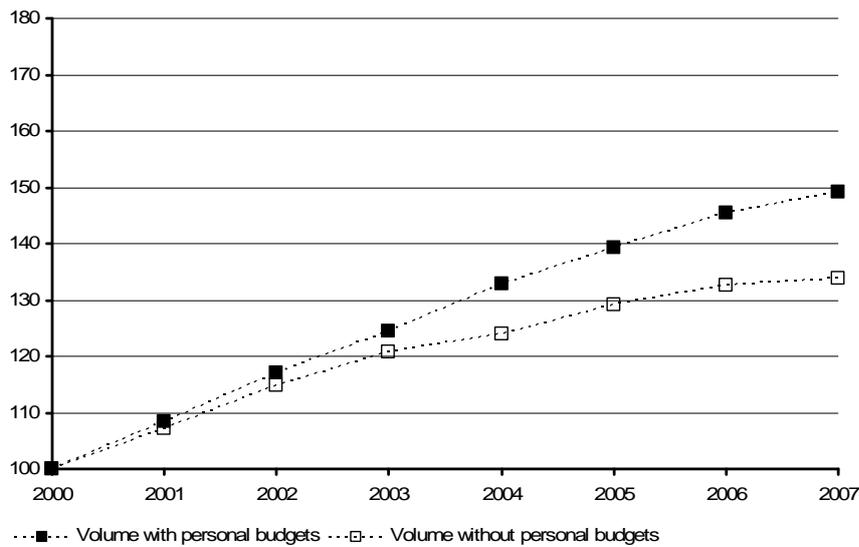
In Figure 5.3, volume growth is decomposed into different parts, from which the PGB's are excluded. A huge contribution to the remaining volume growth comes from care given to patients who were on waiting lists. This care comprises assistance to self-supporting patients, care in surrogate family homes and activities in day-care centres. Production data about waiting lists are recorded up to the year 2003. This production cannot be tracked separately from 2004, since it has been integrated with regular care. The average annual volume growth, without PGB's, in the period 2000-2003 is 6.5 percent, which drops to 4.1 percent when the waiting list production is excluded. Table 3.1 shows that the number of patients who were taken from waiting lists and received care in 2003 was about nine times higher than in 2000. The production value in 2003 was more than 200 million Euros. These facts give an indication of the extent to which waiting list care contributed to volume growth.

Another factor that contributed significantly to volume growth is care given to mild mentally disabled patients with severe behavioural disorders. This group of patients is referred to as 'SGLVG' in the Netherlands. Figure 5.3 shows that the largest positive contributions of this type of care to volume growth are realised in 2001 and 2002. SGLVG-care is financed with a supplementary fund, which is assigned to health care institutes for mentally disabled patients in addition to the regular funding for nursing and care. The supplementary fund is used by institutes in order to offer additional care, such as daily activities (Esdégé, 2002).

Originally, the supplementary fund was meant for new patients only. Due to a cause won by disabled care institutes, the supplementary fund was also assigned to existing patients retrospectively. In 2003, the Dutch Ministry of Public Health proposed an act, by which institutes can only receive supplementary funding for new patients since that year.

The average annual volume growth without SGLVG-care is 4.9 percent in the period 2000-2003, which is 1.6 percent below the volume growth without PGB's in the same period. If both SGLVG-care and waiting list care are excluded, then the average annual volume growth becomes equal to 2.5 percent (see second line from below in Figure 5.3). This means that SGLVG-care and waiting list care have a combined contribution of four percentage points to the average annual volume growth in the period 2000-2003.

Figure 5.3 Contributions of waiting list care and SGLVG-care to production volume without personal budgets, 2000 = 100. (Source: Statistics Netherlands, NZa)
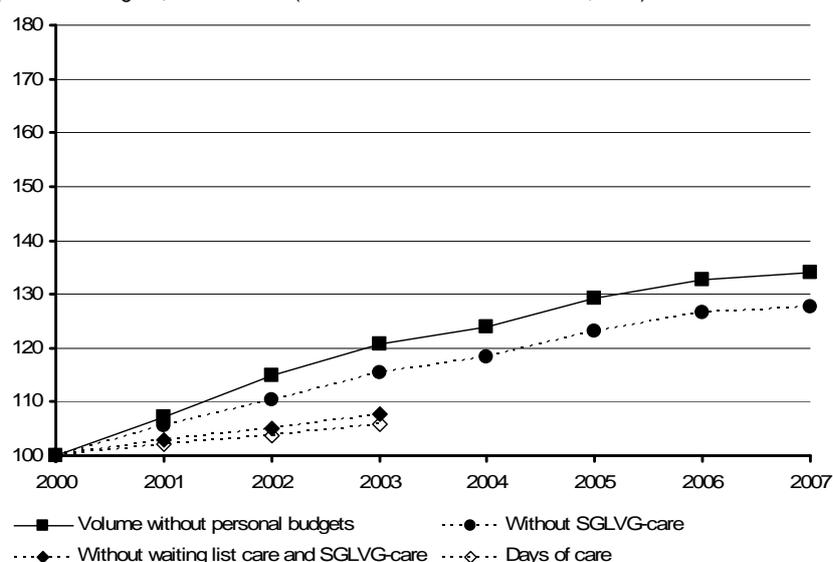
The sum of days of care over all the institutes, including days with daily activities in day-care centres, increased with 2.0 percent per year on average in the period 2000-2003. This total number of days can be obtained as the sum of the days in columns 5 and 6 of Table 3.1. If PGB's, SGLVG-care and waiting list care are excluded from the total volume, then a contribution of 0.5 percentage points to volume growth results that can be ascribed to the weighting of days for the remaining types of care. Table 3.1 shows that care for mild forms of mental disability decreases, while care for severe mental disabilities increases. The tariffs for the severe forms are higher than for the milder forms, so that the severe forms have a larger weight in the overall volume index.

5.2 Intramural and extramural care

In Figure 5.4, the overall volume index shown in Figure 5.1 is decomposed into volume indices for intramural and extramural care. The volume index for extramural care is also shown for the part of care without PGB's. The volume of intramural care increased at an average annual rate of 2.6 percent. The volume of extramural care shows a much more rapid growth, with an annual rate of 15.6 percent. This means that the share of extramural care in the disabled care sector is increasing.

Care financed with personal budgets contributed with more than five percentage points to the average annual volume growth of extramural care. The volume growth is particularly strong in 2004. The financing system for extramural care underwent an important change in that year. Institutes were allowed to offer extramural care products from different health care sectors, so that their product range increased. New products appeared in the disabled care sector in 2004, such as different types of ambulatory mental health care.

However, the largest contribution to extramural volume growth in 2004 can be ascribed to a group of products that can be denoted as support or assistance. This type of care encompasses assistance with regard to activities in daily life, such as planning, taking decisions, performing tasks, organising and stimulating household and personal care, and participation in social life. For children and adolescents it is also possible to get assistance with regard to homework and after-school reception. The production value of support and assistance in 2004 was 309 million Euros, which makes up 29 percent of the total production value of extramural care in 2004. The production value in 2003 is less than 50 percent of the value in 2004, which gives an indication of the importance of support and assistance for extramural volume growth.

Figure 5.4 Chained volume indices for intramural and extramural care, 2000 = 100.
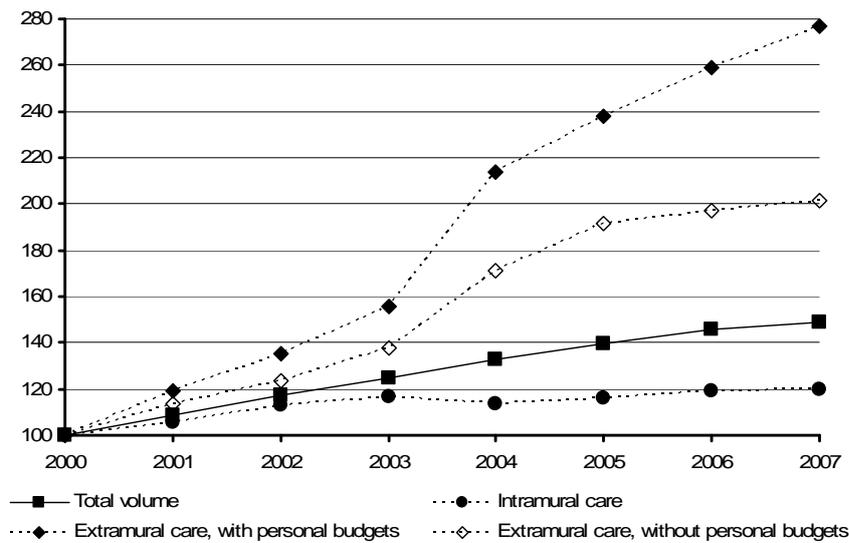(Source: Statistics Netherlands, NZa, CVZ)

Figure 5.4 also shows that the volume of intramural care decreased in 2004. Based on the NZa-data, the volume decreased with 2.9 percent with respect to 2003. It is difficult to trace the exact causes of this decline. According to the NZa, the calculated volume growth until 2003 may slightly overestimate the true growth. In order to receive a budget, an institute makes an assessment of the production quantities that it expects to deliver during a year in agreement with a health insurer. Production assessments are the only available data for product quantities until 2004, so that these are used in the index calculations. Since 2004, both production assessments and actual product quantities delivered by health care institutes became available. The actual product quantities are used in the index calculations from 2004 onwards. However, since hard evidence about a possible discrepancy between actual and assessed product quantities is lacking, the results have not been adjusted.

5.3 Volume by patient age

The data also allow us to make a distinction according to age. The derivation of volume growth figures by age is, however, more difficult than for intramural and extramural care. A part of the production data is not differentiated according to age. Distinctions by age can however be made by using days as quantity measure. Figure 5.5 shows the nursing days for mentally disabled patients in institutes with treatment. The nursing days are subdivided into two age groups: patients of age 20 and older, and patients younger than 20. The total number of days in Figure 5.5 is equal to the sum of the days for the mentally disabled groups LMVG, EZVG and JLVG in Table 3.1. The nursing days are converted into index numbers, with numbers of days set at 100 for the year 2000.

The difference between the developments of nursing days between the two age groups in Figure 5.5 is striking. The nursing days for patients of age 20 and older increased with 1.0 percent per year on average, while the nursing days for patients younger than 20 increased with 3.1 percent per year. The increase of the number of nursing days for patients with behavioural disorders has contributed significantly to the increase of nursing days among young patients. Another contribution to this growth may come from short stays.

Figure 5.5 Nursing days for mentally disabled patients in institutes with treatment, subdivided into two age groups, 2000 = 100. Nursing days in 2000: 2,298,425 (younger than 20) and 10,767,186 (age 20 and older). (Source: NZa, Statistics Netherlands)
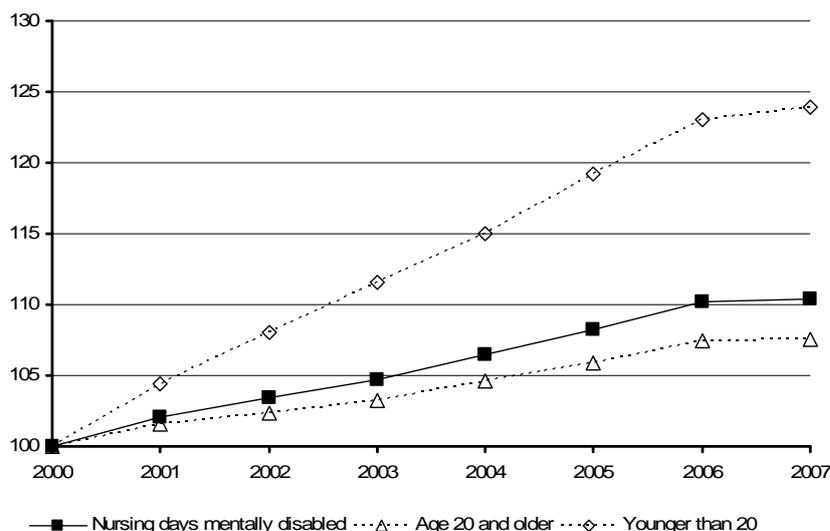
5.4 Sensitivity analyses

There are some uncertain factors in the results of this section. Assumptions about these uncertainties were made in Section 5.1 ('base values') in order to calculate the price and volume indices. An important question therefore is to what extent the results will be influenced by variations around the base values of the uncertain factors. The following variations were studied:

- The price indices for new products and for products of which only production values are known, are assumed to be equal to the price index of the product match in every year, for both intramural and extramural care. In terms of the linking parameters introduced in Section 4, this means that $r = s = 1$. In the sensitivity analyses, we consider the cases $r, s = 1 \pm 0.025$. In other words, the price indices of the two aforementioned product sets are then assumed to be 2.5 percent larger or smaller than the price index of the product match.
- The production-related tariffs of day-care centres and surrogate family homes are assumed to increase with four percent every year until 2003 in the base values. In the sensitivity analyses, we consider price increases of two and six percent.
- The user cost of capital for intramural care is distributed over the individual types of care according to their share in the total production value, which was motivated by the tariff structure for extramural care. A question that may be worth investigating is whether different distributions will have a strong impact on price and volume indices. As an alternative to the 'value share approach', we also distributed the user cost of capital uniformly over days of intramural care, irrespective of the type of care. In fact, this is the distribution used for capacity-related costs.

The first two variations have very small effects on the overall price and volume indices. This is even the case when variations in more than one factor are combined. Changes in year-to-year volume indices are smaller than 0.15 percentage points. After 2004, the volume indices even remain almost unchanged. This can be explained by the fact that the tariffs and the production quantities are available for all the products in the NZa-dataset, so that the parameter s is no longer needed in the results. In addition, the number of new products has become smaller after the introduction of the new policy for extramural care in 2004. Because of this, the influence of the parameter r has become smaller as well.[8]

---

[8] It can be easily verified with expression (A6) in Appendix A that the price index tends to the price index for the product match, as the value shares v_t and λ_t of new products and of products, for which only the production values are known, decrease. The influence of the parameters r and s on the price and volume indices will therefore be smaller.

Finally, the tariffs of surrogate family homes and day-care centres are available from 2003 onwards. These three factors reduce the uncertainty in the results after 2004, which appear to be very robust.

Also the alternative distribution of the user cost of capital over intramural care products has small effects on the overall price and volume index. If the user cost of capital is distributed uniformly over days of intramural care, then the average annual volume growth in the period 2000-2007 will be 5.7 percent instead of 5.9 percent. The smaller growth can be explained in part by the smaller cost weights for the heavier forms of care. For instance, in Table 3.1 we saw that the nursing days for severe to profound mental disabilities increase, while the days for the lighter forms of mental disability decrease. The increase for severe to profound mental disabilities will give a smaller contribution to the overall volume growth with the alternative distribution of capital costs over intramural care types. But also in this case the effects on the base results are small.

6. Discussion

6.1 Main results

The results of this study show that the volume of disabled care in the Netherlands has grown rapidly, at an average rate of almost six percent per year in the period 2000-2007. The expenses increased with 8.7 percent per year in this period, so that prices increased with 2.7 percent per year on average. As a comparison, the gross domestic product of the Netherlands grew with 1.9 percent per year in the same period. Inflation, measured as the consumer price index, increased with 2.2 percent per year. The price increase in the disabled care sector thus lies somewhat above the inflation, while the production volume grows rapidly, also when compared to GDP. The greatest part of the increase of the expenses in the disabled care sector can thus be ascribed to the growth of the production volume.

Extramural care shows by far the largest volume growth: 15.6 percent per year against 2.6 percent per year for intramural care. The share of extramural care in the disabled care sector is thus increasing. A great part of the growth of extramural care can be attributed to the fast growth of personal care budgets. The introduction of the new policy for extramural care in 2004 allowed health care institutes to offer types of care from different health care sectors. The subsequent introduction of new types of care and broadening of existing types of care contributed to the fast volume growth of disabled care in 2004 with respect to 2003. The volume of extramural care increased with 37.2 percent in that year, while the total volume increased with 6.8 percent (see Figure 5.4 and Table 5.1).

The rapid volume growth of disabled care stands in sharp contrast with the slow growth of the Dutch population, which grew at a rate of 0.4 percent per year between January 2000 and January 2007. There are several reasons for this large difference in growth rates. The analyses in Section 5.1 showed that two events had a significant impact on the volume growth between 2000 and 2003 (see Figure 5.3). A large number of clients were taken from waiting lists and offered care (Table 3.1). This 'waiting list care' contributed 2.4 percentage points to the average annual volume growth. An additional contribution of 1.6 percentage points comes from care offered to mild mentally disabled patients with severe behavioural disorders ('SGLVG-care'). The fact that SGLVG-funds were assigned to existing patients retrospectively before 2003, led to a huge increase of SGLVG-care in 2001 and 2002.

A third factor that should be mentioned is the extension of the group of mentally disabled with 'mentally subnormal' persons. According to studies by the Dutch Social and Cultural Planning office SCP, it is likely that an increasing number of mentally subnormal clients have received disabled care (Woittiez et al., 2005). However, there is uncertainty in the numbers of clients. Moreover, the NZa-data do not specify production information for mentally subnormal patients. It is therefore difficult to draw conclusions about the contribution of this group to volume growth, but it should be mentioned as a possible source.

Another way of putting the results into perspective would be to compare the volume growth with the growth of the number of clients over the years. This was done in a previous study for elderly care (Chessa and Okkerse-Ruitenberg, 2007). Unfortunately, data about the number of clients are very

scarce for disabled care. Data are available only for 2002, while preliminary figures have been assembled at Statistics Netherlands for 2007.[9] The information is thus not sufficient in order to make comparisons between volume growth and the growth of the number of clients on a yearly basis.

Disabled care has grown at smaller rates after the introduction of the new policy for extramural care in 2004. The total volume, including the care financed from personal care budgets, increased with 2.5 percent in 2007 with respect to 2006. This growth percentage coincides with model predictions of the Netherlands Bureau for Economic Policy Analysis (CPB) and the Dutch Ministry of Health, Welfare and Sport for the respective periods 2008-2011 and 2008-2020. According to their analyses, the average annual growth rate of disabled care in these periods will be 2.5 percent.

6.2 Comparisons with other methods

The main results presented in Figure 5.1 are compared here with three other methods: (1) the old method used at Statistics Netherlands in the National Accounts, (2) the method used in a study by the Dutch research and consultancy office Prismant, and (3) a Paasche volume index and a Laspeyres price index.

The old CBS-method
The method that has been used at Statistics Netherlands so far calculates a weighted price index over different institutes of disabled care. A volume index is derived from the price index and an index of production value. The price and volume indices for the old method apply to care offered by institutes. The method presented in this paper has been applied to a broader range of care. A part of the personal care budgets is used by budget holders to finance care from disabled care institutes, so that this care is included in the National Accounts under institutes for disabled care. The other part of personal care budgets is used by budget holders to pay members of so-called 'family households' for care supplied, such as volunteer aid. In 2007, about 53 percent of the care financed with personal care budgets was provided through family households. In order to compare the results for the old and new method, we exclude this part of care in the new method. This implies that we will obtain different results compared to those in Figure 5.1.

The value, price and volume indices for the old and new method are given in Table 6.1.[10] These year-to-year indices show great differences between the two methods for several years. Also the value indices show large differences, in particular for 2002 and 2004. The production values in the National Accounts are larger than the values used for the new method in Table 6.1. As was pointed out in footnote 7, a part of disabled care was excluded in this study. But that part does not fully explain the differences between the production values for the old and new method. It is not clear whether larger values for personal care budgets are used for the old method. The differences could also be caused by different data sources.

The price indices show large differences for the years 2003 and 2005. The differences for the other years are quite small. Apart from 2003 and 2005, the old price index method gives results that are close to the price indices obtained for the new method. It is not clear why the results for 2003 and 2005 are so different.

The volume indices show big differences between the two methods. This is a consequence of the differences between the value and price indices. If the same value indices were used in both methods, then obviously the differences between the volume indices would have been small for the old and new method in four out of six years. The smallest differences are obtained for the last two years. The differences for the value and price indices are small as well for 2006 and 2007.

As a final remark, notice that the year-to-year volume indices in Table 6.1 for the new method and those in Table 5.1 show clear differences, in particular after 2003. The difference between the two

---

[9] The data for the year 2002 were collected within the context of the project Vraaggestuurde Bekostiging ('Demand-driven Funding'), and are available at the website of the Ministry of Health, Welfare and Sport (www.brancherapporten.minvws.nl). It is not clear whether the data include clients with a personal care budget. The data for 2007 at Statistics Netherlands are derived from the report Jaardocument Maatschappelijke Verantwoording. These figures do not cover the total amount of disabled care. The coverage is about 90 percent in terms of production value.

[10] In 2001, a revision was carried out in the Dutch National Accounts. This year is left out in Table 6.1.

year-to-year volume indices is close to one percentage point in 2006 and 2007. The difference in 2004 is even about two percentage points. These differences emphasise once again the contribution of the volume growth of care from personal budgets to the total volume growth. Figure 5.2 shows that the contribution by personal care budgets is especially large after 2003. Leaving out a part of personal care budgets, like the 'family household part' in Table 6.1, therefore has a significant impact on the overall volume growth.

Table 6.1 Year-to-year value, price and volume indices
for the old and new index method at Statistics Netherlands.
Care provided by 'family households', financed from a part
of personal care budgets, is excluded here.
(Source: NZa, Statistics Netherlands, CVZ)

		Old	New
2002	value	116,1	113,4
	price	105,3	105,5
	volume	110,3	107,5
2003	value	108,1	108,8
	price	106,2	102,9
	volume	101,8	105,7
2004	value	105,3	107,1
	price	102,5	102,3
	volume	102,7	104,7
2005	value	105,8	105,4
	price	104,4	100,8
	volume	101,3	104,6
2006	value	104,3	105,2
	price	101,5	101,6
	volume	102,8	103,5
2007	value	104,2	104,0
	price	102,7	102,3
	volume	101,5	101,7

The Prismant method

The study by Dell and Vandermeulen (2005) proposes a volume index for disabled care, which is a weighted combination of indices for nursing days, days in day-care centres and ambulatory contacts. Changes over time in group size of clients are used as a proxy for quality changes. As the Prismant study was published several years ago, it is not possible to compare the results with the volume indices of our method for the whole period 2000-2007.

The Prismant study gives average annual growth rates for the production volume in three different time periods. We selected the period 1998-2002, since the other two periods go back until 1995. The time period used in the present paper starts at 2000, which hampers a good comparison as well. Nevertheless, it is worth mentioning the results for the Prismant method. Their method gives an average annual volume growth rate of 5 percent during 1998-2002. Our method gives an average growth rate of 8.2 percent per year in the period 2000-2002.

Although the time periods are not of the same length, it is still interesting to try to find reasons for the smaller growth rate in the Prismant method. It is plausible to claim that the largest differences between the two methods will be found in the period 2000-2002. Waiting list funds and SGLVG-funds to existing clients were not assigned before 2000, while the development of personal care budgets since 2000 suggests that their contribution to production volume is small before 2000.

We calculated the volume growth with our method for the period 2000-2002 by leaving out personal care budgets, waiting list care or SGLVG-care and also combinations of these three types of care. Leaving out all these types of care results in an average annual volume growth of 2.5 percent in 2000-2002, which is in agreement with the analysis that was done in Section 5.1 (see Figure 5.3). The volume growth is thus much smaller than the five percent obtained by Prismant. A better match is

obtained when personal care budgets are left out. If also SGLVG-care is left out, then the average volume growth obtained with our method is exactly five percent. If waiting list care is left out instead of SGLVG-care, then the average volume growth becomes 4.6 percent.

The volume index of Prismant is based on direct quantity measures for several main types of care. As we could not find volume data for personal care budgets, PGB's could have been left out in the Prismant method. And if PGB's are included, then the volume growth of PGB-care is probably assumed to be the same as for the main types of disabled care. Contributions to value increase are then modelled as mere price effects.

Paasche volume and Laspeyres price indices
The convention used at Statistics Netherlands in price and volume methods is to use Laspeyres indices for volume and Paasche indices for price. We also calculated the impact on the results when using a Laspeyres price index and a Paasche volume index for disabled care. The average annual growth rate for the Paasche volume index is 0.3 percentage point lower than for the Laspeyres volume index. This difference is not very large, but should not be left aside either. Some years show larger differences, in particular 2005, for which the difference between the year-to-year volume indices is 0.8 percentage point. Several extramural products show sudden changes in the amount of care and in the tariffs with respect to 2004. This causes relatively large shifts in the cost weights of the product quantities, which partly explains the difference between the Laspeyres and Paasche volume index in 2005.

6.3 Final remarks

Classification of index method
According to the Eurostat handbook, disabled care belongs to the product class CPA 85.31 "Social work services with accommodation" (Eurostat, 2001, p.121). A great part of disabled care in the Netherlands is non-residential, which in principle should be classified as CPA 85.32 "Social work services without accommodation". In the Dutch National Accounts, disabled care institutes are defined as industry sector ("RegKol") 85 312. Extramural disabled care is not considered as a different product group in the Dutch National Accounts, but is integrated with the disabled care services with accommodation. The health care services thus form a single product group.[11] A distinction between residential and non-residential services cannot be made until the next revision of the National Accounts.

As was said in the introduction, the old method used at Statistics Netherlands indirectly derives a volume index from a price-index. The question is whether the new method satisfies the conditions for a B-method. According to the handbook, "occupant days by type of institution and fully adjusted for changes in quality will meet the requirements for an A method. This supposes that the services provided within each type of institution are sufficiently homogeneous. If quality adjustment is not made a B method is obtained. Also the total number of occupant days may be classified as a B method" (Eurostat, 2001, p.121).

The volume index presented in this paper makes use of product quantities that are differentiated according to various factors, which include institution type, severity and type of disability, residential and non-residential care, age and group size. The volume index should therefore be classified as at least a B-method. While it is true that only production values are known for care financed with personal care budgets, the use of the price index for extramural care in order to derive a volume index for personal care budgets should be reasonable. Care financed with personal budgets can only be non-residential. The fact that product quantities are not available for personal care budgets should therefore not influence judgements about the classification of the index method.

For social work services without accommodation, the Eurostat handbook says that "the number of persons receiving care by level of care is an A method for non-market output. Using the total number of persons receiving care may be considered a B method" (Eurostat, 2001, p.121). Data about numbers of clients who received disabled care are limited in this study, so that we considered other

---

[11] This is not the case for elderly care. In that case, the Dutch National Accounts do make a distinction between health care sectors that offer services with and without accommodation.

quantity measures. Since the product quantities are distinguished by 'level of care', the index method could be classified as an A-method. The index method for the entire disabled care sector could thus be viewed as a combination of an A-method and a B-method.

Quality of care
The index method makes use of a detailed differentiation of disabled care. For example, intramural care for mentally disabled patients is subdivided into care by severity of mental disability, patient age, group size, and whether patients have other types of disability or behavioural disorders as well. Volume indices are calculated for the types of care, which are subsequently combined into an overall index. The product differentiation employed in this paper is an implicit way of incorporating quality of care into a volume index (Schreyer, 2008). 'Explicit' quality adjustments, such as quality of life, have not been considered so far.

Changes in the financing system
Institutes in the elderly care, long-term mental health care and disabled care sector have experimented this year with a new financing system. The new budgeting system will be introduced in January 2009. Institutes will receive budgets based on the amount, type and severity of care that clients require. This implies, amongst others, that capacity of health care institutes will no longer be used as an explicit parameter to establish budgets. Both the indication of clients, regarding type and amount of health care required, and the financing of health care will be based on 'health care packages' (in Dutch: Zorgzwaartepakketten, or ZZP's). The types of care that have been used up to date are bundled into a smaller number of products, which are the ZZP's in fact. There are 10 ZZP's for elderly care, 13 ZZP's for long-term mental health care and 29 ZZP's for disabled care. The ZZP-system was proposed in order to achieve greater transparency in the financing of health care.[12]

A ZZP is grossly defined in terms of a client profile and the types and amount of care provided by the ZZP. Client profiles in disabled care encompass different health aspects, such as the extent to which clients are self-supporting, whether clients require support from a psychosocial and cognitive perspective and whether they have behavioural problems. There are ZZP's for different types and severity of disability.

The new financing system will pose new challenges with regard to the development of index methods. Types of care are defined in a different way with ZZP's. An important question is whether the old data format can be linked to ZZP-data. This is crucial for the derivation of price and volume indices in 2009. According to the NZa, data will be made available to Statistics Netherlands in the old data format as well in 2009, in other words, also with the products as defined up to date. This could be of great help for the derivation of price and volume indices for 2009 with respect to 2008. The methodological problems for 2009 will not show up in subsequent years, since only ZZP-data will be used for two successive years in order to calculate price and volume indices. The index method described in Appendix A can be used in that situation as well.

Acknowledgements

---

[12] More information about ZZP's can be found on the website of the Dutch Ministry of Health, Welfare and Sport, at www.minvws.nl/dossiers/zorgzwaartebekostiging.

References

Chessa, A.G., and Kleima, F.J. (2006). The Dutch experience in measuring health output and labour productivity. Discussion paper 06002, Statistics Netherlands.[13]

Chessa, A.G., and Okkerse-Ruitenberg, M. (2007). The rapid growth of elderly care in the Netherlands. In: *Gezondheid en Zorg in Cijfers*, pp. 81-89. Statistics Netherlands.[14]

Dell, M.W., and Vandermeulen, L.J.R. (2005). *Labour productivity in the health care sector*. OSA-publication ZW 63. Prismant, March 2005. (In Dutch)

Esdégé (2002). Annual report of Disabled Care institute Esdégé-Reigersdaal, 2002. (In Dutch)

Eurostat (2001). Handbook on price and volume measures in national accounts.

NZa (2008). Elke dag goed besteed: onderzoek dagbesteding gehandicaptenzorg. (A research on day-care for mentally disabled persons). Research report, Dutch health authority, January 2008. (In Dutch)

Schreyer, P. (2008). Output and outcome – Measuring the production of non-market services. Paper presented at the 30th General Conference of The International Association for Research in Income and Wealth, Portorož, Slovenia, August 24-30, 2008. The paper can be downloaded from the website http://www.iariw.org/

Statistics Netherlands (2007). Inventory of sources and methods for price and volume measures in the Dutch national accounts. Internal report prepared for Eurostat, October 2007.

Woittiez, I., Ooms, I., Schoemakers-Salkinoja, I., and Kuhry, B. (2002). Modelling disabled care. Work document 81. Sociaal en Cultureel Planbureau, The Hague, April 2002. (In Dutch)

Woittiez, I., Crone, F., Jonker, J., Ooms, I., and Stevens, J. (2005). Care for mentally disabled: developments in demand. Sociaal en Cultureel Planbureau, The Hague, August 2005. (In Dutch)

---

[13] This paper was presented at the joint OECD/ONS/Government of Norway workshop *Measurement of non-market output in education and health*, London, October 3-5, 2006.

[14] Written in Dutch. An English translation of this paper is in preparation.

Appendix A: Technical outline of the index method

This appendix gives a technical outline of the index method used to decompose yearly value changes into price and volume indices. By convention at Statistics Netherlands, a Laspeyres volume index and a Paasche price index are used. Two questions are at the centre of this appendix: (1) how can the Laspeyres volume index and the Paasche price index be adjusted in order to incorporate the effects of new and disappearing products, and (2) how could we handle products of which the production values are known, but not the production quantities and prices?

First, some notation is introduced. We denote by G_t the set of products i in year t with known prices $p_{i,t}$ and quantities $q_{i,t}$. The set H_t is introduced to denote the set of products with unknown prices and quantities, which are also denoted by $p_{i,t}$ and $q_{i,t}$. The production values $p_{i,t} q_{i,t}$ of the products $i \in H_t$ are known. We denote the total values in year t of the products in the sets G_t and H_t by

$$W_t^{G_t} = \sum_{i \in G_t} p_{i,t} q_{i,t},$$

and

$$W_t^{H_t} = \sum_{i \in H_t} p_{i,t} q_{i,t}.$$

The objective is to decompose the following value index into a Laspeyres volume index and a Paasche price index in year t with respect to year $t-1$:

$$(A1) \quad \frac{W_t^{G_t} + W_t^{H_t}}{W_{t-1}^{G_{t-1}} + W_{t-1}^{H_{t-1}}} = \frac{\sum_{i \in G_t} p_{i,t} q_{i,t} + \sum_{i \in H_t} p_{i,t} q_{i,t}}{\sum_{i \in G_{t-1}} p_{i,t-1} q_{i,t-1} + \sum_{i \in H_{t-1}} p_{i,t-1} q_{i,t-1}}.$$

The price and volume index are defined with respect to the union of the product sets in the years t and $t-1$, that is, $G_t \cup H_t \cup G_{t-1} \cup H_{t-1}$. We now derive expressions for the Paasche price index and the Laspeyres volume index in year t with respect to year $t-1$, which we refer to as $P_{t,t-1}$ and $V_{t,t-1}$, respectively.

Paasche price index

The price index is obtained by linking the prices in years t and $t-1$ to the quantities in year t:

$$(A2) \quad P_{t,t-1} = \frac{\sum_{i \in G_t} p_{i,t} q_{i,t} + \sum_{i \in H_t} p_{i,t} q_{i,t}}{\sum_{i \in G_t} p_{i,t-1} q_{i,t} + \sum_{i \in H_t} p_{i,t-1} q_{i,t}}.$$

Notice that the price index reduces to an expression, in which summations are carried out over the sets G_t and H_t. Products that were offered in year $t-1$ but not in year t do not appear in (A2), since the quantities of these products are equal to zero in year t.

Only a part of the denominator of the price index can be calculated. The prices in year $t-1$ of products that are offered in year t but not in year $t-1$ are not available. Furthermore, the second term in the denominator of (A2) contains the prices in year $t-1$ and the quantities in year t of the set H_t. This term cannot be calculated either, since only the production values of these products are given. Values for $P_{t,t-1}$ can be obtained by making assumptions about the price indices of new products and the set H_t. An expression for $P_{t,t-1}$ containing these assumptions will be derived below.

We introduce the following notation. We denote the set of products that are offered both in year t and in $t-1$ as $G_{t,t-1}$, which is shorthand notation for the intersection $G_t \cap G_{t-1}$ ('product match'). The

set of products that are offered in year t but not in year $t-1$ is denoted as $G_t \backslash G_{t-1}$ ('new' products). Similarly, $G_{t-1} \backslash G_t$ is the set of products that are offered in year $t-1$ but not in year t ('old' products). The price index of the product match is denoted by

$$(A3) \qquad P_{t,t-1}^{G_{t,t-1}} = \frac{\sum_{i \in G_{t,t-1}} p_{i,t} q_{i,t}}{\sum_{i \in G_{t,t-1}} p_{i,t-1} q_{i,t}}.$$

We now relate the Paasche price indices of the sets $G_t \backslash G_{t-1}$ and H_t to the price index of the product match in the following way:

$$(A4) \qquad \frac{\sum_{i \in G_t \backslash G_{t-1}} p_{i,t} q_{i,t}}{\sum_{i \in G_t \backslash G_{t-1}} p_{i,t-1} q_{i,t}} = r_t P_{t,t-1}^{G_{t,t-1}},$$

$$(A5) \qquad \frac{\sum_{i \in H_t} p_{i,t} q_{i,t}}{\sum_{i \in H_t} p_{i,t-1} q_{i,t}} = s_t P_{t,t-1}^{G_{t,t-1}},$$

where $r_t, s_t > 0$ for all t. Price index (A2) can now be rewritten as

$$(A6) \qquad P_{t,t-1} = P_{t,t-1}^{G_{t,t-1}} \left(\mu_t + v_t r_t^{-1} + \lambda_t s_t^{-1} \right)^{-1}.$$

In this expression, μ_t, v_t and λ_t are the value shares in year t of the product match, the set of new products and the product set with unknown prices and quantities, respectively, that is

$$(A7) \qquad \mu_t = \frac{\sum_{i \in G_{t,t-1}} p_{i,t} q_{i,t}}{\sum_{i \in G_t} p_{i,t} q_{i,t} + \sum_{i \in H_t} p_{i,t} q_{i,t}},$$

$$(A8) \qquad v_t = \frac{\sum_{i \in G_t \backslash G_{t-1}} p_{i,t} q_{i,t}}{\sum_{i \in G_t} p_{i,t} q_{i,t} + \sum_{i \in H_t} p_{i,t} q_{i,t}},$$

$$(A9) \qquad \lambda_t = \frac{\sum_{i \in H_t} p_{i,t} q_{i,t}}{\sum_{i \in G_t} p_{i,t} q_{i,t} + \sum_{i \in H_t} p_{i,t} q_{i,t}}.$$

The inverse term in (A6) denotes the contribution of products outside the product match to the total price index. This term is a (classical) rewriting of the Paasche price index, in which the price index of the product match is set equal to 1.

In the results for disabled care the assumption was made that $r_t = s_t = 1$, so that the price indices for both intramural and extramural care simplify to the form:

$$(A10) \qquad P_{t,t-1} = P_{t,t-1}^{G_{t,t-1}}.$$

The price index $P_{t,t-1}$ is greater than the price index of the product match when varying r_t or s_t such that they become greater than 1. The opposite effect is obtained when $r_t, s_t < 1$, as one would expect.

From a mere theoretical perspective, it may be interesting to consider the limit cases where r_t and s_t become infinitely large on the one hand, and where r_t or s_t goes to zero on the other hand. The case where r_t and s_t go to infinity represents the situation that the price indices of the sets $G_t \backslash G_{t-1}$ and

H_t increase with respect to the price index of the product match. Since the numerator on the left-hand side of (A4) is known in practice, an increase of r_t means that prices $p_{i,t-1}$ of new products $i \in G_t \backslash G_{t-1}$ decrease, as the quantities $q_{i,t}$ of new products in year t are known. An increase of s_t means that values $p_{i,t-1}q_{i,t}$ of products in H_t decrease. As both r_t and s_t increase, the price index tends to the limit

$$(A11) \quad \lim_{r_t,s_t \to \infty} P_{t,t-1} = P_{t,t-1}^{G_{t,t-1}} \mu_t^{-1}.$$

The price index thus tends to the price index of the product match, which is adjusted according to the inverse of the value share of the product match in year t. The reciprocal value of μ_t represents the contribution from the ('large') increase of the prices of products belonging to $G_t \backslash G_{t-1}$ and H_t. The smaller μ_t, the larger the contribution to the price index.

If one of the prices in $G_t \backslash G_{t-1}$ or H_t increases in year $t-1$, then r_t or s_t decreases, so that the price index $P_{t,t-1}$ would eventually go to zero. This means that the decrease in price in year t becomes infinitely large: the price decrease of a single product in $G_t \backslash G_{t-1}$ or H_t then eventually dominates the behaviour of the overall price index $P_{t,t-1}$. This happens when the price of that single product has a nonzero quantity in year t.

Usually, the value shares ν_t and λ_t are small, so that in practice the price index $P_{t,t-1}$ will be close to the price index of the product match. Sensitivity analyses, performed by varying r_t and s_t around their base value 1, will then show small deviations from the price index of the product match. To get an idea, consider the example where the value share μ_t of the product match $G_{t,t-1}$ in year t is equal to 0.9. Furthermore, let the price index of the product match be equal to 1 and let $r_t = s_t = 1.03$, so that the prices of the product sets $G_t \backslash G_{t-1}$ and H_t increase by three percent in year t. Substituting these figures into (A6) yields an overall price increase in year t of 0.29 percent.

Laspeyres volume index

The Laspeyres volume index $V_{t,t-1}$ with respect to the set $G_t \cup H_t \cup G_{t-1} \cup H_{t-1}$ can be written as

$$(A12) \quad V_{t,t-1} = \frac{\sum_{i \in G_t} p_{i,t-1}q_{i,t} + \sum_{i \in H_t} p_{i,t-1}q_{i,t}}{\sum_{i \in G_{t-1}} p_{i,t-1}q_{i,t-1} + \sum_{i \in H_{t-1}} p_{i,t-1}q_{i,t-1}}.$$

An expression for this volume index can be directly obtained by dividing the value index (A1) and the price index (A6). However, we prefer to derive an expression step by step, in order to give a factorisation of the volume index into contributions from different product subsets (product match, new products, etc.).

We rewrite expression (A12) such that all its terms can be computed. We write the numerator as follows:

$$(A13) \quad \sum_{i \in G_{t,t-1}} p_{i,t-1}q_{i,t} \left(1 + \frac{\sum_{i \in G_t \backslash G_{t-1}} p_{i,t-1}q_{i,t}}{\sum_{i \in G_{t,t-1}} p_{i,t-1}q_{i,t}} + \frac{\sum_{i \in H_t} p_{i,t-1}q_{i,t}}{\sum_{i \in G_{t,t-1}} p_{i,t-1}q_{i,t}} \right).$$

By making use of expressions (A4) and (A5), we can write (A13) as

$$(A14) \quad \sum_{i \in G_{t,t-1}} p_{i,t-1}q_{i,t} \left(1 + \frac{\sum_{i \in G_t \backslash G_{t-1}} p_{i,t}q_{i,t}}{r_t \sum_{i \in G_{t,t-1}} p_{i,t}q_{i,t}} + \frac{\sum_{i \in H_t} p_{i,t}q_{i,t}}{s_t \sum_{i \in G_{t,t-1}} p_{i,t}q_{i,t}} \right),$$

which can be written in the more compact form

26

$$(A15) \quad \sum_{i \in G_{t,t-1}} p_{i,t-1}q_{i,t}\left(1 + r_t^{-1}\frac{W_t^{G_t \backslash G_{t-1}}}{W_t^{G_{t,t-1}}} + s_t^{-1}\frac{W_t^{H_t}}{W_t^{G_{t,t-1}}}\right).$$

We now group terms in (A15) to obtain the expression

$$(A16) \quad \sum_{i \in G_{t,t-1}} p_{i,t-1}q_{i,t}\frac{W_t^{G_{t,t-1}} + r_t^{-1}W_t^{G_t \backslash G_{t-1}}}{W_t^{G_{t,t-1}}}\left(1 + \frac{s_t^{-1}W_t^{H_t}}{W_t^{G_{t,t-1}} + r_t^{-1}W_t^{G_t \backslash G_{t-1}}}\right).$$

The denominator of (A12) can be written in a form similar to (A16):

$$(A17) \quad \sum_{i \in G_{t,t-1}} p_{i,t-1}q_{i,t-1}\frac{W_{t-1}^{G_{t-1}}}{W_{t-1}^{G_{t,t-1}}}\left(1 + \frac{W_{t-1}^{H_{t-1}}}{W_{t-1}^{G_{t-1}}}\right).$$

By substituting (A16) in the numerator and (A17) in the denominator of (A12) we obtain the following expression for the Laspeyres volume index:

$$(A18) \quad V_{t,t-1} = V_{t,t-1}^{G_{t,t-1}}\frac{W_{t-1}^{G_{t,t-1}}}{W_{t-1}^{G_{t-1}}}\frac{W_t^{G_{t,t-1}} + r_t^{-1}W_t^{G_t \backslash G_{t-1}}}{W_t^{G_{t,t-1}}}\left(1 + \frac{s_t^{-1}W_t^{H_t}}{W_t^{G_{t,t-1}} + r_t^{-1}W_t^{G_t \backslash G_{t-1}}}\right)\Big/\left(1 + \frac{W_{t-1}^{H_{t-1}}}{W_{t-1}^{G_{t-1}}}\right).$$

This expression factorises the volume index into contributions from different product subsets. The first term on the right-hand side of (A18) is the Laspeyres volume index of the product match $G_{t,t-1}$, that is:

$$(A19) \quad V_{t,t-1}^{G_{t,t-1}} = \frac{\sum_{i \in G_{t,t-1}} p_{i,t-1}q_{i,t}}{\sum_{i \in G_{t,t-1}} p_{i,t-1}q_{i,t-1}}.$$

The second and third term on the right-hand side of (A18) represent the contributions from old and new products, respectively, to the volume index. The ratio of the two terms within brackets on the right of (A18) represents the contribution of the sets H_t and H_{t-1} to the volume index.

If $r_t = s_t = 1$, then the volume index simplifies to

$$(A20) \quad V_{t,t-1} = V_{t,t-1}^{G_{t,t-1}}\frac{W_{t-1}^{G_{t,t-1}}}{W_{t-1}^{G_{t-1}}}\frac{W_t^{G_t}}{W_t^{G_{t,t-1}}}\left(1 + \frac{W_t^{H_t}}{W_t^{G_t}}\right)\Big/\left(1 + \frac{W_{t-1}^{H_{t-1}}}{W_{t-1}^{G_{t-1}}}\right).$$

This expression is used in the results for disabled care, together with price index (A10).

If r_t and s_t become large, then it follows from (A18) that

$$(A21) \quad \lim_{r_t, s_t \to \infty} V_{t,t-1} = V_{t,t-1}^{G_{t,t-1}}\mu_{t-1},$$

where μ_{t-1} denotes the value share of the product match in year $t-1$, that is:

$$(A22) \quad \mu_{t-1} = \frac{\sum_{i \in G_{t,t-1}} p_{i,t-1}q_{i,t-1}}{\sum_{i \in G_{t-1}} p_{i,t-1}q_{i,t-1} + \sum_{i \in H_{t-1}} p_{i,t-1}q_{i,t-1}}.$$

Volume index (A21) corresponds to price index (A11). It is easily verified that the limit price and volume indices give the value index (A1).

In the discussion of the limit price index (A11), we pointed out that increasing r_t and s_t correspond to decreasing prices in year $t - 1$ of new products in year t and decreasing values $p_{i,t-1}q_{i,t}$ of products in H_t. It then follows from the numerator of (A12) that these products do not contribute to the volume index. The volume index then reduces to the volume index of the product match multiplied by μ_{t-1}. The value share μ_{t-1} in fact describes the contribution to the volume index of old products and products in H_{t-1}. As contributions from new products and products in H_t become smaller, the volume index decreases while the price index increases, as we saw before.

Aggregation of volume indices

If an overall Laspeyres volume index has to be calculated that encompasses different sectors of the economy, then one should apply the methodology described in this appendix first to each individual sector, with different parameters r_t and s_t for each sector. The Laspeyres volume indices for the different sectors are then combined by weighting every volume index according to the value shares of the sectors in year $t - 1$.

Appendix B: English-Dutch terminology and abbreviations

Capacity-related costs	Capaciteitsgebonden kosten	
User cost of capital ('capital costs')	Kapitaallasten	
Cure Insurance Act	Zorgverzekeringswet	Zvw
Day-care centres	Centra voor dagactiviteiten, dagverblijven	
Disabled health care	Gehandicaptenzorg	
Dutch health authority	Nederlandse Zorgautoriteit	NZa
Exceptional Medical Expenses Act	Algemene Wet Bijzondere Ziektekosten	AWBZ
Health Care Insurance Board	College voor Zorgverzekeringen	CVZ
Home health care	Thuiszorg	
Homes for the elderly	Verzorgingshuizen	
Mental health care	Geestelijke gezondheidszorg	
Mentally disabled	Verstandelijk gehandicapt (of beperkt)	
- Mild	- Licht	LVG
- Moderate	- Matig	MVG
- Severe	- Ernstig	EVG
- Profound	- Zeer ernstig	ZEVG
Mentally subnormal	Zwakbegaafd	
Nursing homes	Verpleeghuizen	
Personal (care) budget	Persoonsgebonden budget	PGB
Physically disabled	Lichamelijk gehandicapt (beperkt)	
Policy rules	(NZa-) beleidsregels	
Production-related costs	Productiegebonden kosten	
Sensory disabled	Zintuiglijk gehandicapt (beperkt)	
Surrogate family homes	Gezinsvervangende tehuizen	GVT
- Annex	- Dependance	