Comparing Hospital Prices and Volumes Across Countries: A New Approach

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INTRODUCTION

1. The measurement of prices and volumes of health and education services both in a temporal and a spatial context still constitutes a challenge for national accountants and price statisticians. Where such services are provided on a non-market basis, national accounts measures their output in current prices as the sum of the costs incurred in their production. Traditionally, the output in constant prices, or the volume of output, has been measured by summing the volume of each of the inputs. But by equating the volume of output with the volume of inputs, this approach renders the results unusable for any analysis of productivity, as productivity has been defined away.

2. In recent years an increasing number of countries have worked towards output-based measures of the volume of these services. The Eurostat Handbook and Price and Volume Measures in National Accounts (2001) discusses the various issues at stake for non-market services and proposes concrete output measures for education and health services. The OECD (Schreyer 2010) took a closer look at the measurement of the volumes of health and education services. Although this work is mainly devoted to price and volume measures in the temporal context, much of the discussion and argumentation also applies to the spatial context, i.e. international comparisons, which is the subject of this paper. National accountants generally calculate changes in volumes over time by deflating changes in current price aggregates by adequate temporal price indices. Similarly, one can use appropriate spatial price indices (Purchasing Power Parities or PPPs) to deflate current price aggregates (typically in different currencies) in order to compare the volume of output (or consumption) between countries.

3. Eurostat and OECD have calculated PPPs for GDP and some 50 product groups, including health, on a regular and timely basis since the early 1980s. Frequently, PPPs at the level of total GDP rather than the available health-specific PPPs have been used for converting health expenditures to a common unit for international comparisons (e.g. OECD, 2013). Using traditional health PPPs, which are based on input methods (predominantly by comparing salaries of medical and non-medical staff across countries) would imply an assumption of equal productivity of inputs across countries, which is clearly unrealistic.

4. However, using GDP PPPs instead of health-specific PPPs entails the assumption that relative price levels of health goods and services are equal across countries, an assumption that has been criticised in the literature (Gerdtham and Jönnson, 1991; Kavanos and Mossialos, 1999; Melberg 2011). For example, in Australia, in the ten years between 2001 and 2011 growth in health prices was nearly double the growth in the overall consumer price index (ABS, 2011). Similarly, in the United States between 1984 and 2009, medical inflation has exceeded annual overall inflation for every year except 1998 (Newman and Davis, 2010). There are a variety of reasons why growth in health prices exceeds general prices, including rising administrative costs, higher prices for health-related technologies and low productivity. This is likely to be true in many countries, implying that GDP PPPs do not accurately reflect health-specific price relatives.

5. Neither the health-specific but input-based PPPs nor the economy-wide PPPs thus appear to be reliable instruments for comparing prices and volumes of health services and, consequently, researchers have proposed various ways of deriving output-based, health-specific PPPs. Wordsworth and Ludbrook (2005) produced technology-specific PPPs based on hospital outputs, rather than inputs. For purposes of an

economic evaluation, they compared the cost-effectiveness of dialysis across ten renal centres in eight countries. They found that choice of currency conversion measure can significantly influence the results and interpretation of economic evaluations.

6. This paper presents the results of a joint effort between OECD and Eurostat in developing output-based PPPs for health goods and services. The main novel feature is the collection of comparable prices for hospital services that can then be applied to matching national accounts expenditure data so as to derive consistent price and volume comparisons of health expenditures. The new output-based methodology was implemented by Eurostat and OECD for the official calculation of PPPs at the end of 2013.

7. The results presented in this paper add considerable value to the understanding of health expenditures and may have important consequences for the way future studies are analysed and reported. Through various methodological innovations we could make the analysis less restrictive than several other studies in terms of the assumptions required or the need for separate primary data collections. Overall, having health and hospital-specific PPPs (rather than broader GDP PPPs) removes the need to assume that the relative prices between health and hospital products and other goods and services in the economy are the same across countries. Further, the move from input to output-based health and hospital PPPs relaxes the assumption that productivity is the same across countries.

8. For international comparisons of prices and volumes of health goods and services, it is crucial that they are not influenced by differences across countries in the shares of total expenditures incurred by households, government or non-profit institutions serving households (NPISHs). This paper therefore uses the concept of Actual Individual Consumption (AIC) on health, which is the sum of all expenditures of these three institutional sectors.

9. Total AIC on health consists of expenditures on a variety of goods and services. Different approaches are used for calculating PPPs for the different components. However, the bulk of the expenditures are on general hospital services, as we will see later. Moreover, the main new element of the measurement of health PPPs refers to the approach for hospital services. For that reason, part I of this paper lays out the methodology and reports on the results for general hospitals. Part II discusses the methods and results for the overall health sector.

PART I: PPPS FOR HOSPITALS

10. Price levels of hospital services are a natural departure point for the comparison of prices and volumes of health products more broadly: they constitute an important part of total health expenditure and are a good way for laying out the OECD/Eurostat methodology of collecting quasi-prices and expenditures that are required for the PPP calculation. This part of the paper therefore provides an overview of the methodology for hospital services, details of the data sources and samples, and the main results of the study on general hospitals.

1.1 PPP survey on hospital prices

Output-based methodology for hospitals: main features

11. The key methodological aspect of this work is the derivation of output-based, as opposed to input-based hospital PPPs. The following summary of the methodology is based on Koechlin *et al.*, 2010; Lorenzoni and Pearson, 2011; and European Union/OECD, 2012 where more detail is provided. In general, three main problems have to be addressed in the measurement of PPPs. The first is to identify products that are comparable across countries. This can be complicated because products are not identical, because there are differences in quality or because products simply do not exist in all countries. The second issue is to ensure representativeness of products: whatever price is compared, it has to be the price of a product that is widely and typically purchased in each country. The third issue arises when there is a product, but no meaningful market price for comparison. Issues one and two arise in the comparison of all prices, issue three arises in the comparison of products that are produced and delivered outside markets. In many countries, health services count among these products.

12. Previous calculations of PPPs for health services have therefore often been based on prices paid for inputs (such as doctor or nurses wages), rather than the prices paid for health services outputs. This approach is considered unsatisfactory. The input-based approach assumes that health care productivity is uniform across countries implying that countries are all equal in their ability to convert inputs to outputs.

13. The alternative is to adopt an output-based approach. This entails the implementation of a price survey covering hospital services[1]. Designing such a survey requires:

- The identification and definition of hospital outputs that can be measured across countries; and
- The estimation of the "prices" for these hospital outputs, accounting for the fact that in many countries no easily observable market price will exist for hospital services.

14. The approach here takes advantage of routinely collected administrative information through secondary databases[2] to estimate 'quasi-prices' (see below for further explanations) for a representative set

[1] It was also investigated whether an output volume approach were feasible, i.e. an approach based on measuring directly the quantity and quality of output on the basis of numbers of treatments. However, it turned out that the DRG systems in place in different countries are not sufficiently comparable for this approach to work.

[2] Secondary, or administrative, datasets contain coded data that describe services provided by healthcare providers. They are usually available through health administrations and national insurance funds for the purposes of reimbursement and health financing.

of health products. In so doing, it has the advantages of larger sample size, greater external validity[3] and limited costs of collecting data as compared to the alternative, a specific primary data collection effort that would have to be undertaken.

Identifying and defining hospital outputs: case types

15. The Eurostat Handbook on Price and Volume Measures in National Accounts (2001) defines the output of health services as "the quantity of health care received by patients, adjusted to allow for the qualities of service provided, for each type of health care. The quantities should be weighted together using data on the costs or prices of the health care provided. The quantity of health care received by patients should be measured in terms of complete treatments". For practical reasons, however, in this study the definition of output of health services is restricted to complete treatments delivered by a single provider which, in this case, are hospitals[4]. A hospital output is called a case type and refers to a hospital service that is similar from a clinical perspective and in terms of its consumption of resources. Two categories of case types are distinguished: medical and surgical. The medical case types specified refer only to inpatient services whereas the surgical case types are further divided between those that require hospitalisation and those that can be performed on an outpatient (day care) basis. The inclusion of outpatient cases reflects the project's intention to take into account changes in medical practice over time.

16. The international use of the International Classification of Disease (ICD) codes is a key enabling factor in collecting data across countries. For each product, a descriptive definition is given first. Then the ICD-10 codes for diagnoses and ICD-9-CM codes for procedures that identify the case type are provided. Finally, rules and criteria for inclusion/exclusion are reported. The case types identified for inclusion in the PPP studies have been selected on the basis that they were common procedures or diagnoses and account for a significant percentage of hospital expenditure. In addition, selected surgical case types had to be procedures that would be the principal procedure within one hospitalisation and medical case types had to be for medical conditions that were clearly identifiable.

17. With the advent of output-based hospital funding, it has become feasible to define similar case types across countries. Numerous countries have adopted case-mix type systems to purchase hospital products, but these have developed on a national basis resulting in substantial differences between countries' classification systems. The OECD undertook a review of secondary datasets to investigate the feasibility of identifying sufficiently similar product types across countries. The review concluded that whilst most countries had Diagnosis Related Groups (DRG)-type systems in place, the international comparability of product classification systems is limited. This implies that careful mapping between the codes used in different national systems is required in order to get comparable information (Lorenzoni and Pearson, 2011).

18. Twenty-one surgical and seven medical case types were selected for the study. Medical case types are defined as those where no operating room procedure are performed. In addition, separate outpatient data was provided for four surgical case types[5], giving us access to data on 32 different products. The case type list is presented in Annex 1. In a further effort to maximise cross-country comparability, only 'standard' hospitalisations for each case type are included in the data collection. This meant excluding

[3] External validity refers to how accurately the data and the conclusions drawn from the data represent what goes on in the population.

[4] In reality, treatments are often delivered by a combination of providers, e.g., a general practitioner, a medical specialist, a hospital, etc.

[5] Arthroscopic excision of meniscus of knee, cataract surgery, ligation and stripping of varicose veins - lower limb and tonsillectomy and/or adenoidectomy.

hospitalisations where (i) the standard profile of care was not followed due to death or transfer to another facility; and (ii) the length of stay[6] was greater than 1.5 standard deviations away from the national case type mean. Restricting the sample in this way decreases the within case type variation, and improves the clinical comparability. The list of case types have been refined and updated as part of the several pilot phases of the project.

Estimating quasi-prices for hospital case types

19. To represent "value" of goods and services, prices should be observed from transactions in open and competitive markets. Primarily this means that prices should correspond to the value that informed consumers, making choices in open and competitive markets, attach to different commodities. Such price observations are not always readily available in the health care sector where non-market producers are often present.

20. When goods or services are supplied by a non-market producer the prices charged to consumers are significantly below the cost incurred in production. In some cases, the price may even be zero. It would make no sense to compare such prices charged to patients or consumers across countries as they reflect administrative decisions and not the value of products. In such cases, measurement can be based on costs per unit of case type or *quasi-prices*. They are those (unobserved) 'prices' that emulate a competitive situation where prices equal average costs per product. Unit costs can be treated *as if they were prices* (Diewert 2011 and 2012; Schreyer 2012). We use the term 'quasi-prices' in recognition that those values are frequently not observed in open and competitive market transactions and are imputed to approximate what a market price might have been, if there were a market (Evans 2013).

21. How then are quasi-prices derived? Alongside the introduction of activity-based funding mechanisms in many OECD countries, systems have been put in place to approximate the monetary value of services provided by hospitals. These provide, in theory, an indication of the purchasers' willingness-to-pay (usually government or insurer) and the providers' willingness-to-accept these values as the price for hospital services.

22. The hospitals PPPs survey collects data on the average quasi-prices for the selected case types. Quasi-prices are normally extracted from administrative databases maintained for the purposes of reimbursement and health financing. The quasi-price can be a negotiated price or an administered price; where the former refers to prices that have been established through negotiations between purchasers (third party payers) and providers of hospital services and the latter reflect the average costs of the service provided. In either case, it is important that they cover the same types of costs across all participating countries reflecting the direct costs as well as the capital costs and overhead costs relating to the production of health services. The cost items to be included are listed in Annex 2 - Table 1.

Data sources and sample

23. The 2013 data collection gathered 2011[7] data on hospital activity and quasi-prices for a basket of 32 hospital products, using a standardized questionnaire. Out of the 37 European countries participating in Eurostat's regular PPP program, thirty-one countries participated in the 2013 survey: Austria, Belgium,

6 The number of days an inpatient spends in hospital. It is calculated in different ways for different purposes. The most common involves subtracting the discharge date from the admission date.

7 Data were collected for three years 2010, 2011, 2012 but it was decided to present only results for the year 2011 in this document as data were missing for some countries for 2010 and were still preliminary for some countries for 2012.

Bulgaria, Croatia, Cyprus[8,9], Czech Republic, Denmark, Estonia, Finland, France, the former Yugoslav Republic of Macedonia (FYROM), Germany, Hungary, Iceland, Ireland, Italy, Lithuania, Latvia, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland[10] and the United Kingdom[11]. Six out of the 37 countries did not participate in the 2013 survey: Albania, Bosnia and Herzegovina, Greece, Montenegro, Serbia and Turkey. For those countries an input based approach was used in the calculations. This was the case also for Cyprus as the number of cases reported was low.

24. Out of the 9 non-European OECD- countries, 7 participated in the 2013 survey: Australia, Canada, Chile, Israel, Japan, Mexico and the United States. In addition, data were received from Russia. For the two countries that did not participate in the survey – Korea and New Zealand – an input based approach was used in the calculations. This was also the case for the US as specificities of the method used for calculation limit international comparability[12]. Annex 3 reports the list of countries that participated in the study as well as the type of method used.

PPP calculations and price level indices

25. The survey also collects data on the number of cases recorded for each case type. Multiplying the average quasi-prices by the corresponding case numbers provides each case type with a value. These case type values can be summed across case types to give a total value for all case types with which the individual case type values can be converted into percentage shares. The percentage shares are used as weights when calculating PPPs for hospital services[13].

26. PPPs for hospital services were first compiled for the 37 countries which could report quasi-prices and weights according to the agreed methodology and PPPs for the ten remaining countries were estimated according to the input approach. The methodology used to calculate PPPs can be found in Chapter 7 of the Eurostat-OECD PPP Manual (Eurostat, OECD (2012)).

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8 Footnote by Turkey: the information in this document with reference to « Cyprus » relates to the southern part of the Island. There is no single authority representing both Turkish and Greek Cypriot people on the Island. Turkey recognizes the Turkish Republic of Northern Cyprus (TRNC). Until a lasting and equitable solution is found within the context of United Nations, Turkey shall preserve its position concerning the "Cyprus issue".

9 Footnote by all the European Union Member States of the OECD and the European Union: the Republic of Cyprus is recognized by all members of the United Nations with the exception of Turkey. The information in this document relates to the area under the effective control of the Government of the Republic of Cyprus."

10 Switzerland collected hospital data for 2011 on a voluntary basis. Only since 2012 it is mandatory for hospitals to provide data according to the Swiss DRG tariff system. This new calculation system is still under development.

11 England only.

12 The Agency for Healthcare Research and Quality (AHRQ) filled in the output-based hospitals PPPs survey for 2011 for the United States. However, after reviewing preliminary results, an input-based approach was used as several specificities of the method used for the calculation limit the international comparability of the US estimates. In particular, it was not possible to exclude outliers in terms of the length of stay from the population under study and to include data on outpatient surgical case types which represent a large part of hospital activity and expenditure. OECD will work with AHRQ for further data collection and methodological development which should enable future inclusion of output-based figures for hospitals PPPs in across countries comparisons.

13 It should be noted that those weights are based on the sample of case types, not the population that this sample is supposed to represent.

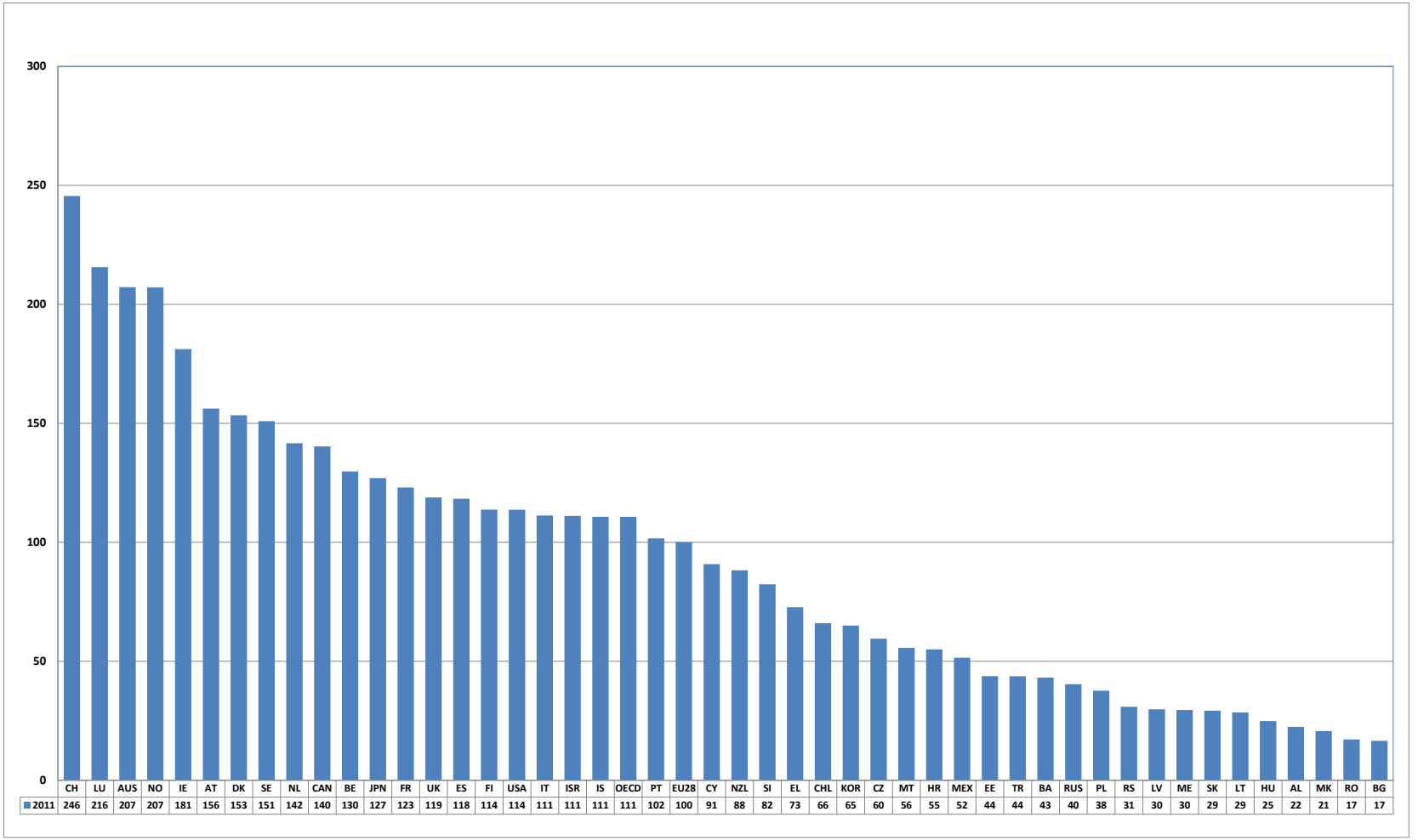
27. PPPs were then used to derive price level indices (PLIs). PLIs are the ratios of PPPs to exchange rates. The average PLI of the group of 28 EU Member States was calculated as the weighted average of the PLIs of the different countries (with total expenditure on hospitals as weights). This average was then set to equal 100 and each country's PLI expressed in relation to it. PLIs provide a measure of the difference in price levels between countries by indicating – for a given category or aggregate – the number of units of the common currency needed to buy the same volume of the category or aggregate. Price levels depend on exchange rates and maybe subject to large variations in line with exchange rates swings and should therefore be interpreted with caution.

1.2 Main results: price level indices for hospital services[14]

28. As shown in Figure 1, price level indices for hospital services vary widely across countries. Bulgaria and Romania have price levels that are 17% of the average EU price level, whereas in Switzerland hospital services are priced at 246% of the EU average, a range of nearly 1 to 15. Broadly, three clusters of countries can be identified: fifteen mainly Central and Eastern Europe (CEE) countries and Western-Balkan countries with PLIs below 50, twenty-three countries with PLIs between 50 and 150 and eight countries with PLIs above 150.

[14] The results for Germany are under review so are not included in this paper.

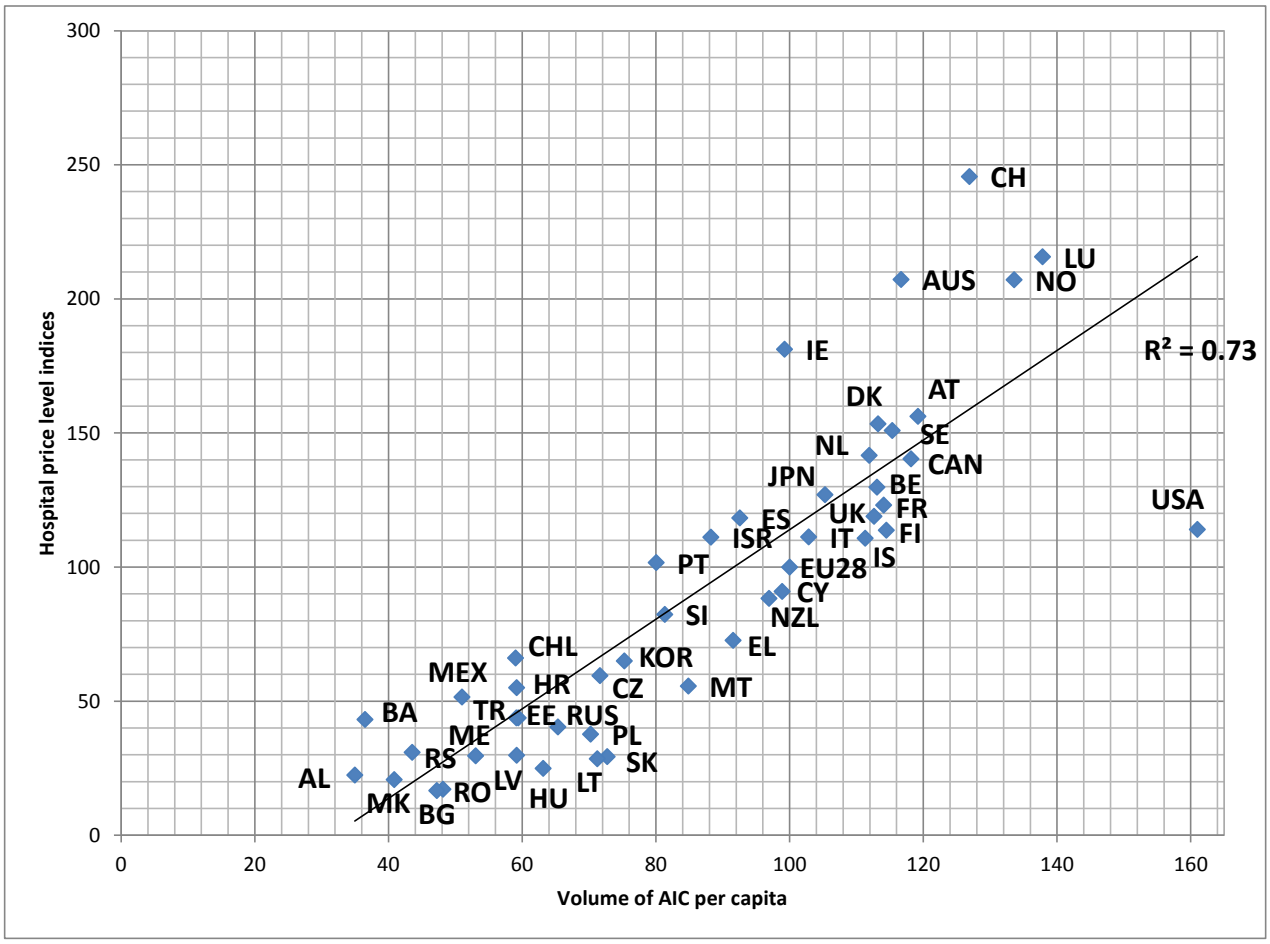
Figure 1. Price levels for hospital services, 2011, EU28=100



	CH	LU	AUS	NO	IE	AT	DK	SE	NL	CAN	BE	JPN	FR	UK	ES	FI	USA	IT	ISR	IS	OECD	PT	EU28	CY	NZL	SI	EL	CHL	KOR	CZ	MT	HR	MEX	EE	TR	BA	RUS	PL	RS	LV	ME	SK	LT	HU	AL	MK	RO	BG
2011	246	216	207	207	181	156	153	151	142	140	130	127	123	119	118	114	114	111	111	111	111	102	100	91	88	82	73	66	65	60	56	55	52	44	44	43	40	38	31	30	30	29	29	25	22	21	17	17

29. Price levels tend to correlate with income levels: richer countries have generally higher price levels than poorer countries. This correlation is stronger for services (non-tradable) than for goods (tradable). Figure 2 displays the price levels for hospitals plotted against the index of real per capita expenditure on total actual individual consumption (AIC), which corresponds to household consumption adjusted for social transfers in kind, that is the health, education or housing services provided by government or NPISHs for free or at low cost. There is indeed a strong correlation: higher levels of AIC correspond to higher price levels for hospitals, in line with expectations.

Figure 2. Comparison of price levels for hospital services and per capita actual individual consumption, 2011, EU28=100

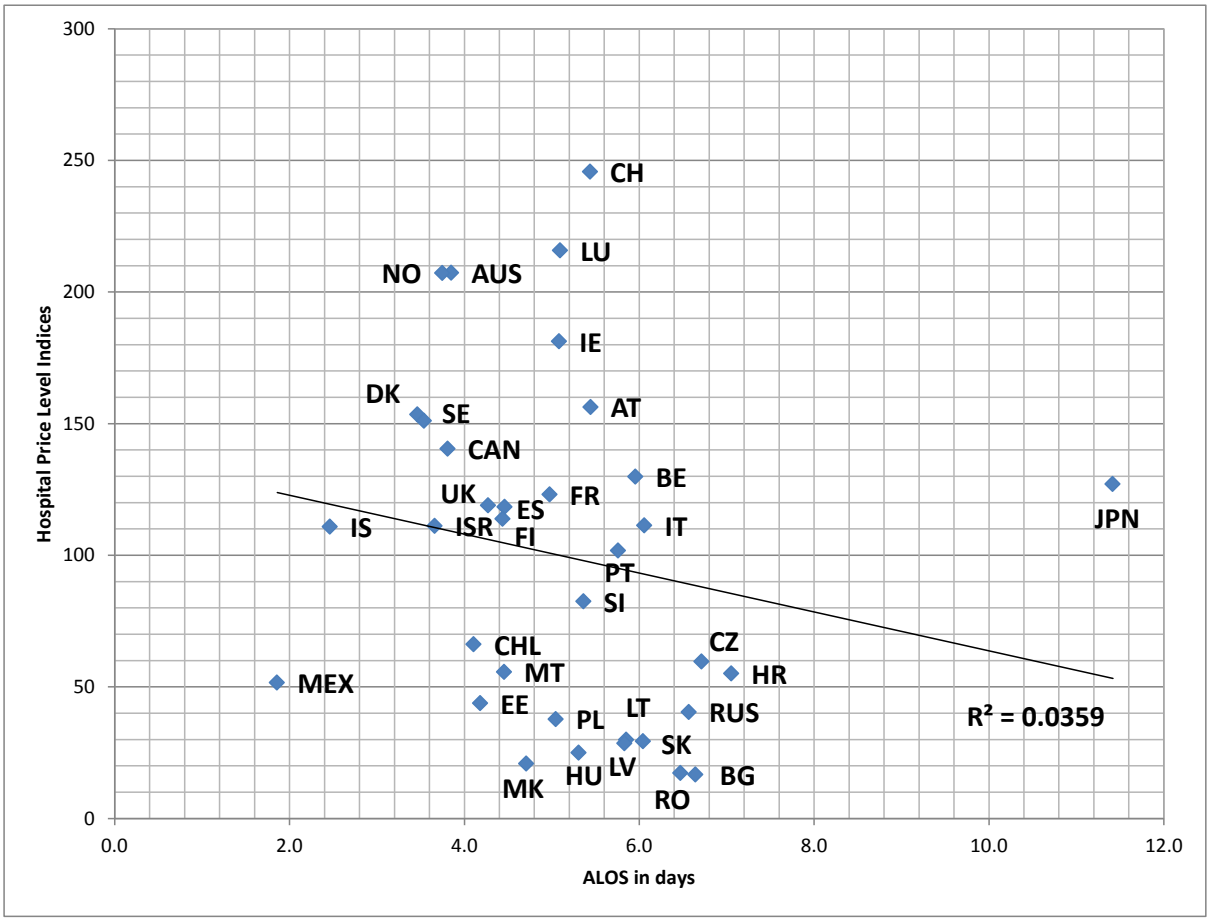


***Cross-country and case type variation in average length of stay*[15]**

30. Can the observed price differences be related to differences in average length of stay (ALOS)? Overall, ALOS was 5.3 days and ranged from 2.5 in Iceland to 7.1 in Croatia (average over all case types). There is some evidence of systematic variation in ALOS with Nordic countries reporting ALOS at the lower end of the distribution whereas CEE countries tend to report higher than average ALOS. Figure 3 plots the average ALOS against the price levels for hospitals. There appears to be practically no correlation between overall average ALOS and price levels, implying that the observed differences in prices for hospital services cannot be explained by systematic differences in ALOS across countries.

[15] For the Netherlands, average length of stay by case type was not available.

Figure 3. Comparison of price levels for hospital services and average length of stay, 2011, EU28=100



31. At case type level, the highest ALOS was reported for colorectal resection (13.1 days) and the lowest ALOS was observed for cataract surgery (1.9 days).

Limitations of the study

32. The comparison of product types across countries assumes that these services are delivered with the same level of quality. This is a strong assumption but it should be noted that it is also implicit in other PPP comparisons, especially for market services. Also, the methodology at hand has been designed to minimise biases through quality differences by only comparing hospital products with the same or very similar characteristics. In this way, stratification keeps quality constant if the products included in a particular stratum are relatively homogeneous (Atkinson, 2005).

33. Nevertheless, further work may be required to control for potential quality differences. Future methodological work could, in the first instance, improve product homogeneity by adding further criteria to the product selection process. For instance, it is feasible to add the type of surgery (laparotomic versus laparoscopic surgery) for hospital products such as appendectomy, cholecystectomy and abdominal and vaginal hysterectomy. This would entail regular monitoring of hospital products, particularly when different technologies become available. Over the longer term, methodological advancement could occur by augmenting the analysis with an explicit quality adjustment based – as an example - on post-treatment survival, life expectancy and waiting times (Castelli *et al.*, 2007; Deveci, 2011) and patient-reported outcome measures (NHS Information Centre, 2011; Gutacker *et al.* 2011).

34. The increased use of DRG-based systems for hospital financing should contribute to improving comparability further in the future. Moreover, the representativity of the hospital sample should increase over time as DRG-based payment systems are refined. Finally, where the quasi-prices are actually used to pay for hospital services, both payers and suppliers of hospital products have a strong incentive to ensure that the quasi-price measures reflect the opportunity costs of providing and purchasing hospital services.

35. The case type definitions do not take into account the "severity" [16] of the hospitalization case as proxied through secondary diagnoses and/or age. The main reasons for that are in the way severity is measured and in coding practices among countries[17]. In a bid to increase homogeneity even further, countries were asked to restrict their sample of hospitalisations to standard profiles of care and a length of stay no greater than 1.5 standard deviations away from the case type mean. Even with these restrictions, it is possible that cross-country heterogeneity in any specific case type remains.

PART II: PPPS FOR TOTAL HEALTH EXPENDITURES

36. Hospital services are an important part of overall health care. To obtain PPPs for total health care, PPPs for hospital services need to be combined with PPPs for other goods and services. It is important to note that hospitals are the key health care institution in all OECD health systems. On average, OECD countries spend approximately 36% of overall health care expenditure on hospital services. Thus the results presented in this part are highly dependent and correlated to the hospitals results presented and discussed in Part I of this document.

2.1 Data and methods for calculating PPPs for total health

The classification for health expenditure

37. The classification of health expenditure and a related set of weights to be used in the calculation of the output-based health PPPs combine information from the System of Health Accounts (SHA) with the standard national accounts expenditure aggregates for health.

38. The classification (see Annex 2 - Table 2) is based on the classifications of providers and of functions that are used in the SHA[18]. The first four items include all services provided by hospitals, as a whole and broken down into their three major classes (general, mental and speciality hospitals). We excluded long term care home services provided by hospitals as those services are for the most part included in social protection expenditure in SNA. The same approach is used for the fifth category, services provided by nursing and residential care facilities, for which long term home care services have also been excluded. Goods and services provided by the remaining two categories of the provider classification (i.e. "Providers of ambulatory health care" and "Retail sale and other providers of medical goods") have been broken down into the main categories of the functional classification. These include out-patient medical, dental and paramedical services, as well as pharmaceutical products, other medical

[16] Complexity of cases refers to a set of interrelated but distinct patient attributes – including severity of illness, prognosis, treatment difficulty, need for intervention and resource intensity – that are not captured by the case types definitions.

[17] The completeness of hospital coding, represented by the mean number of secondary diagnoses, can differ across countries in terms of who is responsible for code assignment, strength, and scope of incentives for coding and implementation of coding guidelines,.

[18] Annex 2 – Table 2 is based on the SHA 1.0 classifications. Note that the new SHA 2011 (OECD, Eurostat, WHO 2011) presents minor changes to the provider and functional classifications.

products, and therapeutic appliances and equipment. Annex 2 – Table 3 reports the correspondence between the SHA classification codes and the PPP expenditure categories.

Calculation of the weights of the different categories

39. The relative weight of each of the items included in the classification was calculated using the SHA data which are reported annually by the large majority of OECD and European countries. For this exercise, data refers to 2011 as reported in the 2013 OECD-Eurostat-WHO joint SHA data collection. The relative weights represent the share of health expenditure of each item in total expenditure on personal health care (excluding long term home care). Imputations were made for those countries for which the implementation of SHA has not been completed yet. Results for 2011 are presented in Annex 1 - Table 2, where shadowed rows identify the countries for which SHA data were not available and therefore imputed[19].

Calculation of health PPPs

40. The PPPs for health have been calculated using the shares for the 10 categories of expenditures as weights and the PPPs calculated for each category as described in Annex 2 - Table 4. For mental health and substance abuse hospitals as well as for speciality hospitals it was decided to use the same PPP as for general hospital services as the breakdown from SHA between different type of hospitals is not always available and accurate. For nursing and residential care facilities, PPPs are currently calculated on the basis of prices for medical hospital services per day of stay. This is a proxy that needs to be improved upon.

41. For the six categories of outpatient services and medical goods, PPPs were used that are calculated on the basis of regular PPP price surveys on those goods and services.

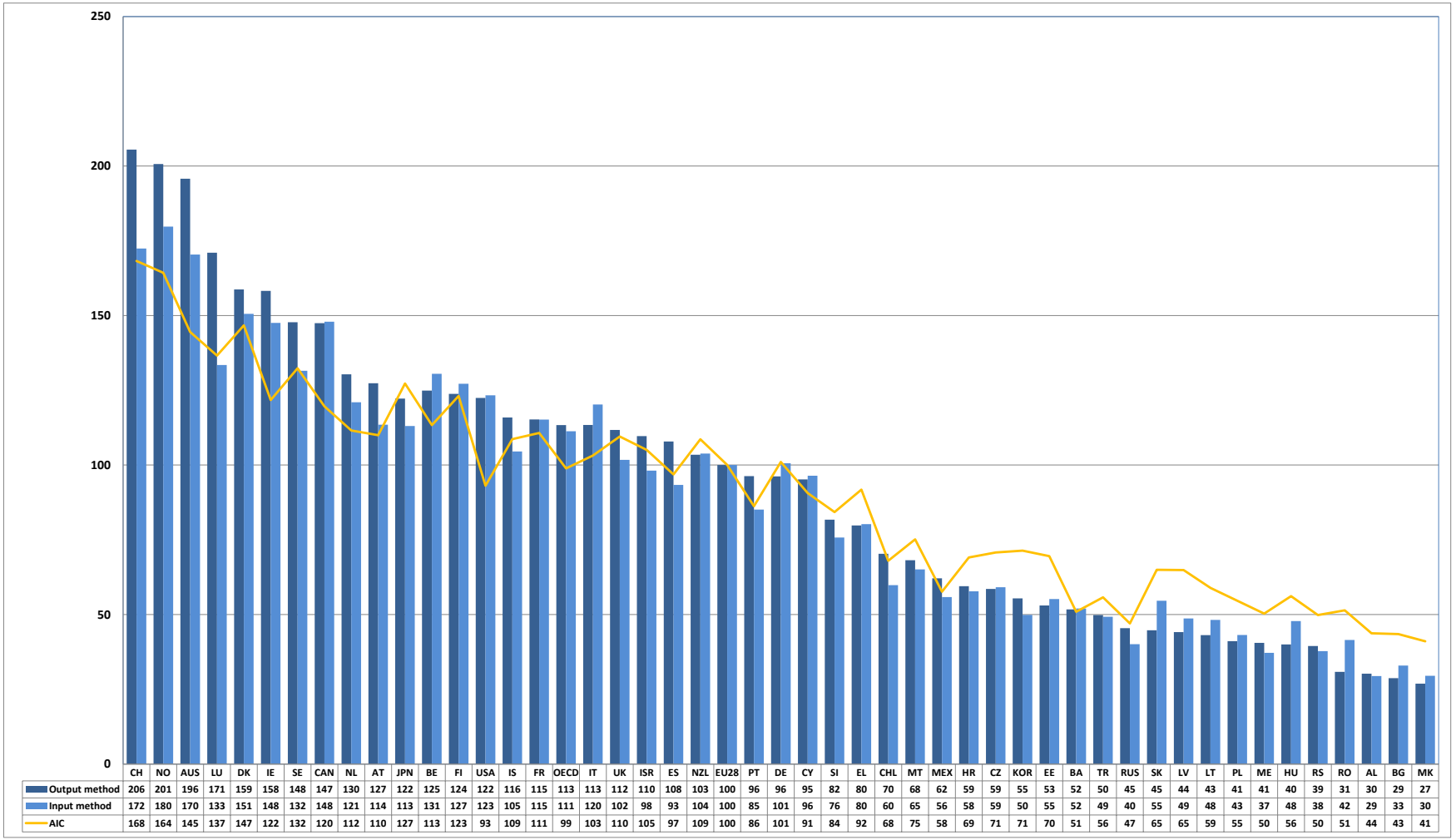
42. For the ten countries which did not participate in the hospital price survey, we used the PPP for "hospital services" coming from the traditional input approach PPP calculations for the three categories relating to hospital services and the PPPs for social protection for nursing and residential care facilities.

2.2 Main results for health

43. Figure 4 shows the PLIs for the overall health sector, including hospitals, outpatient services, pharmaceuticals, medical goods and therapeutic appliances. A comparison of PLIs calculated on the basis of the output-based methodology and the input-based methodology is reported, along with total AIC. We observe a larger spread of the output-based results as compared to the input-based ones: from 27 in the former Yugoslav Republic of Macedonia to 206 in Switzerland. The spread of price levels for health is wider than the spread of price levels for total AIC, which is because AIC includes a larger share of tradables that have lower price dispersion.

[19] To do that, we first identified homogeneous groups of health systems for countries reporting SHA questionnaire, then assign those countries not reporting SHA to one of those groups and lastly impute the missing values. The identification of homogeneous groups was derived from the analysis proposed by Joumard and colleagues in 2010, where OECD countries were clustered into 5 groups, primarily on the basis of their institutional characteristics. Within each group, an average value of each expenditure component has been computed on the basis of the available information. Those average values have then been imputed to the countries without SHA data within each group.

Figure 4. Comparison of PLIs for health, output-based and input-based method, and AIC, 2011, EU28=100



	CH	NO	AUS	LU	DK	IE	SE	CAN	NL	AT	JPN	BE	FI	USA	IS	FR	OECD	IT	UK	ISR	ES	NZL	EU28	PT	DE	CY	SI	EL	CHL	MT	MEX	HR	CZ	KOR	EE	BA	TR	RUS	SK	LV	LT	PL	ME	HU	RS	RO	AL	BG	MK
Output method	206	201	196	171	159	158	148	147	130	127	122	125	124	122	116	115	113	113	112	110	108	103	100	96	96	95	82	80	70	68	62	59	59	55	53	52	50	45	45	44	43	41	41	40	39	31	30	29	27
Input method	172	180	170	133	151	148	132	148	121	114	113	131	127	123	105	115	111	120	102	98	93	104	100	85	101	96	76	80	60	65	56	58	59	50	55	52	49	40	55	49	48	43	37	48	38	42	29	33	30
AIC	168	164	145	137	147	122	132	120	112	110	127	113	123	93	109	111	99	103	110	105	97	109	100	86	101	91	84	92	68	75	58	69	71	71	70	51	56	47	65	65	59	55	50	56	50	51	44	43	41

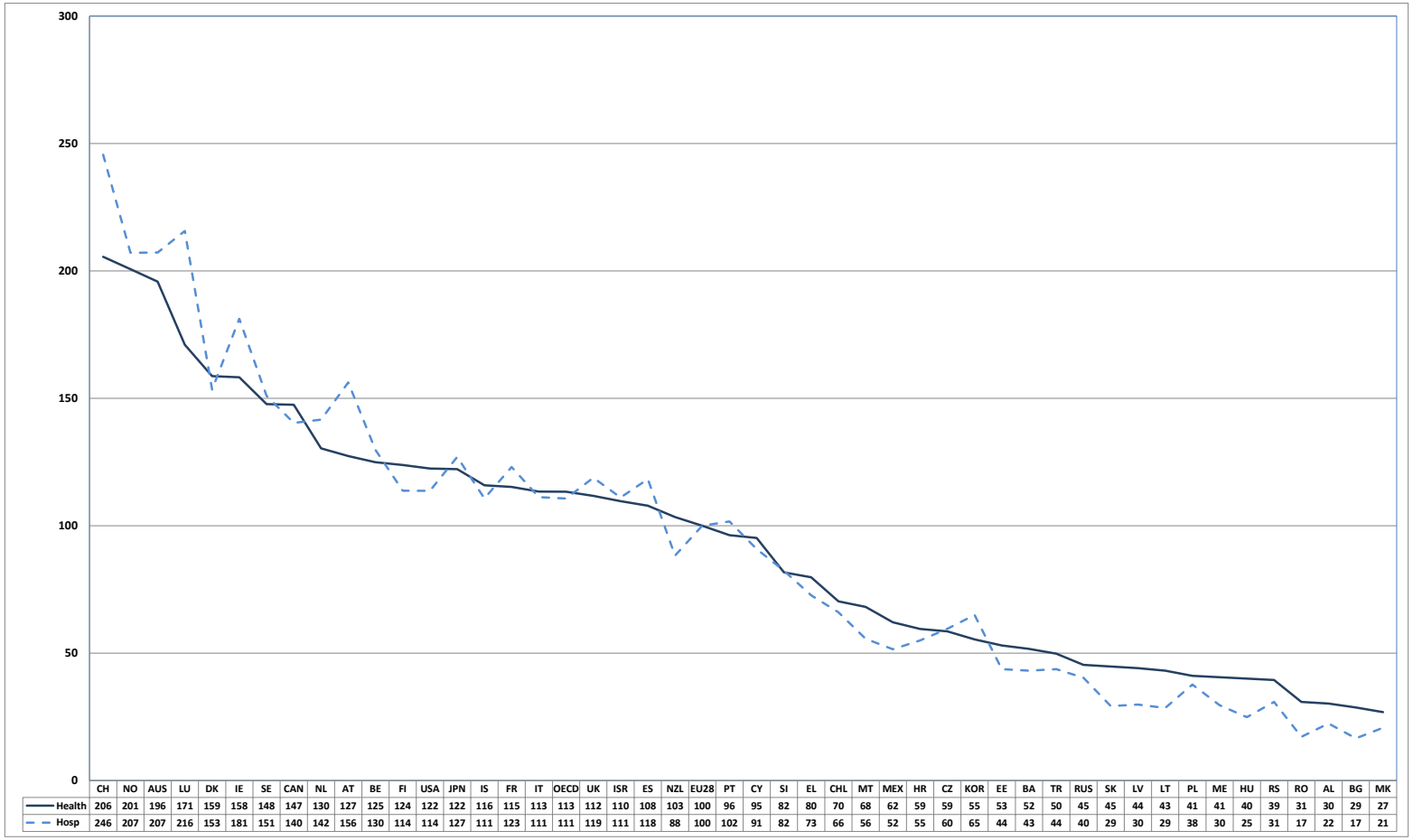
44. The spread of health PLIs is less pronounced than that of hospital PLIs reported in part I of this paper, as shown in Figure 5. This is in line with expectations because total health includes also health products, such as pharmaceuticals and therapeutic appliances which are tradable. By dividing total health expenditures (as reported in the national accounts) with their respective PPPs as calculated above, a measure of real (i.e. price level adjusted) expenditures, or volume, is obtained. To compare those volumes across countries, they are further divided by the population of each country and indexed to the average volume per capita of the EU28.

45. Per capita volume indices for the year 2011 for health as a whole compiled using the new method are compared with the, previously published, input-based results and with total AIC in Figure 6. This figure shows that per capita volume indices for health compiled with the output-based methodology vary from 24 in Albania to 201 in the US. The output-based methodology appears to reduce the per capita volume indices for the Nordic countries (except Finland) as well as Luxembourg, Switzerland, Australia, Spain and Austria. On the other hand, per capita volume indices are higher with the new methodology for a number of CEE countries, including Lithuania, Slovakia, Romania and Hungary. This is due to both the change of methodology for the calculation of PPPs for hospital services, to the change of structure and data sources for the weights, and the new methodology for the calculation of PPPs for total health expenditures. It is difficult to disentangle the different effects.

46. It is worth noting that the impact of the new method on broad macro-economic aggregates is limited. Differences in per capita volumes do not exceed 3 points, whether Actual Individual Consumption (AIC) or GDP is considered. Country rankings stay almost unchanged.

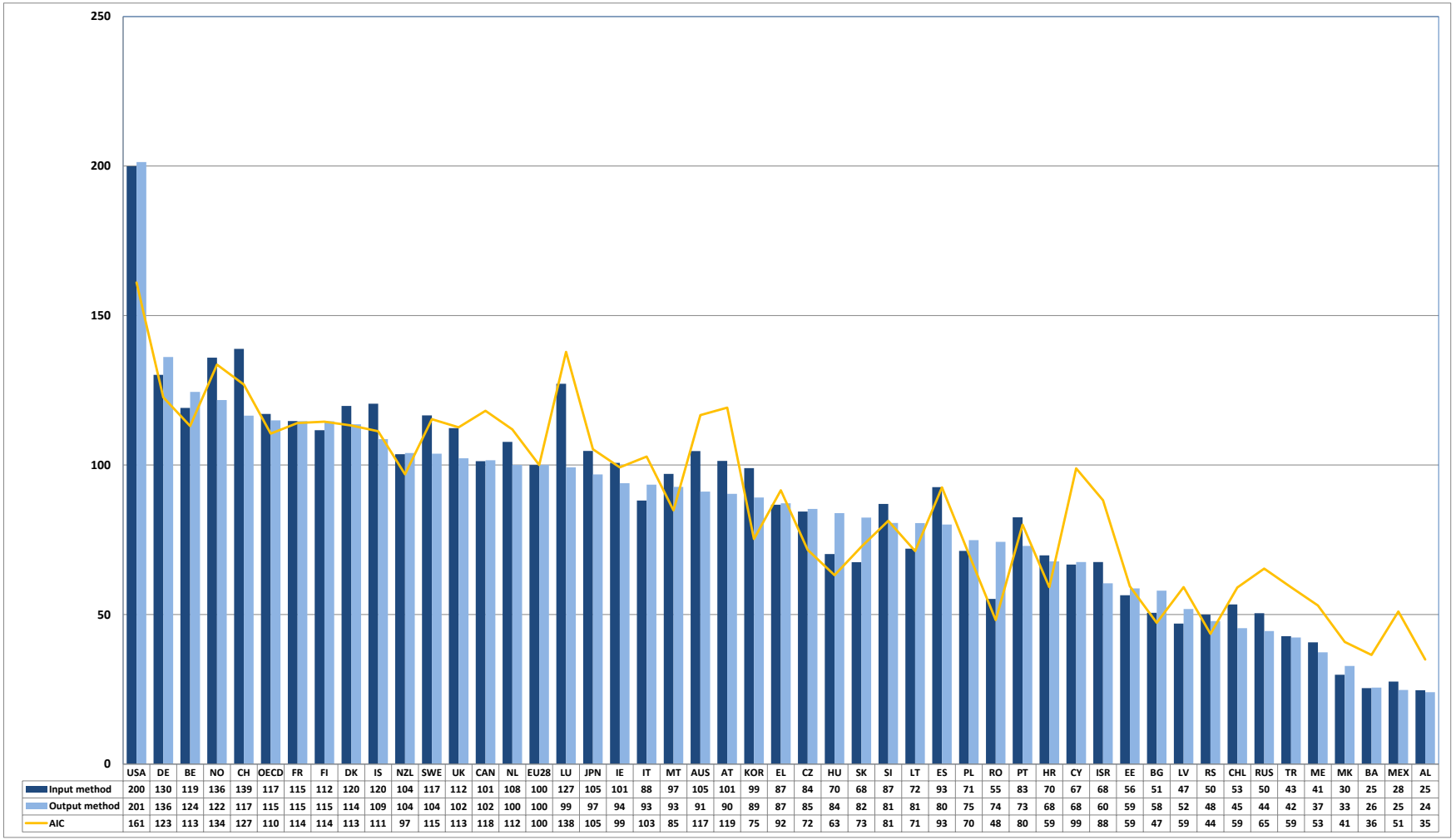
47. Per capita volume indices are more equal across countries when health-specific PPPs are used. This can be explained by the fact that price level indices for health vary more across countries than price level indices for GDP as shown in Figure 7.

Figure 5. Price levels for hospital services and health, 2011, EU28=100



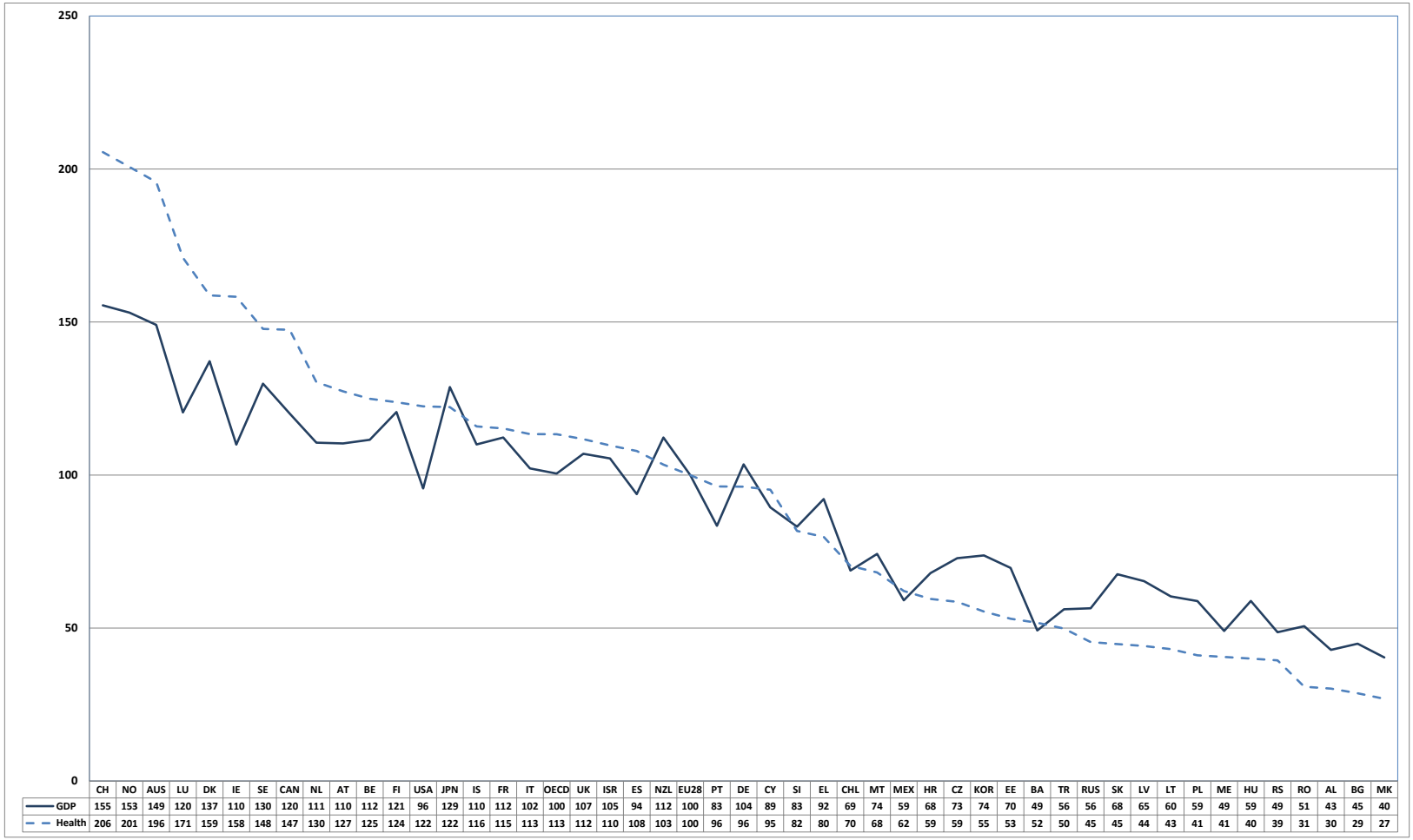
	CH	NO	AUS	LU	DK	IE	SE	CAN	NL	AT	BE	FI	USA	JPN	IS	FR	IT	OECD	UK	ISR	ES	NZL	EU28	PT	CY	SI	EL	CHL	MT	MEX	HR	CZ	KOR	EE	BA	TR	RUS	SK	LV	LT	PL	ME	HU	RS	RO	AL	BG	MK
Health	206	201	196	171	159	158	148	147	130	127	125	124	122	122	116	115	113	113	112	110	108	103	100	96	95	82	80	70	68	62	59	59	55	53	52	50	45	45	44	43	41	41	40	39	31	30	29	27
Hosp	246	207	207	216	153	181	151	140	142	156	130	114	114	127	111	123	111	111	119	111	118	88	100	102	91	82	73	66	56	52	55	60	65	44	43	44	40	29	30	29	38	30	25	31	17	22	17	21

Figure 6. Comparison of per capita volume indices for health, output-based and input-based method, and AIC, 2011, EU28=100



	USA	DE	BE	NO	CH	OECD	FR	FI	DK	IS	NZL	SWE	UK	CAN	NL	EU28	LU	JPN	IE	IT	MT	AUS	AT	KOR	EL	CZ	HU	SK	SI	LT	ES	PL	RO	PT	HR	CY	ISR	EE	BG	LV	RS	CHL	RUS	TR	ME	MK	BA	MEX	AL
Input method	200	130	119	136	139	117	115	112	120	120	104	117	112	101	108	100	127	105	101	88	97	105	101	99	87	84	70	68	87	72	93	71	55	83	70	67	68	56	51	47	50	53	50	43	41	30	25	28	25
Output method	201	136	124	122	117	115	115	115	114	109	104	104	102	102	100	100	99	97	94	93	93	91	90	89	87	85	84	82	81	81	80	75	74	73	68	68	60	59	58	52	48	45	44	42	37	33	26	25	24
AIC	161	123	113	134	127	110	114	114	113	111	97	115	113	118	112	100	138	105	99	103	85	117	119	75	92	72	63	73	81	71	93	70	48	80	59	99	88	59	47	59	44	59	65	59	53	41	36	51	35

Figure 7. Comparison of price levels indices for GDP and health, 2011, EU28=100



	CH	NO	AUS	LU	DK	IE	SE	CAN	NL	AT	BE	FI	USA	JPN	IS	FR	IT	OECD	UK	ISR	ES	NZL	EU28	PT	DE	CY	SI	EL	CHL	MT	MEX	HR	CZ	KOR	EE	BA	TR	RUS	SK	LV	LT	PL	ME	HU	RS	RO	AL	BG	MK
GDP	155	153	149	120	137	110	130	120	111	110	112	121	96	129	110	112	102	100	107	105	94	112	100	83	104	89	83	92	69	74	59	68	73	74	70	49	56	56	68	65	60	59	49	59	49	51	43	45	40
Health	206	201	196	171	159	158	148	147	130	127	125	124	122	122	116	115	113	113	112	110	108	103	100	96	96	95	82	80	70	68	62	59	59	55	53	52	50	45	45	44	43	41	41	40	39	31	30	29	27

CONCLUSIONS

48. The new output-based methodology developed for calculating hospital and health PPPs appears to be sound and reliable. It increases the price level of health products in high income countries, while the opposite is true for a large part of lower income countries. The new output-based methodology reduces the per capita volume of health services for the Nordic countries (except Finland) as well as Switzerland, Luxembourg, Australia, Spain and Austria. On the other hand, per capita volume indices are higher with the new methodology for a number of CEE countries, including Lithuania, Slovakia, Romania and Hungary.

49. Improvements to the methodology are needed in particular for nursing and residential care facilities, for which the PPPs are currently calculated on the basis of prices for medical hospital services per day of stay. Work is already on-going in this area. Moreover, the increased use of DRG-based systems for hospital financing should contribute to improving comparability further in the future.

50. The small impact at the macro-economic level in no way reduces the importance of the new set of health PPPs for analyses of the health sector. In particular, we find that in wealthier countries, the price level index for GDP tends to be lower than the new health PLI results while in lower income countries the opposite phenomenon can be observed (see Figure 6). In other words, relative prices for health services tend to increase with rising income levels, confirming similar observations in the literature. The direction that the new health prices take is therefore plausible.

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ANNEX 1: CASE TYPES LIST

Medical case types

M01, Acute Myocardial Infarction

M02, Angina pectoris

M03, Cholelitiasis

M04, Heart failure

M05, Malignant neoplasm of bronchus and lung

M06, Normal delivery

M07 Pneumonia

Surgical case types

S01 Appendectomy

S02 Caesarean section

S03 Cholecystectomy

S04 Colorectal resection

S05 Coronary artery bypass graft

S06 Discectomy

S07 Endarterectomy: vessels of head and neck

S08 Hip replacement: total and partial

S09 Hysterectomy: abdominal and vaginal

S10 Knee replacement

S11 Mastectomy

S12 Open prostatectomy

S13 Percutaneous transluminal coronary angioplasty (PTCA)

S14 Peripheral vascular bypass

S15 Repair of inguinal hernia

S16 Thyroidectomy

S17 Transurethral resection of prostate

S18 Arthroscopic excision of meniscus of knee (Inpatient and Outpatient)

S19 Lens and cataract procedures (Inpatient and Outpatient)

S20 Ligation and stripping of varicose veins – lower limb (Inpatient and Outpatient)

S21 Tonsillectomy and/or adenoidectomy (Inpatient and Outpatient)

ANNEX 2: TABLES

Table 1. Cost covered by quasi-prices

Overhead costs	Medical infrastructure	Laundry
		Sterilization
		Patient transport within the hospital
		Food service to patients
		Other (includes patient transport outside the hospital, staff transport, transportation of samples/blood)
	Non-medical infrastructure	Administrative staff
		Cleaning
		Security
		Gardening
		Desk officers
		Telephone
		Printing and stationery
		Rent
		Taxes
		Energy
		Water
		Waste disposal
		IT/IS services
		Building maintenance
		Equipment maintenance
Capital costs[1]		Consumption of fixed capital
Direct costs	Compensation of employees	Medical staff
		Nursing staff
		Technical staff
		Administrative staff
	Goods and services	Medical and surgical equipment[2]
		Laboratory equipment[2]
		Disposables (including medical and surgical supplies)
		Drugs
		Medical gases
		Dressings
		Prosthesis

[1] Capital costs should also cover research and development (R&D) but as countries have difficulty determining the cost of this item, R&D is not included in the quasi prices reported.

[2] Includes small tools - that is goods that may be used repeatedly or continuously in production over many years but may nevertheless be small, inexpensive and used to perform relatively simple operations

Table 2. SHA-based weights by category and by country, 2011

Countries	Hospital services				Nursing and residential care facilities	Out-patient medical services	Out-patient dental services	Out-patient paramedical services	Pharmaceutical products	Other medical products	Therapeutic appliances and equipment
		General	Mental	Speciality (other then mental health and substance abuse hospitals)							
AUS	0.44	0.42	0.03	0.00	-	0.24	0.07	0.06	0.16	-	0.03
AT	0.45	0.42	-	0.03	0.10	0.16	0.06	0.03	0.14	0.00	0.05
BE	0.37	0.31	0.05	0.01	0.15	0.21	0.04	0.04	0.18	0.00	0.02
CAN	0.34	0.29	0.02	0.03	0.12	0.19	0.08	0.03	0.19	0.01	0.03
CHL	0.43	0.41	0.01	0.01	0.04	0.22	0.03	0.04	0.19	0.01	0.04
CZ	0.47	0.42	0.02	0.03	0.02	0.17	0.06	0.06	0.18	0.01	0.03
DK	0.56	0.51	0.05	-	0.14	0.10	0.06	0.02	0.08	0.01	0.04
EE	0.49	0.47	0.00	0.03	0.03	0.10	0.07	0.05	0.22	0.01	0.02
FI	0.39	0.39	0.00	-	0.08	0.25	0.07	0.02	0.15	0.00	0.03
FR	0.40	0.36	0.04	-	0.07	0.17	0.05	0.06	0.18	0.01	0.05
DE	0.35	0.32	-	0.03	0.09	0.20	0.09	0.05	0.17	0.00	0.06
EL	0.41	0.36	0.02	0.04	0.01	0.21	-	0.05	0.30	-	0.02
HU	0.32	0.29	0.00	0.03	0.03	0.18	0.03	0.04	0.36	0.01	0.03
IS	0.37	0.36	-	0.00	0.13	0.23	0.06	0.02	0.13	0.03	0.02
IE	0.46	0.38	0.02	0.05	0.06	0.14	0.05	0.04	0.21	0.02	0.02
ISR	0.46	0.38	0.02	0.05	0.06	0.14	0.05	0.04	0.21	0.02	0.02
IT	0.46	0.38	0.02	0.05	0.06	0.14	0.05	0.04	0.21	0.02	0.02
JPN	0.49	0.46	0.03	0.00	0.04	0.19	0.06	0.01	0.20	0.00	0.01
KOR	0.45				0.02	0.19	0.09	0.01	0.21	-	0.02
LU	0.39	0.33	0.02	0.03	0.18	0.20	0.06	0.04	0.09	0.01	0.03
MEX	0.43	0.41	0.01	0.01	0.04	0.22	0.03	0.04	0.19	0.01	0.04
NL	0.39	0.29	0.09	0.02	0.23	0.14	0.04	0.02	0.12	-	0.05
NZL	0.47	0.45	0.01	0.00	0.11	0.19	0.04	0.06	0.11	0.01	0.02
NO	0.45	0.36	0.09	-	0.22	0.12	0.06	0.01	0.08	0.00	0.05
PL	0.38	0.34	0.02	0.02	0.02	0.20	0.06	0.05	0.26	0.00	0.02
PT	0.41	0.40	0.01	-	0.02	0.27	-	0.06	0.20	-	0.04
SK	0.28	0.27	0.01	0.00	-	0.17	0.05	0.09	0.31	-	0.10
SI	0.46	0.36	0.02	0.08	0.06	0.14	0.06	0.02	0.20	0.02	0.04
ES	0.45	0.42	0.01	0.02	0.07	0.17	0.06	0.02	0.18	0.01	0.03
SE	0.57	0.57	-	-	-	0.16	0.09	-	0.13	0.01	0.04
CH	0.40	0.31	0.04	0.06	0.19	0.18	0.07	0.04	0.10	-	0.02
TR	0.47	0.47	-	0.00	0.07	0.20	0.08	0.01	0.13	0.02	0.03
UK	0.46	0.38	0.02	0.05	0.06	0.14	0.05	0.04	0.21	0.02	0.02
USA	0.37				0.07	0.41	-	-	0.14	-	0.02
CY	0.49	0.35	0.02	0.11	0.01	0.20	0.05	0.08	0.15	0.00	0.02
LV	0.37	0.29	0.04	0.05	0.06	0.17	0.03	0.04	0.28	0.00	0.04
LU	0.41	0.35	0.01	0.05	0.02	0.15	0.06	0.04	0.11	0.17	0.03
RO	0.41	0.31	0.02	0.09	0.03	0.09	0.03	0.05	0.38	0.00	0.01
BG	0.44	0.32	0.00	0.11	0.00	0.08	0.05	0.04	0.38	-	0.02
MT	0.46	0.38	0.02	0.05	0.06	0.14	0.05	0.04	0.21	0.02	0.02
HR	0.45	0.40	0.02	0.03	-	0.10	0.07	0.05	0.28	0.03	0.02
MK	0.46	0.38	0.02	0.05	0.06	0.14	0.05	0.04	0.21	0.02	0.02
BA	0.46	0.38	0.02	0.05	0.06	0.14	0.05	0.04	0.21	0.02	0.02
ME	0.46	0.38	0.02	0.05	0.06	0.14	0.05	0.04	0.21	0.02	0.02
RS	0.46	0.38	0.02	0.05	0.06	0.14	0.05	0.04	0.21	0.02	0.02
AL	0.46	0.38	0.02	0.05	0.06	0.14	0.05	0.04	0.21	0.02	0.02
RUS	0.46	0.38	0.02	0.05	0.06	0.14	0.05	0.04	0.21	0.02	0.02

Table 3. Mapping between SHA functional and provider classifications and PPPs expenditure categories

SHA functional classification	*SHA provider classification*	*PPP Expenditure category*
Personal care HC.1-HC.5 (excluding HC3.3)	Hospitals (HP1)	Hospital services
Personal care HC.1-HC.5 (excluding HC3.3)	General hospitals (HP1.1)	General
Personal care HC.1-HC.5 (excluding HC3.3)	Mental health and substance abuse hospitals (HP1.2)	Mental
Personal care HC.1-HC.5 (excluding HC3.3)	Speciality (other then mental health and substance abuse hospitals) (HP1.3)	Speciality (other then mental health and substance abuse hospitals)
Personal care HC.1-HC.5 (excluding HC3.3)	Nursing and residential care facilities (HP2)	Nursing and residential care facilities
Out-patient medical services (HC1-3 excluding HC1.3.2	Total expenditure HP.3-HP.4	Out-patient medical services
Out-patient dental services (HC1.3.2)	Total expenditure HP.3-HP.4	Out-patient dental services
Out-patient paramedical services (HC4)	Total expenditure HP.3-HP.4	Out-patient paramedical services
Pharmaceutical products (HC5.1.1+HC5.1.2)	Total expenditure HP.3-HP.4	Pharmaceutical products
Other medical non-durables (HC5.1.3)	Providers of ambulatory health care (HP3) +Retail sale and other providers of medical goods (HP4)	Other medical products
Therapeutic appliances and other medical durables (HC5.2)	Providers of ambulatory health care (HP3)+Retail sale and other providers of medical goods (HP4)	Therapeutic appliances and equipment

HC3.3: Long-term nursing care: home care

Table 4. PPPs used in the calculation of health PPPs by health expenditure category

Category	*Method used to calculate PPP*
General hospitals	Output approach – Hospital services
Mental health and substance abuse hospitals	Output approach – Hospital services
Speciality hospitals	Output approach – Hospital services
Nursing and residential care facilities	PPPs for medical hospital services per day
Outpatient medical services	Out-patient medical services (PPP health survey)
Outpatient dental services	Dental services (PPP health survey)
Outpatient paramedical services	Paramedical services (PPP health survey)
Pharmaceutical products	Pharmaceutical products (PPP health survey)
Other medical products	Other medical products (PPP health survey)
Therapeutic appliances	Therapeutic appliances (PPP health survey)

ANNEX 3: LIST OF COUNTRIES AND METHOD USED

Code	*Description*	*Co-ordinating organisation*	*Input- or output-based method used for hospital services?*
AL	Albania	Eurostat	Input
AUS	Australia	OECD	Output
AT	Austria	Eurostat	Output
BE	Belgium	Eurostat	Output
BA	Bosnia	Eurostat	Input
BG	Bulgaria	Eurostat	Output
CAN	Canada	OECD	Output
CHL	Chile	OECD	Output
HR	Croatia	Eurostat	Output
CY	Cyprus	Eurostat	Input
CZ	Czech Republic	Eurostat	Output
DK	Denmark	Eurostat	Output
EE	Estonia	Eurostat	Output
RUS	Federation of Russia	OECD	Output
FI	Finland	Eurostat	Output
FR	France	Eurostat	Output
MK	FYROM	Eurostat	Output
DE	Germany	Eurostat	Output
EL	Greece	Eurostat	Input
HU	Hungary	Eurostat	Output
IS	Iceland	Eurostat	Output
IE	Ireland	Eurostat	Output
ISR	Israel	OECD	Output
IT	Italy	Eurostat	Output
JPN	Japan	OECD	Output
KOR	Korea	OECD	Input
LV	Latvia	Eurostat	Output
LT	Lithuania	Eurostat	Output
LU	Luxembourg	Eurostat	Output
MT	Malta	Eurostat	Output
MEX	Mexico	OECD	Output
ME	Montenegro	Eurostat	Input
NL	Netherlands	Eurostat	Output
NZL	New Zealand	OECD	Input
NO	Norway	Eurostat	Output
PL	Poland	Eurostat	Output
PT	Portugal	Eurostat	Output
RS	Republic of Serbia	Eurostat	Input
RO	Romania	Eurostat	Output
SK	Slovak Republic	Eurostat	Output
SI	Slovenia	Eurostat	Output
ES	Spain	Eurostat	Output
SE	Sweden	Eurostat	Output
CH	Switzerland	Eurostat	Output
TR	Turkey	Eurostat	Input
UK	United Kingdom	Eurostat	Output
USA	United States	OECD	Input