Part IV

Public expenditure on health: its growing importance, drivers and policy reforms to curb growth

SUMMARY

The title of Chapter IV is "Public expenditure on health: its growing importance, drivers and policy reforms to curb growth".

Firstly, the Chapter discusses the growing importance of public health care expenditure (HCE) both as a share of total government outlays and GDP. Past developments of HCE are reviewed with a double focus on historical trends and the more recent evolution since the 2008-2009 economic recession.

In the EU, public spending on health gradually increased from 5.7% of GDP in 1980 to about 8% in 2010. This upward trend in the HCE-to-GDP ratio includes periods of faster and slower growth, showing a pattern of staggered increase over time. Although within a general upward trend, expenditure levels differ substantially across countries, measured either in per capita nominal terms (PPS adjusted) or as a share of GDP.

Following the 2008-2009 recession, when the HCE-to-GDP ratio went up in a large majority of EU Member States, largely reflecting unchecked growth in expenditure levels combined with a contraction of nominal GDP, 2010 shows a reduction in the HCE-to-GDP ratio, which is not only due to a return to GDP growth, but also to some containment in spending.

Although being too early to draw definite conclusions, most EU Member States have recently introduced reforms that are mainly focused on generating immediate savings, possibly not paying enough attention to medium and longer term goals, such as improving the efficiency and quality of health expenditure. In this context, the average decline in 2010 across the EU of expenditure on health promotion and disease prevention – while generating short term savings – could turn out to be counterproductive if average health status eventually deteriorates, bringing with it a rise in future health spending.

Secondly, the part evaluates spending on key areas of public provision of health services and their role in the dynamics of total expenditure growth across the EU. Traditionally, hospital care takes the highest share in spending (approximately 41%), followed by ambulatory care (25%), and pharmaceuticals (14%). Over time, these shares have remained nearly unchanged across the EU, despite the much stated consensus among researchers and policy makers that moving health care out of the resource intensive hospital sector towards more cost-effective primary and ambulatory care services, and providing a bigger role for disease prevention and health promotion can improve the value for money of public health care funding. An example of the failure in shifting significantly resources across major spending areas to improve overall efficiency is that despite the substantial decrease in the capacity of hospital beds in recent years, the expenditure share of hospital care has not declined though.

Thirdly, drawing on health care research, the Chapter reviews empirical findings regarding the main drivers of HCE. Overall, empirical studies show that demographic factors, such as population ageing, have had a second order impact on expenditure growth compared with other drivers, such as income, technology, relative prices, and policies and institutional settings.

Based on the health literature, an econometric model is estimated to explain past trends of HCE and make long term projections. The model specification retained fits well with the European Policy Committee-European Commission (EPC-EC) methodology to project long term age related costs, because the macroeconomic variables needed to project future public health expenditure are available in the long term age related projections of the EPC-EC.

Three scenarios for the HCE-to-GDP ratio up to 2060 are presented and then results are compared with other projections, such as from the OECD, IMF, and the EPC-EC 2012 Ageing Report. Overall, the projection scenarios based on the PFR 2013 methodology are by in large equivalent to OECD's corresponding ones, and IMF's, but are significantly above the EPC-EC long term health projections carried out in the framework of the 2012 Ageing Report, basically because the latter do not consider residual growth or a time drift accounting for the effect of omitted variables, such policies and the institutional setting.

Projections carried out under the PFR 2013 methodology represent an acute reminder of the need to proceed with the efforts to curb HCE growth and improve the efficiency of health

systems. In fact, in the absence of additional control measures, projection outcomes suggest on average a near doubling of the HCE-to-GDP ratio across the EU between 2010 and 2060.

Fourthly, a taxonomy of recently implemented health reforms is presented, suggesting that reforms are mainly focused on generating savings and improving the financing side. Few EU Member States have been active in structural reforms directed at generating efficiency gains. However, as laid out in the analysis, there seems to be ample scope for further reforms improving the performance of health care systems and their long term financial sustainability.

Concluding, since the 2008-2009 crisis the focus of reforms has been on generating savings and improving the financing side, with few reforms aiming at improving the value for money of public health care. Emergency measures on the financing and cost-saving side may be a necessary condition to improve the fiscal positions of government in times of economic crisis. However, they are not a sufficient condition for securing long term sustainable improvements in the value for money of public health care services.

In view of future fiscal challenges related to rising health care costs, EU Member States will have to strengthen reform efforts in the coming years, and broaden their scope to cover also efficiency and quality issues.

1. INTRODUCTION

This part studies the growing importance of public spending on health. It describes past and recent trends in public health spending, compares it with other items of public spending and looks in more detail at the evolution of health spending during the years of the economic crisis (Chapter IV.1). It then explains which areas of healthcare provision, such as hospital and ambulatory care, may be responsible for the observed increase in expenditure. It further discusses the underlying demographic and non-demographic drivers of health expenditure growth. This prepares the ground for projecting future levels of spending (Chapter IV.2). Using econometric methods, the role of demographic and non-demographic drivers of health expenditure is analysed, and long-run projections of health expenditure up to 2060 are presented. Finally, given the current and future fiscal pressures, health policy reforms are discussed, which could improve the fiscal sustainability and the performance of health care systems (Chapter IV.3). Further, an attempt is made to assess whether and to what extent health care policy reforms implemented in recent years, notably as a response to the economic crisis, can be expected to increase the efficiency and cost-effectiveness in the health sector and to control future health expenditure growth. Chapter IV.4 concludes.

2. THE EVOLUTION OF HEALTH EXPENDITURE

2.1. THE EVOLUTION OF HEALTH EXPENDITURE

2.1.1. Past and recent trends in health expenditure

Total (public and private) expenditure on health in the EU absorbs a significant and growing share of Member States' resources, having grown from an average of about 7.1% of GDP in 1980 to 10.3% in 2010. ([89]), ([90]) Public expenditure on health reached an EU average of about 7.8% of GDP in 2011, having increased from about 5.7% in 1980. ([91]) In almost all EU Member States, public expenditure on health covers a large majority of total expenditure, averaging 77% in the EU in 2010. Private expenditure often has a supplementary character, concentrated on treatments that are not considered to be necessary for saving human life (dentistry, plastic surgery, etc.). and on some pharmaceutical goods. The share of private expenditure on total expenditure has increased from roughly 20% in 1980 to about 23% in 2010.

Table IV.2.1 shows significant differences in expenditure across EU Member States. Looking at the latest data available (2009-2012), the share of public expenditure on health as percentage of GDP ranged from 3.3% in Cyprus to over 9.4% in Denmark. Generally, expenditure on health is significantly lower in the Member States that accessed the EU after 2004, although the observed differences between countries may be narrowing.

While public expenditure on health, both as a share of GDP and in per capita terms, have risen markedly over the past decades (Table IV.2.1 and Graph IV.2.1) different periods can be identified with regards to the evolution of expenditure-to-GDP ratios. A first period comprises the 1960s and 1970s when public expenditure on health as a percentage of GDP grew particularly fast because many Member States substantially increased the share of the population covered by publicly funded health services and goods either via national health services or compulsory social health insurance schemes. This coverage extension was complemented in the following decades with continued progress in medical knowledge and technology resulting in new or improved treatment possibilities, and which may have contributed to the recent general upward increase in health expenditure.

A second period refers to the 1980s, when expenditure growth slowed down, as a result of increasing efforts of budgetary consolidation, together with levelling off effects due to the near completion process of broadening the coverage of health systems. This resulted in the near stabilisation of the public health expenditure-to-GDP ratio in the second half of the 1980s up to 1990, when the upward trend in the expenditure ratio picked up again. Between the late 1990s and the early 2000s, the rise in the expenditure ratio slowed down again, but was then followed by another period of increase, albeit at a slower pace. Since 2000, two periods can be distinguished for the public expenditure-to-GDP ratio: a fairly stable period in the first half of the decade, followed by an accelerated increase from 2006 up to 2009. In both 2010 and 2011, the expenditure-to-GDP ratio has decreased.

A closer look at annual nominal growth rates for the EU as a whole during the last decade reveals (Graph IV.2.2) that both total (public and private) and public expenditure on health grew faster than prices (using the GDP deflator, see also Graph IV.2.4) and also faster or largely in line with nominal GDP up to 2007. While the pace of health expenditure growth decelerated in 2008 and 2009,

([89]) The OECD definition of expenditure on health is used. This defines total expenditure on health as the sum of expenditure on activities that – through application of medical, paramedical, and nursing knowledge and technology – has the goals of: promoting health and preventing disease; curing illness and reducing premature mortality; caring for persons affected by chronic illness who require nursing care; caring for persons with health impairments, disability, and handicaps who require nursing care; assisting patients to die with dignity; providing and administering public health; providing and administering health programmes, health insurance and other funding arrangements.

([90]) The terms health spending, health expenditure or expenditure on health are used interchangeably in this report.

([91]) Note that data on health expenditure used in this contribution comes from international datasets: EUROSTAT, OECD health data and WHO health for all. For all countries with the exception of Ireland, Greece, Malta, United Kingdom and Italy (the latter up to 2009), expenditure data in this section are based on the so-called System of Health accounts and the joint EUROSTAT/OECD/WHO questionnaire.

Table IV.2.1: **Past trends in total and public expenditure on health in EU Member States 1980-2012**

	Total (public and private) expenditure on health as % of GDP										Public expenditure on health as % of GDP										
	1980	1990	2000	2006	2007	2008	2009	2010	2011	2012	1980	1990	2000	2006	2007	2008	2009	2010	2011	2012	
BE	6.3	7.2	9.0	9.6	9.7	10.1	10.9	10.5	:	:	:	:	6.1	7.1	7.0	7.5	8.1	7.9	8.0	:	BE
BG	:	5.2	6.1	7.2	7.3	7.3	:	:	:	:	:	5.2	3.7	4.1	4.2	4.2	:	:	:	:	BG
CZ	:	4.7	6.5	7.0	6.8	7.1	8.2	7.5	7.5	:	:	4.4	5.7	5.8	5.6	5.6	6.7	6.2	6.3	:	CZ
DK	8.9	8.3	8.3	9.6	9.8	9.9	11.5	11.1	:	:	7.9	6.9	7.3	8.4	8.4	8.6	9.8	9.4	:	:	DK
DE	8.4	8.3	10.3	10.6	10.4	10.5	11.6	11.6	11.3	:	6.6	6.3	8.3	8.1	8.0	8.2	9.0	8.9	8.7	:	DE
EE	:	:	5.3	5.1	5.4	6.1	7.0	6.3	5.9	:	:	:	4.1	3.7	3.9	4.7	5.3	5.0	4.7	:	EE
IE	8.3	6.1	6.3	7.5	7.5	8.7	9.9	9.2	8.9	:	6.7	4.3	4.6	5.7	5.9	6.7	7.3	6.5	6.0	:	IE
EL	5.9	6.6	7.9	9.7	9.7	9.7	10.6	10.2	9.1	:	3.3	3.6	4.8	6.0	5.9	6.1	7.0	6.4	5.9	:	EL
ES	5.3	6.5	7.2	8.4	8.5	9.0	9.5	9.6	9.3	:	4.2	5.1	5.2	6.0	6.1	6.5	7.2	7.1	6.8	:	ES
FR	7.0	8.4	10.1	11.0	11.0	11.2	11.9	11.6	11.6	:	5.6	6.4	8.0	8.7	8.7	8.4	9.0	9.0	8.9	:	FR
IT	:	7.7	8.1	9.0	8.7	9.1	9.3	9.3	9.2	9.2	:	6.1	5.8	6.9	6.6	7.0	7.4	7.4	7.2	7.2	IT
CY	2.8	4.5	5.7	6.3	6.0	5.8	:	:	:	:	1.5	1.8	2.4	3.1	2.9	3.0	3.3	3.3	:	:	CY
LV	2.1	2.5	6.0	6.8	6.2	6.5	6.8	:	:	:	:	2.5	3.2	4.3	4.2	4.1	:	:	:	:	LV
LT	:	3.3	6.5	6.2	6.2	6.6	7.5	7.0	:	:	:	3.0	4.5	4.3	4.6	4.8	5.6	:	:	:	LT
LU	5.2	5.4	5.8	7.7	7.1	6.8	:	:	:	:	4.8	5.0	6.4	6.6	6.0	5.7	6.9	:	:	:	LU
HU	:	:	7.0	8.1	7.4	7.3	7.5	7.8	7.9	7.8	:	:	5.1	5.8	5.2	5.0	5.1	5.2	5.1	:	HU
MT	:	:	6.8	8.4	8.7	8.3	8.5	8.7	9.7	:	:	:	4.9	6.4	5.8	5.8	5.5	5.7	:	:	MT
NL	7.4	8.0	8.0	9.7	9.7	9.9	12.0	12.0	11.9	:	5.1	5.4	5.0	7.4	7.3	7.4	:	:	:	:	NL
AT	7.4	8.3	9.9	10.3	10.3	10.5	11.1	11.0	10.8	:	5.1	6.1	7.6	7.7	7.8	8.0	8.5	8.4	8.2	:	AT
PL	:	4.8	5.5	6.2	6.4	7.0	7.4	7.0	6.9	:	:	4.4	3.9	4.3	4.5	4.9	5.2	5.0	4.8	:	PL
PT	5.3	5.9	8.8	9.9	10.0	10.2	10.8	10.7	10.2	:	3.3	3.7	6.2	6.7	6.7	6.7	7.2	7.1	6.7	:	PT
RO	:	2.9	5.2	5.1	5.2	5.4	5.7	:	:	:	:	2.9	3.6	4.1	4.3	4.5	4.5	:	:	:	RO
SI	4.4	5.6	8.3	8.2	7.8	8.3	9.3	9.0	8.9	8.8	4.4	5.6	6.1	6.0	5.6	6.1	6.8	6.6	6.5	6.4	SI
SK	:	:	5.5	7.3	7.7	7.8	9.1	9.0	7.9	:	:	:	4.9	5.0	5.2	5.4	6.0	5.8	5.6	:	SK
FI	6.3	7.7	7.2	8.3	8.2	8.4	9.1	8.9	9.0	9.1	5.0	6.3	5.1	6.2	6.0	6.2	6.9	7.2	6.8	6.9	FI
SE	8.9	8.2	8.2	9.1	8.9	9.2	10.0	9.6	9.5	:	8.2	7.4	6.9	7.3	7.3	7.5	8.1	7.7	7.7	:	SE
UK	5.6	5.9	7.0	8.5	8.4	8.7	9.8	9.6	9.4	:	5.0	4.9	5.5	6.9	6.9	7.2	8.2	8.0	7.8	:	UK
EU27	**7.1**	**7.3**	**8.6**	**9.4**	**9.3**	**9.6**	**10.5**	**10.4**	**10.2**	**:**	**5.7**	**5.8**	**6.6**	**7.2**	**7.2**	**7.3**	**8.1**	**8.0**	**7.8**	**:**	**EU27**
EU15	7.1	7.4	8.7	9.6	9.5	9.8	10.7	10.6	10.4	:	5.7	5.8	6.7	7.4	7.3	7.6	8.3	8.1	7.9	:	EU15
EU12	2.8	4.4	6.0	6.6	6.6	6.9	7.5	7.5	7.3	:	1.5	4.0	4.4	4.8	4.7	5.0	5.4	5.4	5.3	:	EU12

Note: §Total and public expenditure on health follows the OECD definition (also used by Eurostat and WHO for those Member States that use the system of health accounts (SHA)) and as such it includes expenditure on: Services of curative care + Services of rehabilitative care + Services of long-term nursing care + Ancillary services to health care + Medical goods dispensed to out-patients + Services of prevention and public health + Health administration and health insurance + Expenditure on services not allocated by function + Investment (gross capital formation) in health. Note that the figures on Germany cover the country before and after reunification, thus causing a break in the series, which should be taken into account when interpreting the results over time.
Source: OECD health data, Eurostat data and WHO Health for All database for health expenditure data. Eurostat data for public (government) expenditure using COFOG. EU and EA averages are weighted averages by either GDP or public expenditure where relevant and calculated by Commission Services

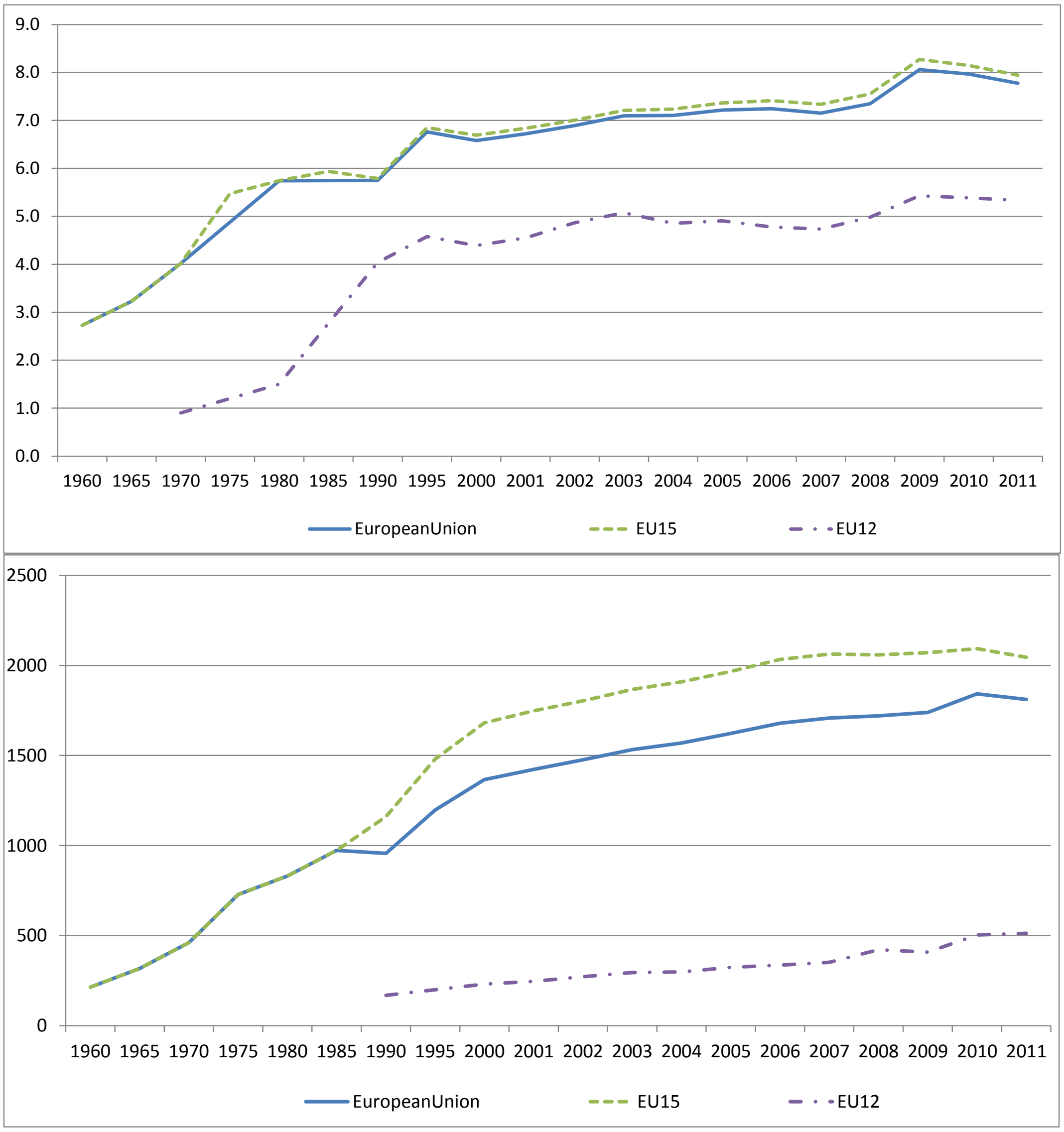
it remained far above inflation and nominal GDP growth, which turned negative in 2009. In 2010 and 2011, following the economic crisis of 2009, health expenditure grew at a slower pace than nominal GDP.

The overall relative low nominal increases in expenditure in 2010 and 2011 have contributed in addition to inflation and population growth to negative per capita real growth rates in public health expenditure in several Member States: Ireland, Greece, Portugal, Spain, United Kingdom, Estonia, Slovenia and Italy (Graph IV.2.3). At the EU level, the real growth rate of per capita public considerably slowed down in 2010 and turned negative in 2011, after having averaged 2.2% between 2003 and 2009. This decrease in expenditure seems especially large in those Member States with relatively high increases in nominal expenditure levels just prior to the crisis i.e. between 2003 and 2009. Thus, to a certain extent, growth rates in 2010 and 2011 may have rebalanced growth rates in previous years: Member States with high growth rates in 2003-2009 reverting towards low growth rates in 2010 and 2011, and vice versa.

Graph IV.2.4 shows that real public expenditure on health not only increased faster than real GDP and prices for most of the period1996 to 2011, but also grew faster than total government expenditure, (whose annual real growth rates, though positive, were mostly below real GDP growth rates). Exceptions are the years 2001 and 2010, when total government expenditure rose faster than public expenditure on health. As a consequence, the share of public health in government expenditure has risen from 12.3% in 1996 (11.5% in 1980) to almost 15% in 2011 (Graph IV.2.5).

Between 1996 and 2011, most categories of government expenditure (e.g. education, environment, and social protection) retained roughly constant shares in total expenditure. The rising share of health expenditure was partly compensated by a reduced share of general public

Graph IV.2.1: **Evolution of public expenditure on health as a share of GDP and as real expenditure per capita in the EU, 1960 - 2011**



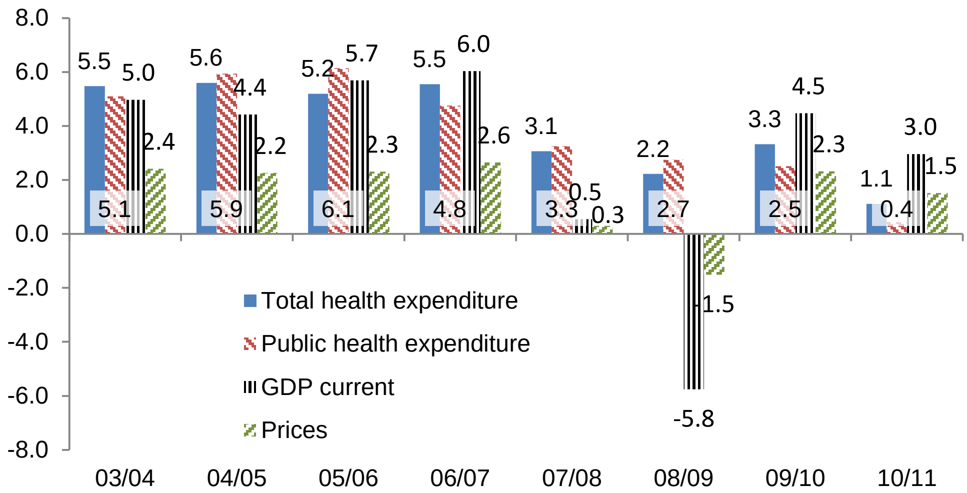
Note: The methodology used to compute health expenditure has changed over time so that there are breaks in the time series used to compute the graphs above. The most recent methodological change is the move to the OECD System of Health Accounts (SHA), a methodology introduced in 2000. Moreover, EU Member States are at varying stages in the process of implementing the SHA. As for the EU15, the geographic coverage also changed over time due to the reunification of Germany.
Source: Commission services; calculations based on Eurostat, OECD and WHO health data.

services. Public expenditure on public expenditure on health is now the second highest expenditure share with about 15%, after social protection has over time kept the highest public expenditure share with about 40%.

2.2. THE IMPACT OF THE CURRENT ECONOMIC CRISIS: A CLOSER LOOK

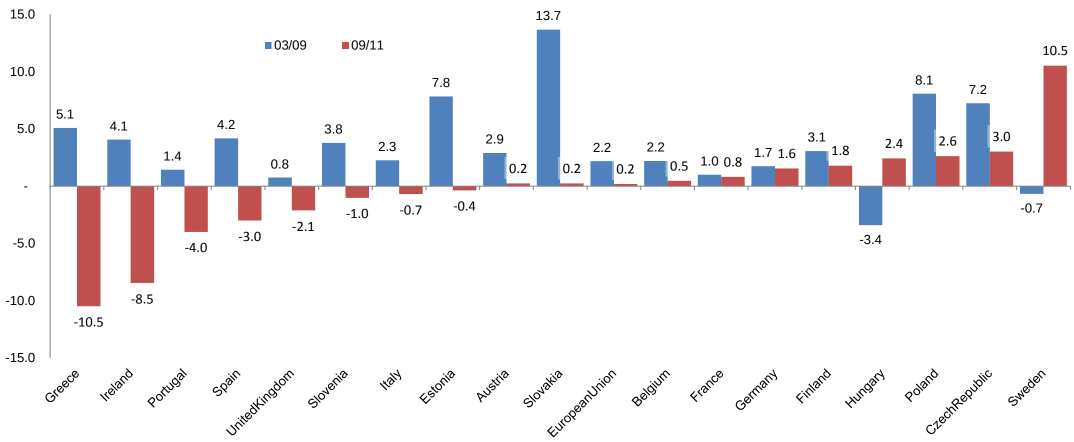
To understand the impact of the recent economic crisis, it is important to note that trends observed in

Graph IV.2.2: **Annual average growth rates in nominal total and public health expenditure in EU27, 2003 – 2011**



(1) See Table IV.2.1 for missing values
Source: Commission services calculations based on Eurostat, OECD and WHO health data.

Graph IV.2.3: **Annual average growth rates in real public health expenditure per capita, 2003-2009 and 2009-2011**



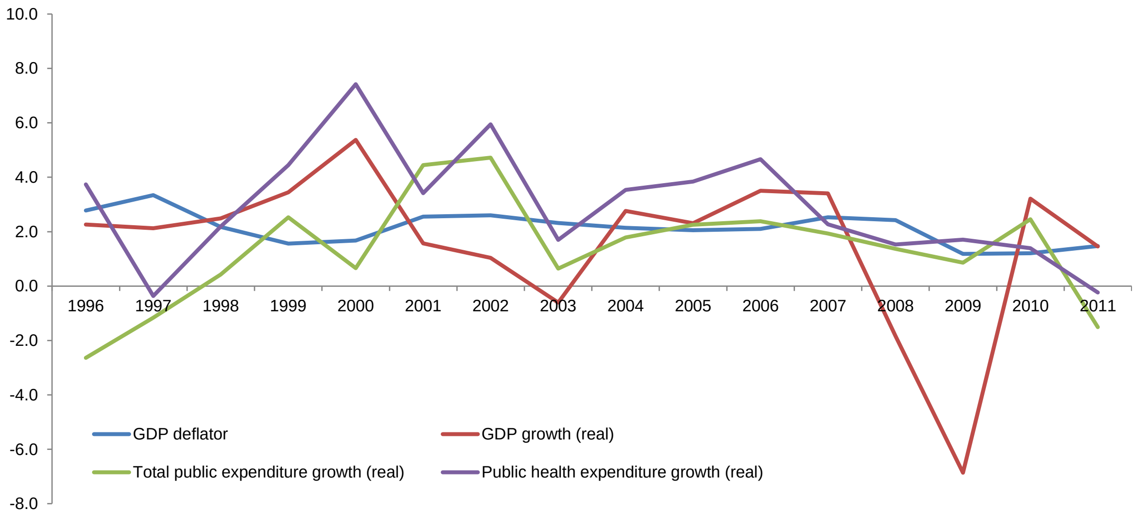
(1) Only for Member States with available data in 2003/2011.
Source: Commission services calculations based on Eurostat, OECD and WHO health data.

the expenditure-to-GDP ratio can be the result of fluctuations in any of its components, i.e. health expenditure or GDP. For example, the increase in public health expenditure as a percentage of GDP observed in the early 2000s was partly due to the economic slowdown observed at that time.

Likewise, the 2008-2009 increase in the expenditure-to-GDP ratios in the EU is strongly related to the economic downturn when GDP growth slowed down in 2008, and in some Member States even became negative in 2009.

In addition, some Member States maintained or even increased expenditure on health as part of their economic recovery programmes. In 2008, economic developments drove up the public health expenditure-to-GDP (HE-to-GDP) ratio in the EU by 0.1 pp. This reflects increases in many Member States (Table IV.2.1). The exceptions are Bulgaria, the Czech Republic, Malta and Portugal, where the HE-to-GDP ratio remained constant, and France, Latvia, Luxembourg and Hungary where the HE-to-GDP ratio marginally decreased. In Member States where GDP contracted in 2008, the

Graph IV.2.4: **Annual real growth rates of total government expenditure, public expenditure on health and GDP, 1996-2011**



Source: Commission services

increase in the HE-to-GDP ratio ranged between 0.2-0.4 p.p. in Denmark, Italy, Sweden and the United Kingdom to 0.8 p.p. in Ireland and Estonia (Table IV.2.1).

In 2009, GDP growth rates turned negative in most EU Member States (see Graph IV.2.6). For many Member States there was no immediate change in health policy to curb expenditure. Despite negative GDP growth rates, many Member States continued to register increases in health expenditure. In another group of Member States, expenditure was reduced though by less than the fall in GDP (see Member States with thick blue bars below the zero line see Graph IV.2.6).

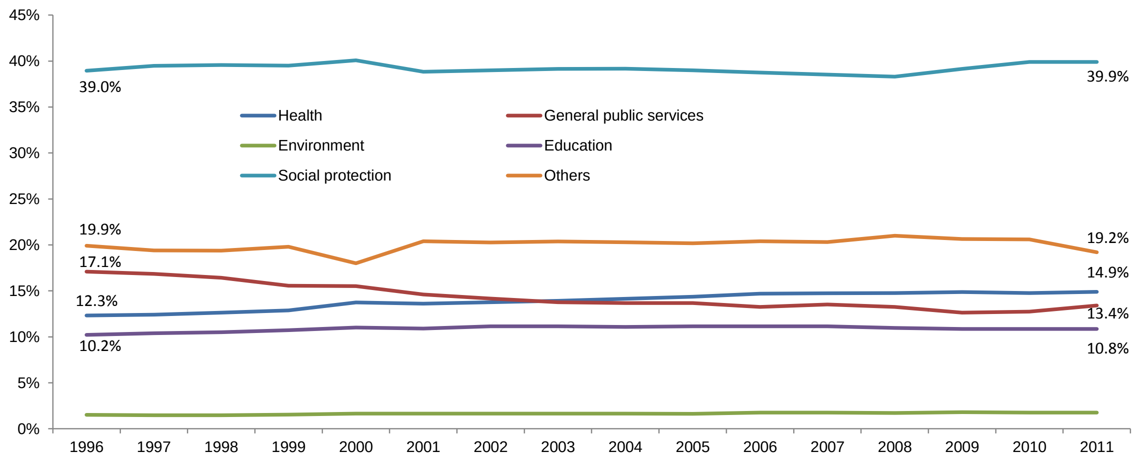
As a result, from 2008 to 2009, the HE-to-GDP ratio increased in all Member States for which there are data available, and in many cases by a considerable margin. The exceptions are the Netherlands and Romania, where the expenditure ratio remained constant, and Malta where it decreased by 0.3 p.p. (Table IV.2.1). Increases in the HE-to-GDP ratio ranged from 0.3 p.p. in Cyprus to over 1.0 p.p. in the United Kingdom, the Czech Republic, Luxembourg and Denmark (Table IV.2.1).

The economic crisis of 2009 was followed by a period of budgetary adjustment associated with the need to reduce large government deficits (and the accumulation of government debt) and to put public finances on sustainable paths. Consequently, in many EU Member States constraints have been placed on various areas of public policy, affecting both the provision and funding of health goods and services in the short to the medium term.

As part of this process, and since 2010, many Member States have undertaken or planned reforms aimed at adapting the financing and generating savings through efficiency gains (see Section IV.3.2). Several Member States (see Member States with red thick bars below the zero line in Graph IV.2.7) appear to have been successful in reducing expenditure growth in health. This contributed to the observed reduction in the HE-to-GDP ratio in 2010 and 2011 (as well as in per capita health expenditure in 2011 as shown above). In Greece and Ireland, a decrease in nominal expenditure levels was registered in 2010 and 2011; although in these Member States - as shown above – such reduction had been preceded by an above average growth in expenditure levels in previous years.

In some other Member States, which registered GDP growth in 2010 commonly after large contractions in 2009 (e.g. Sweden, Poland, the United Kingdom, Malta, Hungary, Estonia and Lithuania), this was accompanied by rises in health expenditure, though at a slower pace than GDP

Graph IV.2.5: **The shares of health and other public expenditure categories within total government expenditure, 1996-2011**



Note: category "Others" is the sum of spending on defence, order and safety, economic affairs and housing and recreation, culture and religion.
Source: Commission services calculations based on Ameco and Cofog data.

growth (see Member States with the red thick bars above the zero growth line in Graph IV.2.6). As a result, the HE-to-GDP ratio decreased in all Member States except France, Italy and Cyprus where it remained constant and in Malta, Hungary and Finland where it increased (Graph IV.2.7). In 2011, as GDP growth exceeded the nominal growth in health expenditure, HE-to-GDP ratios declined further in most Member States with available data, except for Belgium and the Czech Republic.

Note that the impact of the economic crisis on the HE-to-GDP ratio cannot yet be fully assessed given the lag in data availability for 2012. Comparable international databases (OECD, Eurostat, WHO) report expenditure data normally with a two-year lag from the current year, i.e. most recent data for most EU Member States refer to either 2010 or 2011.

2.3. AREAS CONTRIBUTING TO GROWTH IN HEALTH EXPENDITURE

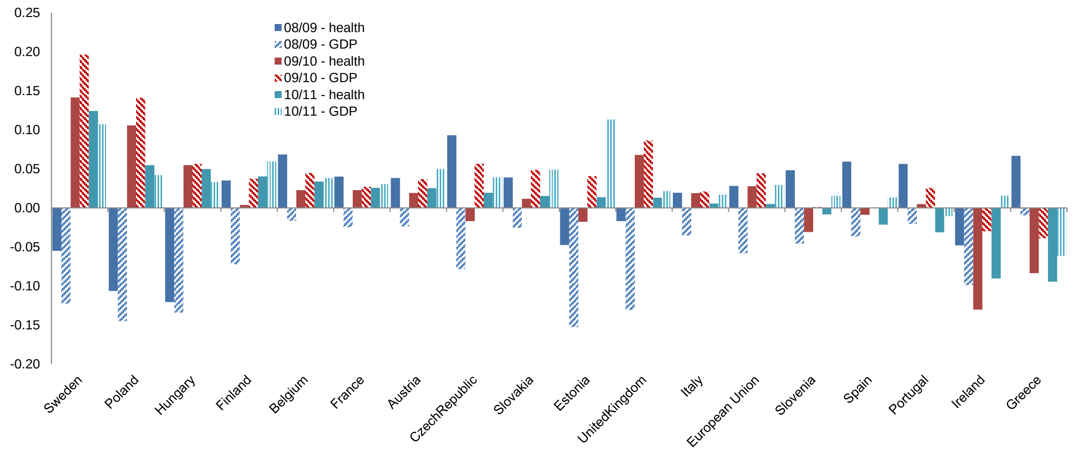
It is now useful to assess whether the increase in total health expenditure shown in section IV.2.2 is uniform across the different categories of health expenditures or if it is concentrated in only a few. This analysis serves different purposes. Firstly, it can help revealing the priority areas of recent public policy action on health expenditure. Secondly, it allows discussing/identifying potential areas for implementing policies that could generate efficiency gains. The analysis carried out in this section complements the assessment of the main expenditure drivers done in Chapter IV.2. Thirdly, it allows discussing to what extent reforms undertaken in the wake of the economic crisis, and discussed at length in section 3 of this Chapter, can indeed be expected to substantially improve the value for money of public health funding.

Traditionally, hospital care takes the highest share in spending (approximately 41%), followed by ambulatory care ([92]) (25%), pharmaceuticals ([93])

([92]) Ambulatory care may refer to primary and secondary care. Primary care is generally understood as work of physicians, which are the initial point of consultation for patients in a health system (usually general practitioners). Secondary care refers to work by medical specialists (e.g. cardiologists, urologists). Primary care is usually to a much greater extent provided outside of the hospital system than secondary care. This section focuses on primary care.

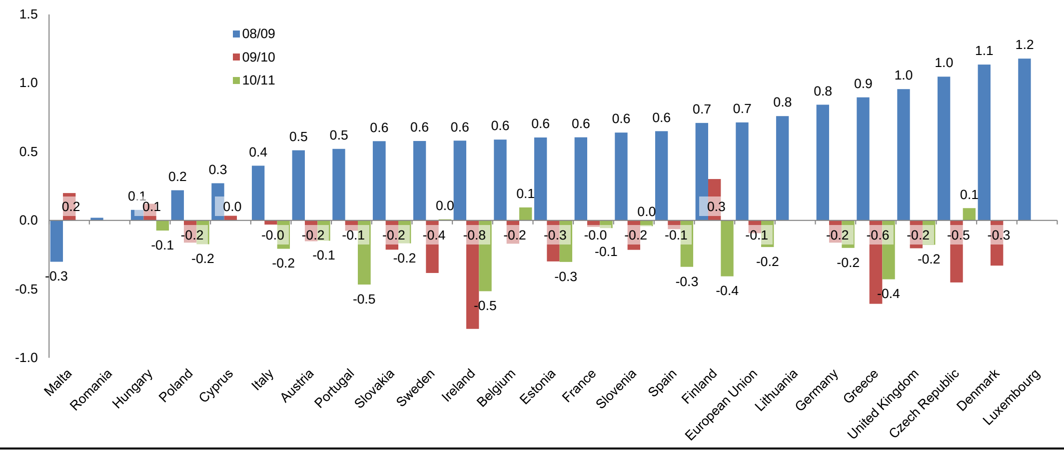
([93]) Pharmaceuticals include extemporaneous medicinal preparations, originator and generic medicines, serums and vaccines, vitamins and minerals and oral contraceptives. Pharmaceuticals are consumed in the inpatient (mostly hospitals) and outpatient (mostly pharmacies) sector. However, comparable cross-country data on pharmaceutical spending is not available for the inpatient sector for most of the EU Member States. Consequently, most of the data refers to expenditure on pharmaceuticals taken in outpatient settings (i.e. not during hospitalisation). Pharmaceutical spending, as described here, corresponds to System of Health Accounts category HC51:" Pharmaceuticals and other medical non-durables".

Graph IV.2.6: **Annual average nominal growth rates in public health expenditure and GDP, 2008-2009, 2009-2010 and 2010-2011**



(1) Only for Member States with available data in 2008-2011.
Source: Commission services calculations based on Eurostat, OECD and WHO health data.

Graph IV.2.7: **Changes in public health expenditure to GDP ratio in pp. of GDP, 2008-2009, 2009-2010 and 2010-2011**



Source: OECD health data 2013, Eurostat data and WHO Health for All database for health expenditure data. EU averages are weighted averages and calculated by Commission Services.

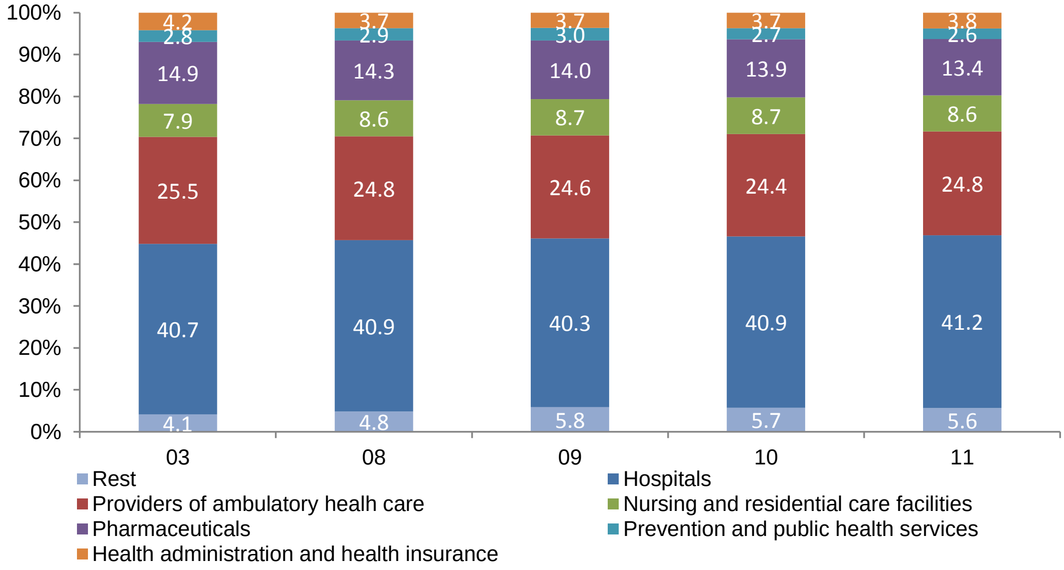
(14%), nursing and residential care (9%), health administration and insurance (4%) and prevention and public health services (3%).

Over time, these shares have changed slightly at the EU level, either increasing (nursing and residential care), remaining constant (hospitals and prevention) or decreasing (health administration, ambulatory care and pharmaceuticals) (Graph IV.2.8).

Graph IV.2.9 shows that between 2003 and 2011, public health expenditure grew differently across major areas.

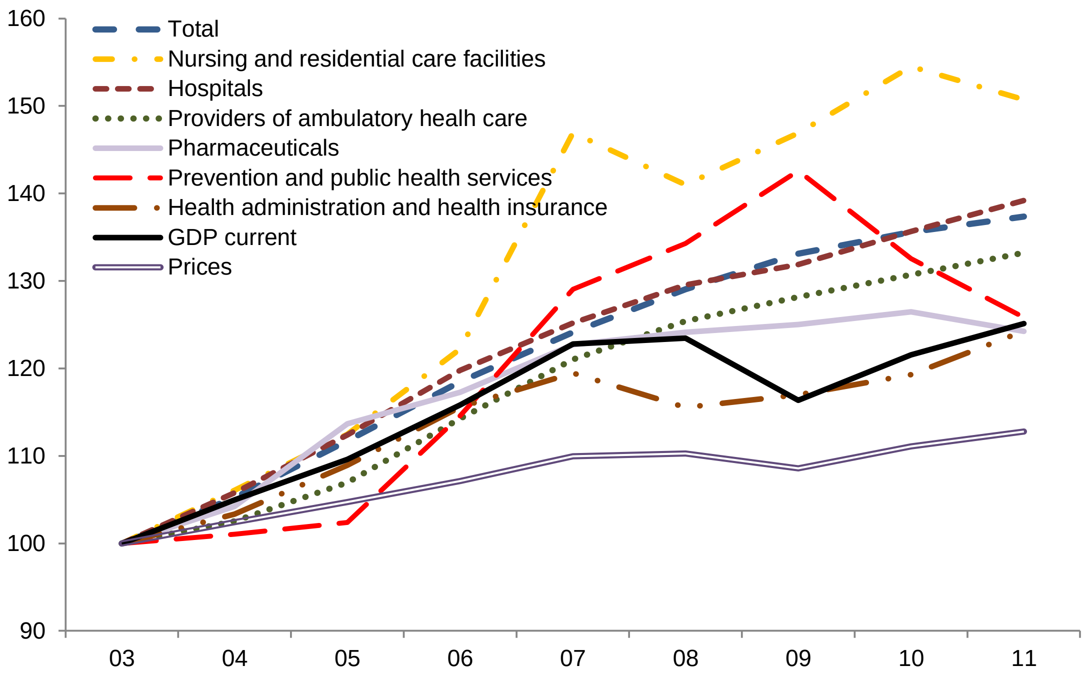
Public expenditure on nursing and residential care facilities has seen the highest increase of around 50% between 2003 and 2011. This reflects the growing supply of nursing care services and facilities, due to the growing demand of the aged

Graph IV.2.8: **Distribution of public health expenditure by areas in the EU, 2003 to 2011**



Source: OECD health data 2013, Eurostat data and WHO Health for All database for health expenditure data. EU averages are weighted averages and calculated by Commission Services.

Graph IV.2.9: **Evolution of public health expenditure by main areas (2003 = 100) in the EU, 2003-2011**



(1)The graph shows the evolution by "indexing" the expenditure (in current prices) in each year to that of 2003. The graphs again show that total and public expenditure on health have increased faster than GDP and prices throughout the decade
Source: OECD health data 2013, Eurostat and WHO Health for All database for health expenditure data. EU averages are weighted averages and calculated by Commission Service

population for long-term care services having increased faster than total public expenditure on health (37%). Expenditure on the area of ambulatory care shows a steady increase over time, but in line with the increase in total public expenditure on health. Expenditure on disease prevention, health promotion and public health services has also grown fast until 2009, before 2010 also due to expenditure taken to address the pandemic flu outbreak, but has seen a substantial decrease since 2010. Pharmaceutical spending was growing at a slower pace than total expenditure since 2006, and has stabilised in 2011. Finally, expenditure on health administration and insurance was the item that has increased proportionally less with expenditure levels in 2010 more or less at the same level of 2007 and small increase only in 2011.

Graph IV.2.8 shows that hospital care accounts for about 40% of total expenditure, followed by ambulatory care and pharmaceutics with around 25% and 14%, respectively. A breakdown of total expenditure growth between 2003 and 2011 suggests that hospital care was the main area of expenditure growth, ([94]) due to its relative size in total expenditure and its growth rate, which has been higher than total expenditure growth: Hospital care accounts for 37% of expenditure growth, followed by ambulatory care (30%), nursing and residential care (15%), spending on pharmaceuticals (10%), health administration (5%) and health prevention (3%).

The above analysis suggests that the expenditure share of hospital care has not reduced its importance in terms of total expenditure in the first decade of the 21st century. However, this masks significant changes in the provision of health services over time (Box IV.2.1), such as the decreasing number of acute care beds, the shortening in the average length of stay of hospital inpatients, and the rising amount of day case discharges from hospitals.

Still, all these changes did not translate into substantial shifts in expenditure shares across the various health expenditure areas. This is despite the much stated consensus among researchers and policy makers that moving health care out of the resource intensive hospital sector towards more cost-effective primary and ambulatory care services, and providing a bigger role for disease prevention and health promotion can improve the value for money of public health funding (European Commission-EPC, 2010b).

Based on this analysis, it is reasonable to assume that modes of provision of health services have not changed in line with best practices advocated in the economic literature i.e. the policy focus has not changed substantially. Or else, that significant changes in the provision have effectively taken place, but have largely been offset by rising costs due to technological progress and low productivity growth in the health sector. The analysis indicates that there remains ample scope for further reforms, such as reducing the focus on hospital care, incentivising the provision of primary care and stronger focus on services of disease prevention and health promotion. It will be important to understand if reform measures undertaken during or in the aftermath of the economic crisis target these areas.

2.4. EXPLAINING THE UNDERLYING DRIVERS OF HEALTH EXPENDITURE

As discussed above, during most of the second half and especially the last decades of the 20th century, public health expenditure grew faster than national income in all EU Member States. Within this general trend, spending levels between countries vary substantially, measured either in per capita nominal terms (adjusted for PPS) or as a share of GDP (Section IV.2.1). Many studies have attempted to explain the underlying drivers of the growth in health expenditure for the purpose of explaining cross-country differences in expenditure patterns and in order to project future expenditure levels (Chapter IV.2). Drawing on health research, the following discussion summarises the hypotheses and empirical findings that have been put forward to explain expenditure growth.

It is common in the literature to differentiate between demographic (population size, age structure, and health status) and non-demographic factors (income, health technology, relative prices, and institutional settings and policies).

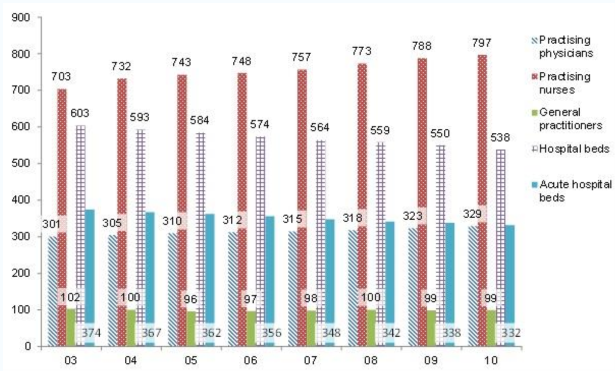
([94]) Although the share of one-day surgery went up.

Box IV.2.1: **The changing landscape of public health provision.**

The evolution of health expenditure is naturally linked to the use of resources, such as capital and labour. Being a highly labour-intensive sector, the number of practicing nurses and physicians in the EU has increased constantly since 2003, reaching 797 nurses and 329 physicians per 100 000 inhabitants in the EU (Graph IV.2.10). At the same time, the number of general practitioners (GPs) has slightly decreased since 2003 from 102 to 99 GPs per 100 000 inhabitants. This may to a certain degree reflect the growing degree in medical specialization, accentuating the need for specialists rather than generalists. However, GPs constitute an important element of every health system, figuring as gatekeepers to further levels of care and being a key element of cost-effective health provision (See section IV.3.1). Insufficient availability of GPs may drive up costs in other parts of health systems, such as in ambulatory specialist or inpatient hospital care (European Commission-EPC 2010).

The number of all hospital beds, i.e. including curative (acute), psychiatric and long-term care beds, has been decreasing over time, reaching an average of 538 beds per 100 000 inhabitants in the EU (Graph IV.2.10). The decrease is to a large degree due to the decreasing number of acute hospital beds from 374 to 332 beds per 100 000 inhabitants. Despite the substantial decrease in the capacity of hospital beds, the share of expenditure on hospitals has not been reduced. This shows that policy reforms focusing on reducing hospital bed capacity are clearly not sufficient to induce a shift in the use of total resources between the main health expenditure areas.

Graph IV.2.10: **Physicians, nurses and hospital beds per 100 000 inhabitants in the EU, 2003 to 2010**



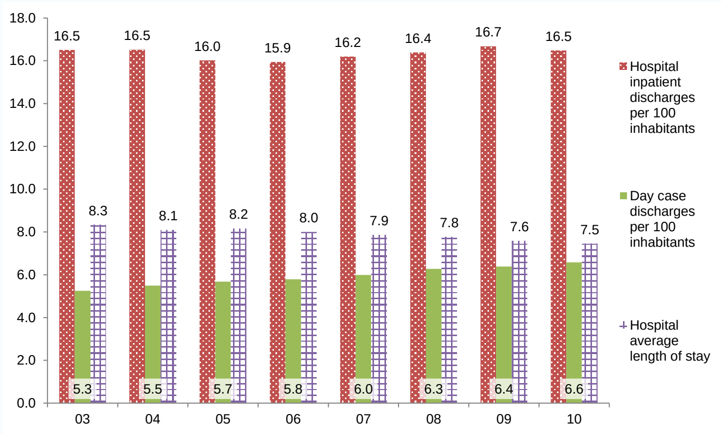
(1) EU averages are weighted averages and calculated by Commission Services.
Source: OECD health data 2010, Eurostat data and WHO Health for All database for health expenditure data.

While the number of beds decreased, the output of hospitals increased at the same time, mainly with the rising amount of day case discharges from 5.3 to 6.6 discharges per 100 inhabitants from 2003 to 2010 (Graph IV.2.11). More day case discharges became feasible mainly due to changes in medical technology, allowing for a faster recovery of patients and allowing for shorter stays at the hospitals, but were also related to changes in payment systems for hospitals services, incentivising shorter lengths of stay. This has helped containing the increase in inpatient discharges, which have remained relatively stable at around 16.5 discharges per 100 inhabitants. Medical progress and changes in payment systems have reduced the average length of stay in acute care hospitals from 7.6 to 6.3 days per patient throughout 2003 to 2010 (reported only, without graph). This translates into the reduction of the average length of stay in all types of hospitals, which went down from 8.3 to 7.5 days per patient in the same time period.

(Continued on the next page)

Box (continued)

Graph IV.2.11: **Hospital discharges and average length of stay in hospitals in the EU, 2003 to 2010**



(1) EU averages are weighted averages and calculated by Commission Services
Source: OECD health data 2012, Eurostat data and WHO Health for All database for health expenditure data.

Demographic factors

Population size and age structure

Expenditure on health naturally depends on the number of people in need of health care. This is determined by factors such as population size and the age composition. Expenditure is perceived to increase considerably at older ages, as elderly people often require costly medical treatment due to multi-morbidities and chronic illnesses. Improvements in life-expectancy may therefore lead to increases in health expenditure if not accompanied by improvements in health status.

Health status

However, the relation between life-expectancy and health expenditures is more complex, because it is also influenced by proximity to death. According to the “red herring” hypothesis (Zweifel et al., 1999), age and health expenditure are not related once remaining lifetime (proximity to death) is taken into account. Zweifel et al. (1999) show that the effect of age on health costs is not relevant during the entire last two years of life, but only at the proximity of death does health expenditure rises significantly. Therefore, improvements in life-expectancy due to decreases in mortality rates may even reduce expenditure on health. Empirical studies have partially confirmed this hypothesis. ([95]) When controlling for proximity to death, age per se plays a less important role in explaining health expenditure increases. The extent to which living longer leads to higher costs seems to depend largely on the health status of the population. If rising longevity goes hand in hand with better health at older ages, health needs will decline and this may drive down health expenditure (Rechel et. al. 2009). Three competing hypotheses have been proposed for the interaction between changes in life-expectancy and the health status. According to the "expansion of morbidity hypothesis", reductions in mortality rates are counterbalanced by rises in morbidity and disability rates (Olshansky et al., 1991). The "compression of morbidity hypothesis" claims that bad health episodes are shortened and occur later in life (Fries, 1989). The "dynamic equilibrium theory" suggests that decreases in mortality rates and in the

([95]) For an overview of the literature see Karlsson and Klohn (2011).

prevalence of chronic diseases are broadly offset by an increase in the duration of diseases and in the incidence of long term disability rates (Manton, 1982). There is so far no empirical consensus on which of these three hypotheses is better equipped to explain health expenditure developments. ([96])

Non-demographic factors

Income

Income is another key determinant of health costs (Gerdtham and Jönsson, 2000). A priori, it is unclear whether health expenditure is an inferior, a normal or a superior good, i.e. it is the income elasticity of health demand lower, equal or higher than one? As in the EU a high share of health expenditure is covered by public health insurance schemes, the individual income elasticity of demand is low. At the same time, increases in insurance coverage have strengthened the link between national income and aggregate demand for health services, through the implicit softening of budgetary constraints. In fact, income elasticity tends to increase with the level of aggregation of the data, implying that health expenditure could be both "an individual necessity and a national luxury" (Getzen, 2000). Maisonneuve and Martins (2006) suggest that the high income elasticities (above one) often found in macro studies may result from the failure to control for price and quality effects in econometric analysis. More recent studies, tackling some methodological drawbacks of previous ones (e.g. related to omitted variables and/or endogeneity bias), estimate income elasticities of health demand of around one or below (Azizi et al., 2005; Acemoglu et al., 2009). ([97]) Estimates of income elasticities provided in Chapter IV.2 confirm this finding.

Relative prices

Baumol's (1967) seminal "unbalanced growth model" provides a simple but compelling explanation for the observable rise in health expenditure in the last decades. This model assumes divergent productivity growth trends between "stagnant" (personal) services and a "progressive" sector (e.g. manufacturing and agriculture). Due to technological constrains (e.g. difficulty in automating processes), productivity growth is largely confined to the "progressive" sector. Assuming that wages grow at the same rate in the "stagnant" and "progressive" sectors of the economy, then unit labour costs and prices in the "stagnant" sector will rise relative to those in the "progressive" sector. What will happen to the demand for "stagnant" sector products depends on their price elasticity. If it is high, such activities will tend to disappear (e.g. craftsmanship), but if those products are a necessity with low price elasticities (e.g. health, education), its expenditure-to-GDP ratio will trend upwards (Hartwig, 2011; Baumol, 2012).

Using US data, Nordhaus (2008) confirmed Baumol's hypothesis of a "cost-price disease" due to slow productivity growth in labour intensive sectors, namely industries with relatively low productivity growth ("stagnant industries") show percentage-point for percentage-point higher growth in relative prices. Using a panel of 19 OECD countries, Hartwig (2008) finds robust evidence in favour of Baumol's hypothesis that health expenditure is driven by wage increases in excess of productivity growth in the whole economy.

Technological advances in medical treatments

In the past decades, health expenditure has been growing much faster than what would be expected from changes in demography and income. Many studies claim that the gap is filled by technologic advances in the health sector. Innovations in medical technology allow for expanding health care to previously untreated medical conditions and are believed to be a major driver of health expenditure. Smith et al. (2009) suggest that between 27% to 48% of health expenditure since 1960 is explained by innovations in medical technology. Earlier studies estimated that about 50% to 75% of increases in total expenditure were driven by technology (Newhouse, 1992; Cutler, 1995; Okunade and Murthy, 2002; and Maisonneuve and Martins, 2006).

Cutler (2004) argues that technological advances in medical sciences have generated both far-reaching advances in longevity and a rapid rise in costs. Chandra and Skinner (2011) attempt to better understand the links between technological

([96]) See for e.g. the Global Forum for Health Research (2008).
([97]) For a review of the literature on income elasticity estimates see Annex 3 in Maisonneuve and Martins (2013).

progress in health and its impact on costs and the effectiveness of treatments. They rank general categories of treatments according to their contribution to health productivity, defined as the improvement in health outcome per cost. Within a model framework, they propose the following typology for the productivity of medical technology: firstly, highly cost-effective innovations with little chance of overuse, such as anti-retroviral therapy for HIV; secondly, treatments highly effective for some but not for all (e.g. stents); and thirdly, "grey area" treatments with uncertain clinical value such as ICU days among chronically ill patients.

Regulations

Another important dimension of public health expenditure is the regulatory settings and policies on the provision and financing of health care. Regulations may set budgetary constraints, define the extent of public health coverage, and provide behavioural rules and incentives for providers and payers aimed at the financial or medical quality of outcomes. Jenkner et al. (2010) suggest that reliance on market mechanisms ([98]) and the stringency of budgetary caps on expenditure are negatively related to growth in public expenditure on health, while intensity of regulations and degree of centralisation are positively related to growth in public health expenditure.

Summing-up

Overall, empirical studies show that demographic factors, such as population ageing, have had a positive impact on expenditure growth, but rather of a second order, when compared with other drivers, such as income, technology, relative prices and institutional settings. A major example of the importance of non-demographic factors is the expansion of population coverage of health insurance schemes, which by now has largely been completed in most EU Member States.

Chapter IV.2 provides further empirical estimates of the relative importance of non-demographic versus demographic factors in explaining expenditure growth. These estimates are later used to project expenditure growth in a long term perspective up to 2060, indicating a mounting fiscal pressure from projected future increases in the HE-to-GDP ratios and the resulting need for cost-containment policies.

In summary, a rising share in the public HE-to-GDP ratio is observed over time. A general upward trend in the HE-to-GDP ratio includes periods of faster and slower growth, showing a staggered increase over time (Section IV.2.1). Although being too early to draw definite conclusions, an "pause" in a rising trend is observed in the follow-up to the economic crisis, albeit differing across Member States. Following 2008 and 2009, where the HE-to-GDP ratio went up for a great majority of countries, 2010 shows a reduction in the expenditure ratio which is not only due to the GDP expansion but also to some containment in health expenditure growth (Section IV.2.2). ([99])

Such increases in the expenditure share of HE have been accompanied by a rise in the fiscal burden. Given limited government resources, health may have already crowded out significantly other government outlays (Section IV.2.1). Given the bleak prospects implied in the projections for future public HE-to-GDP ratios (see Chapter IV.4), this raises important issues as to how public expenditure on health will be financed and/or whether other public expenditure trade-offs will need to be made, *inter alia*, involving the adequate provision of health services and goods both in terms of quantity and quality.

Notably, (past) expenditure trends driven by growing demand do not appear to have mainly resulted from demographic changes. Instead, they appear to have largely been driven by policies enlarging the coverage by public health insurance schemes of the population, by technological trends,

([98]) In Jenkner et al. (2010), "market mechanisms" is a factor score resulting from a principal component analysis of 20 qualitative policies and institutions indicators presented in Joumard et al. (2010). The "market mechanisms" factor score is mainly characterised by the following indexes: i) "private provision" of health (breakdown of physicians and hospital services according to their nature i.e. public or private); ii) "user information" (on quality and prices of various health services); iii) "choice of insurers" (in case of multiple insurers: the ability of people to choose their insurer); and iv) "insurer levers" (insurers' ability to modulate the benefit basket).

([99]) For a number of countries, 2010 may also be seen as a rebalancing year, when expenditure levels are corrected downwards after the high growth rates of previous years.

by low productivity growth in a highly labour intensive sector, and by the overall regulatory framework.

During the period 2003-2011, health expenditure shares by main category remained relatively stable. In fact, as shown, hospital care continuously takes the highest share in expenditure, followed by ambulatory care, pharmaceuticals, nursing and residential care, health administration and insurance, and prevention and public health services (Section IV.2.3). Noticeably, hospital care remains the largest share of total expenditure on health, while growth in hospitals' expenditure has been the second highest during the last decade, although some positive developments have occurred such as the rise in one-day surgeries. This is so despite the acknowledgement by the research community, as well as policy makers, that the expenditure share of hospital care in total health should be reduced. This suggests that further reforms are necessary in this area in order to curb future expenditure growth.

In order to improve on the existing regulatory framework and curb future expenditure growth, it is important to understand which drivers of public health expenditure identified in the literature (Section IV.2.4) – population size and structure, health status, income, relative prices, technology, and regulatory settings and policies – play a major role in the observed expenditure patterns. The next section attempts to address this issue.

3. TESTING HYPOTHESES ON THE DRIVERS OF HEALTH EXPENDITURE AND PROJECTING PUBLIC EXPENDITURE IN THE LONG RUN

The previous section, which described major past and recent trends in public expenditure on health, the impact of the recent economic crisis and the evolution of expenditure by main category, raises a number of important questions. Will the observed long term trends continue unchecked in the future? And why are there such large differences in per capita levels and in growth rates of health expenditure across Member States? What are the main factors driving growth rates in health expenditure?

In an attempt to answer these questions, this section addresses - in a statistical/econometric perspective - the issue of expenditure drivers i.e. what explains expenditure growth and what may happen to public expenditure on health in the future. (100)

Firstly, the analysis estimates regressions with total public HE as the dependent variable to obtain income and price elasticities of health expenditure. These elasticities are later used to project future HE-to-GDP ratios. The choice of total public HE as dependent variable reflects the "practical" nature of our problem: we want to build a methodological framework to project long term total public HE. The regression specification retained fits well with the EPC-EC methodology to project age related costs (DG ECFIN-EPC(AWG), 2012), because the macroeconomic variables needed to project future total public HE are available in the long term age related projections. (101)

Secondly, we carry out a typical accounting analysis or breakdown of total public HE over the last 25 years in its main drivers (Mainsonneuve and Martins, 2013). For such breakdown, we prefer using more consensual/central values for the income and price elasticities in the empirical literature. This type of analysis disentangles between demographic (age structure of the population), and non-demographic drivers of total public expenditure on health, such as income and relative prices (i.e. Baumol's "cost-price disease"), although leaving a large residual component unexplained, reflecting omitted variables, such as technology and policy regulations.

Thirdly, the analysis presents another type of regression to explain the drivers of health expenditure in a more theoretical perspective, following Baumol's "unbalanced growth model". (102) Specifically, we use Hartwig's (2008) methodology to test empirically the main implication of Baumol's "unbalanced growth model", namely that health expenditure is driven by wage increases in excess of productivity growth in the whole economy.

3.1. DATA

Data on public health expenditure are primarily taken from the System of Health Accounts (SHA) as provided by the OECD and Eurostat, and supplemented by national data sources. (103) The dataset covers the 27 EU Member States and Norway. For some Member States, data series are available since the mid-1970s, (104) although time coverage is unbalanced across countries.

The following variables are used in all estimated regressions. The relative price index for health

(100) Based on Medeiros and Schwierz (2013), "Estimating the drivers of public health expenditure in the European Union: Baumol's 'cost-disease' revisited", forthcoming.

(101) IMF and OECD have adopted similar work streams: Jenkner E., Karpowicz I., Kashiwase K., Shang B., Soto M., Tyson J., (2010), and Maisonneuve C. and Martins J. (2006, 2013), respectively.

(102) In this second type of regression, we use current instead of total (current and capital) expenditure, because capital investment does not play a role in Baumol's model; and total expenditure instead of public, because we are now interested in analysing overall expenditure determinants not in making projections of public health expenditure.

(103) Public expenditure on health is defined by the "core" functional components of health (SHA categories HC.1 – HC.9), including capital investment in health (HC.R.1).

(104) Data for 11 countries are available since the mid-1970s, namely for Austria, Germany, Denmark, Spain, Finland, Luxembourg, the Netherlands, Norway, Portugal, Sweden, and the United Kingdom.
Data used in the econometric analysis were collected between November 2012 and January 2013. Therefore, data for 2011 are not included, as the data update was too late to rerun calculations. However, this is not expected to change significantly the results. Recall that regressions were also estimated excluding the most recent years to check for the overall robustness of results.

services $(p \equiv \frac{p_h}{p_y})$ is the ratio of the health price deflator P_h over the GDP deflator (P_y). Nominal public health expenditure and nominal GDP are deflated using, respectively, the health price index and the GDP deflator with base year 2005, and then converted for the same year using purchasing parity standards (PPS). ([105]) GDP data (real and nominal), wages and CPI indexes, and PPS are all taken from the European Commission Ameco database, and population data from Eurostat.

Given the strong evidence suggesting that relative prices of health services have been increasing on a regular basis, it is important to include information on health prices in the regression specifications. Maisonneuve and Martins (2013) use the value-added deflator in the Health and Social Work sectors, taken from the OECD STAN database. Unfortunately for the purpose of this analysis, the geographical coverage of the STAN database is very limited. ([106])

Elk et al. (2009) methodology to construct a price index for health services using macro data for wages and prices (the overall consumer price index), is applied in the following way:

$$P_h = W^{\phi} * CPI^{1-\phi} \qquad (1)$$

where the price of health services (P_h is a weighted average of wages for the whole economy (W) and overall consumer prices (CPI). The latter is used because the health sub-component of Eurostat's HCPI is only available since 1996. The weights (ϕ) are country specific and are calculated using national accounts input-output tables.

$$\phi = \frac{W + {}^{2}/_{3} * IC}{X} \qquad (2)$$

where IC and X are total intermediate consumption and total production, respectively, in the Human Health Activities sector of national accounts data (Eurostat). Thus, the weight is defined as the compensation for employees in the health sector plus the estimated compensation for employees in the intermediate consumption part (using for the latter an estimated wage share of 2/3) divided by total production.

The proxy price indices for health services built using (1) and (2) closely follow those taken from the OECD STAN database (Medeiros and Schwierz, 2013).

Estimating income and price elasticities of public health expenditure

Panel regressions are primarily run using data in growth rates and assuming country fixed-effects. Initially, an attempt was made to run the regressions mainly in levels instead, requiring the existence of a co-integration relationship. However, co-integration tests were inconclusive, depending on the variables considered and on the inclusion or not of a deterministic time trend in the co-integration test. Moreover, results regarding the existence of a steady state for the HE-to-GDP ratio depended on co-integration (see Box IV.3.1). Therefore, in order to make sure that results are not spurious, regressions are run using data in growth rates (Jenkner et al., 2010).

Assuming that variables are first order integrated, ([107]) panel regressions can be estimated in first differences (i.e. growth rates).

$$\Delta logh_{i,t} = \alpha + \mu_i + D_{85} + a * \Delta logx_{i,t} + b * \Delta log\, y_{i,t} + c * \Delta log\, p_{i,t} + \varepsilon_{i,t} \qquad (3)$$

where Δ is the first difference operator (i.e. $\Delta z_t = z_t - z_{t-1}$)

Equation (3) ([108]) assumes that real per capita growth in public health expenditure ($h_{i,t}$, deflated

([105]) The same procedure was followed in Gerdtham et al. (1995) and Barros (1998). For example, the dependent variable (real per capita health expenditure) is valued at constant 2005 prices (in national currency units using P_h as deflator) and then converted in PPS for 2005.

([106]) Using the OECD STAN database, health prices indices can be obtained for only 13 European countries: Austria, Belgium, the Czech Republic, Germany, Denmark, Finland, France, Hungary, Italy, the Netherlands, Norway, Sweden, and Slovenia.

([107]) Medeiros and Schwierz (2013) present a series of unit root tests (both country-specific and panel) for HE, GDP and relative prices. Overall, the evidence seems to support the unit root hypothesis (i.e. series are generally non-stationary in levels). Given that nobody ever suggested that these series could be second order integrated or higher, running regressions in growth rates (i.e. in first differences) is sufficient to avoid obtaining spurious results.

([108]) For practical/feasibility reasons, the reduced form equation (3) ignores two-way causation effects between economic growth and heath. Within a neo-classical growth model,

Table IV.3.1: **Common income (η) and price elasticities (γ) estimates**

	Growth rate equations no co-integration				Level equations co-integration		
	OLS	OLS	IV	IV	OLS	IV	IV
	(1)	(2)	(3)	(4)	(5)	(6)	(6a)
	All observations	Excl. 10% more influential	All observations	Excl. 10% more influential	All observations	All observations	All observations excl. 2009 & 2010
Income elast. (η)	0.20 *	0.20 **	0.77	0.96 ***	0.51 (0.57)	0.66 (0.75)	0.64 (0.73)
Price elast. (γ)	-0.32 *	-0.14	-0.62 ***	-0.48 *	-0.24 (-0.33)	-0.41 (-0.51)	-0.36 (-0.47)
legend: * p<0.05; ** p<0.01; *** p<0.001							

(1) In columns 5 to 6a, there are two values in each cell. The first refers to the model in levels without demographic variables; the second (in parenthesis) refers to the corresponding model including two demographic variables, namely the young and old age population ratios.
Source: Own calculations based on SHA and national data.

using health services prices P_h) is a function of a common growth rate across all countries (α); a country-specific growth rate differential (i.e. country-fixed effects μ_i) a period dummy (D85), signalling a common shift in the growth rate after 1985; real per capita GDP growth rate ($y_{i,t}$, deflated using the GDP deflator P_y); relative price of health services ($p_{i,t}$); and a population composition effect ($x_{i,t}$). (109) The common growth rate (α) and country-fixed effects (μ_i) capture time-invariant factors, such as institutional settings, and national idiosyncrasies.

Given the specification of the regressions in first differences of logarithmic variables, two elasticities are directly obtained from the estimates: i) a common income elasticity ($\eta\equiv\tilde{b}$); and ii) a common price elasticity ($\gamma\equiv\tilde{c}$), (110) which are later used in the projections.

Note that in order to test the robustness of the results, a number of regressions were estimated. Firstly, regressions are estimated using both ordinary least squares (OLS) and instrumental variables (IV). (111) Secondly, regressions are estimated including or not the 10% more influential observations in the panel. (112) Thirdly, regressions are also estimated in levels either including or not demographic variables.

Table IV.3.1 presents estimates of these two elasticities, resulting from a number of regression specifications (see Annex, Tables IV.A1.1 and A1.2).

Income elasticity (η) estimates are mostly below one, while those obtained using IV are significantly higher than using OLS. Overall, results are in line with recent income elasticity estimates of health expenditure. (113) For example, Maisonneuve and Martins (2013) suggest an income elasticity of health expenditure centred around 0.8 (revising downwards their previous unitary estimate made in 2006), while Acemoglu et al. (2009), using carefully designed econometric techniques to identify causality effects of income on health expenditure, and using data for the Southern United States, find an income elasticity below unit (0.72 with an upper interval value of

Barro (1996a) proposes a framework that considers the interaction between health and economic growth, obtaining positive synergies. Better health tends in various ways to enhance economic growth, whereas economic advance encourages further the accumulation of health capital. Using a panel of around 100 countries from 1960 to 1990, Barro (1996b) finds strong support for the general notion of conditional convergence, including a positive impact of life-expectancy on the GDP growth rate. Overall, empirical results suggest a significantly positive effect on growth from initial human capital in the form of (better) health.

(109) Two variables are used to capture demographic composition effects: i) the fraction of the population below 16 (young population ratio); and ii) the fraction of the population above 65 (old population ratio).

(110) Note that a tilde over a parameter means an estimated value.

(111) IV may alleviate the problem of potential endogeneity of the income variable (y), using as instruments its lagged values, whereas relative prices (p) are assumed to be exogenous, because the proxy variable being used (based on wages in the whole economic and CPI inflation) can be treated as an exogenous regressor. Adequate instruments for the relative prices variable were not found.

(112) The 10% more influential observations are identified using Cook's measure of distance, which is a statistic of the effect of one observation simultaneously on all regression coefficients. Eliminating the most influential observations is an attempt to exclude outliers.

(113) See Appendix 3 in Maisonneuve and Martins (2013) for a review of recent literature on income elasticity estimates.

Table IV.3.2: **Breakdown of public health expenditure growth (a), 1985-2010 (b) Annual averages in percentage**

	Period	Number of observations	alth spendi (1)	Age effect (2)	Income effect (c) (3)	Price effect (d) (4)	Residual (5)=(1)-(2)-(3)-(4)
BE	1996-2010	14	1.7	0.1	1.0	-0.3	0.9
BG	1992-2007	16	-0.1	0.1	2.1	-0.6	-1.7
CZ	1994-2010	14	0.4	0.1	1.8	-0.9	-0.6
DK	1985-2010	26	1.0	0.1	0.9	-0.5	0.6
DE	1993-2010	18	1.5	0.3	0.8	-0.2	0.6
EE	1996-2010	15	0.6	0.1	3.5	-1.4	-1.5
IE	1996-2010	15	3.3	-0.1	2.5	-0.9	1.8
EL	1988-2010	23	2.8	0.2	1.3	-0.3	1.7
ES	1985-2010	25	3.1	0.1	1.4	-0.3	1.9
FR	1991-2010	19	1.2	0.1	0.7	-0.3	0.7
IT	1989-2010	22	1.8	0.2	0.6	-0.1	1.0
CY	1996-2011	16	4.5	0.0	0.8	-0.4	4.1
LV	1992-2008	14	2.0	0.2	1.1	-0.8	1.5
LT	1996-2009	12	3.9	0.2	3.1	-2.0	2.5
LU	1985-2009	23	2.2	0.0	2.3	-0.8	0.7
HU	1993-2010	17	-0.5	0.1	1.6	-0.5	-1.6
MT	1996-2009	14	3.0	0.2	1.3	-0.7	2.2
NL	1985-2009	24	2.9	0.1	1.3	-0.3	1.7
NO	1985-2011	25	2.2	0.0	1.2	-0.3	1.3
AT	1985-2009	25	2.4	0.1	1.3	-0.4	1.4
PL	1993-2010	17	2.3	0.1	3.2	-0.9	0.0
PT	1996-2010	14	2.2	0.2	0.9	-0.4	1.5
RO	2000-2009	10	2.8	0.1	3.4	-1.9	1.3
SI	1993-2010	18	1.4	0.3	2.2	-0.5	-0.7
SK	1996-2010	15	1.9	0.0	2.9	-1.1	0.1
FI	1985-2011	25	1.7	0.2	1.3	-0.7	0.9
SE	1994-2010	17	1.2	0.0	1.6	-0.6	0.1
UK	1994-2010	16	3.2	0.0	1.4	-0.5	2.3
Non-weighted avg./tot		509	2.0	0.1	1.7	-0.7	0.9
% of total				5.4	83.9	-32.4	43.2
Weighted average			2.0	0.1	1.2	-0.4	1.1
% of total				7.0	59.0	-18.2	52.1

Source: Own calculations based on SHA and national data

1.13). In the breakdown exercise of total pubic HE presented in Table IV.3.2, the stylised values used for the income and price elasticities are 0.7 and -0.4, respectively.

The estimates for the price elasticity (114) (γ) are correctly signed and lower than 1 (in absolute value) as expected (i.e. inelastic demand), while those obtained using IV are significantly higher (in absolute value) than those obtained using OLS. Price elasticity estimates around -0.4 are similar to those obtained in other empirical studies (e.g. Maisonneuve and Martins, 2013).

Breakdown of total public HE in its main drivers: the minor role of ageing

Table IV.3.2 presents a breakdown of total public HE growth into different drivers for the period 1985-2010. In line with estimates in the empirical literature, the income and price elasticities are set to 0.7 and -0.4, respectively, while demographic effects are determined using estimates from equation (3). (115) The results suggest that since

(114) Medeiros and Schwierz (2013) accept the null hypothesis of equivalence between the estimated regression and an alternative specification where the relative prices variable is split into two variables: health prices and the GDP deflator. Under this equivalence, the price elasticity estimate of HE equals the relative prices estimate.

(115) The OLS regression 1 in Annex, Table IV.A1.1, is used. According to these estimates: a 1% increase in the fraction of the population below 16 ("young population ratio") increases real per capita public HE by 0.08%; while a 1%

1985 changes in demographic composition played a minor role in driving up total public HE. ([116]) Using weighted averages, (see last row of Table IV.3.2) the rise in per capita income explains about 59% of the total increase in expenditure, price effects dampened expenditure by 18%, demographic composition effects accounted for an increase of just 7%, ([117]) while residual effects account for around 52%. The decomposition supports the hypothesis outlined in Chapter IV.1 that past trends in expenditure were mainly driven by non-demographic factors, including income and price effects. Note the importance of residuals largely due to omitted variables, such as technologic innovations in the medical field and policy regulations.

Testing Baumol's "unbalanced growth model"

In this section, Hartwig's (2008) methodology is used to test empirically the main implication of Baumol's "unbalanced growth model", namely that current total (public and private) health expenditure is driven by wage increases in excess of productivity growth in the whole economy.

Current instead of total (current and capital) HE is used, because the difference between the two – capital investment – does not play a role in Baumol's model. Also note that both public and private expenditure are used, whereas in the estimation of price and income elasticities and projection sections, the dependent variable is public total HE. The different focus reflects the fact that public total expenditure is used to make projections, whereas now expenditure drivers are discussed from a more theoretical perspective.

Baumol (1967) developed a simple neo-classical growth model that can be used to rationalise the rapid and persistent rise in current total (public and private) HE in recent decades and assess future developments. The main implication of Baumol's model is that current total expenditure is driven by wage increases in excess of productivity growth. Using variables expressed in growth rates, current total (public and private) HE is regressed on real per capita income and a variable which is the difference between wage and productivity growth for the whole economy.

Baumol's "unbalanced growth model" would be consistent with a statistical significant coefficient of around one for the "Baumol" regressor: $(\widehat{W_t} - \widehat{lp_t})$ which is the difference between the growth rates of nominal wages per employee and labour productivity for the whole economy (Hartwig, 2008) ([118]).

The following linear regression is estimated (for a derivation see Box IV.3.2):

$$\widehat{H_{i,t}} = a * \left(\widehat{W_{i,t}} - \widehat{lp_{i,t}}\right) + b * \hat{y}_{i,t} + \varepsilon_{i,t} \qquad (4)$$

where $\widehat{H_{i,t}}$ is the growth rate of nominal current per capita HE; $\widehat{W_{i,t}}$ the growth rate of nominal wages per employee; $\widehat{lp_{i,t}}$ is the growth rate of labour productivity in the whole economy; $\hat{y}_{i,t}$ denotes the growth rate of real per capita GDP; and $\varepsilon_{i,t}$ is a stochastic variable.

Table IV.3.3 summarises estimation results for equation (4), using three estimations. ([119]) In all cases, and similarly to Hartwig (2008), strong support is found in the data for the Baumol's "unbalanced growth model". As predicted, the value of the estimated "Baumol" coefficient is (statistically) close to one, remaining largely stable across specifications. Note also the high significance of the real per capita GDP regressor. Until recently, the latter variable had emerged in the literature as the only uncontroversial explanatory variable in health expenditure regressions, using cross-section or longitudinal country data (Gerdtham and Jönsson, 2000).

increase in the fraction of the population above 65 ("old population ratio") increases real per capita public HE by 0.2%.

([116]) In order to capture the demographic structure of the population, the average age of the population was also tried as a regressor, but was not retained. For data availability and logistic reasons, no attempt was made to calculate a proxy for the fraction of the population in the proximity of death.

([117]) Note that this reflects historical developments not representing a projection of future developments. In the 2012 EPC-EC Ageing Report, the impact of ageing on health expenditure up to 2060 is calculated using specific age profiles by country and gender.

([118]) This basically assumes that relative outputs between health services and "progressive" sectors are constant, and that health prices are a mark-up over costs (see Box IV.3.2).

([119]) Namely, an OLS, a cross-section fixed-effects, and a time fixed-effects.

Overall, it can be concluded that developments in current total (public and private) HE in European countries since 1960s are in line with Baumol's theory of "unbalanced growth". Wage increases in excess of productivity growth are a statistical significant explanatory variable of (nominal) HE growth. This finding is robust to the inclusion of (real) GDP as an additional explanatory variable.

Table IV.3.3: **The "Baumol variable" unsplit and per capita real GDP as drivers of the nominal growth rate of current per capita health expenditure (log differences)**

Regressions	OLS	Cross-section fixed-effects	Time period fixed-effects
Variables			
Constant	0.02356***	0.02770***	0.02370***
Baumol var.= dlog(wspe)-dlog(prod)	1.04048***	0.98814***	0.96907***
dlog(GDPrpc)	0.68223***	0.62080***	0.83058***
Number of observations	607	607	607
R squared adjusted	0.67878	0.59139	0.56109
Root mean squared error	0.03992	0.0394	0.03765
Wald test (p-value) a)	0.1812	0.7241	0.388
legend: * p<0.05; ** p<0.01; *** p<0.001			

(1) dlog(wspe)= log difference of wages and salaries per employee in the whole economy, dlog(prod)= log difference of labour productivity (real GDP per employee) in the whole economy, and dlog(GDPrpc) = log difference of real per capita GDP.
a) Tests the null hypothesis that the coefficient of the Baumol variable is one.
Source: OECD Health Database and Ameco Database.

The three major results derived from the econometric analysis are: i) in a historical perspective, breakdowns of public HE growth using stylised values (derived from the empirical literature) for the income and price elasticities show that demographic factors played a minor role in explaining total growth; ii) the strong rise in relative prices of health services in the past half century is linked to lower or stagnant productivity growth in that sector; and iii) combined with a relatively inelastic demand, a rise in relative prices of health services generates a trend increase in the HE-to-GDP ratio.

Long term projections for the total public health expenditure-to-GDP ratio (HE-to-GDP)

The results of the econometric analysis on the determinants of HE growth are used to calculate long term projections (up to 2060) for the HE-to-GDP ratio. Equation (3) estimated in growth rates (see Annex, regression 4 in Table IV.A1.1) is used for the projections.

The exogenous variables used are taken from (an updated version) of the 2012 Ageing Report, notably real GDP, labour productivity and demographic variables.

In the projection formula (see Box IV.3.3) relative prices of health services are proxied using labour productivity. Note also the important role played in the projections by a deterministic time trend, largely reflecting the impact of omitted variables. ([120])

A major advantage of using growth rate estimates is that the impact of demographic composition can be considered. This among the factors determining HE growth allows the estimation of demographic effects, whereas in level equations, demographic variables are not part of the co-integration vector. There are also a number of technical advantages in using equations in growth rates: i) first, co-integration tests are inconclusive (see Box IV.3.1); and ii) a formulation in growth rates is compatible with the existence of a constant steady-state for the HE-to-GDP ratio.

The model specification used to estimate total public health expenditure fits well with the European Policy Committee-European Commission (EPC-EC) methodology to project long term age related costs (DG ECFIN-EPC(AWG), 2012), because the macroeconomic variables needed to project future public health expenditure are available in the long term age related projections, namely real GDP, GDP prices, wages, labour productivity, and demographic variables.

Calibration and results

Estimates of equation (3) in growth rates (see Annex, regression 4 in Table IV.A1.1) are used for the income and price elasticities. Note that instead of using the country-specific time drift $\psi_i \equiv \alpha + \mu_i + D_{85}$, a common time drift (ψ_i) is used, calculated as the non-weighted average over the 28 countries considered in the analysis (EU27 and Norway; regression 4, Table IV.A1.1 in Annex), thereby correcting for the excessive

([120]) In order to make reasonable (i.e. within plausible bounds) projections, some kind of a priory judgment is still needed about the relevance of historical trends for determining future values of the time drift (ψ_t), and future values for the pass-through of productivity gains into relative price increases (ϕ_i).

Box IV.3.1: **Co integration and the health care expenditure to GDP ratio (HCE to GDP)**

Running regressions in levels requires co-integration of expenditure and income variables.

In case variables are co-integrated, the following long term relationship can be estimated:

$$\log h_{i,t} = \alpha_0 + \alpha * t + \mu_i * t + D_{85} * t + a * \log x_{i,t} + b * \log y_{i,t} + c * \log p_{i,t} + EC_{i,t} \quad \text{(i)}$$

with $EC_{i,t}$ being the error correction term which is assumed to be stationary.

The corresponding error correction model (ECM) is:

$$\Delta \log h_{i,t} = c + \beta_1 * \Delta \log x_{i,t} + \beta_2 * \Delta \log y_{i,t} + \beta_3 * \Delta \log p_{i,t} + \delta * EC_{i,t-1} \quad \text{(ii)}$$

In the ECM equation (ii), the crucial parameter to be estimated is δ, which should be negative, giving the speed of convergence of deviations of per capita health care expenditure to long term values.

Estimates of the (lagged) error correction term are significantly negative (see Annex, Table A3), indicating that per capita health care expenditure deviations from their long term values are corrected each year by about 20% i.e. expenditure deviations take about 5 years on average to converge to their long term ratios.

Ultimately, level regressions are used as a kind of "sensitivity test" to results obtained using growth rate regressions. The main reasons are: i) panel co-integration tests are inconclusive; and ii) assuming co-integration has the unpalatable implication that the HCE-to-GDP ratio does not appear to have a steady-state.

Using Westerlund's (2007) panel co-integration test, it is found that co-integration of $h_{i,t}$, $p_{i,t}$, and $y_{i,t}$ depends critical on adding or not a deterministic trend to the co-integration relationship. The three variables are found to be co-integrated only when a deterministic trend is not considered. However, even in the no deterministic trend case, adding a fourth variable, representing the composition of the population, would lead us also to reject co-integration.

Furthermore, stationarity of the HCE-to-GDP ratio crucially depends on existence of a co-integration relationship (Medeiros and Schwierz, 2013). We estimate that co-integration implies an annual time drift of 1.4% in the HCE-to-GDP, whereas no co-integration (with the regression estimated in growth rates) implies a constant ratio.

Box IV.3.2: **A simplified version of Baumol's "unbalanced growth model"**

Following Baumol (1967) and Hartwig (2008), let us assume that labour productivity in the "stagnant" sector (i) stays constant, while it grows at the constant rate *r* in the "progressive" sector (ii).

$$Y_{1t} = aL_{1t} \qquad \text{(i)}$$

$$Y_{2t} = bL_{2t}e^{rt} \qquad \text{(ii)}$$

where Y_{1t} and Y_{2t} are output levels in the two sectors at time *t*, L_{1t} and L_{2t} are the quantities of labour employed, and *a* and *b* are constants.

Wages are equal across the two sectors and grow in line with labour productivity in the "progressive" sector:

$$W_t = We^{rt} \qquad \text{(iii)}$$

with *W* being some constant.

Relative costs per unit of output (the "stagnant" over the "progressive" sectors) is given by:

$$\frac{C_1}{C_2} \equiv \frac{\frac{W_tL_{1t}}{Y_{1t}}}{\frac{W_tL_{2t}}{Y_{2t}}} = \frac{\frac{W_tL_{1t}}{aL_{1t}}}{\frac{W_tL_{2t}}{bL_{2t}e^{rt}}} = \frac{be^{rt}}{a} \qquad \text{(iv)}$$

where C_1 and C_2 represent costs per unit of output.

Over time ($t \to \infty$), relative costs (iv) tend to infinity. Consequently, under "normal" circumstances (i.e. prices set as a mark-up over costs), and with an elastic demand, *there is a tendency for outputs of the "stagnant" sector to decline and perhaps, ultimately, to vanish* (Baumol, 1967, p. 418).

However, parts of the "stagnant" sector produce necessities, such as education and health care, for which the price elasticity is very low.

As an illustration, Baumol (1967) considers the case where despite the change in their relative costs and prices, the magnitude of the relative outputs of the two sectors is kept constant (e.g. through government subsidies):

$$\left(\frac{b}{a}\right)\frac{Y_{1t}}{Y_{2t}} = \frac{L_{1t}}{L_{2t}e^{rt}} = K \qquad \text{(v)}$$

with K being some constant.

Let $L_t = L_{1t} + L_{2t}$ be total employment, then it follows:

(Continued on the next page)

Box (continued)

$$L_{1t} = (L_t - L_{1t})Ke^{rt} \quad \leftrightarrow \quad L_{1t} = \frac{L_t Ke^{rt}}{1 + Ke^{rt}} \qquad \text{(vi)}$$

$$L_{2t} = L_t - L_{1t} = \frac{L_t}{1 + Ke^{rt}} \qquad \text{(vii)}$$

According to (vi) and (vii), over time ($t \to \infty$), L_{1t} tends to L_t: and L_{2t} to zero.

In the "unbalanced growth model", if the ratio of outputs of the two sectors is kept constant, an ever larger share of labour must move to the "stagnant" sector, while the amount of labour in the "progressive" sector will gradually tend to zero.

After presenting a simplified version of Baumol's "unbalanced growth model", we will now derive an expression for the nominal growth rate of current total per capita HE, which can be tested in a regression.

Using a supply-side approach, (i) and (iii) can be used to express nominal current total HE as:

$$\mathrm{HE_t} = \gamma \mathrm{W_t} \mathrm{L_{1t}} \qquad \text{(viii)}$$

with γ being the mark-up of prices over costs. Equation (viii) can be re-arranged as:

$$\mathrm{H_t} \equiv \frac{\mathrm{HE_t}}{\mathrm{P_t}} = \gamma \frac{\mathrm{W_t}}{\frac{\mathrm{GDP_t}/\mathrm{P_y}}{\mathrm{L_t}}} \frac{\mathrm{GDP_t}/\mathrm{P_y}}{\mathrm{P_t}} \frac{\mathrm{L_{1t}}}{\mathrm{L_t}} = \gamma \frac{\mathrm{W_t}}{\mathrm{lp_t}} \mathrm{y_t} \frac{\mathrm{L_{1t}}}{\mathrm{L_t}} \qquad \text{(viiia)}$$

with H_t being nominal current total per capita HE; P_t population; GDP_t nominal GDP; P_y the GDP deflator; $lp_t \equiv \frac{GDP_t/P_y}{L_t}$ labour productivity; and $y_t \equiv \frac{GDP_t/P_y}{P_t}$ real per capita GDP.

Differentiating the logarithm of (viiia):

$$\mathrm{dlog(H_t)} = \mathrm{dlog(W_t)} - \mathrm{dlog(lp_t)} + \mathrm{dlog(y_t)} + \mathrm{dlog(L_{1t})} - \mathrm{dlog(L_t)} \qquad \text{(viiib)}$$

Or expressed in growth rates:

$$\widehat{H_t} = \widehat{W_t} - \widehat{lp_t} + \widehat{y_t} + \widehat{L_{1t}} - \widehat{L_t} \qquad \text{(viiic)}$$

According to (vi), over time ($t \to \infty$), L_{1t} tends to L_t, thereby $\widehat{L_{1t}} \approx \widehat{L_t}$

Consequently, equation (viiic) can be approximated as: $\widehat{H_t} \approx \widehat{W_t} - \widehat{lp_t} + \widehat{y_t}$ (ix)

(Continued on the next page)

Box (continued)

Equation (ix) suggests that the growth rate of nominal current total per capita HE can be broken down into the sum of the Baumol variable ($\widehat{W}_t - \widehat{lp}_t$), where $\widehat{W}_t$ and $\widehat{lp}_t$ represent the nominal growth rate in wages per employee and productivity growth in the whole economy, respectively, and the growth rate of real per capita income ($\hat{y}_t$).

However, an important point should be made here. Note that per capita GDP (y_t) and labour productivity (lp_t) are linked by the identity:

$$\mathrm{y_t} \equiv \mathrm{lp_t} * (1 - \mathrm{ur_t}) * \mathrm{ar_t} \qquad \text{(x)}$$

where labour market variables, respectively, the unemployment (ur) and activity (ar) rates are present.

Taking the first difference of the logarithm, equation (x) can be expressed in growth rates as:

$$\hat{y}_t - \widehat{lp_t} \approx \widehat{ar}_t - \Delta ur_t \qquad \text{(xi)}$$

Identity (xi) implies that regression (ix) can be estimated only if the term $\widehat{ar}_t - \Delta ur_t$ changes over time.

amplitude of country-specific estimates in order not to extrapolate country-specific idiosyncrasies over a long period. ([121]) ϕ_i is the weight of labour costs in total health expenditure. In the projections, it is assumed that there is a marginal improvement in the pass-through of productivity gains to relative price increases, specifically, ϕ_i is reduced by 10% in the entire projection period over historical values. This reduction is a proxy for limited/sporadic reductions in the labour content of production (technological progress) in the health sector. ([122])

Exogenous variables for population by single age, real GDP, GDP prices, and labour productivity are taken from DG ECFIN's Winter 2013 economic forecasts and a March 2013 update of the 2012 Ageing Report for the period up to 2060. ([123])

Equation (iii) in Box IV.3.3 subsumes three alternative scenarios for a common time drift (ψ_t) between 2010 and 2060: i) constant ("cost-pressure"); ii) linear decreasing to zero ("linear cost-containment"); and iii) geometric decreasing to a very low value ("geometric cost-containment "). ([124])

The cost-pressure scenario sets a common time drift at the annual value of 0.59 p.p. during the entire projection period, which together with other demographic and non-demographic effects yields a considerable increase in the projected public HE-to-GDP ratio from 6.5% in 2010 to 11.7% in 2060 (non-weighted average of the EU27, Table IV.3.4). Two cost-containment scenarios are calculated as well. One assumes the linear reduction in the time drift from 0.59 p.p. in 2010 to zero in 2060, and another assumes a geometric

([121]) A necessary condition for the stationarity of the HE-to-GDP ratio (iii, in Box IV.3.3) is for the time drift to be "forced" to converge to zero over time ($\lim_{t\to\infty} \psi_t=0$), or less constraining, for the HE-to-GDP ratio to be bounded away from implausible high values. This eventually requires dampening the positive time drift, which requires making arbitrary assumptions (Maisonneuve and Martins, 2013). The time drift is likely to decrease in future relatively to historical trends, reflecting, inter alia, completion of the process of broadening insurance coverage of health systems, but it is likely to "converge" to a strictly positive value as the time drift includes technological progress in the health sector. The trajectory assumed for ψ_t during the projection period has a significant impact on the results.

([122]) This could be interpreted as a reduction in the labour content of intermediate goods consumption in the health sector.

([123]) Taking into account a few pension peer reviews endorsed by the EPC until April 2013.

([124]) In the "geometric cost-containment" scenario, the common drift is assumed to decline from 0.59% in 2010 to 1% of 0.59% in 2060. In their cost-containment scenario, Maisonneuve and Martins (2013) also assume that the common "residuals" converges (linearly) from 1.7% in 2010 to 0% in 2060.

Box IV.3.3: **Derivation of the formula for the projection of HCE to GDP ratios**

Dividing health services prices (equation 1): $P_h = W^{\phi} * CPI^{1-\phi}$ by the GDP deflator (p_y), we obtain an expression for relative prices: $p \equiv \frac{p_h}{p_y} = \left(\frac{W}{p_y}\right)^{\phi} * \left(\frac{CPI}{p_y}\right)^{1-\phi}$. Assuming that CPI and GDP inflation are identical, we can express the growth rate of relative prices as:

$$\hat{p} = \phi * \widehat{\left(\frac{W}{P_y}\right)} \qquad \text{(i)}$$

where a hat over a variable means a growth rate (i.e. the first difference of the logarithm).

Furthermore, assuming that real wages ($\frac{W}{p_y}$)are proportional to labour productivity (lp), it follows that:

$$\hat{p}_{i,t} \approx \phi_i * \widehat{lp}_{i,t} \qquad \text{(ii)}$$

In line with Baumol's "unbalanced growth theory", equation (ii) states that relative prices of health services grow proportionally with (overall) labour productivity, implicitly assuming that there is limited labour productivity growth in the health sector. Note that the factor of proportionality is country-specific (ϕ_i), reflecting the fraction of labour costs in total costs in the human health sector of national accounts data.

Equation 3 can be rewritten as the HCE-to-GDP ratio ($Z_{i,t}$):

$$\Delta \log Z_{i,t} \equiv \Delta \log \frac{h_{i,t} * p_{i,t}}{y_{i,t}} \approx \psi_t + (b-1) * \Delta \log y_{i,t} + (1+c) * \Delta \log p_{i,t} + a * \Delta \log x_{i,t} \qquad \text{(iii)}$$

Using (ii) and the definition of elasticities into (iii):

$$\hat{Z}_{i,t} \approx \psi_t + (\eta - 1) * \hat{y}_{i,t} + (1+\gamma) * \phi_i * \widehat{lp}_{i,t} + a * \hat{x}_{i,t} \qquad \text{(iv)}$$

recall that $\psi_t \equiv \alpha + \mu_i + D_{85}$ is a common time drift; η and γ are the income and price elasticities, respectively.

Equation (iv) links changes in the HCE-to-GDP ratio to a common time drift: ψ_t; a country-specific income effect: $(\eta - 1) * \hat{y}_{i,t}$; a labour productivity/Baumol effect: $(1+\gamma) * \phi_i * \widehat{lp}_{i,t}$; and changes in demographic composition: $a * \hat{x}_{i,t}$.

Furthermore, per capita GDP (y) and labour productivity (lp) are linked by the identity:

$$y_{i,t} \equiv lp_{i,t} * (1 - ur_{i,t}) * ar_{i,t} \qquad \text{(va)}$$

where labour market variables, respectively, the unemployment (ur) and activity rates (ar) are present.

Box (continued)

Taking the first difference of the logarithm, equation (va) can be expressed in growth rates as:

$$\hat{y}_{i,t} \approx \widehat{lp}_{i,t} - \Delta ur_{i,t} + \widehat{ar}_{i,t} \qquad \text{(vb)}$$

Equations (iv) and (vb) indicate that both per capita GDP (or labour productivity), together with labour market variables (both the unemployment and activity rates), drive the dynamics of the HE-to-GDP ratio.

Table IV.3.4: **Projections of the public health expenditure-to-GDP ratio**

	2010	2060		
		Cost-pressure scenario, constant (1)	Cost-containment scenario, linear (2)	Cost-containment scenario, geometric (3)
BE	8.0	13.8	11.9	10.9
BG	4.3	8.8	7.5	6.9
CZ	6.3	12.3	10.6	9.7
DK	9.5	13.8	14.5	13.3
DE	8.9	15.2	13.1	12.0
EE	5.0	10.5	9.0	8.3
IE	6.4	11.8	10.1	9.3
EL	6.1	9.4	8.1	7.5
ES	7.1	12.0	11.9	9.4
FR	9.0	15.1	12.9	11.9
IT	7.4	12.2	10.5	9.7
CY	3.3	5.8	4.9	4.5
LV	4.0	8.5	7.3	6.7
LT	5.5	11.5	9.9	9.1
LU	6.5	11.3	9.7	8.9
HU	5.0	9.1	7.8	7.2
MT	8.0	10.7	9.2	8.4
NL	7.4	12.9	11.1	10.2
AT	8.4	14.6	12.6	11.5
PL	5.0	9.2	7.9	7.2
PT	7.1	11.9	10.2	9.4
RO	4.4	8.2	7.0	6.5
SI	6.6	12.5	10.7	9.9
SK	5.8	11.3	9.7	8.9
FI	8.0	12.3	10.5	9.7
SE	7.7	14.4	12.4	11.4
UK	8.0	14.6	12.5	11.5
EU15 a)	7.6	13.2	11.4	10.4
EU27 a)	6.5	11.7	10.1	9.3

Source: Own calculations based on estimates of equation 3 (regression 4 in Table IV.A1.1), using "exogenous" variables from DG ECFIN's Winter 2013 economic forecasts and a March 2013 update of the 2012 Ageing Report.
a) Non-weighted average

(i.e. accelerated) reduction in the time drift from 0.59 p.p. in 2010 to 1% of 0.59 p.p. in 2060 (or 10% of 0.59 p.p. by 2035). Even in the scenario that projects an accelerated reduction in the common time drift, the public HE-to-GDP ratio is still expected to increase by just under 3 p.p. of GDP from 6.5% in 2010 to 9.3% in 2060 (non-weighted average of the EU27). ([125])

As a whole, projections shown in Table IV.3.4 represent an acute reminder of the need to proceed with the efforts to curb HE growth and improve the efficiency of health systems. In fact, in the absence of additional control measures (i.e. in the "cost-pressure" scenario), projection outcomes suggest on average increase of 80% in the HE-to-GDP ratio across the EU between 2010 and 2060.

Comparison with other projections

Table IV.3.5 presents an adaptation of Table 4.3 of Maisonneuve and Martins (2013), describing major aspects of the different projection "technologies", namely the demographic assumptions ("Health ageing"), and non-demographic drivers, such as income, price elasticity and a time drift/residual growth component. ([126]) Covering these "fields" of analysis, Table IV.3.5 compares a few long term projections of the HE-to-GDP ratio, coming from the EPC-EC (2), the IMF (1), the OECD (2), and the PFR 2013 (2).

As a consequence of different assumptions, the EPC-EC projections (both baseline and risk scenarios) are the lowest, largely because they do not consider a time drift (or residual growth). In the IMF projections, the assumption of a low income elasticity is broadly offset by considering country-specific residual growth. IMF projects an increase of 4.5 p.p. in the public HE-to-GDP ratio for the EU15 between 2010 and 2050, largely exceeding EPC-EC projected increases of only 1.0 p.p. and 1.5 p.p., in the baseline and risk scenarios, respectively. Although being difficult to compare to OECD projections (as IMF projections end in 2050), IMF results seem to lie in between OECD's cost-containment and cost-pressure scenarios.

([125]) It should be recalled that all three scenarios presented in Table IV.3.4 assume a 10% reduction in the labour productivity/relative prices pass-through parameter (ϕ_i) due to the assumption of limited/sporadic labour savings in the health sector.

([126]) In this Chapter, see Box IV.3.4 for a brief overview of different projection methodologies.

Table IV.3.5: **Public expenditure on health: a comparison of different projections**

	PFR 2013	PFR 2013	EC-AWG	EC-AWG	OECD	OECD	IMF
	(Cost-containment geometric scenario)	(Cost-pressure constant scenario)	(Reference scenario)	(Risk scenario)	(Cost-containment scenario)	(Cost-pressure scenario)	
Methodology	Econometric model (regression in first differences)	Econometric model (regression in first differences)	Accounting framework	Accounting framework & econometric model (regression in first differences)			Econometric model (regression in first differences)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Health ageing	Effect of two demographic variables (younger than 16 and older than 64)	Effect of two demographic variables (younger than 16 and older than 64)	1 year gain in life expectancy= 1/2 year in good health	1 year gain in life expectancy= 1/2 year in good health	1 year gain in life expectancy= 1 year in good health	1 year gain in life expectancy= 1 year in good health	1 year gain in life expectancy= 1/2 year in good health
Income elasticity	0.96	0.96	1.1 in 2010 → 1 in 2060 (incudes other non-demographic factors)	1.3 in 2010 → 1 in 2060 (incudes other non-demographic factors)	0.8	0.8	0.3
Price elasticity	-0.48	-0.48	---	---	---	---	---
Time drift / Residual growth	Common time drift 0.59% in 2010 → 1%*0.59% in 2060	Common time drift 0.59% kept constant over the projection period	---	---	Common residual 1.7% in 2010 → 0% in 2060	Common residual 1.7% kept constant over the projection period	Country specific residual kept constant over the projection period
Results (Selected EU countries)	in pp of GDP change 2060-2010 (in parenthesis pp change from 2050-2010)						in pp of GDP change 2050-2010
France	2.9 (2.5)	6.1 (4.8)	0.0 (0.0)	0.0 (0.0)	2.2	6.1	2.6
Germany	3.1 (2.5)	6.3 (4.7)	0.0 (0.0)	0.0 (0.0)	2.3	6.2	1.5
Italy	2.3 (1.9)	4.8 (3.7)	0.0 (0.0)	0.0 (0.0)	2.6	6.4	1.1
Netherlands	2.7 (2.3)	5.4 (4.2)	0.0 (0.0)	0.0 (0.0)	2.4	6.3	4.9
Spain	2.3 (2.0)	4.9 (3.7)	0.0 (0.0)	0.0 (0.0)	2.8	6.7	3.5
United Kingdom	3.5 (2.9)	6.6 (5.0)	0.0 (0.0)	0.0 (0.0)	2.0	5.9	8.2
EU15 a)	2.8 (2.4)	5.6 (4.3)	0.0 (0.0)	0.0 (0.0)	2.4	6.2	4.5
EU27 a)	2.8 (2.3)	5.2 (4.0)	1.2 (1.1)	1.7 (1.7)	---	---	---

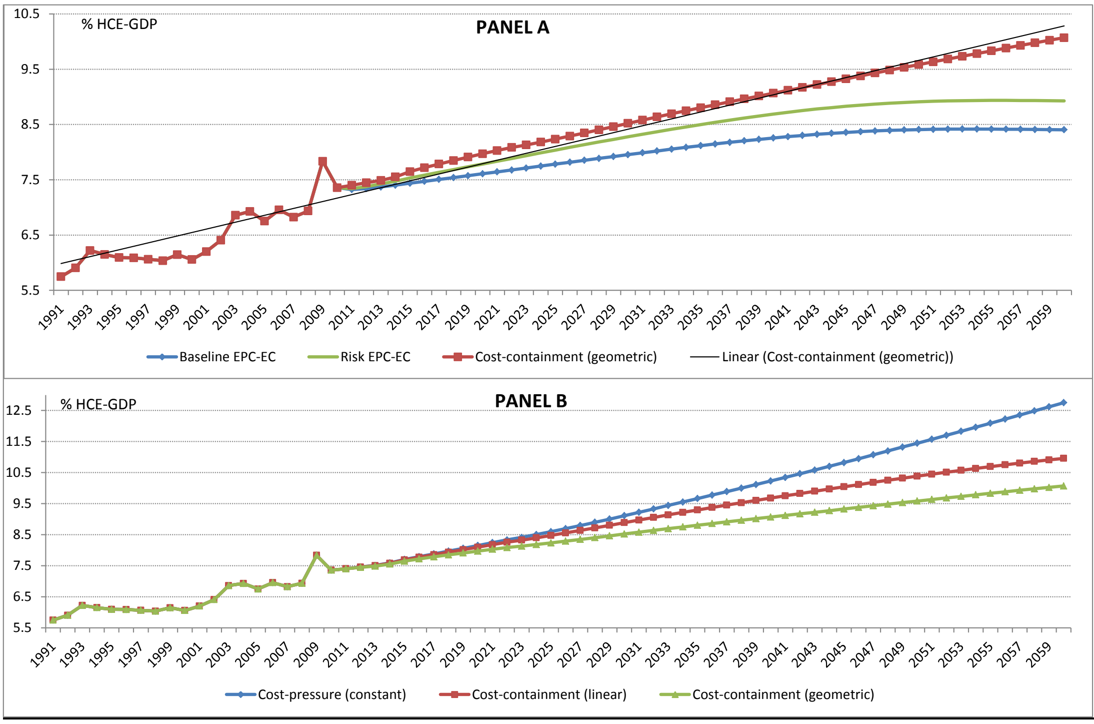
Source: Commission services (based on Table 4.3 from Maisonneuve and Martins, 2013).

Applying the methodology developed in this chapter, the cost-pressure scenario projects a slightly lower variation in the HE-to-GDP ratio than OECD's corresponding one (a variation of+5.6 p.p. versus +6.2 p.p. in the period 2010-2060 for the EU15), whereas the reverse occurs for the cost-containment scenario (a variation of +2.8 p.p. versus +2.4 p.p. in the period 2010-2060 for the EU15). Overall, the projection scenarios based on the PFR 2013 methodology are by in large equivalent to OECD's corresponding ones (Table IV.3.5). However, it should be acknowledged that the methodology developed in this Chapter uses econometric estimates of population composition effects on per capita expenditure to calculate ageing costs, whereas all other methodologies use age profile estimates of HE, together with an assumption on the impact of rises in life-expectancy on the duration of periods in good health.

Graph IV.3.1 presents a number of HE-to-GDP projections for an aggregate of EU Member States. ([127]) Panel A presents the cost-containment (geometric) scenario and the t wo EPC-EC health scenarios (baseline and risk) included in the 2012 Ageing Report - European Commission (DG ECFIN)-EPC (AWG) (2012b). A linear trend, derived from the cost-containment scenario, is also included to facilitate interpretation of results. Graph IV.3.1 (Panel A) suggests that the cost-containment scenario largely follows a linear extrapolation of actual data, although a negative gap emerges at the end of the projection period. Conversely, the two EPC-EC scenarios are clearly below this "mechanical" linear extrapolation of historical trends, largely reflecting the absence of a

([127]) The non-weighted average of 11 EU Member States for which sufficiently long series are available (Austria, Germany, Denmark, Greece, Spain, Finland, France, Italy, Luxembourg, Latvia, and the Netherlands).

Graph IV.3.1: **Projections of the health expenditure to GDP ratio for a selected group of countries**



(1) Projections based on regression 4 estimates (see Annex, Table IV.A1.1), and an update of the 2012 Ageing Report.
Source: a) Non-weighted average of Austria, Germany, Denmark, Greece, Spain, Finland, France, Italy, Luxembourg, Latvia, and the Netherlands

time drift (or residual growth). Panel B presents the three scenarios calculated using the PFR 2013 methodology.

A considerable degree of uncertainty surrounds the exercise of making long term projections for health expenditure, and this is not only because small annual errors - if not centred around zero – accumulate into large discrepancies. ([128]) Uncertainty reflects a multitude of common problems in the health empirical research area, such as omitted variables, ([129]) unbalanced datasets, the role of technical progress, model misspecification; all potentially yielding biased and inefficient estimates, thereby contributing to large residuals or a remaining unexplained large and positive time drift in health expenditure.

Nevertheless, the approach proposed here using econometric techniques is able to generate sensible future projections based on past trends, with results being in line with the existing literature, namely pointing towards a rising fiscal challenge of public HE. Also, the analysis implicitly considers other factors, besides ageing, income and relative prices to explain (future) HE developments, although these factors remain bundled in country-fixed effects and in a deterministic time drift. Nevertheless, the important lesson to be drawn from this analysis is that, to a considerable extent, health expenditure growth remains a policy parameter, in the sense that policy reform can affect outcomes.

Concluding, this chapter suggests that policy reforms aimed at curbing expenditure growth should attempt improving the regulatory/ institutional setting to ensure a more cost-effective use of resources and notably through the use of technology. ([130]) Section IV.2 suggested that an important expenditure category is hospital care,

([128]) For example, a 1 p.p. difference in projections by 2060 (i.e. over 50 years) corresponds to an annual systemic error of just 0.02 p.p..
([129]) Especially those related to policies and the institutional framework.
([130]) One potential further research question could focus on whether those countries having set up systematic health-technology assessment frameworks in the past decade have achieved a more cost-effective use of resources, leading to a slowdown of expenditure growth on health.

whose importance has not diminished despite policy proposals to move primary care from hospital to ambulatory treatment. Therefore, it is important to see if recent reforms and notably those implemented in the aftermath of the crisis are addressing the most significant challenges. The next section attempts to evaluate recent health policy reforms and provide guidance to policy makers towards concrete policies which may help curb expenditure growth in the various areas of health provision.

Box IV.3.4: **Different strategies to project the non-demographic component of public HE**

- ***IMF: Jenkner et al. (2010) and Clements et al. (2012)***
  - Projections of non-demographic and non-income related health expenditure equal estimates of excess cost growth of public health expenditure. Excess cost growth (C) is defined as the excess of growth in real per capita health expenditures over the growth in real per capita GDP, after controlling for the effect of demographic change. Jenkner et al. (2010) estimate a panel regression with country fixed-effects.
  - The following model specification is used:

$$\Delta \log h_{i,t} = \alpha + \mu_i + a * \Delta \log x_{i,t} + b * \Delta \log y_{i,t} + \varepsilon_{i;t} \qquad \text{(i)}$$

  - Country-specific excess cost growth (C) estimates are calculated as:

$$\widetilde{C_1} = \frac{\sum \frac{\widetilde{\Delta h_{i,t,}}|_{\Delta x_{i,t}=0}}{\widetilde{h_{i,t,}}|_{\Delta x_{i,t}=0}} - \sum \frac{\Delta y_{i,t}}{y_{i,t}}}{T_i} \approx \frac{\sum \Delta \widetilde{\log h_{i,t}}|_{\Delta x_{i,t}=0} - \sum \Delta \log y_{i,t}}{T_i} = \tilde{\alpha} + \widetilde{\mu_i} + \left(\tilde{b} - 1\right) * \frac{\sum \Delta \log y_{i,t}}{T_i} \qquad \text{(ii)}$$

  - with a tilde denoting estimates, and T_i the number of years of data available for country *i*. (C) equals the difference between the (geometric) average growth rate of estimated real per capita public health expenditure, after controlling for the impact of demographic composition, minus the (geometric) average growth rate of real per capita GDP.
  - Equation (3) estimated in this chapter differs from equation (i) by the inclusion of a relative price variable (p) and a time dummy (D_{85}). The excess cost growth equation (ii) becomes:

$$\tilde{c_i} = \tilde{\alpha} + \widetilde{\mu_i} + (\tilde{b} - 1) * \frac{\sum \Delta \log y_{i,t}}{T_i} + \widetilde{D_{85}} + (1 + \tilde{c}) * \frac{\sum \Delta \log p_{i,t}}{T_i} \qquad \text{(iia)}$$

  - Table A4 in Annex presents estimates of excess cost growth (C) for a number of regressions estimated in this chapter both in growth rates and in levels. Although displaying large differences across countries, estimates of excess cost growth (C) vary from 1.0% to 1.6% (weighted average), which is in line with results reported in Jenkner et al. (2010), which estimated a weighted average of 1.3% for advanced economies.
  - Summarising, Jenkner et al. (2010) equate non-demographic and non-income related HE growth to country-specific excess cost growth (C) estimates, keeping them unchanged at estimated/historical values during the entire projection period (i.e. up to 2050).

- ***OECD: Maisonneuve and Martins (2006 and 2013)***

(Continued on the next page)

Box (continued)

- Overall, demographic drivers explain relatively little of past developments in health spending; therefore, non-demographic drivers must play an important role, namely income growth and a residual growth component.
- Based on the most recent findings from the empirical literature, an income elasticity of 0.8 is used. This represents a downward revision from the unitary elasticity used in Maisonneuve and Martins (2006).
- The unexplained expenditure residual is derived using a growth accounting framework, which identifies past average growth of health expenditures due to age and income effects (assuming a given value for the income elasticity).
- In order to interpret this residual, an econometric equation is also estimated, incorporating explicitly the effects of prices and a proxy for quality/technological progress.
- The following panel regression, with country fixed-effects is estimated:

$$\log\left(\frac{he}{N}\right) = \alpha_c + \theta * \log(Demo) + \beta * \log\left(\frac{P}{P_Y}\right) + \gamma * log(Q) + \varepsilon * log\left(\frac{Y}{N}\right) + \tau * T + u \qquad \text{(iii)}$$

- where α_c correspond to country fixed-effects; *he* denotes health volumes (deflated for price and quality); *Demo* is the demographic effect captured by the average age of the population; P are health prices; P_Y is the GDP deflator; Q is a quality/technology index for health services; N is total population; T is a deterministic time trend; and u is a randomly distributed residual.
- Using estimates of regression (iii), the overall effect of relative prices and technology is estimated to have increased HE by 0.8% per year. Estimates suggest that the residual expenditure is also driven by other factors, such as changes in policy and institutions which are loosely captured by a time trend, accounting for 0.9% of the increase in health expenditure per year. On average in the OECD area, these estimates suggest that residual growth has increased HE by a total of around 1.7% (i.e. 0.8%+0.9%) per year.
- The estimated total expenditure residual of 1.7% in the OECD area compares with an expenditure residual of 2% obtained using the accounting framework, therefore 0.3% remains unexplained. As a consequence, the projections use 1.7% as the starting value for residual expenditure growth.
- The health expenditure residual component is projected as a whole. Furthermore, a common residual growth is assumed for all countries in order not to extrapolate country-specific idiosyncrasies over a long period, namely country-fixed effects.
- Maisonneuve and Martins (2013) present two main projection scenarios: i) a "cost-containment scenario" assuming that some policy action is taken to curb expenditure pressures, thereby allowing for a gradual reduction in the average residual growth from 1.7% in the starting period to 0% in 2060; and ii) a "cost-pressure scenario" where the average residual growth is assumed to remain constant at a growth rate of 1.7% over the projection period.

(Continued on the next page)

Box (continued)

- ***EPC-EC: European Commission (DG ECFIN)-EPC (AWG) (2011) and European Commission (DG ECFIN)-EPC (AWG) (2012a)***
    - The joint work carried out by the European Policy Committee (Ageing Working Group) and the European Commission (DG ECFIN) on long term age related expenditure acknowledges the significant role played by non-demographic drivers of health expenditure.
    - In the 2012 Ageing Report (AR), the following panel equation was estimated in order to identify non-demographic effects:

$$\Delta\log h_{i,t} = \alpha + \mu_i + D_{85} + \mathrm{a} * \log x_{i,t} + \mathrm{b} * \Delta\log y_{i,t} + \varepsilon_{i,t} \qquad \text{(iv)}$$

    - Note that equation (iv) ignores a number of important explanatory variables, namely relative prices. This is likely to bias upward the income elasticity estimate, which will capture effects due to omitted variables.
    - The main two long term health expenditure projection scenarios included in the 2012 AR consider non-demographic effects. Non-demographic effects are introduced using a common across all EU Member States income elasticity above unit. In the reference scenario the income elasticity decreases from 1.1 in 2010 (the starting period of the projection) to 1 in 2060, whereas in the risk scenario it decreases from 1.3 in 2010 to 1.0 in 2060.

- ***PFR (2013): Medeiros and Schwierz (2013)***
    - Long term health projections presented in this chapter are based on the estimation of equation (3) in growth rates:

$$\Delta\log \mathrm{h}_{\mathrm{i,t}} = \alpha + \mu_\mathrm{i} + \mathrm{D}_{85} + \mathrm{a} * \Delta\log \mathrm{x}_{\mathrm{i,t}} + \mathrm{b} * \Delta\log \mathrm{y}_{\mathrm{i,t}} + \mathrm{c} * \Delta\log \mathrm{p}_{\mathrm{i,t}} + \varepsilon_{i,t} \qquad \text{(v)}$$

or

$$\Delta\log \mathrm{h}_{\mathrm{i,t}} = \psi_t + \mathrm{a} * \Delta\log \mathrm{x}_{\mathrm{i,t}} + \mathrm{b} * \Delta\log \mathrm{y}_{\mathrm{i,t}} + \mathrm{c} * \Delta\log \mathrm{p}_{\mathrm{i,t}} + \varepsilon_{i,t} \qquad \text{(va)}$$

    where $\psi_t \equiv \alpha + \mu_\mathrm{i} + \mathrm{D}_{85}$ is a common time drift. Given the large country heterogeneity, a country-specific time drift is replace by a common time drift that can be changed (i.e. reduced) over time. Note that projections depend on the arbitrary assumptions made on the trajectory of the common time drift (ψ_t).
    - Moreover, note that the macroeconomic variables needed to project future public HE are already available in the EPC-EC methodology to project age related future expenditure (DG ECFIN-EPC(AWG), 2012), namely real GDP, GDP prices, wages, labour productivity, and demographic variables. Using equation (va) to project future public HE is fully consistent with the EPC-EC methodology, potentially strengthening the overall coherence of the projections carried out in the tri-annual Ageing Report exercises.

4. CONTROLLING HEALTH EXPENDITURE GROWTH

4.1. IMPROVING THE PERFORMANCE OF HEALTH SYSTEMS: SOME CONSIDERATIONS

Past and projected future trends of rising public expenditure on health, as estimated in Chapter IV.3, put pressure to improve the performance of health systems in order to reduce costs (savings) and to improve cost-effectiveness (better health outcomes for the same costs). The fact that a considerable part of expenditure growth remains unexplained, as part of "residual growth", stresses the relevance of regulatory settings of health systems in containing expenditure growth. Health systems are complex structures, involving multiple institutional setups for the financing and provision of services, and are built on contractual arrangements involving numerous of economic agents. Therefore, it is difficult to draw general conclusions on the absolute strength and weaknesses of specific characteristics of health systems. Consequently, it is a challenging task to evaluate which reforms may in general improve the value for money of public expenditure on health, possibly contributing to curbing the growth of future health expenditure.

However, some directions for reforms leading to improved system performance and fiscal sustainability of health expenditure can be identified (European Commission-EPC, 2010). These measures include: providing a sustainable financing system; redesigning the public health insurance package so as to incentivise the cost-effective use of treatments; increasing hospital efficiency; improving access to primary care and reducing unnecessary use of specialist and hospital care; increasing value for money in pharmaceutical expenditure by better regulatory policies; increasing the focus on measures of health promotion and disease prevention; improving data collection and information channels to support performance improvements; and using health technology assessments for evaluating the value for money of medical goods and services.

Improving the sustainability of the financing basis of health systems can be achieved in a number of ways. One key aspect is to improve the adaptability, predictability and robustness of the health budget in times of economic crisis. This may be achieved in a number of ways, such as by raising contribution rates and ceilings to social health insurance, broadening the revenue base, including new taxes, enforcing revenue collection and introducing automatic stabilisers through state budget transfers.

Second, health-system performance may be improved by changing the breadth (Who is covered?), scope (Which services are covered?) and depth (What are the user charges?) of public health coverage. ([131]) Access to free public health services may be adapted according to income or disease-related criteria; the publicly reimbursed benefits package may be changed based on objective criteria, including cost-effectiveness; user charges, i.e. private co-payments for using public health services, ([132]) may be changed according to access to care, efficiency and effectiveness considerations.

Depending on the exact design of the measures, they may be expected to improve or worsen the value for money of public expenditure on health: targeted-user charges to incentivise the use of cost-effective medical goods, such as generic pharmaceuticals, and services, aiming at directing users to cost-effective medical services; the redesign of the benefits package excluding (cost-) ineffective medical goods and services; and protective measures for vulnerable groups will have a positive impact. On the contrary, reducing the breadth, scope and depth of coverage may lead to increased future costs, if it results in postponing medically necessary treatment and/or worsening of health status, shifting treatment to more costly levels of care, such as to emergency hospital care, which is delivered free of cost for users in most EU Member States.

Third, improving the performance of health systems may be achieved by moving expenditure

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([131]) World Health Report (2010), "Health systems financing – the path to universal coverage," available at http://www.who.int/whr/2010/en/index.html

([132]) Where treatment alternatives for treating a specific condition exist, cost-sharing is often used as a disincentive for consuming cost-ineffective services or medical products, such as pharmaceuticals. However, patients often cannot judge on the benefits of specific treatments of medical products. Delisting from the publicly reimbursed benefits package may therefore be a clearer signal for patients instead of cost-sharing.

towards particular areas of health provision. In this respect, the main areas are hospital care, ambulatory care, preventive care and pharmaceutical expenditure. As described in Chapter IV.2, expenditure growth on hospital care largely drove total public health expenditure during the last decade.

A first area for improvement is hospital care. A common problem in many EU Member States is that their health systems tend to be centred on hospital care, creating excessive costs. In this regard, the faster increase in hospital care spending compared to total public health expenditure is problematic. It shows that the often debated health reforms aiming at moving from hospital-centric health systems towards a provision of services based at lower levels of care, such as primary care services, have not yet fully materialised. Consequently, cost-efficiency gains may be achieved through additional reductions in excessive hospital bed capacity (OECD 2012), reduction in hospital costs – as some countries seem to provide more cost-efficient hospital care than others or further shifting of hospital inpatient cases towards ambulatory care, which has been achieved to a varying degree across countries. ([133])

A second area for improvement is ambulatory care. Member States with strong sectors of ambulatory care have been shown to be successful in improving health outcomes and reducing costs. Strengthening access to primary care may avoid higher costs to be paid at a higher level of care later on. If Member States wish to encourage the use of primary care as a means to ensure the cost-effective provision of services, then measures have to be implemented to guarantee sufficient numbers and the good geographic distribution of trained and practising primary care physicians and nurses. Relatively low numbers of general practitioners vis-à-vis specialists may result in long-waiting times for primary care consultations. This makes patients seek more expensive consultations with specialists and emergency care units when that is not necessary (i.e. in the presence of common illnesses), rendering referral systems from primary to secondary care less effective as they are bypassed by patients. This may result in additional costs, for example, through unnecessary consultations and (duplicated) medical tests, as well as through unnecessary health infections associated with hospital stays.

A third important area for potential improvements is related to expenditure on pharmaceuticals. Demand for pharmaceuticals has been growing constantly in the past decades, driven often by medical innovation, and the benefits of pharmaceutical consumption have been reportedly to be significant. However, these benefits come at an increasing direct cost (Chapter IV.2). Pharmaceutical markets in the EU are heavily regulated. The different policies are related to pricing, reimbursement, market entry and expenditure, as well as targeted at specific agents such as distributors, physicians and patients. ([134]) Policy makers are growing more aware that, by regulating pharmaceutical markets correctly, efficiency gains can be achieved without compromising the quality of care.

A fourth expenditure area is related to health promotion and disease prevention. As discussed in Chapter IV.2, this expenditure area has experienced a reduction in expenditure levels in 2010. This is so despite the fact that the share of expenditure on health prevention is relatively low, accounting for less than 3% of total public expenditure on health care. There is a wide consensus that many policies of health promotion and disease prevention are cost-effective and may contribute to increasing longevity and health (OECD, 2010). ([135]) In particular, specific fiscal measures such as raising taxes on tobacco, alcohol, and food and drinks containing high levels of fat and/or sugar seem to be particularly cost-effective (WHO 2011, OECD 2010). Given the burden of chronic diseases in the EU, and the fact that they are associated with unhealthy life-styles, health

([133]) There are further important dimensions of possible inefficiencies of hospital care, which are not discussed here due to missing quantitative data to be explored in the analysis. For a broader discussion of this topic, see: http://ec.europa.eu/economy_finance/publications/occasional_paper/2010/pdf/ocp74_en.pdf

([134]) For policies in this area see: European Commission (DG ECFIN) (2012), "Cost-containment policies in public pharmaceutical spending in the EU", European Economy, Economic Papers: 461: http://ec.europa.eu/economy_finance/publications/economic_paper/2012/ecp461_en.htm

([135]) It is interesting to note that shifting budgets raises ethical questions: More preventive care for today's young population may downsize acute care for today's elderly. Thus, care may become cost-effective, but not in the same patient groups.

promotion and disease prevention can help reduce future expenditure in health by limiting the incidence of diseases associated with risk factors, such as obesity, smoking and alcohol consumption.

Additional measures aiming at improving the performance of the health system are: i) health-technology assessments of the cost-effectiveness of medical goods and services, eventually to reduce or fully withdraw public funding for inefficient procedures/treatments; and ii) investments in e-health to improve health systems through better data management, communication and control. As discussed in the "Joint Report on Health Systems", prepared by the European Commission (ECFIN) and the Economic Policy Committee (Ageing Working Group), ([136]) many countries have still ample scope for improvements in these two areas.

Concluding, due to the complexity of health systems no general toolbox for improving health system performance is available. Still, based on general considerations and drawing from country-specific experiences, different guidelines for potential improvements in various areas of health provision can be derived. This serves as a basis for the evaluation carried out in the next section, dealing with the conditions under which recent health reforms can be expected to improve fiscal sustainability of public health provision.

4.2. RECENT HEALTH REFORMS

As presented in Chapter IV.2, HE-to-GDP ratios fluctuated widely from 2008 to 2011, partly driven by cyclical conditions. In response to the economic crisis, many countries pursued health-policy reforms to deal with short-term budgetary pressures, and to improve the medium-to long-term fiscal sustainability of public expenditure on health. This section lists measures taken by EU Member States and carries out a preliminary qualitative assessment of reform outcomes.

The WHO has collected country data on health system responses to the current crisis up to January 2013. ([137]) Preliminary findings of this study show that many EU Member States have responded to the challenges posed by the economic crisis to their health systems by adapting the financing and/or expenditure parameters, as well as, by trying to improve the performance of the system to generate more outputs for the same amount of resources (Table IV.4.1).

Many EU Member States took measures to maintain the level of public funding for health, as increasing unemployment (thus decreasing revenues from payroll taxes) made it difficult to meet expenditure commitments. Therefore, social contribution rates or contribution ceilings have been raised (e.g. the Netherlands, Bulgaria); revenue base for calculating contributions was broadened (e.g. Greece, Portugal, France); revenue collection was strengthened (Hungary); transfers from the state budget were increased (e.g. Germany, Hungary, Lithuania); taxes have been reallocated or earmarked for health (e.g. France, Italy); automatic stabilisers, such as health insurance fund reserves and countercyclical components for government budget transfers were introduced (e.g. the Czech Republic, Estonia, Slovenia).

Contrary to more common type of responses, Germany and Hungary reduced contributions to health insurance schemes to ease pressure on the labour market; Finland and Slovakia decreased state budget allocations to health.

Besides financing issues, EU Member States attempted to reduce expenditure by changing the coverage of public health systems. Access to free public health services was removed for people without permanent resident status (the Czech Republic, Spain) or became income tested (Cyprus, Ireland); the publicly reimbursed benefits package was reduced (e.g. Estonia, Hungary, Lithuania); and user charges, i.e. private co-payments for using public health services, have been increased (e.g. Cyprus, Estonia, Greece, Italy, Latvia). Again and contrary to the common trend of narrowing the coverage of health systems, some Member States instead broadened coverage to the

([136]) Available at: http://ec.europa.eu/economy_finance/publications/occasional_paper/2010/op74_en.htm

([137]) WHO (2013), "Health, health systems and economic crisis in Europe: impact and policy implications," available at: http://www.euro.who.int/__data/assets/pdf_file/0011/186932/Health-and-economic-crisis-in-Europe4.pdf

Table IV.4.1: **Public health policy responses to economic crisis**

Adjusting financing		Country
	Increased contributions to public health insurance system	Netherlands, Bulgaria, Czech Republic, Greece, Portugal, Romania, Slovenia, France, Hungary
	Decreased contributions to public health insurance system	Germany, Hungary
	Increased transfers from state budget	Germany, Hungary, Lithuania, Romania, Slovakia
	Decreased transfers from state budget	Finland, Slovakia
	Reallocated or introduced new taxes	France, Italy, Hungary
	Improved automatic stabilisers	Czech Republic, Estonia, Slovenia, Lithuania, Slovakia
Changing health coverage		
	Reduced population coverage	Czech Republic, Spain, Cyprus, Ireland
	Increased population coverage	Estonia, Greece
	Changed benefits package	Expanding: Belgium, Bulgaria, Italy, Latvia, Netherlands Reducing: Estonia, Hungary, Lithuania, Romania, Netherlands, Ireland, Slovenia
	Changed user charges	Increased: Cyprus, Estonia, Greece, Italy, Latvia, Portugal, Czech Republic, France, Ireland, Slovenia, Spain, Denmark Decreased for vulnerable groups: Greece, Ireland, Portugal, Slovakia, Spain, Latvia, Belgium, France
Generating savings		
	Limited the increase of, freezed or reduced salaries and fees	Belgium, Cyprus, France, Greece, Ireland, Latvia, Lithuania, Portugal, Romania, Slovenia, Spain, Germany, United Kingdom, Denmark, Italy, Slovenia
	Reduced health worker benefits	Cyprus, Estonia, Portugal, Slovenia, Sweden, United Kingdom
	Increased cost containment in hospital spending	Bulgaria, Czech Republic, Denmark, Estonia, France, Ireland, Lithuania, Romania, Slovenia, Latvia
	Increased control of procurement of pharmaceuticals and medical goods	Bulgaria, Czech Republic, Greece, Slovakia, United Kingdom Improved coordination of care: Hungary, United Kingdom
	Strengthened pharmaceutical policy	23 EU Member States
	Reduced capital investments	Romania, United Kingdom, Bulgaria
Improving efficiency		
	Strengthened access to primary care	France, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, United Kingdom
	Developed strategy for quality	United Kingdom
	Expanded use of clinical guidelines	Belgium, Cyprus, Portugal
	Expanded use of HTA	Spain, Cyprus
	Invested in e-health	Czech Republic, Romania
	Took steps to improve population health via health promotion	Belgium, Greece, Hungary, Lithuania, Malta, United Kingdom
	Increased "sin taxes"	e.g.: Bulgaria, Cyprus, Denmark, Estonia, France, Hungary, Portugal, Slovenia, Spain

Source: WHO (2013), " Health, health systems and economic crisis in Europe: impact and policy implications"; European Commission services.
Note: Demark has withdrawn in the meantime the "sin tax" on saturated fat, after introduction in 2011.

long- term unemployed (Greece), added new items on the benefits package (e.g. Belgium, Bulgaria) and decreased user charges, particularly for vulnerable groups (e.g. Greece, Ireland, Portugal, Slovakia).

A third set of measures aims at realising some input cost savings. 15 EU Member States have limited the increase of, freezed or reduced salaries and fees paid to health workers, as wage costs constitute a considerable share of total budgets. However, historical experience suggests that curbing wage cost growth in the health sector below economic wide trends is not feasible over the medium- long-term, because wage policy in the health sector has to remain competitive to attract (young) professionals.

In a number of EU Member States, working hours in the health sector have been increased, while pension entitlements have been reduced (e.g. Estonia, Portugal, Slovenia); similarly, measures curbing hospital expenditure, which is the most important public health expenditure area, inter alia, through lowering services prices or tightening budget constraints were introduced in at least ten EU Member States.

In addition, control of public procurement of medical goods, including pharmaceuticals was fostered (e.g. Bulgaria, the Czech Republic, the

United Kingdom); ([138]) a total of 89 cost-containment measures in pharmaceutical policies were undertaken or planned in 23 EU Member States (Vogler et al., 2011); ([139]) capital investment has also been reduced or postponed (e.g. Romania, the United Kingdom, Bulgaria).

A final set of measures aimed directly at efficiency improvements. ([140]) As discussed in the previous Section, these are important structural measures which can contribute to improving the performance of health systems in terms of increases in efficiency and cost-effectiveness. In this regard, the following measures have been undertaken: access to primary care services was improved (e.g. Greece, Ireland, Italy); a strategy to deal with budget pressure via better quality is being developed (the United Kingdom); evidence-based clinical guidelines to streamline medical pathways towards better quality of care have been expanded ([141]) (Belgium, Cyprus, Portugal); measures of health promotion and disease prevention have been introduced (e.g. Lithuania, Malta, the United Kingdom); the use of health-technology assessments (HTA) has been expanded (Spain, Cyprus); investments in e-health have been made (the Czech Republic, Romania); and taxes on unhealthy goods (so called "sin taxes"), such as alcohol, tobacco, sugary drinks, have been introduced (e.g. Denmark, Estonia, France).

Overall, the implemented or planned reform measures show a broad spectrum of adaptation strategies in the areas of financing, expenditure and health system performance. In terms of the quantity of measures undertaken, the focus was clearly on generating savings and reducing expenditure commitments, such as through increasing user charges (reducing the public share in health care expenditure) and reducing labour input costs and purchasing prices of medical goods and services. A second core area of reforms is targeted to adjust financing systems, in order to secure a level of funding that better matches expenditure commitments in the short-term and is financial sustainable in the medium- to long-term.

A third area deals with measures to increase efficiency. Apparently, only a few EU Member States have undertaken reforms in this area, whereas it would be desirable to put a stronger emphasis on quality improvements of health expenditure. Notably, the average decrease in 2010 and 2011 in the EU of expenditure on health promotion and disease prevention – while generating short term savings – could turn out to be a myopic decision if average health status deteriorate, bringing with it a rise in future health expenditure.

Summing up, a taxonomy of recently implemented measures suggests that reforms observed in the EU are mainly focused on generating savings and improving the financing side. Few EU Member States have been active in structural reforms directed at generating efficiency gains. However, as laid out in the previous section, there seems to be ample scope for further reforms improving the performance of health systems and their financial sustainability. In view of future fiscal challenges related to rising health costs, EU Member States will have to strengthen reform efforts in the coming years, and broaden their scope to cover also efficiency and quality issues.

([138]) E.g., centralised procurement procedures for medical goods may generate savings by achieving lower prices from the bidder.

([139]) A better design of pharmaceutical policies has led to considerable savings in pharmaceutical expenditure in the past and may generate further savings under the current reforms (Carone et al., 2012).

([140]) Broadly, efficiency describes a relation between input and output. Effectiveness relates the input or output to the final policy objective (or the outcome). The effectiveness concept refers the use of public resources for achieving a given set of objectives and corresponds to the popular notion of value for money. See Annex 2 of: http://europa.eu/epc/pdf/joint_healthcare_report_en.pdf

([141]) Clinical guidelines are recommendations on the adequate treatment and care of patients. They are based on the best available evidence and are supposed to reduce undesirable variation in medical practice in order to improve the quality of care.

Box IV.4.1: **Health reforms in France**

The current crisis had a significant impact on the government budget as a whole and on the deficit of the healthcare system in particular. The deficit of the main public health insurance scheme ('Caisse nationale d'assurance maladie des travailleurs salariés' or Cnamts) rose from EUR 4.4 billion in 2008 to 11.6 billion in 2010 (around 0.6% of GDP) due to the fall in contributions engendered by labour market developments while healthcare expenditure continued to increase. The deficit has since been reduced thanks to additional revenue and, to a lesser extent, triggered by expenditure savings, which helped contain spending subject to an annual target ('objectif national des dépenses d'assurance maladie' or ONDAM). The 2013 deficit of the Cnamts is currently expected to be around 0.25% of GDP. ([1])

Additional revenue for the healthcare system has been generated through broadening the tax base, increasing levies and creating new ones as part of successive consolidation packages. A number of social security exemptions such as those that apply to low wages or to overtime work have been reduced or abolished. Social levies on capital income and gains and on real estate gains have been raised. A new 2% levy on non-wage income such as that stemming from employee savings schemes has been created in 2009 and since then increased to 20%. Higher taxation of supplementary health insurance schemes has generated additional revenue. Finally, excise duties on tobacco and alcohol have been raised and a new tax on soft drinks with excessive sugar has been introduced.

The range of services and share of service cost covered was somewhat reduced. The benefits package changed at the margin, with drugs deemed of insufficient medical value no longer reimbursed. User charges were increased as part of the annual savings backing the ONDAM spending norm. Main measures included increasing a daily lump-sum payment for hospital care, introducing a similar one for pharmaceuticals, paramedical services and transport, reducing the reimbursement rate of some drugs and medical devices and lowering the maximum amount of sickness benefits. Yet, supplementary health insurance schemes have been encouraged for low incomes by extending free cover.

Additional savings have been achieved through adapting provider payment and strengthening pharmaceutical policy. Base wages of civil servants have been frozen across all sub-sectors of general government since 2010, which has helped reduce deficits in the hospital sector. Tariffs for a number of health services (radiology, lab tests, hospital care) have been frequently lowered over the last few years. In addition, containing spending on pharmaceuticals has long been an important policy direction in France. In particular, lower prices for publicly purchased or reimbursed pharmaceuticals and medical devices have been negotiated in recent years. Policies to achieve greater use of generic drugs (now available for most chronic conditions) have also been ramped up.

Faced with fewer financial resources, the challenge for the French health system has also been to maintain universal access to high quality healthcare by generating efficiency gains. Primary care has been prioritised as it provides a wide range of vital services including prevention, timely detection of disease and disease management while avoiding use of more expensive services. In particular, financial incentives have been introduced to shift from inpatient to day-case surgery for cases that do not necessitate acute care. In addition to attempts to shift care out of hospitals, steps to enhance efficiency have included: encouraging cost-effective patterns of use in outpatient care, introducing and/or expanding use of practice guidelines and care protocols as well as launching a new, performance-based contract for general practitioners concerning preventive care and chronic disease control and a drug prescription. Despite likely (short-term) savings, it is too early to assess the effects of such strategies on the performance of the health system as a whole.

([1]) Rapport à la Commission des comptes de la sécurité sociale, June 2013, available at: http://www.securite-sociale.fr/Comptes-de-la-Securite-sociale-resultats-2012-previsions-2013.

5. CONCLUSIONS

Public expenditure on health absorbs a significant and growing share of economic resources. Most EU Member States are expected to face strong and growing expenditure pressures on their health systems in the coming decades. As the literature demonstrates the demographic component related to spending pressures on health is relatively small, and is importantly related to other non-demographic drivers, such as the institutional setup of health systems, technological progress and the labour intensive nature of the health sector. As shown in Chapter IV.3, while there is a degree of uncertainty regarding the exact point estimates of future public expenditure on health, most empirical studies coincide on the result that the HE-to-GDP ratio is projected to increase considerably in most EU Member States.

At the same time, the recent worsening of fiscal positions and increases in government debt make fiscal sustainability an acute policy challenge, as it has become more difficult for Member States to maintain sustainable public finances (European Commission, 2012b). Whilst spending on health can contribute to better health, which by itself adds to economic prosperity and well-being through higher labour market participation, productivity, and quality of life, it also crowds out resources available for other policy targets, inter alia, education, R&D, and poverty reduction. This report suggests that the increase in public expenditure on health has been partially offset by a reduction in other expenditure outlays. This underlines the need to increase efforts to decelerate the growth of expenditure on health, notably by curbing the sources of expenditure pressure and improving regulatory frameworks so as to improve the value for money of health services provision.

Chapter IV.4 shows that in the wake of the crisis, many EU Member States have undertaken reforms to curb expenditure pressure. In general, the responses to the financial and economic crisis varied across Member States in Europe. Responses depended on the severity of the crisis itself, but also on the fiscal challenge associated with current and projected future expenditure levels and the need to address particular inefficiencies in health systems. Most of the reform measures undertaken or planned during the economic crisis aimed at adapting financing, generating savings and reducing expenditure commitments. Few measures directly targeted efficiency concerns.

While the latest data from 2010 and 2011 confirm the slowdown of the growth of public expenditure on health, it is too early to assess the effects of measures taken in the wake of the crisis to curb health expenditure trends. Only in a few years it will be possible to assess whether the fall in the HE-to-GDP ratio registered in 2010 and 2011 in many EU Member States is representative of a new trend. Also in order to evaluate the implications of the health policy responses to the crisis, country-specific analysis are needed which place the reforms in a particular national context, taking into consideration country-specific idiosyncrasies.

As discussed in Chapter IV.4, many of the policy reforms adapting the financing of health systems are expected to have positive effects over the economic cycle on the stability of the health budget i.e. financing gaps become less influenced by cyclical conditions. This will help meeting expenditure commitments during economic downturns. Still, in terms of financing there may be a limit in what can be achieved from the revenue side, especially in countries where the overall tax burden on the economy is already high and/or social contributions are high.

It is difficult to evaluate the impact of the cost-saving measures as much depends on their actual design and the fact that they may have an impact on health system performance in the short as well as in the medium and long run. Reducing input costs may also generate savings in the longer term, if they are supported by appropriate financial incentives, which might strengthen the competition of health care providers, aim at improvements in quality and in the overall cost structure of health care. They may lead to the needed consolidation of health markets, inter alia, by reducing excessive hospital bed capacity. They may also lead to immediate and much needed savings and thus improve the fiscal positions of governments. At the same time, budgetary cuts may in some cases imply a postponement of necessary investment, resulting in a gradual deterioration of health infrastructure and higher financing needs in the future.

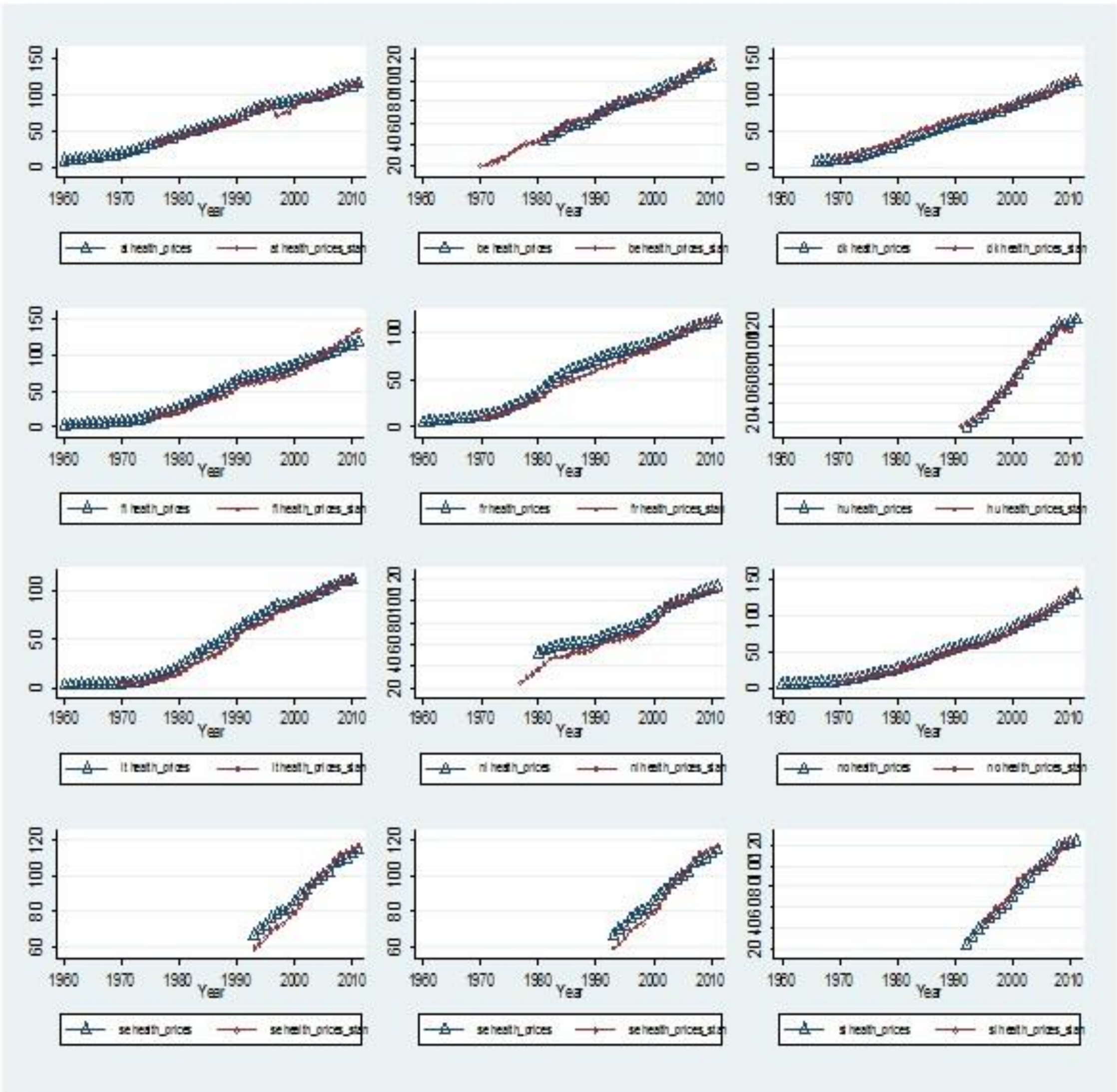
The focus of reforms on generating savings and improving the financing side indicates that there remains scope for further reforms aiming at improving the value for money of public health services. Emergency measures on the financing and cost-saving side may be necessary condition to improve the fiscal positions of government in times of economic crisis. However, they are not a sufficient condition for inducing sustainable improvements in the value for money of public health services.

Few EU Member States have recently implemented measures with a direct impact on efficiency, which would be paramount to increase the overall performance of health systems. In fact, ambitious reforms are needed to turn health systems towards more cost-effective primary and ambulatory care services, as well as towards a bigger role of disease prevention and health promotion. These can be expected to substantially improve the performance of health systems. However, the bulk of measures taken so far during the crisis are mainly aimed at improving the fiscal sustainability of public expenditure on health, also in view of projected future expenditure increases. They seem insufficient to improve the performance of health systems. For example, financing measures alone seem unable to rebalance public expenditure away from hospital care, towards ambulatory care services, disease prevention and health promotion.

In conclusion, there remains ample scope for further reforms improving the performance of health systems and improving their fiscal sustainability. In view of the future fiscal challenges, EU Member States are likely to have to broaden reform efforts towards measures more directly affecting the efficiency and effectiveness of health systems.

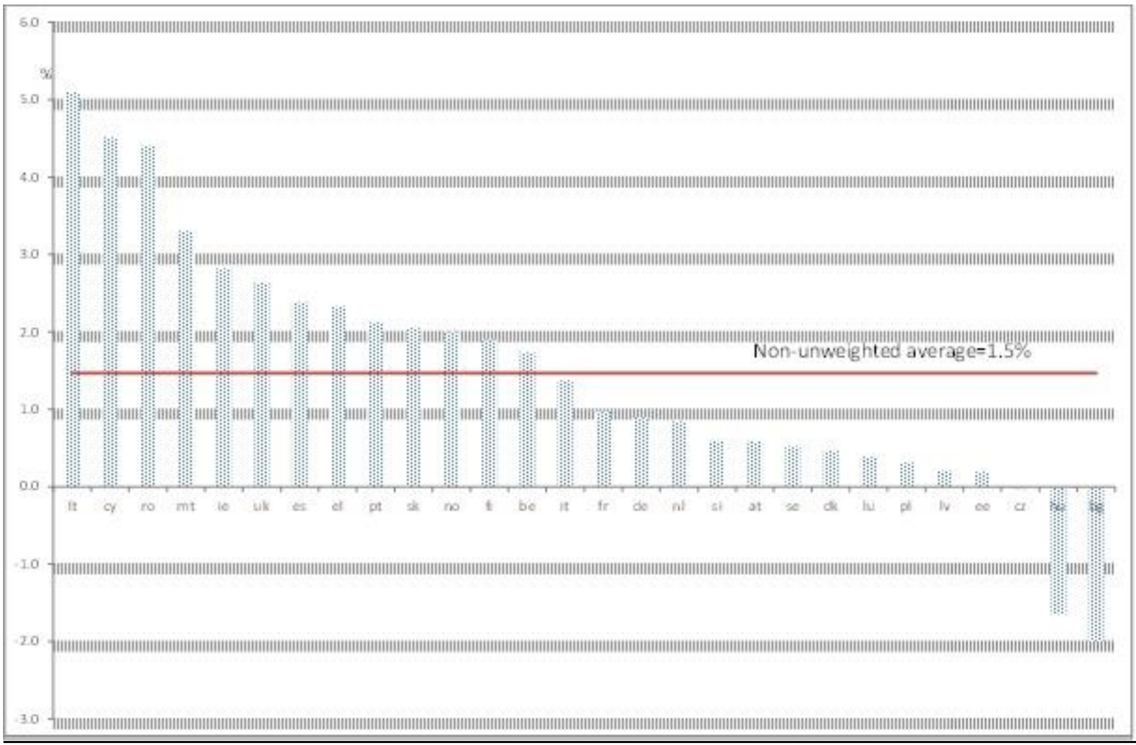
ANNEX 1

Graph IV.A1.1: **Comparing health prices indices (index 2005=100). OECD STAN versus a proxy based on aggregate Ameco data and input-output national accounts data (Eurostat)**



Source: : OECD STAN database, DG ECIN Ameco, and Eurostat

Graph IV.A1.2: **Excess cost growth (C)**



Source: Own calculations based on estimates of regressions 4 (Table IV.A1.1).

Table IV.A1.1: **Regression estimates of real per capita public HCE (variables in levels)**

Regressions	OLS	OLS	IV	IV	IV
	(1)	(2)	(3)	(4)	(4a)
Variables	All observations	excl. 10% more influential	All observations	excl. 10% more influential	excl. 10% more influential and 2009 and 2010
Constant	0.030***	0.019***	0.025**	0.01	0.006
Dummy 1985	-0.012	-0.008	-0.012*	-0.008	-0.007
Per capita GDP (income elast.)	0.204*	0.204**	0.775	0.961***	0.838**
Relative prices (price elast.)	-0.325*	-0.144	-0.616***	-0.478*	-0.279*
Young population ratio	0.083	0.059	0.545	0.455*	0.413
Old population ratio	0.2	0.217	0.319	0.183	0.348
Country fixed effects					
be	-0.003	0.010**	-0.002	0.013***	0.011**
bg	-0.021***	-0.022***	-0.028***	-0.033***	-0.031***
cy	0.027***	0.020***	0.039***	0.037***	0.036***
cz	-0.013**	-0.016**	-0.008	-0.014**	-0.021***
de	-0.007	-0.001	-0.004	0.006	0.001
dk	-0.011***	-0.009***	-0.008*	-0.003	-0.002
ee	-0.012*	-0.003	-0.016*	-0.013*	-0.022*
el	0.006	0.013*	0.01	0.019**	0.021***
es	0.008*	0.013***	0.012	0.019***	0.019***
fi	0.005	0.006**	0.006	0.009**	0.007***
fr	-0.007	-0.001	-0.004	0.005	0.004
hu	-0.025***	-0.030***	-0.022***	-0.024***	-0.033***
ie	0.016***	0.025***	0.012*	0.016***	0.025**
it	-0.004	0.002	0.001	0.011	0.01
lt	0.025***	0.023***	0.029***	0.025***	0.006
lu	0.001	-0.002	-0.003	-0.007***	-0.009***
lv	0.003	-0.004	0.013	-0.021**	-0.01
mt	0.011	0.014*	0.016	0.023**	0.023***
nl	0.003	0.001	0.004	0.004	0.007
no	0.012***	0.018***	0.009***	0.015***	0.017***
pl	0.002	-0.001	-0.001	-0.008	-0.005
pt	0.002	0.007	0.007	0.015**	0.015**
ro	0.015**	-0.004	0.015**	0.009	-0.009
se	-0.007*	-0.002	-0.007**	-0.003	-0.002
si	-0.01	-0.003	-0.013*	-0.003	-0.003
sk	0.001	0.010*	0.002	0.007	0.013
uk	0.013***	0.018***	0.014***	0.020***	0.018***
Number of observations	620	563	614	557	513
R squared adjusted	0.032	0.089	.	.	0.008
Wald test (p-value) a)	0.1584	0.1015	0.049*	0.0122*	0.2855
legend: * p<0.05; ** p<0.01; *** p<0.001					

(1) The country dummy for Austria was (arbitrarily) set to zero in all regressions for collinearity reasons.
a) Tests the null hypothesis (H0) of equivalence between the estimated regression and an alternative specification where the relative prices variable is replaced by two variables: health prices and the GDP deflator (results for the latter regression are not shown).
Source: Own calculations based on SHA and national data.

Table IV.A1.2: **Estimation of the error correction model (for regressions with variables in levels)**

Regressions	OLS	IV	IV
	(5)	(6)	(6a)
			excl. 2009
Variables			and 2010
Constant	-3.8e+01**	-3.1e+01*	-3.1e+01*
Per capita GDP (income elast.)	0.50689	0.66491**	0.63600*
Relative prices (price elast.)	-0.24469	-0.40918	-0.35823
Year	0.01786***	0.01599***	0.01587**
Year * dummy 1985	-0.00002	-0.00002	-0.00002
Country fixed efects			
Year * be	-0.00004	-0.00003	-0.00003
Year * bg	-0.00059**	-0.00050**	-0.00052**
Year * cy	-0.00062***	-0.00059***	-0.00060***
Year * cz	-0.00023**	-0.00019**	-0.00019*
Year * de	0.00004	0.00004*	0.00005*
Year * dk	0.00011***	0.00010***	0.00011***
Year * ee	-0.00046***	-0.00039***	-0.00040**
Year * el	-0.00030***	-0.00027***	-0.00028***
Year * es	-0.00023***	-0.00020***	-0.00021***
Year * fi	-0.00015***	-0.00014***	-0.00014***
Year * fr	0.00004	0.00005*	0.00005*
Year * hu	-0.00032**	-0.00026**	-0.00025*
Year * ie	-0.00017***	-0.00017***	-0.00017***
Year * it	-0.00014***	-0.00012***	-0.00013***
Year * lt	-0.00046***	-0.00039**	-0.00040**
Year * lu	0.00012	0.00007	0.00009
Year * lv	-0.00057***	-0.00049***	-0.00050**
Year * mt	-0.00029***	-0.00024***	-0.00025***
Year * nl	-0.00010***	-0.00010***	-0.00010***
Year * no	-0.00003	-0.00004	-0.00004
Year * pl	-0.00050***	-0.00042***	-0.00044**
Year * pt	-0.00020**	-0.00017**	-0.00017*
Year * ro	-0.00063***	-0.00053**	-0.00054**
Year * se	-0.00002	-0.00001	-0.00001
Year * si	-0.00018**	-0.00015*	-0.00015*
Year * sk	-0.00037**	-0.00031**	-0.00031**
Year * uk	-0.00011***	-0.00010***	-0.00011***
Number of observations	671	665	615
R squared adjusted	0.96433	0.96593	0.96536
Wald test (p-value) a)	0.9608	0.7341	0.7295
legend: * p<0.05; ** p<0.01; *** p<0.001			

(1) The country dummy for Austria was (arbitrarily) set to zero in all regressions for collinearity reasons.
a) Tests the null hypothesis (H0) of equivalence between the estimated regression and an alternative specification where the relative prices variable is replaced by two variables: health prices and the GDP deflator (results for the latter regression are not shown).
Source: Own calculations based on SHA and national data

Table IV.A1.3: **Estimation of the error correction model (for regressions with variables in levels)**

Regressions	OLS	OLS	OLS
	(7)	(8)	(8a)
Variables			excl. 2009 and 2010
Constant	0.03424***	0.03351***	0.03427***
Dummy 1985	-0.01197	-0.01054	-0.00986
(Lagged) Error Correction (EC)	-0.17081***	-0.17787***	-0.17200***
Per capita GDP	0.17841*	0.18971**	0.16455
Relative prices	-0.27145*	-0.28657**	-0.28644**
Country fixed effects			
be	0.00537	0.00453	0.0041
bg	-0.02373***	-0.01967***	-0.02057***
cy	0.02202***	0.02110***	0.02813***
cz	-0.01251**	-0.01327**	-0.01686**
de	-0.00916*	-0.00990*	-0.01360**
dk	-0.01380***	-0.01413***	-0.01559***
ee	-0.01408*	-0.01494*	-0.01177
el	0.00653	0.00591	0.00938*
es	0.00495**	0.00363*	0.00410*
fi	-0.00008	-0.00147*	-0.00079
fr	-0.00123	-0.00204	-0.0026
hu	-0.02541***	-0.02615***	-0.02706***
ie	0.01137*	0.01025*	0.02393***
it	-0.00539	-0.0063	-0.00646
lt	0.02112**	0.02031**	0.02102*
lu	0.00219	0.00183	0.00018
lv	0.00346	0.00297	0.00189
mt	0.00953*	0.00682	0.01002*
nl	-0.00157	-0.00222	-0.00098
no	0.00748***	0.00577***	0.00635***
pl	0.00201	0.00128	0.00156
pt	0.00965*	0.00876*	0.01053*
ro	0.01051	0.00994	0.01444
se	-0.00984*	-0.01062*	-0.01123*
si	-0.00998*	-0.01089*	-0.00936*
sk	-0.00308	-0.00378	-0.00207
uk	0.00366	0.00273	0.00134
Number of observations	638	638	588
R squared adjusted	0.15121	0.16406	0.159

legend: * p<0.05; ** p<0.01; *** p<0.001

(1) The country dummy for Austria was (arbitrarily) excluded from all regressions for collinearity reasons.
Source: Own calculations based on SHA and national data

Table IV.A1.4: **Estimates of excess cost growth (C) Annual averages in percentage**

	Growth rate equations no co-integration				Level equations co-integration		
	OLS	OLS	IV	IV	OLS	IV	IV
	(1)	(2)	(3)	(4)	(5)	(6)	(6a)
	All observations	Excl. 10% more influential	All observations	Excl. 10% more influential	All observations	All observations	All observations excl. 2009 and 2010
at	1.1	0.5	1.2	0.6	1.6 (1.4)	1.6 (1.4)	1.5 (1.3)
be	0.9	1.6	1.0	1.7	1.5 (1.4)	1.5 (1.3)	1.4 (1.2)
bg	-1.6	1.3	-2.3	-2.0	1.4 (1.3)	1.4 (1.3)	1.4 (1.3)
cy	4.3	3.6	5.3	4.5	1.7 (1.5)	1.6 (1.4)	1.2 (1.1)
cz	0.0	-0.9	0.7	0.0	2.1 (1.8)	2.0 (1.7)	1.9 (1.7)
de	0.5	0.4	0.7	0.9	1.8 (1.6)	1.6 (1.4)	1.6 (1.4)
dk	0.5	0.3	0.6	0.5	2.1 (1.9)	1.9 (1.7)	1.9 (1.7)
ee	-0.9	-0.7	-0.1	0.2	2.2 (1.9)	2.1 (2.0)	2.0 (1.9)
el	1.6	1.6	2.2	2.3	1.6 (1.4)	1.5 (1.3)	1.4 (1.2)
es	1.6	1.5	2.2	2.4	1.3 (1.1)	1.3 (1.2)	1.1 (1.0)
fi	2.0	1.7	2.1	1.9	2.0 (1.8)	1.8 (1.6)	1.8 (1.6)
fr	0.8	0.8	0.9	1.0	1.8 (1.6)	1.7 (1.4)	1.6 (1.4)
hu	-1.5	-2.3	-0.9	-1.7	1.6 (1.4)	1.6 (1.4)	1.6 (1.4)
ie	2.0	2.4	2.5	2.8	1.4 (1.2)	1.5 (1.4)	1.1 (1.1)
it	0.9	0.9	1.3	1.4	1.5 (1.3)	1.4 (1.2)	1.3 (1.1)
lt	4.2	4.1	5.0	5.1	3.1 (2.8)	2.9 (2.6)	2.9 (2.6)
lu	0.7	0.0	1.0	0.4	1.7 (1.5)	1.7 (1.6)	1.6 (1.5)
lv	2.2	-0.8	2.9	0.2	2.9 (2.6)	2.6 (2.2)	2.6 (2.2)
mt	2.6	2.9	3.0	3.3	2.1 (1.9)	2.0 (1.7)	1.9 (1.7)
nl	1.1	0.4	1.5	0.8	1.4 (1.2)	1.4 (1.2)	1.2 (1.1)
no	2.1	2.1	2.0	2.0	1.5 (1.3)	1.5 (1.3)	1.3 (1.1)
pl	0.0	-0.8	1.0	0.3	1.2 (1.1)	1.3 (1.3)	1.3 (1.2)
pt	1.7	1.6	2.0	2.1	1.8 (1.6)	1.7 (1.5)	1.5 (1.3)
ro	2.7	3.7	3.5	4.4	2.9 (2.5)	2.7 (2.4)	3.0 (2.7)
se	0.3	0.3	0.5	0.5	1.8 (1.6)	1.7 (1.5)	1.7 (1.5)
si	-0.9	-0.3	-0.3	0.6	1.2 (1.1)	1.3 (1.2)	1.0 (1.0)
sk	0.5	1.0	1.6	2.0	1.9 (1.7)	1.9 (1.7)	1.6 (1.5)
uk	2.4	2.4	2.7	2.6	1.6 (1.4)	1.6 (1.4)	1.4 (1.3)
Non-weighted avg.	1.1	1.0	1.6	1.5	1.8 (1.6)	1.7 (1.5)	1.6 (1.5)
Trimmed non-weighted avg. a)	1.1	1.1	1.6	1.2	1.7 (1.5)	1.6 (1.4)	1.6 (1.4)
Weighted average	1.1	1.0	1.4	1.4	1.6 (1.5)	1.6 (1.4)	1.5 (1.3)
Standard deviation	1.5	1.5	1.6	1.7	0.5 (0.4)	0.4 (0.3)	0.5 (0.4)

(1) a) Non-weighted average of the values within ± 1 standard deviation.
Note: In columns 5 to 6a, there are two values in each cell. The first refers to the model in levels without demographic variables, the second (in parenthesis) refers to the corresponding model including two demographic variables, namely the young and old age population ratios.
Source: Own calculations based on SHA and national data.