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PRICE AND VOLUME MEASURES OF HOSPITAL SERVICES

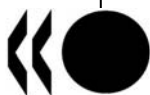
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This document has been prepared by Stefan Pierdzioch, German Federal Statistical Office (FSO), and will be presented under item 10 of the draft agenda

For further information please contact:
Stefan Pierdzioch
E-mail: stefan.pierdzioch@destatis.de

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PRICE AND VOLUME MEASURES OF HOSPITAL SERVICES

Abstract

For national accounts' purposes German Federal Statistical Office (FSO) measures prices and volumes for goods and services according to the statistical classification of products by activity (CPA). For hospital services the price and volume measures depend largely on the funding system of hospitals. On January 1st, 2004 this funding system changed from daily rates to a system based on diagnosis related groups (DRG-system). This means, the price of a hospital service depends no longer on the time spent in hospital, but on diagnoses and treatments. So, German national accounts must develop a new method for measuring prices and volumes, which fits to that German DRG-System.

A research project¹ was used to analyze lots of data about the German DRG-system. This paper, which is based on this research project, introduces the German DRG-system and describes, how yearly and quarterly deflators for hospital services in the national accounts can be developed with DRG-data. Additionally, the paper presents first results of price and volume developments for 2006 and preliminarily for 2007.

1 This research project was funded by the European Union. For contents and results the German FSO is responsible only.

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1 Price and volume measures of hospital services

According to the System of European National Accounts, market production of hospital services should be deflated. As a second possibility, an output method is fine, too. For non-market production of hospital services the output method is the only method allowed. As output indicator countries should use the number of inpatient treatments stratified by diagnosis related groups (DRGs), as one DRG consists of the diagnosis and all treatments that should be done in order to cure the patient. This means using DRGs as quantity indicator is very near to the theoretical concept of measuring hospital output by “complete treatments”². Furthermore, patients are grouped together in groups, which are homogeneous not only in a medical sense, but also according to the cost of the treatment. According to a survey conducted by Eurostat and the OECD, 10 out of 26 interviewed countries use DRG-data for their price and volume measures³. The DRG-systems used by different countries are not identical, but similar. As a consequence, a German method of price and volume measure of hospital services using DRG-data enhances international comparability of German price and volume data.

2 German DRG-System

From 2004 onwards only psychiatric and rehabilitation hospitals continue to charge daily rates. All other hospitals take part in the DRG-system. In this German DRG-system patients are grouped according to their diagnosis and treatments into DRGs. In order to group patients hospitals record main and further diagnoses of the patients, the type of treatment as well as the length of stay of the patient and the number and type of extra treatments (artificial respirations e.g.). Furthermore some personal data is needed, for example age and sex of the patient or type of discharge. Parts of this dataset are sent to the German FSO.

With this data and the help of special software called “grouper” patients are grouped to one particular DRG. In 2007 there were 1082 DRGs in Germany. Due to revision works, the number of DRGs changes slightly from year to year, as DRGs are further split or aggregated. These 1082 DRGs can be aggregated according to diagnosis to 27 major diagnostic categories.

A DRG is named with a four-digit-alphanumerical code. For example, in 2007 B75A stands for the DRG “febrile seizures, age of patient < 1 year”. B is the symbol of the major diagnosis category, in this case it is the major diagnosis category 01 “diseases and disorders of the nervous system”, 75 is the number of the diagnosis. The last letter, in this case “A” stands for the economic complexity of the diagnosis. “A” means a very complex and therefore expensive diagnosis, “I” means least complexity. “Z” means no further stratification applied.

From the reporting year 2005 onwards, German FSO has detailed data of the number of treatments by DRG from the DRG-dataset.

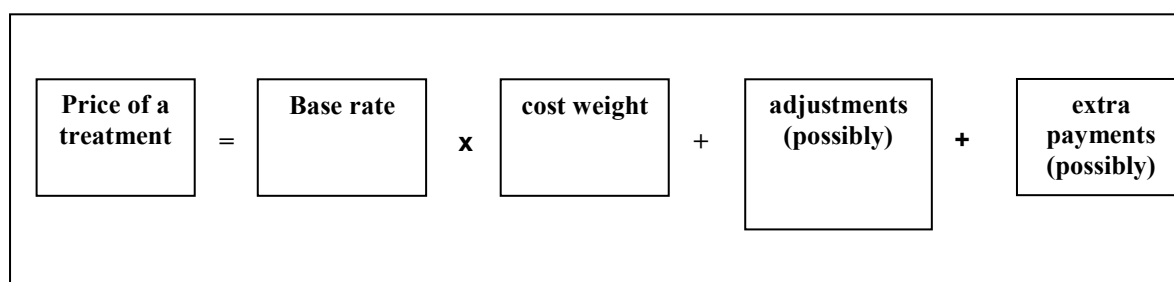
2 Eurostat (Ed.): Handbook on price and volume measures in national accounts. Luxemburg. 2005 p. 117

3 OECD (Ed.): Towards measuring education and health volume output: An OECD handbook (preliminary version), pp 90 et seqq; URL: www.oecd.org/dataoecd/27/42/39333801.pdf, 19.08.08

2.1. Prices for hospital services

The price of a hospital service is calculated out of different parts (see figure 1). The most important parts are the cost weights for each DRG and the base rates (in Euro), that a hospital receives for an average diagnosis.

Figure 1: Calculation of hospital service's prices in the German DRG-System



Price component 1: cost weights

Every DRG has its own cost weight, which indicates the complexity of a particular DRG. In Germany 2007 these cost weights range between 0.106 (DRG O64B, contractions, 1 day in hospital) and 64.899 (A18Z, transplantation of liver, lungs, heart or stem cells, artificial respiration of more than 999 hours). Our example mentioned before (DRG B75A) has a cost weight of 0.531. Those cost weights are valid for one calendar year. They are published in the German DRG-catalogue, which is available on the homepage of the Institut für das Entgeltsystem im Krankenhaus (Institute for the hospital's funding system, InEK)⁴ about three months before the beginning of the reporting year.

Price component 2: base rates

The base rate is the reference price a hospital charges for an average DRG. This means, for a DRG with a cost weight of 1.000 the hospital charges exactly the base rate, which is today at about 2800 Euros.

Up to 2008 there is one base rate for every hospital; from 2009 onwards there will be only one base rate for every region ("Bundesland"). These base rates are negotiated between hospitals and health insurances. As they are free to choose the appointments for the negotiations base rates can change during a year. For price and volume measures, the actually paid base rates ("Zahlbasisfallwerte") are regarded. This means, if the base rate changes during a year, FSO records this as a price change of hospital services. Those base rates are published and regularly updated by the Federal Association of the AOK⁵.

Price component 3: adjustments

Sometimes the treatment of a patient takes extremely more time than expected. In this case the hospital can charge a supplement. The opposite is also true. If a patient can be sent home exceptionally early, the price is reduced. So hospitals avoid that patients are sent home without being cured. Additionally, hospitals can charge extra payments for certain treatments. As FSO does not have any data on this third price component, it was thought about neglecting it. Therefore total DRG-revenues, which are

4 www.g-drg.de

5 AOK is one large statutory health insurance company

known from the DRG-dataset for the reporting year 2006, are compared to DRG-revenues calculated from base rates and cost weights. Excerpts of this comparison are reported in table 1. It shows, that the DRG-revenue structure is quite similar in both versions, so we decided to neglect price component 3 in further.

Table 1: Calculated DRG-revenues (Base rate x cost weight) compared to total DRG-revenues from the DRG-dataset in the German DRG-system 2006 for selected major diagnosis categories (Percentage)

Major diagnosis category (MDC)	calculated DRG-revenues (base rate x cost weight)	total DRG-revenues from the DRG-dataset
MDC 01 Diseases and disorders of the nervous system	7.8	7.6
MDC 04 Diseases and disorders of the respiratory system	6.2	6.0
MDC 05 Diseases and disorders of the circulatory system	17.4	17.1
MDC 06 Diseases and disorders of the digestive system	10.4	10.4
MDC 08 Diseases and disorders of the musculoskeletal system and connective tissue	18.1	17.9
MDC 09 Diseases and disorders of the skin and subcutaneous tissue	3.4	3.4
MDC 11 Diseases and disorders of the kidney and urinary tract	3.3	3.3
MDC 14 Pregnancy, childbirth and the puerperium	3.2	3.1
MDC 15 Newborn	2.6	2.7
other	27.6	28.5
Total	100.0	100.0

These DRG-adjustments are not identical to supplements for facultative services such as single-bed-rooms or treatments by chief physicians. These supplements, which are reimbursed only by some private health insurances⁶, are calculated outside the DRG-system and are neglected in further.

2.2. Diagnoses and DRG-revenues in 2006

As can be seen from table 2, the most important major diagnosis categories in terms of number of patients and DRG-revenues in Germany in 2006 were diseases and disorders of the musculoskeletal system and connective tissue and diseases and disorders of the circulatory system. Please note that the DRG-revenues are calculated by base rates and cost weights only. They do not include adjustments (i.e. price component 3).

6 In Germany two systems of health insurance exist. The common system is the statutory health insurance. Self-employed, civil servants and people with a yearly income exceeding 48,000 Euros can opt-out and choose a private health insurance. Usually private insurances cover also non-standard benefits like single-bed-rooms or treatments by chief physicians.

Table 2: Treatment and DRG-revenue structures 2006 in the German DRG-system for selected major diagnosis categories (Percentage)

Major diagnosis category (MDC)	Number of treatments out of the DRG-dataset	calculated DRG-revenues (base rate x cost weight)
MDC 01 Diseases and disorders of the nervous system	8.1	7.8
MDC 04 Diseases and disorders of the respiratory system	7.4	6.2
MDC 05 Diseases and disorders of the circulatory system	15.5	17.4
MDC 06 Diseases and disorders of the digestive system	12.8	10.4
MDC 08 Diseases and disorders of the musculoskeletal system and connective tissue	14.3	18.1
MDC 09 Diseases and disorders of the skin and subcutaneous tissue	4.3	3.4
MDC 11 Diseases and disorders of the kidney and urinary tract	4.0	3.3
MDC 14 Pregnancy, childbirth and the puerperium	5.4	3.2
MDC 15 Newborn	4.0	2.6
other	24.2	27.6
Total	100.0	100.0

3 A new method for price and volume measures of hospital services in Germany

3.1. Stratification

Before calculating a deflator or a volume index for an output method, it must be decided how to stratify the DRG-data. There are two possibilities, how price or volume developments can be calculated. Firstly, price or volume developments can be calculated for each DRG. This means a stratification of about 1000 quite homogeneous subgroups. But the German DRG-System is yearly updated in a way that some DRGs are aggregated or split further. For example in 2005 there are 954 DRGs and in 2007 there are 1082 DRGs. To calculate correct price and volume developments, it is necessary to analyse in what DRG a certain kind of treatment is grouped in this year and was grouped in the year before. This analyse takes lots of time.

But it is possible to aggregate the DRGs to 27 major diagnosis groups. Here we do not face the grouping problem as the number and type of the major diagnosis categories is not changed over time and it happens only quite rarely that a particular kind of treatment is grouped in two different major diagnosis groups in two consecutive years. But it is implicitly assumed that the structure of the DRGs in each major diagnosis category remains constant over time. This assumption can be checked for the years 2005 and 2006 using special bridge tables published by the federal association of the AOK⁷. Using these tables it is

⁷ http://www.aok-gesundheitspartner.de/bundesverband/krankenhaus/drg_system/ueberleitung/

possible to group 2005's patients to 2006's DRG and compare the structures. The analysis showed at least for those two years – more data is not available up to now – that structures are constant. So we stick to stratification by major diagnosis category. In future it will be necessary to check this assumption again, if large changes in the DRG-system happen.

3.2 *Deflation or output method*

Hospital services in Germany are market production. This means that according to the European regulations both methods (deflation and output method) are possible. The same data base can be used for both the output method and deflation.

Output method

Calculating a volume index for an output method developments of quantities are weighted with revenues. As quantity indicator the quantity of treatments stratified by major diagnosis category can be used. Average cost weights for each major diagnosis category, can be used as weights. For psychiatric hospitals the total number of patients serves as quantity indicator, for rehabilitation hospitals total number of rehabilitation days can be used. As for both hospital types there is no revenue data, cost weights must be used.

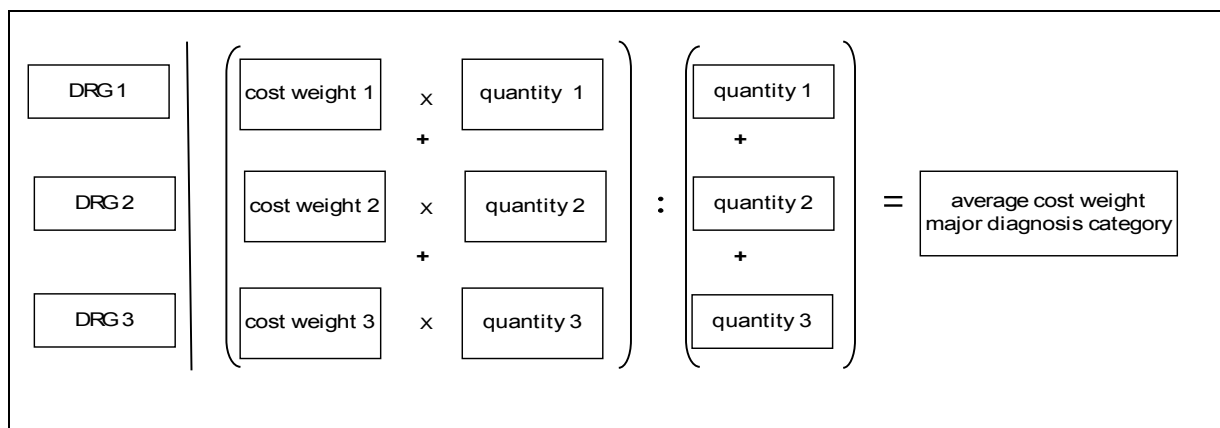
As it can be seen above, in theory it is possible to derive a volume index for German hospital services. But in practice, it is difficult, as the DRG quantity data is not available before about nine months after the end of the reporting year. So estimation for the latest year is needed. As it is very difficult to estimate the number of hospital services correctly, large corrections are supposed to be made, when the data is finally available. Price data is available earlier. Furthermore German FSO wants to develop a method for quarterly calculations of prices and volumes. But there is no quarterly data about treatments, but quarterly data about prices. In the end, deflation seems to be the better method.

Deflation

In comparison to the output method, calculating a deflator means weighting price developments with the number of treatments.

In order to calculate a correct price development, an average cost weight must be calculated for each major diagnosis category. Therefore the cost weights of all DRGs in each major diagnosis category are weighted by the quantity of treatments. (Figure 2)

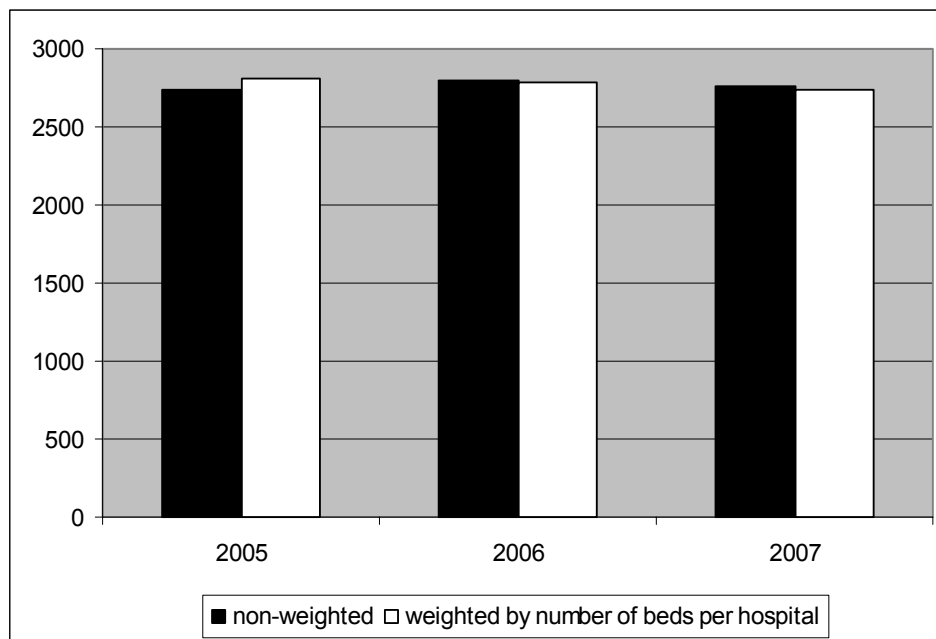
Figure 2: Example of the calculation of an average cost weight for a major diagnosis category



Additionally, an average base rate is needed. The base rates of all hospitals are weighted by their duration and then averaged. It would have been possible to weigh the base rates with the number of hospital beds. German FSO yearly publishes a register of all hospitals containing some data about them, including the number of beds. An experimental calculation resulted in a very small difference between the weighted and the non-weighted version, so the additional weight with hospital beds is rejected.

By multiplying base rates and cost weights one can calculate average prices for each major diagnosis category and finally price developments. These developments are the weighted by the number of treatments to one deflator.

Figure 3: Base rates (Euro) non weighted and weighted by number of beds per hospital



Psychiatric and rehabilitation hospitals do not take part in the DRG-System. They continue to charge daily rates. That is why the data base is by far not as good as for the DRG-System. For psychiatric hospitals and rehabilitation hospitals nothing is known about prices for treatments, so one must stick to costs.

1. Deflation has one advantage over direct volume measurement. Price data for the DRG-System is available long before treatment data is available. Using deflation treatments only serve as weights. If structure of treatments is quite constant over time, one can also use the structure of treatments of the year before as an approximation. German FSO checked this approximation with the help of the bridge tables of the Federal Association of the AOK for the year 2006. In the end, the preliminary result had to be changed by 0.3 percentage points, so this approximation seems to lead to quite good results.

4 Results

Table 3: Value, price and volume development for hospital services

Year	value	price	volume
	Percentage, year-on-year		
2006	2.8	1.8	1.0
2007 ¹⁾	...	-2,3	...

2007 results are preliminary; ... = data not yet available

Table 3 reports the value, price and volume change for the year 2006 and a preliminary price change for 2007. After a price increase in 2006 by 1.8%, prices fall in 2007 by 2.3%. A large part of the price reduction is caused by the splitting of DRGs. As a consequence some treatments were grouped in the cheaper DRG. For example, the DRG E06Z (which stands for a special lung disease) from the DRG-system 2006 was in 2007 split into E06A (this special lung disease with severe complications) and E06B (without severe complications). Most of the treatments from 2006's E06Z would have been grouped in the cheaper E06B in 2007. This causes a price reduction by about 8% for this DRG.

5 Quarterly deflation

Not only yearly deflators can be calculated with this DRG-dataset, but also quarterly deflators. How this works, is shown here for a quarterly deflator for the production approach. German FSO uses this deflator as a base to construct a quarterly deflator for the government final consumption expenditure of hospital services.

The only price component that can change during the year is the base rate, as the base rate depends on the point of time of the hospital's budget negotiations. The base rate data contains the duration of the base rates, so quarterly average base rates can be calculated.

As German FSO does not get any quarterly treatment data, one must assume treatments are equally distributed over the year.

Quarterly prices for treatments can be calculated from the average cost weights - which are constant over the year – and the quarterly average base rates. As weights the quantities of treatments by major diagnosis categories are used. Psychiatric and rehabilitation hospitals do not enter the quarterly deflator, as there is no quarterly data left for these hospital types. But the quarterly results are matched ex-post to the yearly results.

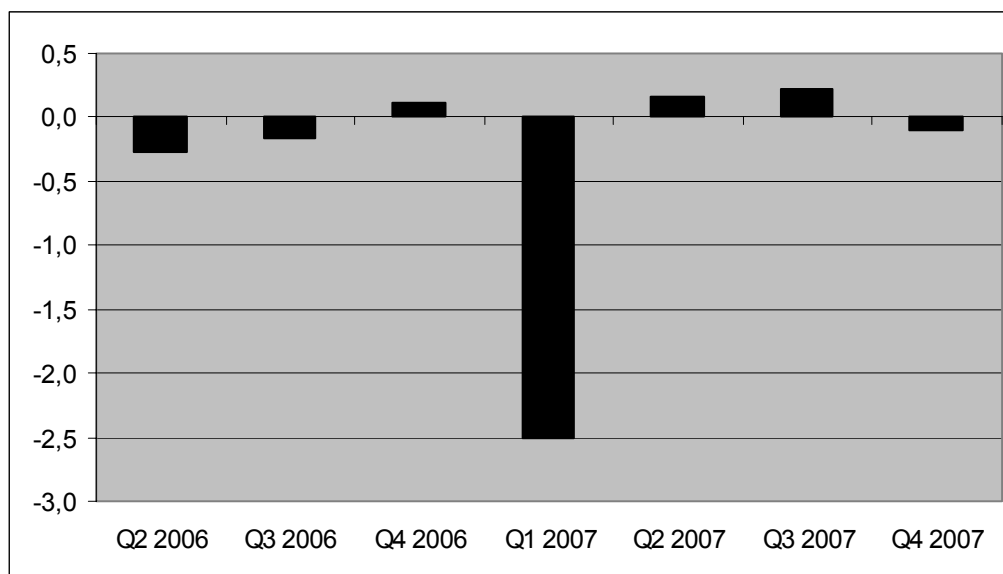
Figure 4: Quarterly price change for hospital services (Percentage quarter on quarter)

Figure 4 sketches the quarter on quarter price changes for hospital services. One thing becomes evident from the figure. There is a strong price change from the fourth quarter 2006 to the 1st quarter 2007. On January 1st new cost weights become effective. This is the main reason for price changes, while price changes due to changes in base rates, which happen also during a calendar year, have a very small effect.

6 Conclusion

On January 1st, 2004 Germany introduced a DRG-System. So, German FSO must change the method of price and volume measure for hospital services. Furthermore, the use of DRG-data leads to an improvement of international comparability, as many other countries also use DRG-data in price and volume measure.

Having the choice between deflation and an output method, deflation turns out to be the better method. Quantities of treatments are available only with a delay of nine months; price data are available much faster. Furthermore, a quarterly price change can be calculated, but a quarterly volume change cannot be calculated directly, as there is no quarterly quantity data available.

In the production approach, price developments for major diagnosis categories are calculated and weighted by the number of treatments. For psychiatric and rehabilitation hospitals there is no price data, so cost development enters the deflator.

For the expenditure approach, Destatis developed yearly deflators on the same data base as for the production approach. These deflators are used to deflate individual consumption expenditure of private households for inpatient services (COICOP 063). Government final consumption expenditure for inpatient services is deflated quarterly.

With these new methods German national accounts use an internationally comparable price and volume measure for hospital services, which is also consistent between production and expenditure approach.