EUROPEAN ECONOMY

Economic Papers 417 | July 2010

Projecting future health care expenditure at European level: drivers, methodology and main results

Bartosz Przywara

Economic and Financial Affairs
DIRECTORATE-GENERAL

EUROPEAN COMMISSION

European Commission
Directorate-General for Economic and Financial Affairs
Publications
B-1049 Brussels
Belgium
E-mail: Ecfin-Info@ec.europa.eu

This paper exists in English only and can be downloaded from the website
ec.europa.eu/economy_finance/publications

A great deal of additional information is available on the Internet. It can be accessed through the Europa server (ec.europa.eu)

KC-AI-10-417-EN-N

ISSN 1725-3187
ISBN 978-92-79-14903-0
doi 10.2765/42844

Projecting future health care expenditure at European level: drivers, methodology and main results

Bartosz Przywara

Executive summary

Predicting the future evolution of health care expenditure is one of crucial challenges facing the European Union and its Member States in the context of the demographic and social changes taking currently place in Europe. To correctly assess the risk of rising health care spending over the next couple of decades and establish adequate policy responses to the challenges, it is essential to devise a reliable method to estimate future health care expenditure. However, the complexity of the systems and multiplicity of factors affecting both total and public spending make this a highly complicated task, where results will always be surrounded by considerable uncertainties.

To tackle this issue a major project was undertaken by the European Commission and Economic Policy Committee which aimed at projecting future public health care expenditure in twenty seven Member States of the European Union and Norway over the period 2007-2060. A unique internationally comparable database has been established and a model built allowing to project health care spending in a common, coherent framework of macroeconomic variables and a set of projections covering a number of other age-related items of public social expenditure. The model incorporates the most recent developments in demography and epidemiology and draws on new insights from health economics, allowing the comparison of the risks and challenges facing both individual countries' health care systems and European society in its entirety.

This paper provides a comprehensive overview of the theoretical background, practical aspects of projecting health care expenditure and the actual results of the projections undertaken in the context of long-term budgetary projections.

1. INTRODUCTION

Predicting future evolution of health care expenditure is one of crucial challenges facing the European governments in the context of the demographic and social changes taking currently place in Europe. As a public good provided, at least in basic terms, free of charge to the whole population, health care is a major and constantly growing component of public finances. Expenditure on health care has been growing, both in absolute and relative terms (as percentage of GDP and of total government outlays) ever since governments took up responsibility for universal provision of health care. Furthermore, it is expected to continue growing over the decades to come in the context of ageing populations and growing public expectations on the accessibility and quality of care, unless substantial structural reforms in the way health care is provided and financed are enacted. Since significant increase is expected also in public expenditure on pensions, long-term care and other age-related components of social spending, the European governments face the growing risk of undermining long-term sustainability of their public finances.

To correctly assess this risk over the next couple of decades and establish adequate policy responses to the challenges, devising a reliable method to estimate future health care expenditure (as well as other components of public spending) is essential. However, the complexity of the systems and multiplicity of factors affecting both total and public spending make it a complicated and highly uncertain task. Several researchers have attempted to model the financial structure of health care systems and use it to project future evolution of health care expenditure. Although much effort has been invested in modelling the interactions between a number of demographic, social and economic factors affecting health care spending, the large majority of studies remained limited to analysing the features of individual national systems. While very useful in a single-country framework, such an approach is however not sufficient in an international context of a monetary and economic union. Given the large variability of the systems, financing methods and in-built incentives, the main challenge is to reconcile the obvious need for the precision of the model reflecting as many systemic features as possible with the comparability across the systems.

Tackling this issue has been the main idea behind the large project undertaken by the European Commission and Economic Policy Committee which aimed at projecting future public health care expenditure in twenty seven Member States of the European Union and Norway. A close collaboration between the Commission services and the delegates of the Member States allowed the establishment of a unique internationally comparable database and to build a model allowing to project health care spending in a common, coherent framework of macroeconomic variables and a set of projections covering a number of other age-related items of public social expenditure. The model incorporates the most recent developments in the demography, epidemiology and health economics, allowing the comparison of the risks and challenges facing both individual countries' health care systems and the European society in its entirety.

This paper provides a comprehensive overview of the theoretical background, practical aspects of projecting health care expenditure in a unique multinational context and the actual results of the projections undertaken in the context of long-term budgetary projections. Section 2 provides a short overview of the project. Section 3 provides the literature overview and a discussion of the factors affecting health care expenditure. Section 4 describes the methodology against the background of the similar exercises undertaken at national and international level. Section 5 presents the actual results of the projection exercise, their possible interpretation and unavoidable limitations. Section 6 concludes by suggesting a number of policy recommendations which can be drawn from the exercise.

2. THE EUROPEAN COMMISSION/ECONOMIC POLICY COMMITTEE PROJECTIONS OF THE ECONOMIC AND BUDGETARY IMPACT OF AGEING POPULATIONS

2.1. Health care expenditure: a historical perspective.

The governments of all EU Member States are heavily involved in the financing, and in some cases in the provision, of health care[1]. Consequently, health care spending is a major, and growing over time, source of fiscal pressure, see Table 1.

Total health care spending, both public and private, increased rapidly during the 1960s and 1970s and at a slower rate, in the 1980s. It picked up again in the 1990s in most Member States and continued growing in the first decade of the 21st century. In 2006 it amounted on average to 9% of GDP in the EU, but the countries differed considerably ranging from 5% in Estonia and Romania to almost 11% of GDP in France and over 10% in Germany and Austria. Taken by itself public spending on health care rose as a share of GDP during the 1970s in the countries for which data are available. In the 1980s and 1990s, the increasing trend slowed down, and even reversed in a few countries, due to overall budgetary consolidation efforts. It picked up again in the late 1990s and especially in the 2000s to reach an average level of 6.7% of GDP in 2006 (ranging from less than 3% of GDP in Cyprus to almost 9% of GDP in France). A convergence or catch-up process is evident across countries, with the largest increases over time occurring in countries with the lowest initial levels[2]. Health care spending has also been growing as a share of total primary government spending, especially during the 1990s, suggesting that health budgets fared better than other expenditure items during periods of fiscal consolidation. Currently it accounts for between 12% and 15% of government outlays in most EU countries, although the dispersion is wide ranging from 6% in Cyprus to almost 18% in Germany.

---

[1] This may reflect shared view on the economic rationale for public sector involvement in health care markets based on efficiency and equity considerations. Health care markets suffer from the typical problems of insurance markets such as adverse selection (which may make it difficult for persons with higher health risks to obtain affordable coverage leading to a sub-optimal consumption of health care services), moral hazard (whereby the insured person may have an incentive to over consume health care services as they do not bear the full cost) and asymmetric information (whereby health care providers may be in a position to induce the demand for treatment and extract economic rents).

[2] For example, public spending on health care in Portugal grew from 1.5% of GDP in 1970 to 7.2% of GDP in 2006, in Spain from 2.3% to 6.0% and Greece from 2.3% to 5.9%. A similar trend is expected to take place in the Newly Acceded Member States of the Central and Eastern Europe due to the increasing living standards, although the range of growth will be probably smaller given the significant role of publicly provided health care in the pre-transition period.

Table 1 Past trends in health care spending (public and private) in EU Member States, 1970-2006

	Public health expenditure as % of GDP					Public health expenditure as % of total health expenditure				Public health expenditure as % of total government outlays			
	1970	1980	1990	2000	2006	1980	1990	2000	2006	1980	1990	2000	2006
BE	:	:	:	6,6	6,8*	:	:	77	64*	:	:	:	14,7
BG	:	:	:	3,6	4,1	:	:	58	57	:	:	:	10,9
CZ	:	:	4,6	5,9	6,1	:	98	91	88	:	:	14,1	13,8
DK	:	7,9	6,9	6,8	8,1	89	83	82	84	14,9	12,3	12,7	15,7
DE	4,4	6,6	6,3	8,2	8,1	79	76	80	77	:	:	18,2	17,9
EE	:	:	:	4,1	3,8	:	:	77	74	:	:	:	10,9
IE	4,1	6,8	4,4	4,6	5,5	82	72	73	77	:	10,2	14,7	16,3
EL	2,3	3,3	3,5	4,7	5,9	56	53	59	62	:	:	10,1	14,0
ES	2,3	4,2	5,1	5,2	6,0	79	78	72	71	:	:	13,2	15,5
FR	4,1	5,6	6,4	8	8,8	80	76	79	80	12,3	12,9	15,5	16,6
IT	:	:	6,1	5,8	6,9	:	79	72	77	:	11,6	12,7	14,2
CY	:	:	:	2,4	2,8	:	:	42	44	:	:	:	6,8
LV	:	:	:	3,3	3,6*	:	:	55	57*	:	:	:	6,4*
LT	:	:	:	4,5	4,3	:	:	69	70	:	:	:	8,1
LU	2,8	4,8	5	5,2	6,6	92	93	90	86*	:	13,2	13,9	17,1
HU	:	:	:	4,9	5,9	:	:	71	71	:	:	10,6	11,3
MT	:	:	:	4,9	6,5*	:	:	72	77*	:	:	:	:
NL	:	5,1	5,4	5	6*	69	68	63	61*	9,3	9,8	11,4	:
AT	3,3	5,1	6,1	7,6	7,8	69	73	77	76	10,3	11,9	14,7	15,7
PL	:	:	4,4	3,9	4,3	:	92	71	70	:	:	9,4	9,9
PT	1,5	3,4	3,8	6,4	7,2	64	64	73	70	:	:	14,9	15,3
RO	:	:	:	3,4	3,5	:	:	74	77	:	:	:	7,5
SI	:	:	:	6,2	6,0	:	:	74	72	:	:	:	11,4
SK	:	:	:	4,9	5,0	:	:	89	68	:	:	9,7	13,6
FI	4,1	5	6,2	5,1	6,2	79	81	71	76	12,4	13,0	10,6	12,7
SE	5,8	8,2	7,4	7	7,5	92	90	85	82	:	:	12,6	13,7
UK	3,9	5	4,9	5,6	6,9	89	83	80	81	11,0	12,0	14,3	15,7

***2005**
Sources: OECD Health Data 2009, Eurostat

The prospect of a rapidly ageing population in Europe has added to concerns about the impact of rising health care spending on government finances. Following the exercises carried out in 2001 and 2006[3], the Economic Policy Committee and the European Commission has recently published a major report examining the impact of ageing populations on public spending (see: European Commission and Economic Policy Committee, 2009).

2.2. The projection exercise – an institutional context

The new set of age-related public expenditure projections has been performed for all twenty-seven EU Member States and Norway[4] and covered spending on pensions, health care, long-term care, education, and unemployment transfers for the period from 2008 to 2060. The projections were endorsed by the ECOFIN Council of 5 May 2009, and accompanied the Commission Communication[5]. The projection exercise was carried out jointly by the European Commission's Directorate General for Economic and Financial Affairs and the national authorities via the Ageing Working Group attached to Economic Policy Committee. An overview of the projection exercise is presented on Graph 1. Its unique value-added and

---

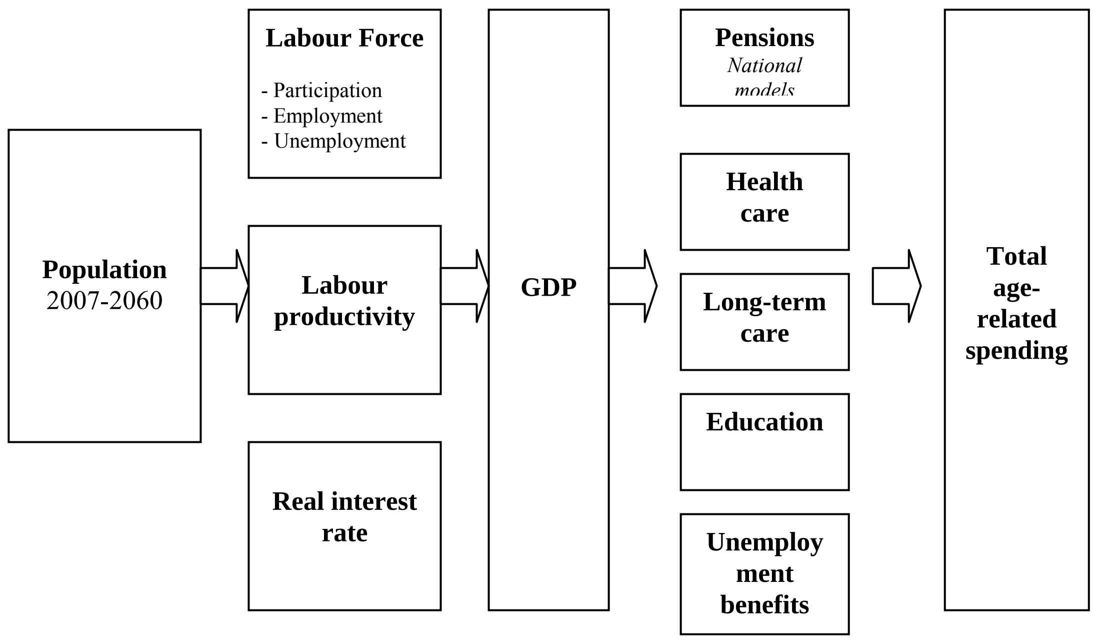
[3] Economic Policy Committee (2001) and Economic Policy Committee and European Commission (2006).

[4] Norway has a status of observer in the Ageing Working Group.

[5] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions - Dealing with the impact of an ageing population in the EU (2009 Ageing Report), COM/2009/0180 final.

strength stems from the fact that it brought together experts from both international organisations and national authorities. In this way, cross-country comparability has been assured, while at the same time due account has been taken of country specific circumstances and the large diversity of national social protection and health care systems.

Graph 1 Overview of the EPC/Commission economic and budgetary projection exercise



Source: European Commission and the EPC.

The projections are generally - and for the reference scenario in particular - made on the basis of "no policy change", i.e. only reflecting enacted legislation, but not possible future policy changes (although account is taken of provisions in enacted legislation that enter into force over time). The projections are made on the basis of legislation enacted by July 2008. They are also made on the basis of the current behaviour of economic agents, without assuming any future changes in behaviour over time: for example, this is reflected in the assumptions on participation rates which are based on the most recently observed trends by age and gender. While the underlying assumptions have been made by applying a common methodology uniformly to all Member States, for several countries adjustments have been made to avoid an overly mechanical approach that leads to economically unsound outcomes and to take due account of significant country-specific circumstances.

The starting point in the projection exercise was a common population projection for 27 EU Member States and Norway produced by Eurostat (EUROPOP2008, for methodological details see: Lanzieri 2009 and Eurostat 2007). In the next step, the Commission and Ageing Working Group agreed a common set of underlying economic assumptions, most importantly on the evolution of the labour market variables and productivity. By combining the population projections with the economic assumptions, a projection was made for GDP growth potential for all Member States up to 2060. Following this, the underlying population and GDP growth projections were used to project public spending on five categories of expenditure affected by population ageing. Projections for spending on pensions were made using the models established by the Member States' authorities. Projections for spending were also made for health care, long-term care, education and unemployment transfers, this time using common models developed by the European Commission. The final step was to aggregate all the projections to get an overall picture of how ageing will affect public spending.

The budgetary projection exercise is linked to the assessment of long-term sustainability of public finances[6] and serves as a tool to measure the economic and budgetary consequences of ageing in the general context of the fiscal surveillance and promotion of structural reforms. With the populations getting older and in many cases smaller over time, old-age dependency rates are projected to increase considerably over the coming decades. This tendency, combined with regular growth in public spending on health and long-term care due to extra-demographic factors, puts a growing pressure on the public budgets, financed by contributions from a stagnating size of active population. This trend, observed in the past decades and expected to continue in the future, requires substantial and rapid reforms to be undertaken by policymakers at national level in order to avoid a dramatic worsening of the fiscal stance.

3. FACTORS DRIVING HEALTH CARE SPENDING

3.1. A number of demographic and non-demographic drivers of spending

Unlike public spending on pensions, which are solely determined by demographic developments and the institutional setting of the pension scheme, expenditure on health care is driven by a complex set of interrelated demand and supply side factors. While a widespread belief links the average health care expenditure to the age of an individual, several studies show that the demand for and use of health care depends ultimately on the health status and functional ability of citizens. While age is a useful indicator of the health status of an elderly person (which is shown by the steep upward slope of age-related expenditure profiles), it is not the causal factor. Therefore several other factors should be taken into account when projecting future developments of health care spending. Those factors can be classified in at least two different ways: following their character/properties and the type of economic agent they involve on the one hand, and distinguishing between factors that affect demand and supply side of health care provision on the other hand.

[6] For details see: European Commission (2009)

Graph 2 Classification of factors underlying developments in health care expenditure

	Demographic factors	Health factors	Economic and social factors	Public policy factors
Demand side factors	• Size and structure of the population	• Health status of the population, in particular of elderly cohorts • Death-related costs	• National/ individual income • Income elasticity of demand for health care • Social determinants of health (environment, living conditions) and health-related behaviour • Public expectations and real convergence in living standards	• Health promotion and disease prevention policy
Supply side factors			• Development of new technologies and medical progress • Unit costs in health care sector relative to the other sectors of economy • Resource inputs, both human and capital	• Contribution of public and private budgets to the financing of health care • Insurance schemes • Remuneration schemes in health care sector • Regulation and/or liberalisation of the market for health care services and pharmaceuticals

Source: own compilation

Given these considerations, reliable projections of future public expenditure on health care need to include not only demographic changes, but also a series of non-demographic factors. However, given limited data availability in many of the quoted areas not all of them can be modelled in the projection exercise. In addition, it is equally important is to understand the complexity of the network of interrelated factors and to approximate the degree of uncertainty related to each of them.

3.2. Demographic trends in Europe. How do they affect health care spending?

Current demographic trends in Europe are worrisome. Although, with fast developments in medical science, technology and treatment techniques, an average European lives ever longer and - arguably – healthier, constantly growing share of the elderly in total population raises urgent concerns about financial and organisational efficiency of health care and social security systems. This trend is projected to continue in the foreseeable future, although at a different pace across countries, which offers a certain room for different types of reforms and policy actions in the face of the ageing challenge.

In order to understand the complexity of the demographic processes, the main factors underlying them in the recent decades need to be analysed. As agreed in most studies, growth in the share of the elderly has been driven mainly by declining fertility rates and falling mortality rates (which increase life expectancy) affecting people of practically all age groups.

As stated, population ageing is driven by falling *fertility rates*. While surveys indicate that the desired fertility has remained roughly constant in recent years, the number of children born (real fertility) has continued falling due to increased female labour market participation, improving women's education, changing lifestyles, diffusion of contraceptives and lack of access to childcare facilities (for wider discussion on trends in fertility, see: McDonald 2000 and 2002). Those developments are accompanied by a trend of postponement of childbearing, whereby the women give birth to their first child later in life.

These findings are confirmed by empirical evidence in most European countries. Over the last three decades of the 20th century (1970-2000) fertility rats fell practically in all European countries (on average from 2.3 in 1970 to 1.5 in 2000)[7], although a slight recovery has been observed in a number of countries over the first decade of 21st century. There have been a clear convergence trend, as the countries with the highest initial fertility rates (Ireland, Spain, Portugal, the Netherlands, where fertility rates exceeded 3 in the 1960s) have seen them falling considerably faster than the countries where they were initially relatively lower (Hungary, Czech Republic, Finland, Sweden, Luxembourg). Consequently, the fertility rates are currently well below the natural replacement rate of 2.1 required to maintain the population size and age structure in all EU Member States, even if they vary considerably across individual countries (from over 2 in Ireland and France to about 1.3 in Slovakia, Romania and Hungary).

The debate on the future trends in fertility rates across European countries remains open. Although several authors argue that falling trend will continue, quoting e.g. the *low fertility trap hypothesis*[8], most forecasts expect the unfavourable current trend to reverse in the decades to come (see Graph 3), although not enough to stabilise the population size and age structure. According to Eurostat's demographic projections (see: Lanzieri 2009 and Eurostat 2007) fertility rates are projected to increase between 2008 and 2060 in all countries except Ireland, France (expected to fall), Denmark, Finland, Sweden and the UK (expected to remain constant) and from 1.52 in 2008 to 1.64 in 2060 on average. Given the assumption of convergence in the average median age at childbearing, the rise will be sharper in EU12 (from 1.36 to 1.54) than in EU15 (from 1.64 to 1.72)[9].

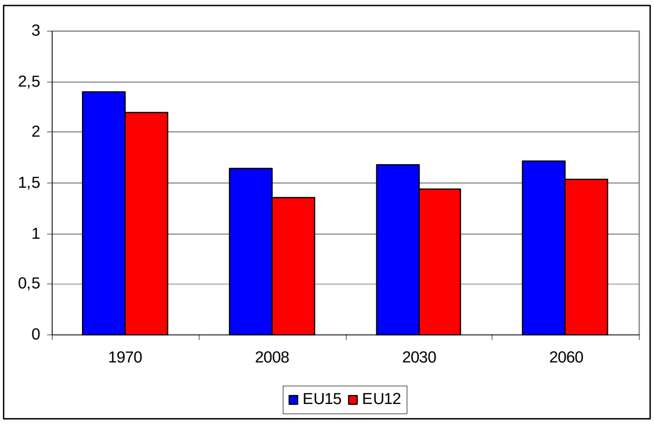
---

[7] EU27, unweighted average. These and the following data have been taken from Eurostat database.

[8] This hypothesis, proposed by Lutz and Skirbekk (2005), points at three interconnected mechanisms which can potentially lead to a continued downward trend in the number of births in Europe. A demographic mechanism works through the fall in the number of potential mothers in line with the decrease in the population size. A sociological mechanism is related to the partially irreversible change in the family size that young people perceive as normal or optimal. Finally, an economic mechanism consists of the changing balance between the consumption aspirations (the standard of living experienced in the parental home) of young people and expected income per capita in a family consisting of a given number of persons.

[9] All over the text the abbreviations EU12 or RAMS (Recently Acceded Member States) refers to twelve countries which joined the European Union in 2004 and 2007 (Bulgaria, Czech Republic, Estonia, Cyprus, Latvia, Lithuania, Hungary, Malta, Poland, Romania, Slovenia, Slovakia), while EU15 refers to fifteen countries which had been EU members by then (Belgium, Denmark, Germany, Ireland, Greece, Spain, France, Italy, Luxemburg, the Netherlands, Austria, Portugal, Finland, Sweden, the UK).

Graph 3 Past and projected fertility rates for the EU15 and EU12, in children per woman



Source: Eurostat

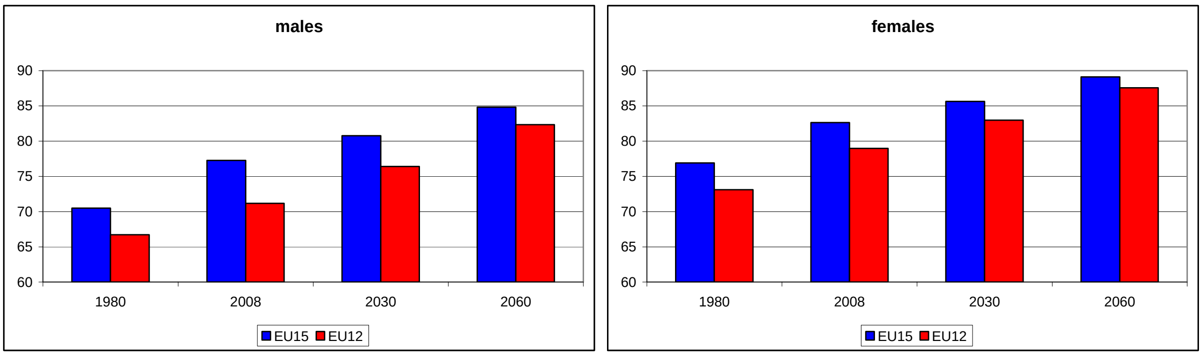
Also *mortality rates* have shown a clear downward trend over the recent decades, leading to a constant increase in life expectancy[10]. Having compared available data from the past 160 years, Oeppen and Vaupel (2002) observed that life expectancy has been growing in a linear way, at an almost constant pace of about 3 months per year. Similar conclusion on the linear trend in life expectancy was drawn by White (2002) who analysed a group of 21 high-income countries over the period 1955-1996. According to Suzman et al. (1992), in 18 countries of Western Europe life expectancy at birth increased by an average of 6.3 years between 1960 and 1990. During the same period, life expectancy at the age of 60 increased by 3.5 years among women and 1.7 year among men. Similar conclusions can be drawn from the analysis of the more recent EU data: between 1980 and 2007 life expectancy at birth increased on average by some 6.2 years for men and 5.8 years for women (weighted average of the countries for which the data are available[11]). Again, large variation is noticeable across the European countries, with a clear division between EU15 and EU12 Member States. Central and Eastern European Recently Acceded Member States, although comparable in terms of life expectancy to the EU15 in the past decades (1960-1980), have subsequently lost distance and performed much worse than their Western European counterparts. Over the period 1980-2007, men in those countries gained only 3.5 years (compared to 6.9 years in the EU15), while women 4.7 years (compared to 6.0 years). However, this gap is expected to narrow down again in the decades to come, as convergence in lifestyles, levels of consumption and quality of social services will drive mortality rates down. This is reflected in Eurostat's demographic projections where, while mortality rates are projected to keep falling and, accordingly, life expectancy is projected to continue its rising trend in all EU Member States (for details see: Lanzieri 2009 and Eurostat 2007), a strong convergence between EU15 and EU12 is assumed to take place. Consequently, between 2008 and 2060 life expectancy at birth is projected to grow in EU12 by 11.2 years for males and 8.6 years for females, while only by 7.6 years for males and 6.5 years for females in EU15 (see Graph 4 and annex 2.2 for more detailed information).

---

[10] Nevertheless, some researchers challenge the thesis of the linear increase in the life expectancy, arguing that there is a biological limit to the human life, see e.g. Fries (1980, 1983, 1989, 1993) or Carnes and Olshansky (2007).

[11] BE, BG, CZ, DK, DE, GR, ES, LT, LU, HU, MT, AT, PT, RO, SK, FI, SE. These and the following data have been taken from Eurostat database.

Graph 4 Past and projected life expectancy at birth, EU15 and EU10, in years



Source: Eurostat

The main reasons for increases in life expectancy have been changing over time. Until the 1970s-1980s, gains in life expectancy at birth mainly resulted from decreases in mortality rates of new-borns and children, mainly due to improvements in hygiene and better nutrition of children. Then, in more recent decades a new trend emerged, one of fast falling mortality among the elderly which resulted in a rapid increase in the total number of people in their eighties and nineties and which, at least partially, explains the diverging trends between EU15 and EU12 countries.

Such dramatic fall in mortality among the elderly population may be explained by a number of factors. The greatest gains have been observed in treating the most common causes of death, such as heart disease (which accounts for 25-50% of deaths) and stroke (10-25%), while therapies for cancer – the second most frequent cause of death – have still not resulted in a significant improvement (Brody et al., 1992, Nusselder and Mackenbach, 1997). Changes in socio-economic conditions, universal access to medical care, nutrition, housing, sanitation and living habits (Fogel, 1994), as well as successes with community education and preventative health programmes have obviously also played a role.

Generally speaking, if maintained over the coming decades, the presented trends in fertility and mortality may lead to important changes in the age structure of the population and have far reaching consequences on the macroeconomic situation in Europe.

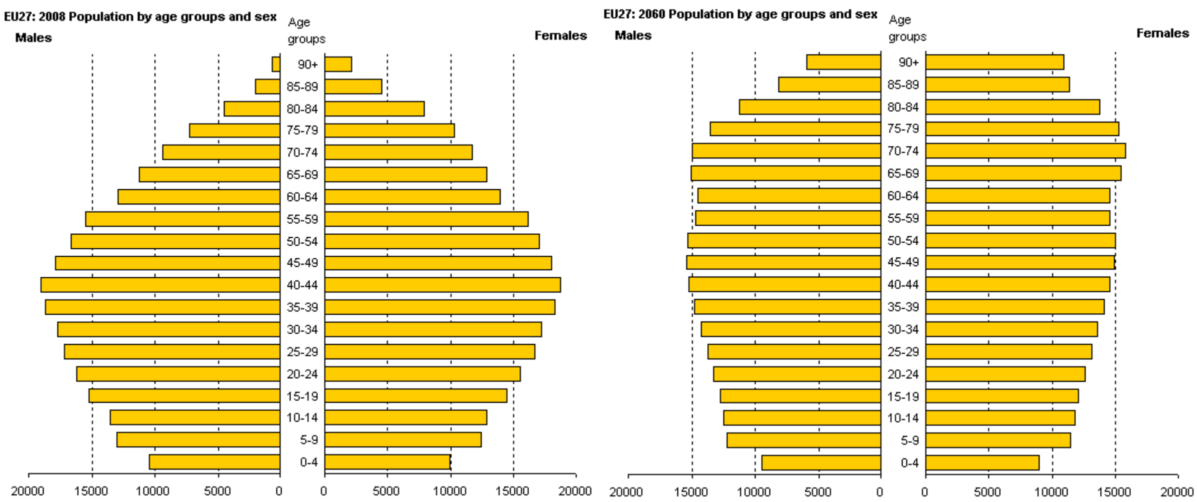
According to the Eurostat demographic projections, the population in the EU27 will be both smaller and older in 2060 than it is in 2008 (see Table 2 and Graph 5). Total population is projected to increase by 2%, but 13 countries, mainly in the Central and Eastern European EU12 countries is expected see their population shrink. The general picture also hides significant divergences in the demographic trends between individual countries. Large changes are also expected in the age structure of the population. A large majority of countries are expected to experience a drop in the size of both young (0-14) and working age population (15-64). The share of the latter, main contributor to the social protection systems is projected to fall dramatically from 67% to 56% of total population. Again, the Recently Acceded Member States will be mostly affected, with a decrease from 70% to 53% of total population. While younger cohorts shrink, the share of elderly (65+) and very old (80+) population is projected to grow in all countries and on average by 13% (from 17% to 30%) and 8% (from 4% to 12%) p.p. respectively.

Table 2 Overview of the projected changes in the size and age structure of the population, in millions

	Total population			Young population (1-14)			Working-age population (15-64)			Elderly population (65+)		
	2008	2060	*% change*	2008	2060	*% change*	2008	2060	*% change*	2008	2060	*% change*
BE	10,7	12,3	*15*	1,8	1,9	*7*	7,0	7,1	*1*	1,8	3,3	*80*
BG	7,6	5,5	*-28*	1,0	0,7	*-36*	5,3	3,0	*-44*	1,3	1,9	*42*
CZ	10,3	9,5	*-8*	1,5	1,2	*-21*	7,4	5,2	*-30*	1,5	3,2	*110*
DK	5,5	5,9	*8*	1,0	1,0	*-5*	3,6	3,5	*-4*	0,9	1,5	*74*
DE	82,2	70,8	*-14*	11,3	8,9	*-21*	54,4	38,9	*-29*	16,5	23,0	*39*
EE	1,3	1,1	*-15*	0,2	0,2	*-20*	0,9	0,6	*-31*	0,2	0,3	*51*
IE	4,4	6,8	*53*	0,9	1,1	*27*	3,0	3,9	*29*	0,5	1,7	*245*
GR	11,2	11,1	*-1*	1,6	1,4	*-10*	7,5	6,2	*-18*	2,1	3,5	*68*
ES	45,3	51,9	*15*	6,6	6,7	*1*	31,1	28,4	*-9*	7,5	16,8	*123*
FR	61,9	71,8	*16*	11,3	12,0	*6*	40,3	41,2	*2*	10,2	18,6	*82*
IT	59,5	59,4	*0*	8,3	7,2	*-14*	39,2	32,7	*-17*	12,0	19,4	*63*
CY	0,8	1,3	*66*	0,1	0,2	*42*	0,6	0,8	*40*	0,1	0,3	*251*
LV	2,3	1,7	*-26*	0,3	0,2	*-34*	1,6	0,9	*-43*	0,4	0,6	*48*
LT	3,4	2,5	*-24*	0,5	0,3	*-39*	2,3	1,3	*-42*	0,5	0,9	*66*
LU	0,5	0,7	*52*	0,1	0,1	*35*	0,3	0,4	*35*	0,1	0,2	*153*
HU	10,0	8,7	*-13*	1,5	1,1	*-27*	6,9	4,8	*-30*	1,6	2,8	*71*
MT	0,4	0,4	*-1*	0,1	0,1	*-23*	0,3	0,2	*-23*	0,1	0,1	*131*
NL	16,4	16,6	*1*	2,9	2,5	*-15*	11,1	9,6	*-13*	2,4	4,5	*87*
AT	8,3	9,0	*8*	1,3	1,2	*-2*	5,6	5,2	*-8*	1,4	2,6	*83*
PL	38,1	31,1	*-18*	5,9	3,5	*-40*	27,1	16,3	*-40*	5,1	11,3	*120*
PT	10,6	11,3	*6*	1,6	1,4	*-11*	7,1	6,3	*-11*	1,8	3,5	*88*
RO	21,4	16,9	*-21*	3,3	1,9	*-40*	15,0	9,1	*-39*	3,2	5,9	*85*
SI	2,0	1,8	*-12*	0,3	0,2	*-19*	1,4	1,0	*-32*	0,3	0,6	*83*
SK	5,4	4,5	*-16*	0,9	0,5	*-40*	3,9	2,4	*-39*	0,6	1,6	*154*
FI	5,3	5,4	*2*	0,9	0,9	*-5*	3,5	3,0	*-14*	0,9	1,5	*72*
SE	9,2	10,9	*18*	1,5	1,8	*16*	6,0	6,2	*3*	1,6	2,9	*80*
UK	61,3	76,7	*25*	10,7	12,7	*18*	40,7	45,0	*11*	9,9	19,0	*92*
NO	4,7	6,0	*27*	0,9	1,0	*11*	3,1	3,5	*11*	0,7	1,5	*121*
EU27	*495,4*	*505,7*	*2*	*77,5*	*71,0*	*-9*	*333,2*	*283,3*	*-15*	*84,6*	*151,5*	*79*
EU15	*392,2*	*420,5*	*7*	*62,0*	*60,9*	*-2*	*260,7*	*237,7*	*-9*	*69,5*	*121,9*	*75*
EU12	*103,2*	*85,2*	*-17*	*15,5*	*10,1*	*-35*	*72,6*	*45,6*	*-37*	*15,1*	*29,5*	*96*

Source: Eurostat

Graph 5 Total population of 27 EU Member States in 2008 (actual data) and 2060 (Eurostat projections) according to age (in thousands of persons)



Source: European Commission and EPC (2009)

3.3. Is age or health status a more important driver of spending on health care?

On the basis of available evidence one can argue that cost of health care increases with age, but it is health status of an individual (and - in aggregate terms - of the population), rather than age itself, which is the ultimate driving factor.

The macroeconomic evidence on the relationship between age and health care costs is ambiguous. While some studies have brought no evidence on significant relationship

(Gerdtham et al. 1998, Getzen 1992, Leu 1986, O'Connell 1996), the others argue that the age structure of the population is an important regressor for average health care expenditure per capita (Hitiris and Posnett 1992, Gerdtham et al. 1992a). What is undoubtedly true and shown by a large amount of cross-sectional data is the positive relationship between age of an individual and spending on his/her health care. Empirical evidence, based on the data from a set of industrialised countries, shows that total health care provided to an average person of over 65 years of age costs from 2.7 to 4.8 times (according to Anderson and Hussey 2000) or from 2.8 (Germany) to 5.3 (Japan)[12] times (according to Reinhardt 2000) as much as health care provided to an average person aged 0-64. According to the other calculations, 35-50% of total health expenditure is spent on elderly people (Jacobzone 2002).

Differences have been documented between the subsets of elderly cohort. Both Fuchs (1998b) and Cutler and Meara (1999) have provided evidence that per capita health expenditures amongst the those aged (+85 years old) are twice as high as for the age group 75-84 years, and three times as high as for the group 65-74 years.

A very important issue is whether the ratio of health spending between different age cohorts remains stable over time. Some studies (e.g. Productivity Commission 2004, Health Canada 2001) conclude that it does. However, other studies reject this finding. Cutler and Meara (1997 and 1999), Fuchs (1998a), and Andersson and Hussey (2000) provide the evidence that health care spending for elderly has been increasing over recent decades at a faster pace than for the younger cohorts leading to growing gaps in costs between different age groups. Using recent data on health care from several countries, Grignon (2003) finds that the age profile of health care expenditure became more 'rectangular'[13] over the period 1992-1997. As this trend seems to be persistent over time, he argues that one should not assume constancy of age-related expenditure profiles over the long-term when making projections. To address this problem, one needs to explain the exact relationship between the age and expenditure, or more precisely to divide the total impact of ageing into two separate effects: a 'pure' age effect and an effect linked to state of health.

Indeed, recent research has proven that a one-way causal relationship between age and spending on health care is too simplistic. Over time, there is no clear link at the aggregate level between levels of spending on health care and the demographic situation of societies (Jacobzone 2002). In fact, several studies have found that the impact of ageing on increase in health expenditures is limited to as little as a few percentage points of this increase (Newhouse 1992; L'Horty et al. 1997; Cutler 1995).

Grignon (2003) concludes that, on the basis of recent data, the major factor which explains the relationship between age and health spending is morbidity: each consecutive disease

[12] The very high value in Japan should be regarded with a great deal of caution. The reason is probably the fact that legal arrangements in Japan create incentives for older people to stay in hospitals (where they are entitled to much more allowances and privileges than in the out-patient treatment). This results in a phenomenon of 'bed blockers', confirmed by the data: in 2002 the average length of stay in in-patient care (done mostly by the elderly) amounted to 37.5 days, while in the other OECD countries it was below or around 10 days. (OECD Health Data 2004)

[13] Literally *'le creusement du profil'* which means that the elderly consume more and more health care relatively to the younger cohorts. Not to be confused with the rectangularisation of the survival curve, which means growing survival rate/falling mortality rate of each age cohort (the term currently applies in practice to the oldest cohorts, as in case of the younger people mortality has already reached marginal rates and the further improvement is virtually not visible).

increases yearly spending by a growing amount[14]. At the same time, expenditure tends to be much higher if a person has a complementary insurance coverage. Given the fact that insurance coverage is much narrower among the elderly than among the young (either they are not used to use insurance services, or they do not find them profitable enough), this phenomenon reduces the divergence in spending between the two age categories. Consequently, having accounted for the two previous factors, the author finds that health spending is negatively rather than positively correlated with the age.

Most statistical data and empirical evidence tend to confirm the findings on the 'age structure' of health care provision costs. This is also the case of the most recent data provided by the EU Member States in the framework of the long-term budgetary projection exercise. The data have been reported in the form of age-related expenditure profiles, showing the average spending on health care for each gender and age cohort (see Box 1). When analyzing the data, caution should be exercised, as the age profiles suggest a correlation between age and developments in health care spending over one's lifespan, while in fact health status rather than age is the causal factor which drives changes in health care spending. Moreover, one should bear in mind that age-related expenditure profiles, rather than being direct measures of morbidity or the need for health care services, are the sum of those and other demand and supply factors that affect health care use, such as availability of services and treatments and age-related rationing.

Box 1 ***Age-related expenditure profiles – empirical data used in the projections***

In the framework of the 2009 AWG budgetary projections, age-related expenditure profiles have been provided by twenty four countries (BE, BG, CZ, DE, EE, ES, FR, IT, CY, LV, LT, LU, HU, MT, NL, AT, PL, PT, SI, SK, FI, SE, UK, NO). The data have been gathered according to the precise guidelines based on the System of Health Accounts classification of health care activities[15] and, if necessary, adjusted to correspond to the official OECD/Eurostat figures on public health care expenditure[16]. For the countries which have not provided the data on per capita spending profiles, the average EU15 or EU12 age profiles[17] have been used, adjusted according to the same mechanism.

Graph 6 and Graph 7 show the age-related expenditure profiles for Member States for which data is available and for the average of EU15 and EU12 (RAMS). Table 3 presents the key figures on age-related expenditure profiles, for a number of older age cohorts. Based on these data several conclusions can be drawn:

- in nearly all Member States, and for EU15 and EU12 aggregates, age-related expenditures for older cohorts are considerably higher for males than for females, while for the younger cohorts the opposite applies, although the gap is much less pronounced;

- nominal spending on health is much higher in EU15 than in EU12 countries. EU15 countries spend about 5-6 times more (expressed in euros) on an average elderly person, than EU12 countries. The

[14] e.g. for a man of 65 years of age first illness increases, ceteris paribus, the yearly spending by 360€, the second one by 620€, and the fourth one by 1830€. See: Grignon (2003), p.3.

[15] OECD (2000), *A System of Health Accounts*.

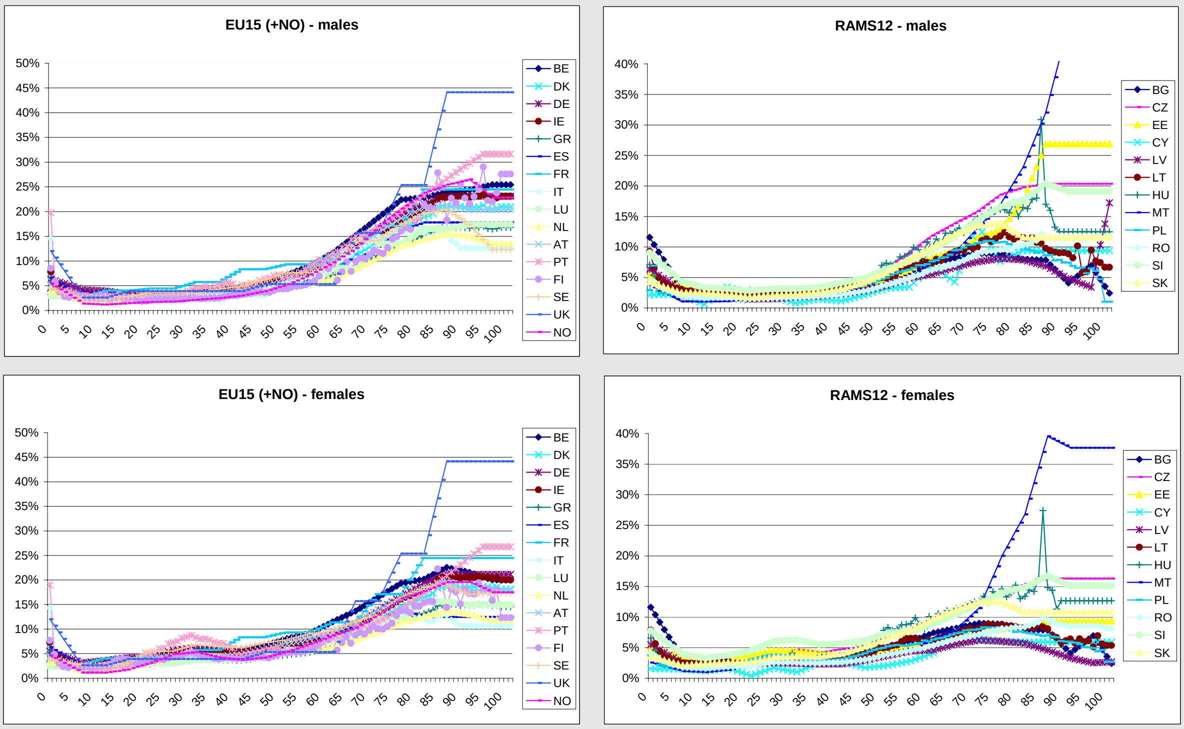
[16] The shape of the profiles (proportion between per capita costs of any two cohorts) has been kept constant, while the nominal level has been adjusted in a way that the sum of per capita costs multiplied by the population of each cohort equalled total public health care expenditure in 2007.

[17] Two separate average profiles are used because, as visible on graph 7, there is a clear difference in the shape of the curve between the Old and the Recently Acceded Member States. The share of GDP per capita spent on health care is comparable up to the age of 60-65, but the shape shows an increasing gap in spending on people in their older ages

gap is less pronounced in real terms (expressed in comparison to GDP per capita), but still significant. Moreover, the gap between the two groups of countries grows noticeably with age. While the difference in real spending between EU15 and EU12 for the cohort aged 60-64 is around 1-1.5% of GDP per capita, it grows up to 5-7% of GDP for the cohort 90-94.

- expressed as a share of per capita GDP, there is a visible difference in the age-related spending profiles between EU15 and EU12 countries[18]. First, in most EU15 countries, spending peaks at between 15 and 20% of per capita GDP compared to between 5 and 15% in most EU12 countries. Second, peak spending occurs somewhat later in EU15 countries in the cohort aged 85 to 90 compared with the EU10 where it occurs in the 75-80 cohort. Thirdly, there appears to be a much sharper tailing-off in spending for the oldest age-cohorts in EU12 countries, which is not so much visible in the average figures influenced by the data from 'outlying' countries (Malta, Estonia, and Slovenia).

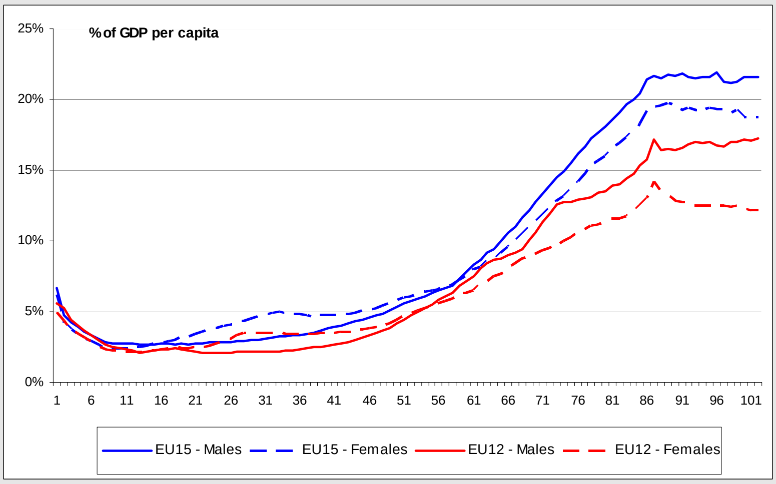
Graph 6 Age-related expenditure profiles for individual EU Member States, males and females



Source: National data

[18] A significant exception is Malta where the shape of the age profile resembles much more that of the average EU15 country. This is why Maltese data have not been taken into account when calculating EU10 average profile. Furthermore, in all scenarios where composite age profiles are used both Malta and Cyprus have been assigned the EU15, rather than EU10 average profile.

Graph 7 Average age-related expenditure profiles for the EU15 and EU12 (males and females)



Source: National data

Table 3 Comparison of the age-related expenditure profiles

	males								females							
	60-64		70-74		80-84		90-94		60-64		70-74		80-84		90-94	
	in euros	as % of GDP p.c.	in euros	as % of GDP p.c.	in euros	as % of GDP p.c.	in euros	as % of GDP p.c.	in euros	as % of GDP p.c.	in euros	as % of GDP p.c.	in euros	as % of GDP p.c.	in euros	as % of GDP p.c.
BE	3677	11,8	5876	18,8	7165	22,9	7633	24,4	3581	11,5	5155	16,5	6359	20,3	6713	21,5
BG	276	7,3	333	8,9	304	8,1	184	4,9	276	7,3	333	8,9	304	8,1	184	4,9
CZ	1468	11,8	1986	15,9	2452	19,7	2535	20,3	1233	9,9	1549	12,4	1909	15,3	2026	16,3
DK	3684	8,8	5793	13,9	7859	18,8	8739	20,9	3372	8,1	5073	12,1	6870	16,4	7773	18,6
DE	2987	10,1	4833	16,4	6330	21,5	6812	23,1	2624	8,9	4100	13,9	5661	19,2	6246	21,2
EE	949	8,2	1323	11,4	2101	18,1	3116	26,9	733	6,3	896	7,7	984	8,5	1085	9,4
IE	4182	9,7	6577	15,3	8923	20,7	9921	23,1	3828	8,9	5760	13,4	7800	18,1	8825	20,5
EL	1449	7,1	2279	11,1	3091	15,1	3437	16,8	1326	6,5	1995	9,7	2702	13,2	3057	14,9
ES	2324	9,8	3075	13,0	4156	17,6	4197	17,8	2108	8,9	2842	12,0	2985	12,6	2937	12,4
FR	3415	11,1	5045	16,4	7250	23,6	7522	24,5	3415	11,1	5045	16,4	7250	23,6	7522	24,5
IT	2439	9,4	3795	14,6	4055	15,6	3262	12,6	1945	7,5	2845	11,0	3094	11,9	2774	10,7
CY	1241	6,2	2359	11,8	1836	9,2	1878	9,4	876	4,4	1315	6,6	1186	5,9	1182	5,9
LV	488	5,6	656	7,5	680	7,8	426	4,9	409	4,7	533	6,1	488	5,6	292	3,3
LT	633	7,6	864	10,4	948	11,5	750	9,1	523	6,3	687	8,3	687	8,3	506	6,1
LU	6144	8,1	9756	12,9	12254	16,1	13113	17,3	6065	8,0	8740	11,5	11457	15,1	11402	15,0
HU	1042	10,2	1457	14,3	1683	16,5	1271	12,5	967	9,5	1283	12,6	1428	14,0	1289	12,7
MT	998	7,5	1732	13,0	3105	23,4	5953	44,8	863	6,5	1601	12,1	3651	27,5	5031	37,9
NL	2289	6,7	3689	10,8	4940	14,4	5132	15,0	2227	6,5	3283	9,6	4324	12,6	4451	13,0
AT	3473	10,6	5175	15,7	6766	20,6	6738	20,5	3135	9,5	4552	13,9	5979	18,2	5960	18,1
PL	608	7,5	855	10,6	782	9,7	582	7,2	508	6,3	650	8,1	600	7,4	473	5,9
PT	1757	11,4	2593	16,9	3577	23,3	4575	29,8	1236	8,1	1778	11,6	2659	17,3	3773	24,6
RO	349	6,1	501	8,8	585	10,3	650	11,5	304	5,4	408	7,2	482	8,5	488	8,6
SI	1590	9,5	2383	14,3	2981	17,9	3212	19,2	1486	8,9	2038	12,2	2496	15,0	2548	15,3
SK	1022	10,1	1364	13,4	1210	11,9	1181	11,6	998	9,8	1253	12,3	1121	11,0	1101	10,8
FI	2777	8,2	4025	11,9	6748	19,9	7954	23,5	2603	7,7	3444	10,2	5139	15,2	5888	17,4
SE	3593	9,9	5294	14,5	7037	19,3	6238	17,1	3577	9,8	4806	13,2	6660	18,3	6316	17,3
UK	2179	6,6	5585	16,8	9160	27,6	14644	44,1	2179	6,6	5585	16,8	9160	27,6	14644	44,1
EU15	46370	9,1	73391	14,4	99312	19,5	109916	21,6	43221	8,5	65003	12,8	88099	17,3	98282	19,3
EU12	10662	8,3	15812	12,3	18667	14,5	21738	16,9	9176	7,1	12546	9,7	15334	11,9	16205	12,6

Source: National data

3.4. *Trends in morbidity and mortality*

There is an ongoing debate in the literature on the extent to which health status (or morbidity) of the population may change over time in relation to the growing life expectancy. Traditionally, a decrease in mortality rates was considered to reflect the improvement in the health status of the population, i.e. a decrease in morbidity. Since reliable empirical evidence (life-tables, precise data on mortality, disability and morbidity) became available, this simple relationship is no longer supported by the data. As the alternative explanations have been sought for the counter-intuitive findings, different theories have emerged, reflecting different views over the possible drivers of change and expected future developments. Three main hypotheses which are quoted in the literature differ mainly by the driver deemed responsible for the observed decline in mortality rates in the old age and, consequently, by the expected impact on the difference between total and healthy life expectancy.

The expansion of morbidity hypothesis was established by Gruenberg (1977), Olshansky et al. (1991) and Verbrugge (1984) and empirically supported by Guralnik (1991). It assumes that the increases in longevity are achieved mainly by the growing capabilities of medicine to prevent fatal outcomes of degenerative diseases, while the pattern of disease remains broadly constant. Therefore, mortality rates decrease over time but, assuming inability of medicine to cure age-related pathologies, prevalence rates increase as people live longer and become, with the age, more vulnerable to chronic diseases. Moreover, a chronic disease can act as a risk factor for other illnesses (for example, a disease suffered earlier in lifetime can have negative consequences later on: a non-fatal disease may not translate directly into higher mortality, but into higher morbidity and disability). Consequently, as their life expectancy increases, people spend most of those additional years of life in bad health or, in other words, a higher proportion of people with health problems survive to an advanced age.

Overall, this hypothesis can be considered as a pessimistic one, which is illustrative of what could happen if there were no improvements in the disease pattern over the lifespan.

The compression of morbidity hypothesis proposed by Fries (1980, 1983, 1989, 1993), assumes that increases in life expectancy are driven mainly by changes in underlying patterns of disease and people live longer because the onset of chronic degenerative diseases is being postponed to later ages. This can be due to improved living conditions, healthier life style or the fact that more and more chronic diseases may be curable. However, according to the hypothesis, humankind has a genetically determined — albeit individually variable — limit to the lifespan and while life expectancy is increasing, it is approaching that limit[19]. Accordingly,

[19] This hypothesis has been challenged later by several authors (see: Oeppen and Vaupel 2002, Robine and Vaupel 2002, Robine et al. 2005)

morbidity and disability will be gradually compressed at very old ages (into the last years of life) and the number of years spent with diseases or disabilities will decrease over time[20]. Thus, healthy life expectancy grows by more than total life expectancy[21].

The dynamic equilibrium/postponement of morbidity hypothesis was proposed by Manton et al. (1995). It posits that the postponement of death to higher ages due to falling mortality is accompanied by a parallel postponement of morbidity and/or disability. Consequently, healthy life expectancy grows broadly at the same rate as total life expectancy (the number of years spent in bad health remains the same). The term 'dynamic equilibrium' is meant to capture the overall changes in life expectancy and severe disability, and as such it is a simplified version of a more sophisticated theory proposed earlier by Manton (1982), which argued that an increased survival may lead to an increase in the number of years spent in bad health. However, the time spent with *severe* morbidity and disability remains approximately constant due to the fact that medical treatments and improvement in lifestyles reduce the rate of progression from less severe to more severe – and disabling – disease states. Thus, not everybody will enjoy the benefits of all gains in life expectancy being spent in full health. Instead, part of the gains in life expectancy may be spent in moderate health and the prevalence of chronic illnesses may increase; however, severe disability which is connected to the most costly part of health care services may be postponed to the final phase of life (meaning that age-related disability rates could decline). These effects may cancel out so that the average number of years spent in morbidity would remain unchanged.

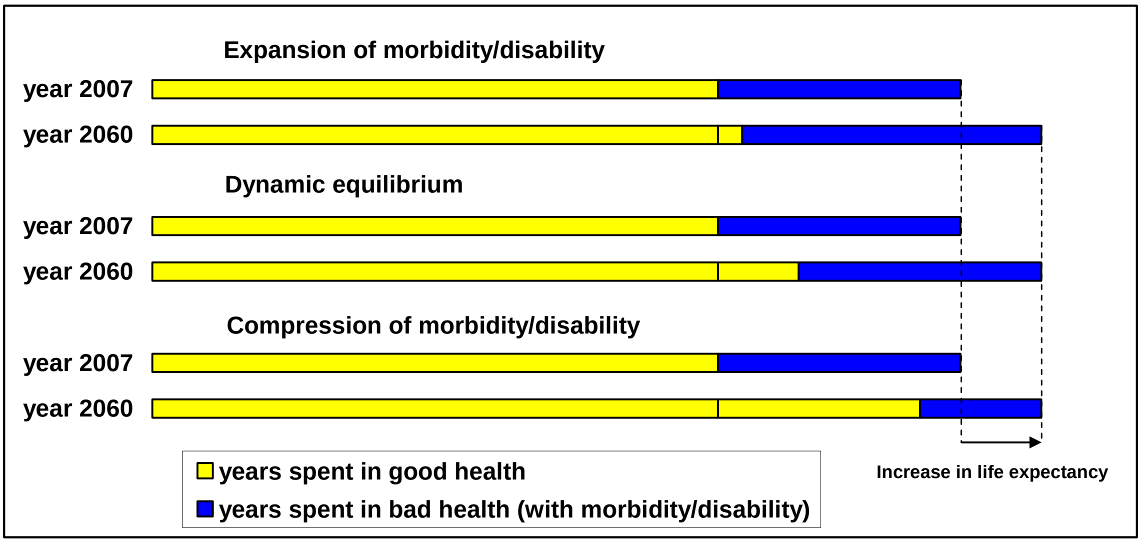
The three presented hypotheses are schematically illustrated on Graph 8[22], where the lighter shaded areas show the years spent in good health (healthy life years) and dark shaded area years lived with disability/morbidity.

[20] In fact, the growth rate of disability-free life expectancy may be temporarily lower than growth rate of total life expectancy, but when total life expectancy is approaching the limit, further improvements in health of population lead to fast increase in disability-free life expectancy.

[21] It is worth mentioning that simple but not exclusive distinction between compression and expansion of morbidity has been developed to include all possible states of the world. Robine and Mathers (1993) proposed for example a wider classification, based on the concept of life expectancy with and without disability and its relations with total life expectancy. According to them, an increase in life expectancy without disability can be called *absolute compression of morbidity/disability*; a decrease in life expectancy without disability – *absolute expansion of morbidity/disability*; a decrease in proportion of life spent with disability together with an increase in the number of years with disability – *relative compression of morbidity/disability*; and an increase in proportion of life spent with disability together with a decrease in the number of years with disability – *relative expansion of morbidity/disability*.

[22] For an overview of existing theories see: Nusselder (2003)

Graph 8 Different hypotheses on the evolution of healthy life expectancy



The answer to the question of which hypothesis best reflects reality depends on the *causal relationship* between morbidity and mortality. If mortality decline is the result of positive health developments, it is accompanied in most cases by an increase in the number of years spent without morbidity and disability. If, on the other hand, reduced mortality is only the result of postponing death without any (or much) improvement in health, the extra years will be spent mainly in bad health.

Recent studies have not provided strong evidence confirming or discarding any of the above hypotheses. Opinions on future directions depend on whether one takes:

- a pessimistic view, where the extension of life expectancy is due only to the improvement of survival technologies and therefore is achieved at the cost of the permanent loss of health. All years of life gained in this way will be spent in bad health, thus the expenditure savings gained thanks to lower mortality (and lower death-related costs) will be offset by increased health care and long-term care spending;

- an optimistic view, where the increase in life expectancy is *the result* of better health. At each age people are healthier and thus fewer of them die. This leads obviously to decrease in health care spending because of fall in both death-related costs and health care costs.

Evidence provided has differed significantly over time, across countries, and also across sexes. Jagger et al. (2009) have analysed the data from thirteen European countries over the period 1995-2001. They have found an overall increasing trend in life expectancy, but considerable heterogeneity in trends in health expectancy. Batljan and Lagergren (2000) found that even if existing state of research does not allow for any conclusive statements, most empirical data support the hypothesis of morbidity postponement. Howse (2006), on the other hand, suggests that morbidity compression hypothesis can be hardly supported by recent data.

3.5. *Death-related costs*

Another approach offering an alternative explanation of the differences in health care spending across age cohorts is linked to the existence of so-called death-related costs. As available data suggests, a primary factor behind the increase in costs as people become older is not the age itself, but the nearness of death. As shown in many studies, the largest part of life-long health care costs is borne in the ultimate period of a person's life, in the last few years or even months before one's death. According to this hypothesis health expenditure on older age groups is high, not so much because their morbidity or disability rates are higher, but because a larger percentage of the persons in those age cohorts die within a short period of time.

There is a growing stock of empirical research analysing and quantifying the impact of these 'death-related costs'. The first to find a positive relationship between health care costs and the remaining time to death were Roos et al. (1987). Their findings were confirmed by a number of further studies by e.g. Lubitz and Riley (1993), Cutler and Meara (1999), Zweifel et al. (1999), Serup-Hansen et al. (2002), Batljan and Lagergren (2004)[23].

The time 'close to death' is defined differently in different studies. In most cases, the analysis covers only the last one or two years of life. Some authors, e.g. Zweifel et al. (1999) and Caisse Nationale (2003), argue that the correlation between time to death and health care spending exists only during the last two years of life and practically disappear once the time span broadens to three or more years from the moment of death. Such an assumption is rejected, however, by Batljan and Lagergren (2004), who investigate impact on health care and long-term care spending further away from the moment of death. According to their findings, the impact, although much weaker, exists even up to six years before death.

Cutler and Meara (1999), Zweifel et al. (1999) and Steinmann et al. (2005), using respectively US and Swiss data, argue that, controlling for health status and proximity to death, age itself does not have an effect on health care spending. Instead, there is a transmission mechanism in which the intermediate variable between the age and health care consumption is health status (higher morbidity and disability incidence at higher ages) and proximity to death.

Another question refers to the pattern according to which death-related costs change with age of a person. The hypothesis of the constancy of per capita costs over the lifespan can be explained in the following way. While the medical treatment to save a young person's life is on average much more costly than the treatment needed to save an older person, many more young people die in accidents which impose little or no costs for health services. Therefore, the two effects may offset each other, at least partially.

However, this hypothesis has been challenged by many authors. Seshamani and Gray (2004a), using the British data, indicate that the age does matter, although do not question the importance of proximity to death as an explanatory variable for increase in health care spending. Brockmann (2002) strongly supports this critique, arguing that in Germany hospital care expenses on the elderly decrease significantly with age and the expenditure curve for non-surviving patients drops almost linearly until it flattens out at the highest ages. Furthermore, most available studies on European data agree on the direction of the evolution of the ratio of costs borne by a decedent and those borne by a survivor over the lifespan.

---

[23] A good overview of the existing empirical studies is provided in Reitano (2006).

Although Madsen (2004), Busse et al. (2002), Ahn et al. (2005), Gabriele et al. (2005), Riedel et al. (2002) vary significantly in relation to the nominal value of the ratio, they all agree that it increases sharply from birth to the age of 10-20 when it reaches its peak and gradually falls thereafter to approach 1 at the highest ages for which data exist. Finally, Lubitz and Riley (1993) agree that the ratio decreases with age for the elderly (65+)[24], but find no conclusive evidence as far as the whole lifespan is concerned. These observations, confirmed also by Grignon (2003) using French data and Levinsky et al. (2001) using US data, may be explained by three phenomena:

- health care rationing done by doctors, for either utilitarian (devoting limited resources on the treatment of younger age cohorts) or professional reasons (e.g. less knowledge about the treatment of the elderly, the higher probability of death among older patients);

- voluntary restraining from receiving health care by older people who find the investment in health will not pay back any more;

- generation effect which reflects differences in perceived needs, mentality and habits between older and younger generations.

Another key question is whether this ratio changes over time, but it remains unanswered, mostly due to the lack of longer time series needed for reliable intertemporal comparisons. Most researchers (e.g. Lubitz and Riley 1993, Garber et al. 1998), argue that the ratio remains broadly constant for each age group respectively. However, others, like Zweifel et al. (1999) show evidence of its strong decreasing trend over time.

Overall, the literature indicates that the higher share of a gender/age group is in its terminal period of life, the higher is its average health care and long-term care expenditure. This is an important conclusion for the possible consequences of population ageing on health care and long-term care costs.

The inclusion of death-related costs in calculating health care expenditure deserves a special consideration in the context of the ageing population. The rationale behind it stems from the fact that the last years of life, irrespective of how long people live, are associated with high health care costs, but as population ages the share of those in terminal phase of their life gets smaller and smaller in each age cohort. Consequently, the effect of ageing on spending is smoothened as decline in the number of people who, in a given age group, have few remaining years of life results in the fall in average health care cost for all age groups, except for the oldest age cohorts[25].

---

[24] The opposite conclusion is drawn by Roos et al. (1987). Using Canadian data, they conclude that total health costs among decedents increase with age. This result is probably due the data sources used which cover not only acute care and visits to physicians, but also stays in the nursing homes, which as an element of long-term care is very closely correlated with age.

[25] This observation shows that the proposed method is theoretically consistent with *dynamic equilibrium hypothesis*, according to which falling mortality rate (and thus growing life expectancy) for each age cohort is associated with a parallel decline in morbidity/disability rate, which results in a fall in health care spending in each age cohort.

Box 2 ***Death-related costs – empirical data***

To quantify the significance of death related costs, data is needed on the difference in health care costs borne by decedents (people who are going to die within a predefined short period of time) and survivors (people who are not in their terminal phase of life). As mentioned above, some data are available in the academic studies, but only at the national or regional level. Unfortunately, given the lack of common methodology there are considerable differences between the datasets as regards technique of measurement, the degree of precision, sample size, time and space coverage, definition of decedent and survivor status, and other characteristics. Moreover, no study provides an estimate of death-related costs covering total health care spending (inpatient care + outpatient care + day care + home care). Instead, most studies provide data only on inpatient hospital care expenditure per capita which is then taken as a proxy for total health care expenditure per capita.

To address high risk of incomparability of the data gathered from academic sources, Member States gathered in the Ageing Working Group were asked to provide data on death-related costs available in their official databases. Thirteen Member States provided the data, whose general characteristics for males and females respectively are summarised in Table 4 and Table 5. In particular, it shows the ratio of spending on a person of a particular age who dies within one year compared with a person who survives that period. For example, spending on health care provided to an average male child aged 0-4 who dies within a particular year is on average 25.9 times higher compared with an average child of the same age who survives.

There appears to be a clear pattern of decline in the ratio of spending on decedents to survivors with age. Moreover, while the ratios diverge widely across countries at younger age cohorts, there is less dispersion amongst older age cohorts where most deaths occur. However, due to different methodologies of data gathering, calculation (e.g. ratio of decedents to survivors differs when calculated on the basis of per capita and per patient spending) and coverage (e.g. either only hospital patients or also other cases taken into account), the data varies significantly across the Member States. For example, Spain and Austria appear to be outliers for both males and females across all age cohorts, with a respectively much lower and higher ratio compared with other countries[26].

---

[26] The Spanish case provides an example of how sensitive are the results to changes in the methodology of calculating *death-related costs*. The ratio used in the projections (ranging from around 7 for the age cohorts 5-35 to 1.3 for the 80+) is calculated by dividing *per patient* cost of decedents (patients) by the *per patient* cost of survivors (patients). Meanwhile, using a different methodology of dividing the *per discharge* cost of decedent (discharges) by the *per capita* cost of survival discharges, gives extremely different results, ranging from 228 for age cohort 10-14 to 7 for the 80+. Slightly different is the case of Austria. Given lack of precise information about costs borne by people dying outside hospitals, Austrian statistics include two sets of data according to two opposite (extreme) assumptions: in the first case deaths occurring outside hospitals are assumed not to generate any costs at all, while in the second case death cases outside hospitals are assumed to cause the same costs as those in hospitals. The ratio of costs borne by decedents to those of survivors shows similar decreasing pattern with age, but differs significantly in value between the two situations: while in the first dataset it ranges from 74.2 for age cohort 10-14 to 3.1 for the 85+, in the second dataset it amounts to 121.6 for the aged 10-14 and 7.3 for the 85+.

Table 4 Ratio between cost borne by a decedent and a survivor, by age cohort - males

	BE	CZ	DK	DE	ES	FR	IT	NL	AT	PL	FI	SE	UK	EU average
0-4	14,0	34,5	10,6	29,2	4,8	6,5	68,0	31,7	34,7	25,7	28,6	15,9	14,6	24,5
5-9	23,0	55,3	10,6	29,2	7,8	6,5	79,5	39,6	34,7	47,0	32,1	15,9	14,6	30,5
10-14	37,7	74,0	10,6	29,2	6,8	6,5	73,1	26,9	53,1	40,7	25,7	15,9	14,6	31,9
15-19	12,1	31,0	10,6	29,2	4,8	6,5	38,7	21,6	53,1	29,5	12,9	15,9	14,6	21,6
20-24	10,0	17,1	10,6	29,2	4,4	6,5	26,0	47,4	39,2	23,0	10,0	15,9	14,6	19,5
25-29	9,0	19,1	10,6	30,8	4,4	6,5	29,0	38,0	39,2	27,4	8,6	15,9	14,6	19,5
30-34	14,6	23,1	10,6	30,8	3,8	6,5	30,4	25,3	35,6	21,2	8,6	15,9	14,6	18,5
35-39	11,0	20,2	10,6	31,0	3,6	6,5	40,5	26,7	35,6	18,3	9,3	15,9	14,6	18,8
40-44	12,7	19,2	10,6	31,0	3,1	6,5	35,3	17,0	28,0	13,6	11,4	15,9	14,6	16,8
45-49	10,9	16,8	10,6	21,1	2,9	8,3	30,9	15,1	17,6	11,1	11,9	15,9	14,6	14,5
50-54	8,8	11,0	10,6	21,1	2,8	8,3	21,1	14,2	15,2	8,9	9,8	15,9	14,6	12,5
55-59	8,5	8,1	10,6	17,6	2,6	3,3	17,1	8,8	12,1	7,8	6,4	15,9	14,6	10,3
60-64	7,3	7,2	8,0	17,6	2,5	3,3	12,1	8,3	9,8	6,6	4,7	15,9	14,6	9,1
65-69	5,6	5,4	8,0	12,0	2,3	2,4	8,5	6,4	8,5	5,6	4,3	15,9	14,6	7,7
70-74	4,5	4,3	4,8	12,0	2,2	2,4	6,2	5,1	6,2	4,5	3,7	15,9	17,9	6,9
75-79	3,3	3,5	4,8	6,6	2,0	2,8	4,5	4,1	4,6	3,9	2,8	15,9	20,5	6,1
80-84	2,6	2,8	2,4	6,6	1,7	2,8	3,3	3,4	3,3	3,3	2,1	15,9	21,9	5,6
85-89	2,0	2,3	2,4	4,3	1,7	1,8	2,5	3,0	2,7	3,0	1,7	15,9	21,8	5,0
90-94	1,7	2,3	1,8	4,3	1,7	1,8	1,7	2,5	2,0	2,9	1,3	15,9	20,4	4,6
95-99	1,3	2,3	1,8	4,3	1,7	1,8	1,7	2,0	2,0	3,0	1,3	15,9	17,6	4,4
100+	0,7	2,3	1,8	4,3	1,7	1,8	1,7	2,0	2,0	3,0	1,3	15,9	17,6	4,3

Note: *A decedent is defined here as a person who will die within one year, a survivor – as a person who will survive at least one year. The Swedish study analyses the effect of the end of life up to six years prior to death, but does not differentiate between age cohorts.*

Source*:* DG ECFIN calculations based on national sources

Table 5 Ratio between cost borne by a decedent and a survivor, by age cohort - females

	BE	CZ	DK	DE	ES	FR	IT	NL	AT	PL	FI	SE	UK	EU average
0-4	19,2	43,5	10,6	29,2	4,4	6,5	79,5	79,1	58,4	39,7	28,6	13,7	15,2	32,9
5-9	39,7	48,2	10,6	29,2	4,8	6,5	163,0	60,0	58,4	50,3	32,1	13,7	15,2	40,9
10-14	15,0	42,5	10,6	29,2	7,8	6,5	101,4	43,3	78,2	49,3	25,7	13,7	15,2	33,7
15-19	13,0	26,2	10,6	29,2	6,6	6,5	46,7	24,7	78,2	37,3	12,9	13,7	15,2	24,7
20-24	15,5	26,2	10,6	29,2	6,0	6,5	32,5	33,2	32,7	26,1	10,0	13,7	15,2	19,8
25-29	8,2	28,7	10,6	30,8	7,2	6,5	25,5	10,4	32,7	24,5	8,6	13,7	15,2	17,1
30-34	11,7	32,0	10,6	30,8	7,1	6,5	28,4	18,9	33,7	25,6	8,6	13,7	15,2	18,7
35-39	13,5	25,7	10,6	31,0	5,6	6,5	37,2	23,5	33,7	23,0	9,3	13,7	15,2	19,1
40-44	15,5	20,4	10,6	31,0	3,9	6,5	40,7	18,1	27,9	20,5	11,4	13,7	15,2	18,1
45-49	11,3	17,1	10,6	21,1	3,1	8,3	31,5	17,2	20,7	15,1	11,9	13,7	15,2	15,1
50-54	12,2	13,6	10,6	21,1	3,1	8,3	26,9	15,5	16,5	12,3	9,8	13,7	15,2	13,8
55-59	10,7	10,7	10,6	17,6	3,0	3,3	23,7	12,9	14,9	10,9	6,4	13,7	15,2	11,8
60-64	8,0	10,0	8,0	17,6	2,8	3,3	16,8	12,4	12,4	9,3	4,7	13,7	15,2	10,3
65-69	6,8	6,8	8,0	12,0	2,5	2,4	11,9	8,3	10,1	7,4	4,3	13,7	15,2	8,4
70-74	5,0	5,1	4,8	12,0	2,2	2,4	8,2	6,4	7,4	5,6	3,7	13,7	17,2	7,2
75-79	3,5	3,7	4,8	6,6	2,0	2,8	5,4	4,6	4,9	4,4	2,8	13,7	18,2	6,0
80-84	2,4	2,9	2,4	6,6	1,6	2,8	3,8	3,1	3,5	3,7	2,1	13,7	18,2	5,1
85-89	1,7	2,2	2,4	4,3	1,6	1,8	2,6	2,5	2,7	3,3	1,7	13,7	16,9	4,4
90-94	1,4	2,2	1,8	4,3	1,6	1,8	1,7	2,0	2,3	2,8	1,3	13,7	14,7	4,0
95-99	1,1	2,2	1,8	4,3	1,6	1,8	1,7	1,7	2,3	2,6	1,3	13,7	11,8	3,7
100+	1,0	2,2	1,8	4,3	1,6	1,8	1,7	1,7	2,3	2,6	1,3	13,7	11,8	3,7

Note: *A decedent is defined here as a person who will die within one year, a survivor – as a person who will survive at least one year. The Swedish study analyses the effect of the end of life up to six years prior to death, but does not differentiate between age cohorts.*

Source*:* DG ECFIN calculations based on national sources

3.6. Economic growth as a driver of health care spending

GDP is considered to be one of the main factors behind evolution in health care spending[27]. It has been shown (Newhouse 1977 and 1992; Leu 1986; Hitiris and Posnett 1992; Getzen 1990; Murthy and Ukpolo 1994; Okunade and Murthy 2002; Productivity Commission 2004) that countries with higher GDP per capita, spend more on health care than the ones with lower income, not only in absolute terms, but also in relative terms (as percentage of their GDP). In

[27] The opposite causal relationship: health status of the population being one of underlying forces driving economic growth has been also analysed in many studies (for a comprehensive overview, see: Suhrcke et al. 2005), but is out of scope of the present paper focusing on health care expenditure.

particular, Newhouse (1977) found that aggregate income explains about 92 per cent of the variance in the level of health-care expenditure between countries.

However, due to the lack of data, the relationship between GDP and health care spending have been much more difficult to prove empirically in a dynamic setting of longitudinal studies (Kanavos and Mossialos 1999, Blomqvist and Carter 1996) than in the international comparisons. In fact, variations in health care expenditure can, only to a very limited extent, be attributed to the fluctuations of GDP growth over time. Only a few studies (e.g. Barros 1998, Roberts 1999, Getzen 2000) have been able to prove that, due to the lack of other reliable variables, GDP is the only factor to have a significant impact on health expenditure growth.

While it is broadly acknowledged that higher national income translates into higher health care expenditure (both total and public), the coefficient of correlation, or the income elasticity of demand for health care remains an apple of discord among the researchers.

Most macroeconomic studies based on aggregate data (e.g. Gertler and van der Gaag 1990, Schieber 1990, Gerdtham et al. 1992, Getzen and Poullier 1992, Fogel 1999) find health care demand highly elastic, with coefficient exceeding one. This finding can be explained by considering health care as a 'luxury good' with an income elasticity exceeding one (Murillo et al. 1993; for a survey of literature on income elasticity of health care elasticity see: Kanavos and Mossialos 1996). Such view was first proposed by Newhouse (1977) who argued that at the margin the demand for health care is related more to 'caring' (subjective components of health) than to 'curing' (physical health). Moreover, to add a temporal dimension, one may argue that health care would be considered a luxury good in poorer countries, and a normal good (with unitary or lower elasticity) in the richest industrialised countries, which would explain a catch-up process of the poorer countries to the high standards of health care already achieved by the richer ones. The 'luxury good' concept has been challenged in the most recent studies (e.g. Baltagi and Moscone 2010) which, using the panel data, have estimated income elasticity as significantly lower than one.

Value of elasticity of health care expenditure is a fundamental issue when making expenditure projections. Budgetary projections look at aggregate measures, which in terms of incentives differ from health care consumption seen from a microeconomic perspective of an individual. The elasticity of an individual's spending on health care in relation to income depends on whether a treatment/medicine is covered by a universal or facultative insurance. If an individual has health insurance, marginal spending on health care does not depend on his or her income: consequently the income elasticity of health care spending could be close to or even below zero. On the other hand, the situation may be reversed if a treatment or drug is not covered by universal insurance. In such case, health care may be considered as a luxury good, especially having in mind that treatments which are not covered by social insurance are those which in most cases do not save people's life, but just 'improve the quality of life'.

None of the two situations described above reflect public spending at an aggregate level. On the one hand, as public health care spending is not part of a pooled fund and must be entirely covered by revenues, there is no moral hazard, no incentives for government to spend more, as is the case for individuals purchasing services and goods that are covered by universal insurance. This is why correlation between health care spending and income is much stronger at an aggregate than at an individual level. On the other hand, given budgetary constraints and caps on spending, public expenditures are not linearly correlated to GDP, especially in periods of fluctuating economic growth, when health budgets may depend on the political agenda rather than economic rationale.

These arguments explain Getzen's (2000) case that '*health care is an individual necessity and a national luxury*'. In other words, while individual income elasticities in the presence of health insurance are typically near or even less than zero, national health expenditure elasticities are commonly equal or greater than one. This hypothesis was supported empirically by comparing the results of several earlier studies focussing at both micro and macro level.

An increase in health care expenditure exceeding income growth can also be explained looking as supply rather than demand side of health care. A phenomenon, called Baumol effect[28], is typical for the sectors which, due to the specific, mainly labour intensive technology of production, are characterised by a slow labour productivity growth. It is due to the fact that the increase in wages, which grow in line with the wages in overall economy, exceeds the output growth. The outcome is that the relative prices of the sector's production grow over time and its share in overall household or nation's consumption expenditure grows over time. The role and size of the effect has been studied in a number of studies (see e.g.: Nordhaus 2006, Hartwig 2007, Pomp and Vujić 2008)

3.7. Technology and medical progress

Technological developments and constant evolution in the state of the art of medical science are arguably major factors affecting the level and rate of change in health care spending (see e.g. Jacobzone 2002; Fogel 2002; Fuchs 1998a). Medical technology can be defined as 'the drugs (pharmaceuticals and vaccines), medical equipment, health-care procedures, supportive systems, and the administrative systems that can tie all these disparate elements together'[29], although given the overwhelming presence of IT technologies in virtually all spheres of health care, it is practically impossible to draw its precise borders. According to the earliest studies investigating the issue (Newhouse 1992, Cutler 1995), technology was supposed to account for between 50% and 75% of health care costs increases, the figure estimated as the residual left after the effects on expenditure of demographical change, income and the other quantifiable factors have been accounted for. Recently, with health care spending driven less and less by labour costs; these figures may be even higher. Indeed, Dormont et al. (2006) have found that over the period 1992-2000 in France the impact of changes in medical practices on increase in health care expenditure has been not only 3.8 times stronger than the effect of changes in the age structure of the population (+12.9% compared to +3.4%) but also more than offset the positive effects of changes in morbidity (-9.7%).

More recent studies have attempted to focus directly on technology-driven changes in health care spending. Cutler and Meara (1997) and Fuchs (1998b) analysed the utilisation of frequently used technology-based medical procedures in the US. Both observed their rapid spread over the recent years, which led them to the conclusion that the diffusion of existing methodologies, rather than the emergence and implementation of new technologies, is major driving force behind the increase in medical spending. Similar conclusions, although using another proxy for technological development, were drawn by Okunade and Murthy (2002). They found empirical evidence that per capita health care expenditure responded to total

---

[28] See: Baumol (1976)
[29] OECD (1998), p.9.

(private and public) R&D spending and health R&D spending in the US during the 1960-1997 period.

An interesting feature of many medical innovations is that they can have two opposite, cancelling-out effects: simultaneously reducing unit costs and increasing total spending, as stated among others by Wanless (2002). Falling unit costs are the result of more efficient equipment and treatment practices. On the other hand, lower prices increase demand for health care, by making it more affordable for wider parts of population. Already existing treatment methods or drugs are modified to become cheaper and used by higher numbers of patients. The other ones, which have not been used in the past because the prices were prohibitively high, become available just because their prices fall to affordable levels. In such cases, reductions in unit cost may lead to such an increase in demand that the total spending rises.

In practical terms, this phenomenon has been demonstrated by Cutler and Huckman (2002). Based on an example of a treatment for coronary artery disease (percutaneous transluminal coronary angioplasty, PTCA), they find that growth in the use of this technological innovation over the last two decades has led to higher total spending despite its decreasing unit cost. However, the magnitude of this increase was reduced by between 10% and 20% due to the substitution of PTCA for the older technologies. In addition, the increased use of PTCA appears to be a productivity improvement.

Although less likely, the opposite effect may also take place. If demand for a given treatment is highly inelastic (thus a reduction in price, due to e.g. appearance of new competitive methods, does not lead to an increase in demand), then progress in technology and new discoveries may result in a fall in total spending. Furthermore, if the diffusion of new medical technologies leads to a lower prevalence of given diseases (or generally improves people's health), it may result in lower need for specific treatments over the long term. One may view this as a trade off between current and future spending. Furthermore, technological progress does not only concern direct treatment techniques or more sophisticated drugs. Another aspect of the same process is an increasingly efficient organisation and administration of health care provision (better and faster access to the information on each patient, more effective division of work between different specialists), which has a definitely positive impact on spending, reducing the costs of health care provision. Still, even if the negative impact of technology on health care spending is theoretically possible, most empirical studies tend to argue in favour of the opposite pattern.

Even if technology is considered to have the greatest impact on the health care spending, the patterns of its development and diffusion remain largely unknown. Although innovation can be basically considered as a constant process, groundbreaking discoveries affecting strongly health care spending are to a large extent unpredictable. Moreover, the issue of technological progress in the health care sector must be tackled in the knowledge that most new inventions take place in one country – the United States – which managed to create an efficient system of economic incentives for research and development, supported by government policy aiming at fostering close links between industry and academia, and protecting strong property rights of the new inventions. In this context, the development of medical technologies is highly dependent on the institutional and economic incentives provided to the researchers by the US government, which in turn are strongly influenced by the political and social situation in that country (Weisbrod, 1991). Further diffusion of technology depends in turn on the supply side factors: generous insurance payouts, state regulation of technology, degree of provider interaction or more general economic incentives related to the national governments' and health-care systems' propensity to pay for the modern technologies (see e.g. Cutler and McClellan, 1996),.

Analysing all the above arguments, one must bear in mind that the impact of technology depends to a considerable degree on the legal and institutional framework for the provision and financing of health care which differ widely across the countries. Hence, in order to be able to fully assess the consequences of new technologies on health care expenditure, one needs a thorough international comparative analysis of health care systems' structure, institutions and embedded incentives driving patients', providers' and payers' decisions.

3.8. Institutional setting of health care system

As mentioned above, the large differences in health care expenditure across different countries cannot be explained entirely by the demographic, economic or technological differences. Legal and institutional architecture of health care provision and financing is undoubtedly an important factor influencing the public and private spending in the sector. However, high complexity of the system and variety of its features makes it very difficult to quantify and compare across the countries.

A number of classifications, stressing different aspects of system's architecture have been proposed in the literature[30]. Most of them are constructed along following dimensions:

- health care coverage (to what extent population, wide range of services and cost of care are financed from public sources)
- financing mechanisms (institutions responsible for collection, pooling and distribution of funds)
- rules of remuneration of the providers (mechanisms to establish price and quantity of provided goods and services)

---

[30] The OECD has established a general classification (according to the main characteristics of the schemes: ownership and management of the entities providing health care as well as the way of financing them) in which health care systems have been divided into three groups:

(i) the public-integrated model links budgetary financing with public health care providers. It mainly concerns hospital care, with staff being employed as public-sector employees, while ambulatory doctors and other health care services providers are often private or independent contractors. This model facilitates universal coverage and aggregate cost containment as the health care spending is built into overall government budget limits. However, it may be less conducive to induce economic incentives favouring quality and efficiency.

(ii) the public-contract model combines public payers (either a State agency or social security fund) with private health care providers. The advantages with respect to the other models are not unequivocal. While the single payer enjoys strong position against providers and can negotiate lower prices and better quality of services, the functioning of independent providers requires stricter regulation and supervision by public authorities and incurs higher administrative costs.

(iii) the private insurance/provider model involves private insurance entities contracting private health care providers. Coverage may be mandatory or voluntary. With the strongest competitive base among the mentioned approaches, the model has the potential to guarantee wide responsiveness to patient needs and incentives for quality improvement, although the evidence of this having happened is mixed. An important additional drawback is the difficulty in ensuring price and cost control.

See: OECD (2004b), pp.22-25.

According to another classification, focussing on the way the health care systems are financed rather than on the ownership structure and contractual relations, the following three models can be constructed:

(i) public tax-financed systems (so-called Beveridge model),

(ii) systems financed through compulsory social security contributions (so-called Bismarck model)

(iii) mixed or predominantly private financing (voluntary health insurance, out-of-pocket payments, various co-funding schemes).

See e.g. Busse et al. (2006).

- competition between providers and insurers (contractual relations between patients, providers and payers)

There have been several attempts to specify the relationship between different health care models and the spending on health care. Although much work has been done to characterise and compare different health care systems, no conclusive evidence has been available so far as for their impact on total and public expenditure or their relative technical, allocative or procedural efficiency. A broad and simplified rule of thumb is that social health insurance countries tend to spend slightly more on health care than the national health service systems financed through general taxation (see e.g. Busse et al., 2006). This may be due to a number of features, characterising each function of the national health system, from the collection of resources through pooling them to the remuneration of providers[31].

The statistical relationship between the financing mechanism and health care expenditure has been analysed by a number of authors, but the results are far from being conclusive. Gerdtham et al. (1992a and 1992b) concluded that public financing of health care services is associated with lower expenditures per capita, and that countries with fee for service as the dominant form of remuneration have higher expenditures. This is probably due to the strict control over health care providers in public-integrated systems. The opposite conclusions can be drawn from a series of studies analysing the institutional drivers of total health care expenditure. L'Horty et al. (1997) and Gerdtham (1992) found the positive correlation between health care spending and public insurance coverage. Leu (1986) argued theoretically that an increase in public health care provision may lead to an increase in total health care expenditure due to two possible effects: a reduction in the perceived price of health care on the part of consumers, and lower incentives for minimising costs in the public. Bac (2004) provided empirical evidence: an increase by 1 per cent of the share of health spending borne by the households' leads to the reduction in total spending by 1.4%.

Some researchers, analysing mainly the US data, show that organisational differences between health care systems affect spending through an effect on the rate of adoption of new technologies by health care providers. Two general hypotheses have been formulated, namely: (i) competition amongst financing entities discourages the adoption of technology by all hospitals in an attempt to reduce costs, and (ii) competition rationalises the adoption of technology in hospitals. Cutler and Sheiner (1997) showed, using empirical evidence from several US states, the strong negative correlation between enrolment in managed care schemes[32] and the medical cost growth. This relationship works through the process of

---

[31] To quote just a few possible arguments, one can mention that social health insurance is characterised by the existence of defined benefits to which all insured are entitled and which must be provided independently of their costs. Such benefit catalogues do not exist in most tax-financed systems, which leaves the authorities with a limited room to decide on the quantity and quality of services purchased according to their financial situation. Moreover, a closer analysis of inpatient care sector shows that the number of impatient admissions per 100 population and year and particularly the length of stay is much higher (by 9% and 81% respectively) in social health insurance countries than in tax-financed systems, due to the predominant per-diem fees typical for the former type. Therefore, the main factor explaining the difference in inpatient expenditure per capita may be the high number of patients admitted for inpatient treatment and lengthy treatments rather than high costs per admission. Finally, administrative costs tend to be higher in a system with a number of relatively small insurance funds competing for customers and negotiating individually with health care providers.

[32] Managed care scheme is a system of health-care delivery that aims to control costs by assigning set fees for services, monitoring the need for procedures such as tests and surgical operations, and stressing preventive care.

medical technology diffusion: States with high managed care enrolment used to be technology leaders in the early 1980s, but in the 1990s, due to limited acquisition of the new technologies, they were only average performers. Opposite conclusions were drawn by Bokhari (2000), who examined the effect of increased competition among Health Maintenance Organisations[33] on hospital competition in the US. Using data on one costly technology, cardiac catherisation, he showed that the hospitals are more likely to adopt costly technologies as the health insurance market becomes more competitive.

3.9. Health care resources

An interesting question is whether there is a relationship between the stock of physical and human resources in the health care sector and health expenditure. The issue is complex given that supply and demand factors are not completely independent. As Schulz (2005) points out, high density of health care services induces high utilisation rates, while waiting lists tend to reduce them. Some authors (Bac and Balsan 2001; Rochaix and Jacobzone, 1997) have thus attempted to model a hypothesis according to which the increase in health care offer (e.g. constant increase in the number of private practitioners) entails an increase in demand. Theoretically, such a relationship results from the asymmetry of medical information between a doctor and a patient as well as low price sensitivity of patients due to the universal insurance coverage. This hypothesis has not been confirmed by empirical evidence, even if it is supposed that it may prove valid above all in the countries where doctors are paid on a fee-for-service basis.

Several empirical studies (e.g. Getzen 1990, Murthy and Ukpolo 1994) have attempted to find statistical correlation between the number of doctors and/or nurses and health expenditure. The results were not conclusive. While most studies (e.g. Bac 2004) linked increase in the number of physicians with growing costs, others, like Gerdtham et al. (1992a), found that an increase in the number of physicians per capita would *reduce* total spending.

A closely related question touching upon the issue of public policy of health care provision is to what extent the commitment of public authorities to provide health care to all citizens affects public health spending. In previous decades a considerable part of the increase in public spending on health was linked to the establishment of universal access for entire population. With near-universal coverage of health insurance and health care provision achieved in all EU Member States, access may be a lesser source of cost pressure in the future. However, some Member States continue to take targeted measures aimed at vulnerable groups in the population. Also, in some countries, universal and comprehensive health insurance does not automatically lead to equitable access to services, and measures have been taken to tackle the lack or misdistribution of health care (e.g. lack of skilled professionals in rural areas, shortages for nurses or certain specialised physicians) or to improve the timeliness of services and reduce waiting lists.

---

[33] Health Maintenance Organisation (HMO) is a type of prepaid medical service in which members pay a monthly or yearly fee for all health care, including hospitalization. Most HMOs involve physicians engaged in group practice. Because costs to patients are fixed in advance, preventive medicine is stressed, to avoid costly hospitalization.

4. METHODOLOGIES USED TO PROJECT HEALTH CARE SPENDING

4.1. Comparison of model-types

There are several theoretical methods which can be used to produce projections of spending on health care. They can be divided into three general groups according to the specific needs of the projections exercise and the availability of the data (Comas-Herrera et al. 2005):

- ***time series-based methods:*** this group of methods is the least demanding in terms of data requirements, as it consists of extrapolating into the future the trends observed in the past. Those methodologies are most appropriate when there is clear and undisturbed trend of a single variable and when structural breaks are not expected. The larger the number of potential explanatory variables, the less reliable are these methods as the impact of possible structural changes in the future cannot be taken into account. Therefore, given the complexity of the network of interrelated factors affecting health care expenditure, such methods seem unfeasible to project spending in the long-term;

- ***macro-simulation models****:* these models (also called cell-based models) consist in disaggregating the overall population into a number of groups having a common set of features. Each cell represents another combination of the characteristics. As the number of individuals in the cell changes so do weights and the aggregate value of the endogenous variable. The focus of the study is on the total population or its subgroups: changes reflected by the model concern those groups rather than the individual components of each one of them;

- ***micro-simulation models:*** observe individual units (individuals, families, households) and their characteristics, instead of measuring changes in aggregate values. Two subgroups may be distinguished: while static models concentrate on the state at a certain point in time, dynamic models investigate changes over time and in response to context changes. Thanks to this feature, the latter can be used to predict the effect of the alternative events over the lifetime. A specific variant of micro-simulation model which has been successfully used health care spending projection exercises at national level are the health-based predictive models, described shortly in Box 3 below.

Box 3 *Health-based predictive models*

Various studies used a methodology to project spending on health care using the data on total health care spending, the share of costs spent on the respective care sectors, and the data on the incidence of diagnostic group in the population[34].

High potential value added characterises the studies based on the actual data on the health status of the population. Such projections use the information on individual patients gathered by hospitals, doctors, or public administration bodies to construct the aggregate indicators measuring health status or health care utilisation at local, regional or national levels.

---

[34] The valuable tool allowing for consistent classification of diseases and international comparisons is the International Classification of Diseases (ICD, 10th revision) which regroups over 2000 diseases and health problems into 22 chapters including several blocks each. For more specific information, see: World Health Organisation (2003), *International Statistical Classification of Diseases and Related Health Problems.10th Revision. Version for 2003*; available at: http://www3.who.int/icd/vol1htm2003/fr-icd.htm

While the methodologies can differ in details, all of them are based on the *Patient Classification Systems (PCS)* which consist of a set of rules which assign each patient or medical case to a specific group. Those groups, characterised by principal diagnosis, presence of a surgical procedure, age, presence or absence of significant co-morbidities or complications, and other relevant criteria are known as *Diagnosis Related Groups (DRG)* (US Congress, 1983).

This health-based approach has been used in several studies, e.g.: Holly et al. (2004) for Switzerland, Meerding et al. (1998) for the Netherlands, Executive NHS (1996) for the UK, Australian Institute of Health and Welfare (1996) for Australia and Moore et al. (1993) for Canada[35].

In Holly et al. (2004) each patient is assigned, via a Patient Classification System, to a single, mutually exclusive group of patients that are expected to consume similar amounts and types of hospital resources. Econometric estimation provides expenditure profile for health care (and long-term) expenditure based on age, sex and Diagnosis Related Groups. Then, past trends and assumptions about future developments are used to project incidence by groups and costs of treatments for the same group, which are further applied to the above expenditure profiles to calculate future spending on health care.

Meerding et al. (1998) have used slightly different methodology. For each healthcare sector, *key variables* are identified which are representative of healthcare use in that sector (e.g. bed days for nursing care; specialist-specific outpatient visits for outpatient care; patient consultations or emergency department visits for general practitioners; consultations and procedures for dental care, etc.) The probability distribution of those variables was derived from sector specific registries and sample surveys. Then total care activity of each sector was disaggregated by sex, age groups and diagnostic groups creating a three-dimensional matrix. For each entry, the average cost was calculated using an assumption that the distribution of costs is the same as the distribution of the key variables for a given sector. This way the share of costs spent on each diagnostic group in each sex and age group could be calculated as the proportion of the key variable in the relevant entry times the total costs for the sector. The results of such estimation need to be interpreted with caution, because of a huge uncertainty related to the data on diseases incidence.

As said before, disaggregation of costs into different Diagnosis Related Groups requires a rich and reliable epidemiological data gathered at the doctor or hospital level. Consequently, the projections using this kind of methodology are feasible so far only in a few countries with best developed reporting systems, and are practically incomparable across countries.

Another difficulty to deal with is embedded in the process of assigning a given cost to the treatment of a given disease. The reasons for that may be numerous:

- the same disease may be treated in a different way according to the diagnosis, available methodology and the budget constraints;
- the same treatment may have positive (synergic) or negative effects on another diseases which the patient suffers;
- many surveys underestimate the secondary/tertiary diagnoses (which determine most cases of some diseases) while paying too much attention on the results of primary diagnoses;
- some diagnoses may simply not be correct.

[35] The previous version of ICD (9th revision) was used.

To conclude, the health-based predictive models are theoretically significantly more reliable than the simple methodologies based only on demographic developments. However, they require a considerable amount of data which, even if existent at the national level, can not be guaranteed quality and consistency. Consequently, even though presenting good perspective for future studies, they cannot be considered as a reasonable option for currently run international projection exercise.

4.2. Limited options for EU-wide health care expenditure projections

The choice of the methodology used to project future expenditure on health care and long-term care depends on the availability and comparability of data on the one hand and the reliability of the expected results on the other hand.

While several alternative micro-simulation models are used to produce projections of spending on health care at the national level, the possibilities to apply them in the specific EU setting are very limited.

The main reason why micro-simulation models are not feasible in an international setting is the unavailability of the data and lack or limitations in its comparability across the Member States. The main difficulty consists in gathering detailed micro data, especially on epidemiological variables and/or on the individual health history, which requires a sophisticated IT patient registration and classification system, and comparable measurement and calculation standards. This issue was addressed at national level by Wanless (2002), who proposed a complex model to project spending within the UK's National Health Service (NHS). His method, instead of projecting the evolution of possible drivers of health care spending in the future, includes the benchmark of health status (expressed in terms of prevalence of given diseases, people's healthy behaviour and performance of public health services) expected to be achieved by a given time in the future. The model combines the assumption of reaching the targets with the expected evolution of exogenous demographic and economic variables to obtain total expenditure growth needed to achieve a given state of public health.

The use of the proposed model is not feasible in an international setting as it is practically impossible to establish the politically consistent social and health targets for 25 different Member States. Since the authority over health care organisation and provision lies entirely in the national authorities' hands, no attempt to predict development of the policy-contingent variables is feasible at the international level.

Another crucial difficulty in running fully comparable projections of health care spending across the Member States is the considerable diversity of the health care systems across the EU countries, since both ownership and management structure of the health care entities and the way they are financed affect cost effectiveness and the total level of spending on health care.

On the other hand, a time series-based method, even though the easiest to perform and the least demanding in terms of input data, cannot be considered as a viable solution either. Given a large number of interrelated factors affecting health care spending and very complex network of reciprocal relationships between them and health expenditure, simple extrapolation of past trends cannot provide reliable projection results. Moreover, as recent data shows, public spending on health care is to a large degree a policy-driven variable and follows only to a very limited degree past trends, which makes the time series-based method even less feasible solution.

To sum up, the comparison of existing broad model-types used to project the spending on health care suggests that an optimal choice and a satisfactory compromise between the needs for reliability and feasibility are the macro-simulation models. The practice confirms this thesis, as the bulk of projections made at both national and international level (see for example: Pellikaan and Westerhout (2004), Grignon (2003), *The Boards of Trustees* (2004), OECD (2006) and Wanless (2002)) can be classified as belonging to this model-type. All of those studies follow the similar methodology which consists in decomposing the population into gender, age, or differently characterised cohorts and assigning each of them a given per capita spending. Then, following different assumptions on developments in demographic and macroeconomic variables, various scenarios are produced to illustrate stylised possible trend.

Since age and gender are the main dimensions according to which the population is decomposed into cohorts, size and structure of the population play the central role in the proposed methodology. However, as discussed above, demand for and use of health care depends ultimately on the health status and functional ability of (elderly) citizens, rather than on their age. While age is a useful indicator of the health status of an elderly population (which is illustrated by the steep upward slope of age-related expenditure profiles), it is not the causal factor *per se*. Therefore, following the discussion in section 2, one can establish a simplified list of the variables, both demographic and non-demographic, that affect health care spending from both demand and supply side and that should be taken into consideration while projecting future developments in public health care spending (see Table for an overview of the drivers of spending and how they have been captured within the budgetary projection exercise).

Table 6 The drivers of health care spending: how they are incorporated in the projection exercise

Demand side factors				
	Mechanism/channel through which health care spending is affected	**Evidence in literature on likely impact on spending**	**Addressed in projections**	**Likely effect on projection results**
Size and age structure of the population	Population size and age structure determines the overall number of persons who potentially need some health care services. Morbidity rates tend to increase sharply at older ages, although age itself is not the causal factor.	Population projections show a large increase in the number of older persons, who are the main consumers of health care. Lower mortality/ consumption of health care is .	*Pure demographic scenario* plus *high life expectancy scenario*.	The 'pure' effect of an ageing population will lead to strong pressure for increased spending.
Health care status of the population, social and environmental determinants of health	Changes in age-specific morbidity rates, driven by social, environmental and technological determinants of health, will alter the demand for health care.	No clear cut evidence on the trends in healthy life years as compared to total life expectancy. Three hypotheses are available: morbidity expansion, dynamic equilibrium and morbidity compression.	*Constant health scenario* and *improved health scenario*.	Future improvements of health care status will lower the projected impact on spending compared to *pure demographic scenario*.
Death related costs	Large share of total health care spending is concentrated in the final phase of life linked to approaching death. When the mortality rate (number of deaths in a given age cohort) declines, per capita health care costs decrease.	Large body of evidence confirming the existence of death-related costs, and that the ratio of spending between decedents and survivors declines with age. No clear evidence on whether the importance of death-related costs has changed over time.	*Death-related cost scenario*.	Increase in health care spending is spread over longer time period. Total spending is lower as compared to *pure demographic scenario*.
Income	Health care expenditure depends on the national income and tends to increase faster than GDP, due to the increase in real living standards, features of health care as a luxury good and/or Baumol effect.	Studies at micro level show income elasticity of demand greater than 1 but neutral at an aggregate level. Real convergence process may lead to an increase in health care spending as a result of absolute increase in demand and a shift towards high quality medical goods and services demanded in fast growing economies.	*Income elasticity scenario* considers an income elasticity of demand greater than 1 for all Member States. *Cost convergence scenario* considers the convergence in age-related expenditure profiles in EU12 to EU15 levels.	Projected increases in spending compared with *pure demographic scenario*.
Prevention policies	Investment in health promotion and disease prevention increases expenditure in short term, but potentially reduces future costs by improving health status of the population.	No clear cut evidence: a detailed case-by-case analysis shows varying levels of cost-effectiveness for different activities and interventions.	Not modelled.	

Supply side factors				
	Mechanism/channel through which health care spending is affected	**Evidence in literature on likely impact on spending**	**Addressed in projections**	**Likely effect on projection results**
Technology	Technology can lower unit costs of providing more efficient treatment, but can push up total spending by making new treatments available for more persons. Technology can lower the demand for health care if early or less invasive interventions improve health care status and lower future health care needs: alternatively, it can increase future health care needs by increasing the survival probabilities of persons with chronic or multiple health conditions.	Not clear cut. Evidence to date suggests that technology has pushed up overall spending as increased demand appears to have outweighed unit cost savings. However, there is considerable uncertainty on future prospects. Prospective technological developments could radically alter treatment possibilities and the health care sector is starting to catch-up with other sectors on the deployment of IT.	*Technology scenario* based on the econometric analysis of past trends in health care spending. A trend coefficient, remaining after the impact of demographic changes and income has been accounted for, is considered as the effect of technological progress and used in the projections of future expenditure.	Progress in medical technology is expected to push up costs compared to *pure demographic scenario.*
Relative costs in the health care sector	Total health care spending driven by the evolution of unit costs for key components (wages, capital investment and pharmaceuticals) relative to the economy as a whole.	Unclear due to data limitations and prevalence of non-market pricing in the health care sector. Wages often covered by collective agreements and pharmaceutical prices are regulated. Evidence from US points to high price inflation for pharmaceuticals but this may be driven by incentives embedded in their market structure.	*Labour intensity* scenario based on an assumption that health care is a labour intensive sector, *fast cost growth* scenario – a sensitivity test on the unit cost growth.	Can push up (if assumed cost driver grows faster than GDP per capita) or reduce (otherwise) projected spending compared with *pure demographic scenario*.
Government policy and institutional settings	Overall spending on health is determined by policy choices on access to health care systems and on quality (waiting times, patient choice etc.) The evolution of spending is also determined by the effectiveness of aggregate budgetary control measures (e.g. spending caps) and micro incentives for patients and health care professionals favouring rational use of resources. Real convergence process also plays a role in designing appropriate health policy setting.	Improved access has been major driver of spending in past decades. Governments face strong pressure to provide access to new medical treatments and to improve quality of services, and existing projections from national sources show that policy choices have a major impact on health care spending. Aggregate budgetary control measures appear to have stemmed increases in health care spending in the 1990s, but long-term effectiveness will require appropriate micro incentives.	Not modelled.	

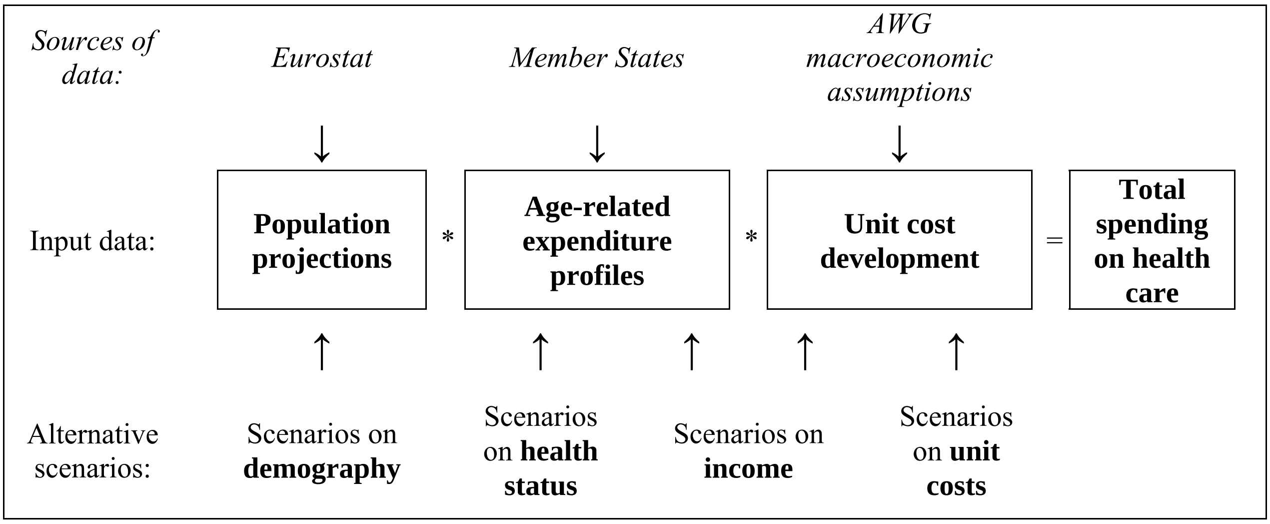
4.3. *Methodology allowing for a wide range of driving factors to be taken into consideration*

For the reasons discussed in the previous section, a macro-simulation model has been chosen to project future health care expenditure in the framework of the long-term budgetary projections run by the Ageing Working Group. Given wide range of underlying factors and channels through which they affect spending, several projection scenarios have been run in order to tackle the issue from a variety of different angles, rather than attempting to construct an all-encompassing projection methodology to capture all demographic and non-demographic factors.

The basic methodology used in the *pure demographic* scenario is a very simple one (see Graph below)[36]. The common elements of all scenarios are the macroeconomic assumptions agreed by the Ageing Working Group and population projections (EUROPOP2008) provided by Eurostat. The age and gender-specific per capita expenditure provided by the Member States is applied to the demographic projections to calculate nominal spending on health care. To keep it constant in real terms a stylised deflator is then applied.

The adjustments reflecting the effects of different factors on health care spending are applied by correspondingly adapting one of three main items of input data: demographic projection scenario, development over time of age-related expenditure profiles, and pattern of unit cost developments (driven in most cases by the macroeconomic variables).

Graph 9 Schematic presentation of the projection methodology



Source: European Commission and Economic Policy Committee (2009)

In order to reflect a wide variety of factors affecting health care spending a number of alternative scenarios have been run. The scenarios have been grouped into four broad categories according to the driving force being modelled and, broadly speaking, the way the basic methodology is adjusted. The four categories are: demography, health status, income, and unit costs. An overview of all scenarios is presented in Table 7 below.

[36] For the formal expression of the projection methodology, see annex 1.

Table 7 Overview of different scenarios used to make the projections of health care spending

	Scenarios on **demography**		Scenarios on **health status**			Scenarios on **income effects**		Scenarios on **unit cost developments**			
	Pure demographic scenario	**High life expectancy scenario**	**Constant health scenario**	**Improved health scenario**	**Death-related costs scenario**	**Income elactity scenario**	**EU12 cost convergence scenario**	**Labour intensity scenario**	**Fast cost growth**	**Technology scenario**	***AWG reference scenario***
Population projection	Europop 2008	Alternative high life expectancy scenario	Europop 2008	Europop 2008	Europop 2008	Europop 2008	Europop 2008	Europop 2008	Europop 2008	Europop 2008	Europop 2008
Age-related expenditure profiles	2007 age-related expenditure profiles held constant over projection period	2007 age-related expenditure profiles held constant over projection period	2007 profiles shift in line with changes in age-specific life expectancy	2007 profiles shift twice as much as changes in age-specific life expectancy	2007 profiles held constant but split into profiles of decedents and survivors	2007 age-related expenditure profiles held constant over projection period	Individual EU12 country profiles converging to the average EU15 profile over the projection period	2007 age-related expenditure profiles held constant over projection period	2007 age-related expenditure profiles held constant over projection period	2007 age-related expenditure profiles held constant over projection period	*2007 profiles shift by half the change in age-specific life expectancy*
Unit cost development	GDP per capita	GDP per capita	GDP per capita	GDP per capita	GDP per capita	GDP per capita	GDP per capita	GDP per worker	GDP per capita + 1 p.p. during the period 2008-2017	GDP per capita + extra yearly rate of growth* in 2007 linearly converging to 0 by 2038/2060	*GDP per capita*
Income elasticity of demand	1	1	1	1	1	1,1 in 2007 converging to 1 by 2060	1	1	1	Below 1* in 2007 converging to 1 by 2038/2060	*1,1 in 2007 converging to 1 by 2060*

* precise values resulting from the technology impact regression estimates. Two alternative variants of convergence period.

Source: EPC and European Commission

4.3.1. Scenarios on demography

The scenarios on demography aim at disentangling pure effect of demographic changes on public health care spending, i.e. eliminating the effect of other, both demand and supply factors. They also show how sensitive public expenditure on health care is to changes in underlying demographic trends.

Pure demographic scenario attempts to isolate the 'pure' effects of an ageing population on health care spending. It assumes that age-related spending per capita on health care in the base year remains constant in real terms over time. Since health care spending, assumed to proxy the morbidity rate, remains constant for each age cohort as life expectancy increases, all gains in life expectancy are assumed to be spent in bad health, while the number of years spent in good health remains constant. In this regard, this scenario follows the *expansion of morbidity/disability* hypothesis quoted in the literature. The constant age profile is applied to the population projections with an assumption that the costs evolve in line with GDP per capita. The evolution of expenditure levels under this assumption can be considered to be neutral in macroeconomic terms – if no change in the age structure of the population occurred, the share of health care sector in GDP would remain the same over the projection period even if the size of the population changed.

Comparison of the results of *pure demographic* scenario with those of ***higher life expectancy scenario*** shows the changes in public spending on health care resulting from a stylised change in demographic trends. It uses *high life expectancy demographic scenario*, which assumes the mortality rates to fall faster than in the baseline scenario so that life expectancy at birth is 1 year higher by the end of projection period. Since assuming of the same relative fall in mortality rates across all age cohorts does not only increase the absolute number of people at each age, but additionally raise the share of the older age cohorts in total population, it should, at least theoretically, have a considerable impact on age-related expenditure items.

4.3.2. Scenarios on health status

Pure demographic scenario which takes into account solely changes in the size and structure of the populations seemingly abstracts from any changes in health status of the population. While it assumes the age-related expenditure profile constant over time, it may overlook the positive developments in health linked to the fall in mortality rates already embedded in the underlying demographic projections. As such, it may be considered as the practical expression of the *expansion of morbidity/disability hypothesis* discussed in section 2.4, which may be too pessimistic in that it implicitly assumes that all the gains in life expectancy up to 2060 would be spent in bad health. In order to address this caveat three health status scenarios have been run.

The ***constant health scenario*** is inspired by the *dynamic equilibrium hypothesis* and captures the potential impact of possible improvements in health status of elderly citizens. It assumes that the number of years spent in bad health during a life time in 2060 is identical to that in 2007, i.e. all future gains in life expectancy are spent in good health. As morbidity rate is assumed to fall precisely in line with falls in mortality rate, it is modelled by progressively shifting the age-related expenditure profile of the base year outwards in direct proportion to the projected gains in age and gender specific life expectancy, embedded in the baseline population projection. This procedure is illustrated in Graph 9 below by the straight dark line, which illustrates the age-related expenditure profile that would be applied in the year 2060. In practical terms, an average person which will reach a given age x in 2060 will be assumed to have the same level of morbidity, and therefore use the same amount of health care as does today a person of age *x-n*, where *n* is the increase in life expectancy at the age of *x* between now and year 2060. Obviously, this increase is the highest for the youngest cohorts (EU27 average increase of 8.5 years for a new-born male and 6.9 years for a new-born female) and decreases gradually with age. Still, given quite steep profile of per-capita spending for the older cohorts (increase from 8-9% of GDP per capita for the cohort 60-64 to 19% (females) and 21% (males) of GDP per capita for the cohort 90-94), a reduction in per capita spending corresponding to a 5-5.5 year gap (which is an average increase in life expectancy at age 65) will amount to an considerable amount of 2% of GDP per capita[37].

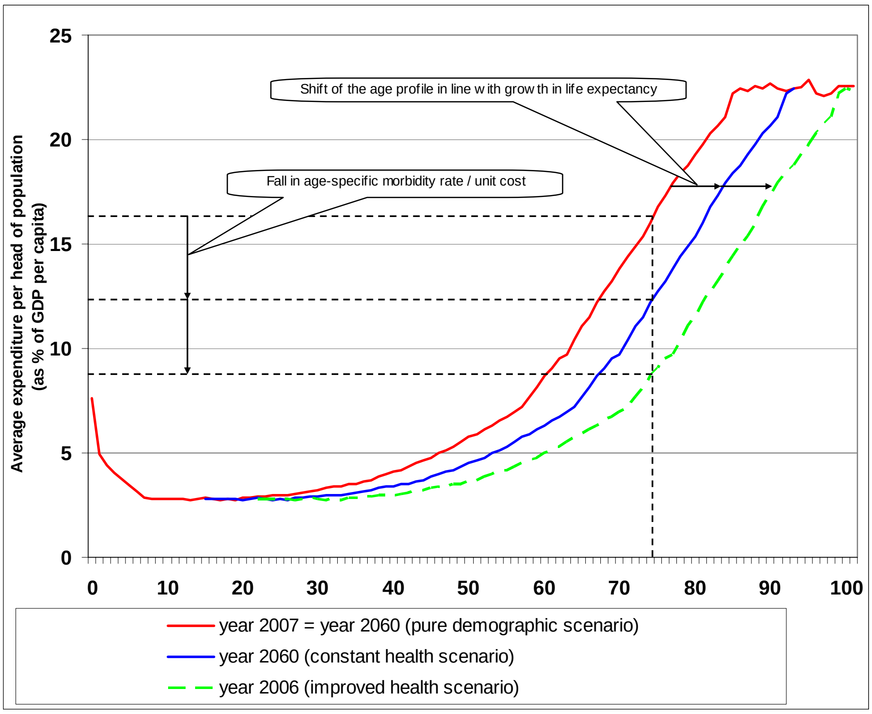
The ***improved health scenario*** is inspired by the *compression of morbidity/disability hypothesis* in that it assumes that the number of years spent in bad health during a lifespan falls while total life expectancy increases. In other words, the morbidity rate is assumed to fall faster than mortality rate. Given the lack of empirical evidence on possible extent of changes, the stylised picture of this process is achieved by progressively shifting the age-related expenditure profile of the base year along the age axis by more (by a stylised factor) than the projected gains in age and gender specific life expectancy. Given the lack of a precise empirical indication of what the scale of possible 'compression' is, a factor of 2 is assumed, providing a mirror picture of morbidity expansion hypothesis on the positive side of the constant health scenario deemed neutral in macroeconomic terms. It is illustrated by dotted line on Graph 10 and is expected to have a considerable impact on health care spending, amounting to about twice the effect of *constant health scenario*. However, its results should be analysed with great caution,

---

[37] The example above illustrates the average EU15 profile. The analogous mechanism applied for EU12 results in a less pronounced change. Given that age profile is much flatter (per capita spending increases from 7-8% of GDP per capita for age cohort 60-64 to 13-17% (for females and males respectively) for age cohort 90-94), the shift of age profile equal to an increase in life expectancy corresponds to 1.0-1.3% of GDP per capita.

remembering that the scenario is a purely stylised one and illustrates a highly optimistic theoretical hypothesis, supported by a limited number of empirical studies.

Graph 9 Illustration of the different scenarios on future morbidity/disability and longevity using age profiles on health care costs



***Source*:** DG ECFIN

An alternative method to project health care spending taking into account probable improvement in health status resulting from the evolution of mortality rates is the ***death-related costs scenario*** which links health care spending to the number of remaining years of life. As discussed above, there is strong evidence that a large share of total spending on health care during a person's life is concentrated in the final years of life. Therefore, as life expectancy increases and smaller share of each age cohort are in their terminal phase of life, health care expenditure calculated using constant expenditure profiles may be overestimated. The reasoning behind the death-related costs theory resolves to similar arguments as in the *constant health* scenario presented above: over time there is a growing gap between two basic assumptions. On the one hand, the assumption of constant age profiles which is a central element of *pure demographic* scenario implies constant morbidity rates and constant health care spending at each age. On the other hand, falling mortality rates embedded in the population projections lead to a fall in the share of those in terminal phase of their lives in each age cohort which, in accordance with the theory, accounts for a disproportionately large share of total health care spending. To address this inconsistency, an average profile of *death-related costs* by age has been constructed based on available data supplied by the Member States (see Table 4 and Table 5)[38]. Subsequently, with the use of this profile, age and gender specific unit costs of health care in each country have been differentiated between decedents (those who die within a calendar year) and survivors in each country. Then, using age and

[38] The figures are available for a limited number of countries and vary considerably across them, therefore it has been decided to use the same, average profile for all Member States participating in the projection exercise.

gender-specific mortality rates population of each age group has been split into the group of decedents and survivors and the respective unit costs have been applied to each one.

4.3.3. Scenarios on income effects

An important factor driving demand for and expenditure on health care is national income. While the correlation between income and demand at the individual level is affected by universal coverage of health insurance often providing incentives for excessive use of some services, the correlation is much more visible at the aggregate level. Several studies tend to suggest that health care spending rises broadly in line with economic growth. The responsiveness of health care spending to the national income, and therefore projected growth in health care spending due to future evolution of macroeconomic variables depends to a large extent on the income elasticity of demand for health care. As proven by empirical data, *'health care is an individual necessity and a national luxury'* and in aggregate terms it is likely to have high, exceeding unity, income elasticity.

According to the literature, international variations in the aggregate health care spending can be broadly explained by the differences in the level of economic development. Investment in new technologies, more sophisticated and effective treatment methods, higher standards of living, public expectations for higher quality of treatment – all those factors contributing to the rise in expenditure are more prevalent in the most developed countries, but also spread to the other ones as the gaps in real income between countries shrink due to the real convergence processes.

Both presented mechanisms have been modelled in the two income scenarios. The first one, ***income elasticity scenario*** shows the effect of elasticity exceeding unity on the evolution of total spending over time. In practical terms, it is identical to the *pure demographic* scenario except that the income elasticity of demand is equal to 1.1 in the base year and converges in a linear manner to 1 by the end of projection horizon in 2060. The elasticity coefficient at the beginning of the period has been chosen arbitrarily, although taking account of empirical evidence on developments in this value over the recent decades (see e.g. Getzen 2000) in light of which it can be considered as a relatively conservative assumption.

The second discussed mechanism has been modelled in the ***cost convergence scenario*** which is meant to capture the possible effect of a convergence in real living standards (which emerges from the macroeconomic assumptions behind projection exercise) on health care spending. It covers only the Recently Acceded Member States (EU12) since in most of them current spending on health care (both in nominal terms and as a % of GDP per capita) is well below the levels observed in EU15 countries. By keeping constant the flatter 2007 age-related expenditure profiles as the basis of the health care projections, the projected budgetary impact of ageing will be less evident in the EU12 countries compared to EU15. *Cost convergence scenario* assumes therefore that the average age-related expenditure of EU12 countries in the base year 2007 progressively increases to the average age-related expenditure profile of EU15 countries by 2060. Such simplified assumption implies that the underlying growth in per capita spending would have to accelerate considerably in the Recently Acceded Member States. Still, since the current gap in per capita spending is significant mainly for the older age cohorts (see Graph 7), the rate of increase would vary considerably across the age groups and the extra spending would concentrate just in the older cohorts. Indeed, if the convergence of EU15 and EU12 age profiles was to be achieved by 2060, per capita spending would grow to a non-negligible extent only for the cohorts aged 70 and more. For example, to complete the convergence process by 2060 would require an average extra yearly increase in spending per capita of 0.3% for males and 0.6% for females for the age cohort 70-74, and about 0.5% and 0.8% respectively for age cohort 90-94.

4.3.4. Unit cost scenarios

A number of other factors have a direct or indirect effect on public spending on health care. Most of the supply side factors affect the evolution of unit cost of health care provision. It can be either driven by the market forces (e.g. increase in prices of resources and raw materials, cost of investments in research and technology or in fixed capital, market-driven rise in wages and salaries), or influenced by the institutional structure of the sector or state regulations (e.g. relatively fast growing wages covered by collective agreements or legally regulated prices of pharmaceuticals). However, most of those factors have not been explored thoroughly enough as to allow for a reliable measurement of their effects. In order to encompass the possible effect of several generally uncountable factors, three stylised scenarios have been proposed. Two of them use similar methodological tool, whereby the unit cost of health care spending is assumed to follow over time a development path varying from the basic GDP per capita growth rate. The third one uses a more sophisticated methodology, whereby an econometric analysis of past trends in health care expenditure drivers enables the estimation of the coefficients of correlation used later in projecting future evolution of costs.

The ***fast cost growth scenario*** is a simple sensitivity test investigating the responsiveness of health care spending to a given change in the unit cost of health care provision, due to an undefined institutional, economic or political factor. It presents a purely stylised situation of the faster evolution of unit costs in the entire health care sector which can be an effect of any possible supply side factor, such as increased investment in technological development, growth in prices relative to the other sectors of the economy, stricter regulation of health care sector, etc. The methodology is identical to the *pure demographic* scenario, but instead of following GDP per capita rate of growth, unit costs are increasing by 1 percentage point above that rate in the first ten years of the projection exercise (2008-17) and thereafter, between 2018 and 2060, in line with the basic GDP per capita growth rate.

The ***labour intensity scenario*** is an attempt to reflect the high labour intensity of health care sector and is constructed similarly to the *pure demographic* scenario except that costs are assumed to evolve in line with the evolution of GDP per worker or, in other words, labour productivity of a person employed in the economy (no information on the productivity in individual sectors is available). As wages are projected to grow faster than GDP per capita, this scenario provides an insight into the effects of unit costs in the health care sector increasing by more than in the economy as a whole. However, to consider the scenario feasible, two strong macroeconomic assumptions need to be established. First, wages must be assumed to be a key determinant of costs in the health sector, which is therefore supposed to be highly labour intensive. Second, wages in the health sector must grow at the same rate as wages in the whole economy, and wages in the whole economy generally follow the trend of economy-wide productivity. If both conditions are met, expenditures per head are assumed to grow at the same rate as productivity in the whole economy[39].

4.3.5. Scenario on the impact of technology

The ***technology scenario*** is an attempt to incorporate the empirical evidence on the impact of technological progress on health care expenditure into the projections. Based on the econometric specification, the past impact of income and technology[40] has been estimated and the results introduced in the projection calculations.

The econometric model, presented in detail in Dybczak and Przywara (2010), estimates health care expenditure developments against demographic and economic explanatory variables. Featured demographic variables are the shares of old (over 80) and young (below 20) people in total population, while the real GDP per capita is interpreted as a measure of overall economic wealth. The regression has been run for all the countries being members of the EU and OECD (EU15, Czech Republic, Hungary, Poland, Slovakia plus Norway, given its participation in the projection exercise) but, as the individual results differed significantly and the length of time series for the four RAMS was deemed insufficient, it has been decided to use the same EU27 coefficients obtained on the basis of the pooled fixed effect regression (see Table 6) in the further calculations.

Table 6 Pooled fixed effect regression estimates.

		HCE_TOT		HCE_PUB	
EU	cons	0.30		0.49	
	GDP	0.68	***	0.65	***
	OVER 80	0.02		0.01	
	BELOW 20	-0.01	*	-0.01	*
	trend	0.02	***	0.02	***
EU_15	cons	0.69		0.76	
	GDP	0.65	***	0.67	***
	OVER 80	-0.02		-0.08	**
	BELOW 20	-0.01	**	-0.02	***
	trend	0.02	***	0.02	***
RAMS	cons	3.04	*	5.88	***
	GDP	0.56	**	0.50	
	OVER 80	0.16	***	0.23	***
	BELOW 20	0.01		-0.03	**
	trend	0.03	***	0.03	

Note: **** statistically significant at 1% level, ** statistically significant at 5% level, * statistically significant at 10% level*
Source: Dybczak and Przywara (2010)

[39] This also implies that either the health care sector does not benefit from productivity gains and that the volume of care services provided does not increase; or alternatively that both productivity in the health care sector, and the volume of services provided grow in line with the rate of economy-wide productivity growth.

[40] Following the conclusions of numerous studies, suggesting that technology accounts for the largest share of health care expenditure growth (see section 2.7.) entire non-demographic and non-income-driven expenditure growth has been attributed to the broadly defined medical technology. This simplified approach is mainly due to the lack of data on the other supply side factors, such as institutional setting, price system etc. Thus, the factor considered as technology includes also the other non-quantifiable supply-side drivers of costs.

The coefficient corresponding to GDP, statistically significant for both EU and EU15 (including Norway)[41], is interpreted as elasticity of health care expenditure with respect to GDP. The value is positive, but significantly lower than unity, which suggests a seemingly counterintuitive result, given the theoretical considerations on income elasticity. However, such an outcome can be, explained by the fact that part of the income effect is captured by the trend coefficient, representing the impact of all unspecified factors, mainly the medical technology developments. Since the latter depends on the investment potential of a country's economy, it is strongly related to the national income. This way the combined effect of economic growth and non-monetary aspects of medical progress is split in the model between the income and trend coefficients.

Those two coefficients are further used in the standard projection model. In the base year an extra yearly increase in unit costs due to technology (and other supply-side effects) is added (its value is of about 2%) and the income elasticity is as low as 0.65. Over time, as the sector is expected to converge towards a steady state development, the two effects are disappearing simultaneously, reaching zero extra cost growth and unity elasticity by 2038 or 2060 (two alternative variants are considered to estimate the sensitivity of the results to the assumed convergence time).

4.3.6. Reference scenario

As argued in the previous sections, actual spending on health care is a combined result of the whole set of interrelated demographic and non-demographic factors. Therefore, the scenarios presented above should not be considered as a reliable prediction of the future, but rather as the sensitivity tests, providing marginal analysis of the separate effect of individual factors. Furthermore, given the complexity of those interconnections and difficulties in defining the most probable course of development in the underlying variables, the probability of predicting the actual development is very limited and subject to high risk. While one possible solution to tackle this problem would be to use stochastic rather than deterministic method of projections, its main value added would be the ability to quantify the level of uncertainty, intrinsically linked to the modelling procedure. Nonetheless, even if highly risky, an attempt to merge a series of quantifiable factors into a single setting and estimate the joint effect of probable combination of underlying factors is a potentially very informative challenge, especially in the context of the public policy of health care provision, which needs to be based on the most reliable forecasts of the expected development in the whole range of health-related variables.

Obviously, the crucial issue in constructing the optimal scenario is the right choice of factors and their expected development path. However, as discussed above, several arguably significant factors are either not sufficiently defined or quantified (e.g. impact of technology, epidemiological analysis of population's health status) or too complex to be reduced to a single variable or a small set of them (e.g. organisation of health care systems). Facing such dilemma, the Ageing Working Group took a pragmatic approach by choosing a set of a few relatively well known and unquestionable factors and calculating their combined impact on health care expenditure. It has been decided to combine the pure demographic impact of ageing population with the neutral assumption on the evolution of health status (which is broadly supported by the empirical evidence

[41] As mentioned, given very small size of the RAMS database (only four countries of this group are members of the OECD while available time series are very short), the results of this specification should be interpreted with caution

on the death-related costs) and the assumption on the moderate impact of national income on the health care spending (chosen on the basis of the past trends). In practical terms, it has been assumed that morbidity rate evolves at half mortality rate over the whole projection period, or in other words, that half of extra years of life gained through higher life expectancy are spent in good health. Furthermore, income elasticity of demand is assumed to equal 1.1 in the base year and converge to unity by 2060.

5. RESULTS OF THE PROJECTIONS

Table 7 below presents a summary of the projected changes in health care spending between 2007 and 2060, measured in % of GDP and expressed as a difference from the *pure demographic scenario*, for all proposed scenarios. The purpose of such presentation setting is straightforward: the difference from the *pure demographic scenario* illustrates the individual impact of each analysed factor on total health care expenditure. The following sections present and discuss briefly the results of each scenario (detailed results are presented in annex 2) and attempt to draw general conclusions on the driving forces of health care expenditure.

Table 7 Overview of projected changes in health care spending as % of GDP between 2007 and 2060 according to different scenarios

	Level 2007	Change 2007-2060	Difference compared to pure demographic scenario									
		Pure demographic	High life expectancy	Constant health	Improved health	Death-related costs	Income elasticity	Cost conver-gence	Labour intensity	Fast cost growth	Technology (convergence by 2060)	Technology (convergence over 30 years)
BE	7,6	1,5	0,5	-1,1	-2,1	-0,3	0,4	:	0,7	0,6	0,6	0,6
BG	4,7	0,7	0,3	-0,7	-1,3	-0,1	0,4	3,4	0,9	0,4	0,4	0,4
CZ	6,2	2,3	0,5	-1,2	-2,1	-0,3	0,5	0,6	1,5	0,6	0,6	0,6
DK	5,9	1,2	0,4	-0,9	-1,7	-0,2	0,3	:	0,5	0,5	0,5	0,5
DE	7,4	2,0	0,5	-1,1	-2,0	-0,5	0,4	:	0,8	0,7	0,7	0,7
EE	4,9	1,2	0,5	-0,9	-1,5	-0,2	0,5	2,1	1,1	0,4	0,4	0,4
IE	5,8	2,0	0,4	-1,0	-1,8	-0,3	0,3	:	0,9	0,6	0,6	0,6
EL	5,0	1,5	0,3	-0,7	-1,3	-0,2	0,3	:	0,9	0,5	0,5	0,5
ES	5,5	1,8	0,3	-0,8	-1,4	-0,3	0,3	:	0,8	0,5	0,5	0,5
FR	8,1	1,4	0,4	-1,0	-1,9	-0,3	0,4	:	0,7	0,7	0,7	0,7
IT	5,9	1,2	0,3	-0,7	-1,4	-0,2	0,3	:	0,6	0,5	0,5	0,5
CY	2,7	0,9	0,3	-0,8	-1,3	-0,1	0,2	4,0	0,3	0,3	0,3	0,3
LV	3,5	0,7	0,3	-0,6	-1,0	-0,1	0,3	4,5	1,0	0,3	0,3	0,3
LT	4,5	1,2	0,4	-0,9	-1,5	-0,2	0,4	3,0	1,3	0,4	0,4	0,4
LU	5,8	1,3	0,4	-0,9	-1,7	-0,3	0,4	:	-0,2	0,5	0,5	0,5
HU	5,8	1,7	0,7	-1,5	-2,4	-0,4	0,5	1,3	1,2	0,5	0,5	0,5
MT	4,7	3,8	0,6	-1,5	-2,7	-1,2	0,4	1,6	1,2	0,6	0,6	0,6
NL	4,8	1,1	0,3	-0,7	-1,3	-0,2	0,2	:	0,7	0,4	0,4	0,4
AT	6,5	1,7	0,4	-1,0	-1,8	-0,4	0,3	:	0,9	0,6	0,6	0,6
PL	4,0	1,3	0,6	-1,9	-3,6	-0,1	0,4	3,6	1,0	0,4	0,4	0,4
PT	7,2	2,2	0,6	-1,2	-2,2	-0,5	0,4	:	0,9	0,7	0,7	0,7
RO	3,5	1,4	0,4	-0,7	-1,3	-0,2	0,4	3,9	1,4	0,3	0,3	0,3
SI	6,6	1,9	0,4	-1,0	-1,8	-0,3	0,5	0,6	2,2	0,6	0,6	0,6
SK	5,0	2,3	0,4	-1,1	-1,9	-0,3	0,6	1,9	1,4	0,5	0,5	0,5
FI	5,5	1,4	0,5	-1,2	-1,8	-0,2	0,3	:	0,6	0,5	0,5	0,5
SE	7,2	0,9	0,4	-0,9	-1,7	-0,2	0,3	:	0,8	0,6	0,6	0,6
UK	7,5	2,2	0,6	-1,2	-2,1	-1,0	0,4	:	0,6	0,7	0,7	0,7
NO	5,6	1,6	0,4	-1,0	-1,8	-0,3	0,3	:	1,0	0,5	0,5	0,5
EU27	*6,7*	*1,9*	*0,5*	*-1,0*	*-2,0*	*-0,5*	*0,4*	*:*	*0,8*	*0,6*	*4,6*	*2,4*
EU15	*6,9*	*1,8*	*0,5*	*-1,0*	*-1,9*	*-0,5*	*0,4*	*:*	*0,7*	*0,6*	*4,7*	*2,5*
EU12	*4,7*	*1,6*	*0,5*	*-1,3*	*-2,5*	*-0,2*	*0,4*	*2,7*	*1,2*	*0,4*	*2,6*	*1,3*

Source: European Commission and Economic Policy Committee (2009)

5.1. Impact of demographic changes on health care spending

The results presented in Table 8 below show that demographic developments are expected to push public spending on health care up by between 0.7 and 3.8 percentage points of GDP in most Member States between 2007 and 2060, and by 1.9% of GDP on average. As expected, large part of that increase is projected to materialise up to 2030, as it is over the first half of the projection period that fastest population growth and ageing process is expected to occur. Despite their less favourable demographic prospects (convergence to lower fertility and lower mortality rates), public spending on health is projected to grow by slightly less in the EU12 than in the EU15 countries. This reflects both lower initial level of spending (4.7% compared to 6.9% of GDP in 2007) and their flatter age-related expenditure profiles.

Table 8 Pure demographic scenario – projection of public health care spending as % of GDP, 2007-2060

	2007	2010	2020	2030	2040	2050	2060	*Change 2007-2060*
BE	7,6	7,7	8,0	8,5	8,8	9,0	9,1	*1,5*
BG	4,7	4,8	4,9	5,0	5,3	5,4	5,4	*0,7*
CZ	6,2	6,3	6,8	7,3	7,8	8,2	8,5	*2,3*
DK	5,9	6,0	6,4	6,8	6,9	7,1	7,1	*1,2*
DE	7,4	7,6	8,1	8,6	9,1	9,4	9,4	*2,0*
EE	4,9	5,0	5,2	5,4	5,7	6,0	6,2	*1,2*
IE	5,8	5,9	6,1	6,5	7,0	7,5	7,8	*2,0*
EL	5,0	5,1	5,3	5,6	6,0	6,3	6,4	*1,5*
ES	5,5	5,6	5,8	6,3	6,9	7,2	7,3	*1,8*
FR	8,1	8,2	8,6	9,0	9,3	9,5	9,5	*1,4*
IT	5,9	5,9	6,2	6,6	6,9	7,1	7,1	*1,2*
CY	2,7	2,8	2,9	3,1	3,2	3,4	3,6	*0,9*
LV	3,5	3,5	3,6	3,7	3,9	4,0	4,1	*0,7*
LT	4,5	4,5	4,8	5,0	5,3	5,5	5,7	*1,2*
LU	5,8	5,9	6,1	6,5	6,8	7,0	7,1	*1,3*
HU	5,8	5,8	6,1	6,5	7,0	7,3	7,5	*1,7*
MT	4,7	4,9	5,7	6,5	7,4	7,9	8,5	*3,8*
NL	4,8	4,9	5,3	5,6	5,8	5,9	6,0	*1,1*
AT	6,5	6,6	7,0	7,5	7,9	8,2	8,2	*1,7*
PL	4,0	4,1	4,4	4,7	5,0	5,2	5,4	*1,3*
PT	7,2	7,3	7,7	8,1	8,6	9,1	9,4	*2,2*
RO	3,5	3,5	3,7	4,0	4,4	4,7	4,9	*1,4*
SI	6,6	6,7	7,2	7,7	8,2	8,4	8,6	*1,9*
SK	5,0	5,1	5,6	6,1	6,6	7,1	7,3	*2,3*
FI	5,5	5,6	6,0	6,5	6,7	6,8	6,9	*1,4*
SE	7,2	7,2	7,5	7,7	7,9	8,0	8,1	*0,9*
UK	7,5	7,6	7,9	8,4	9,0	9,4	9,7	*2,2*
NO	5,6	5,7	6,1	6,6	6,9	7,2	7,3	*1,6*
EU27	*6,7*	*6,8*	*7,1*	*7,5*	*8,0*	*8,4*	*8,6*	*1,9*
EU15	*6,9*	*7,0*	*7,3*	*7,7*	*8,2*	*8,5*	*8,7*	*1,8*
EU12	*4,7*	*4,7*	*5,0*	*5,4*	*5,7*	*6,0*	*6,3*	*1,6*

Source: Based on European Commission and Economic Policy Committee (2009)

Health care spending is sensitive to changes in the assumptions on demographic developments, which is visible in the results of the *high life expectancy scenario*. Faster decline in mortality rate resulting in life expectancy at birth 1 year higher at the end of projection period leads to a relatively strong change in projected expenditure: an additional increase in public health expenditure by between 0.3 and 0.7% of GDP (i.e. on average by an extra 30% over what is projected in the pure demographic scenario) is expected to occur in all Member States of the EU.

5.2. Scenarios on health status

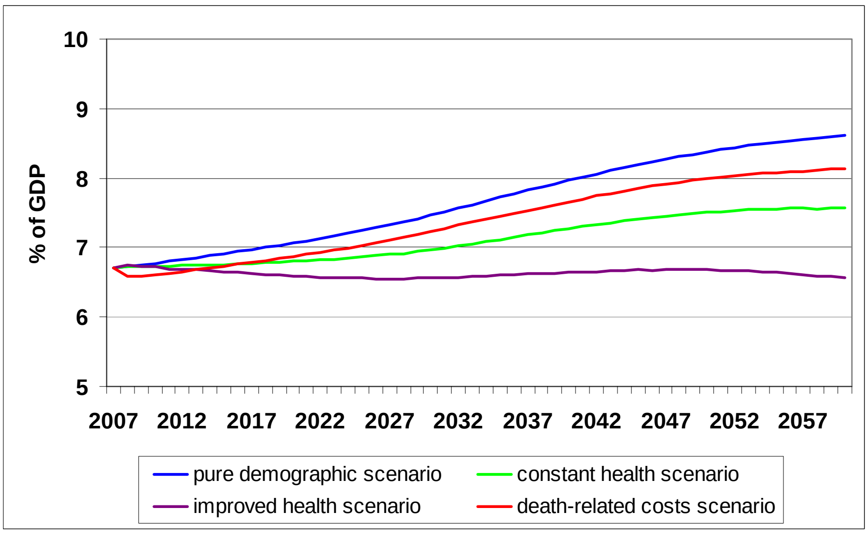
The choice of the assumptions on the future developments in health status of the populations strongly affects the expected evolution of health care expenditure. As expected, improved health care status will attenuate future pressure on health care spending. If it is assumed that healthy life expectancy increases at the same pace as the projected gains in total age-specific life expectancy (*constant health scenario*), then the projected increase in health care spending due to ageing (represented by *pure demographic scenario)* would be more than halved (in an extreme case of Poland expenditure is even projected to decline in real terms). Indeed, public spending on health care in the *constant health scenario* is projected to increase by only 0.8% of GDP in EU15, and 0.3% in the EU12. It is considerably less than 1.8% and 1.6% of GDP increase projected for EU15 and EU12 in the *pure demographic scenario*.

An interesting observation is that in *constant health scenario* most of the projected expenditure savings compared with the *pure demographic scenario* appear to materialise in the first half of the projection period. It can be seen on Graph 10 below which shows a very slow rise in health care expenditure up to 2030.

Furthermore, if healthy life expectancy is assumed to increase twice as fast as total life expectancy (*improved health scenario*), practically all the budgetary impact of an ageing population will be offset by positive developments in health status. Indeed, public health care spending is projected to fall in seventeen analysed countries (by most, 2.2% of GDP in Poland) and increase only in eleven. On average, expenditure is falling by 0.2% of GDP in EU27 but by as much as 0.8% of GDP in Recently Acceded Member States.

Taking death-related costs into account when projecting future health care spending leads to a sizeable reduction in expenditure as compared to the pure demographic scenario over the whole projection period. Public spending on health care is projected to increase on average by 1.4% of GDP, i.e. about 0.5 p.p. of GDP less than in pure demographic scenario. However, the impact of this methodological adjustment varies significantly across countries, which is illustrated by the gap between pure demographic and death-related costs scenarios ranging from less than 0.1% of GDP in Latvia and Bulgaria, to more than 1% in Malta and the UK). Broadly speaking, the projected change in public spending on health care lies between the results of the *pure demographic* and the *constant health* scenarios. According to theory, the discussed scenario reflects the *dynamic equilibrium hypothesis*, thus its results should be similar to those of *constant health scenario*. In reality, however, several data and methodological inaccuracies can justify the considerable gap between the two scenarios. The most important caveats to be taken into account are: incomparability of data on death-related costs with the stylised assumptions on the morbidity rates, the fact that death-related costs are affected by terminal illnesses only and do not reflect developments in other kinds of morbidity, and the fact that data on death-related costs covers only the expenditure borne in the final year of life, thus artificially shortening the period when the health care use is statistically linked to one's death. As in the other health scenarios, the projected increase in spending is somewhat lower in EU12 than EU15 countries due to lower initial levels of spending but also to their flatter age-related expenditure profiles.

Graph 10 Comparison of health care expenditure projections (% of GDP, EU27 average) according to different health status scenarios, 2007-2060



Source: based on European Commission and Economic Policy Committee (2009)

5.3. *Scenarios on income effects*

As discussed above, there is strong empirical evidence on the links between per capita national income and public expenditure on health care as a share of GDP. The strength of the correlation is determined by the income elasticity of demand. The latter, according to both theoretical consideration and empirical evidence is likely to exceed unity but converge to this value as countries extend coverage of health insurance and the public provision of health care goods and services becomes universal. This mechanism is broadly reflected in the *income elasticity scenario*, which assumes income elasticity to converge from 1.1 in 2007 to 1 by the end of the projection period.

As expected, higher responsiveness of health care spending to the national income results in proportionately higher expenditure linked to each percentage point of GDP per capita growth, even though this effect declines as elasticity converges to 1 at the end of projection period. Given the agreed assumptions, total spending on health care is projected to increase on average by 2.3% of GDP, i.e. 0.4% of GDP more than in the *pure demographic scenario*. In nominal terms EU15 can expect a slightly higher increase than EU12 (2.1% compared to 2.0% of GDP), but in terms of percentage increase spending in EU12 countries is projected to marginally exceed that in EU15.

Another way to model the convergence of real income levels and real living standards is to illustrate the effect of those processes on the unit cost of health care provision. Even if per capita spending on health care in EU12 countries (both in nominal terms and as a percentage of GDP per capita) is currently well below the levels observed in EU15 countries, the expected effect of the long-term convergence process is to raise them to the comparable levels. Therefore, the *cost convergence scenario* assumes that the average age-related expenditure in the EU12 countries progressively shifts to the average expenditure of EU15 countries over the projection period.

The results of the scenario show, as expected, a fast convergence in spending on health care as a share of GDP towards the levels observed in the EU15 countries. Average health care spending of the EU12 countries would reach 9.0% of GDP in 2060, which in fact exceeds the EU15 average of 8.7% of GDP. This can be explained by the persistently lower efficiency (the same amount of services provided for a higher cost) of health care systems in the Recently Acceded Member States. On average, spending on health care is projected to increase by 2.7 p.p. of GDP above what is projected with constant national age-related expenditure profiles, with most of the increase occurring at the end of the projection period. This result suggests that effective managing of expectations regarding health care services in EU12 could play a significant role in controlling health care spending in these countries.

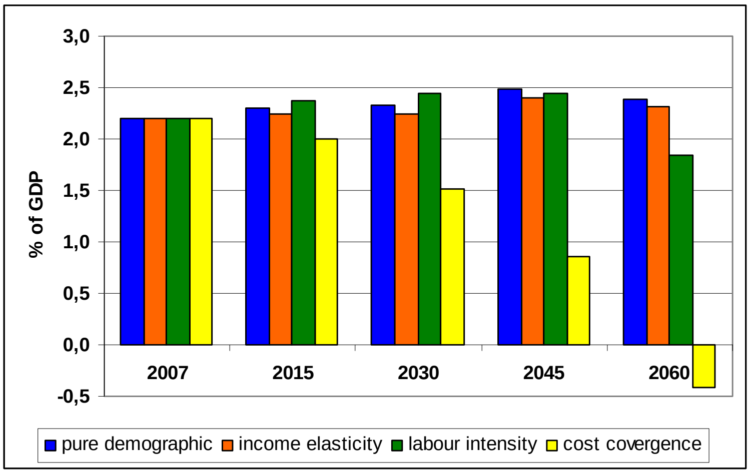
5.4. *Unit cost scenarios*

Health care spending does appear to be sensitive as regards the assumptions on unit costs. This is demonstrated by a simple sensitivity test showing the budgetary impact of a faster increase in the unit costs of health care provided to the population. A seemingly small change in the rate of growth (1 p.p. above the baseline rate over first ten years of the projection period) affects considerably the overall results: increase in health care spending is 0.6 p.p. of GDP higher than in *pure demographic scenario*.

A more specific situation is demonstrated in the *labour intensity scenario*. If an increase in labour costs is considered as the main driver of health care spending (and therefore unit costs are projected to evolve in line with GDP per worker rate of growth), public spending on health care is projected to increase by between 1 and 5 percentage points of GDP between 2007 and 2060. As expected, dispersion of results appears higher than in *pure demographic scenario* but the projected expenditure increases are in most countries higher. For the EU27, average spending on health care is projected to increase by 2.7% of GDP by 2060 if costs evolve in line with GDP per capita compared with a projected increase of 1.9% of GDP if costs evolve in line with GDP per worker. Interestingly, the increase is considerably more pronounced in the Recently Acceded Member States, where growth in labour productivity is projected to exceed on average growth in GDP per capita, especially in the early years of the projection period, due to the ongoing process of real convergence of their economies with the rest of the Union.

Table 12 presents the results of three scenarios on income effects and labour intensity scenario from a perspective of comparison between the West European EU15 countries and Recently Acceded Member States of the Central and Eastern Europe. It clearly shows that the demographic change is the only among the analysed factors that widens the gap in spending (expressed in % of GDP) between the two groups of countries, although the initial strong divergence is somewhat offset in the last decade of the projection period. Higher income elasticity is a smoothening factor, as it strengthens the positive impact on expenditure from faster income growth in the Recently Acceded Member States. An interesting trend arising from the results of the *labour intensity scenario*: labour productivity is expected to grow fast in the EU12 during the first decades of the 21st century, but then to slow down considerably (compared to EU15, but also to GDP per capita) in 2050s and 2060s. Finally, the *cost convergence scenario*, which assumes a hypothetical situation where unit costs of health care in all EU12 countries evolve to the average EU15 cost profile, show a fast increase in total spending in the former, leading to a complete convergence of the overall level of spending in all European countries that is achieved even before the end of the projection period.

Graph 11 Gap between average health care spending in EU15 and EU12 projected according to different income and unit cost scenarios, 2007-2060



Source: based on European Commission and Economic Policy Committee (2009)

5.5. Technology scenario

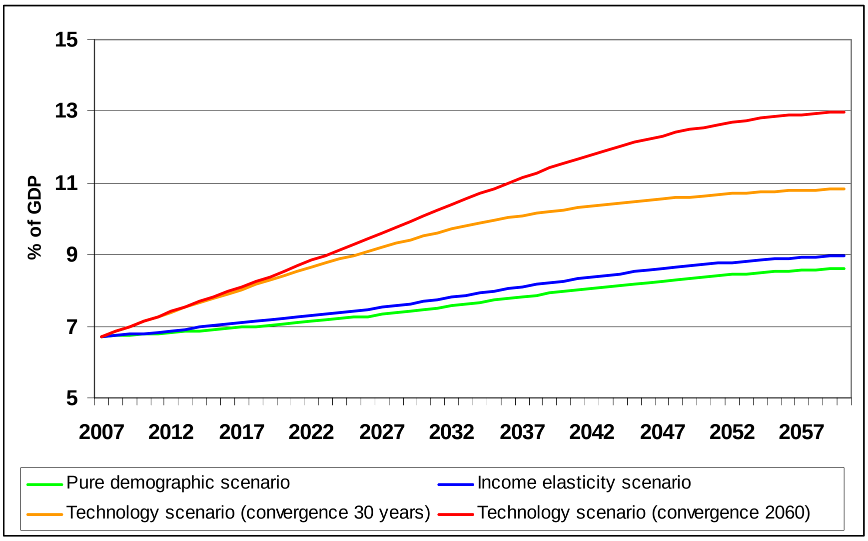
The *technology scenario* takes into account the impact of technological progress (and other supply-side factors) on health care expenditure observed over the recent decades. This effect is incorporated in the health care projection model, but given the expected convergence of the economy (and the health care sector) towards the steady state the impact diminishes over time. The results of the scenario show a strong impact of the additional factors being taken into consideration. The effect is the strongest in the first decades of the projection period, and smoothens later on, as the assumed convergence reduces the impact. In the neutral[42] case of convergence taking place by the year 2060, EU27 average increase in public spending is more than three times as high as the pure demographic impact (6.3% against 1.9% of GDP). Moreover, even if the extra technology effect is assumed to disappear faster (over 30 years), the projected impact is still considerable (4.1% against 1.9% of GDP).

The growth in expenditure due to technology factor, as compared to that calculated according to pure demographic and income elasticity scenarios are presented in Graph 12 below.

---

[42] No estimates are available for the speed of convergence towards the steady state. The effect that disappears gradually over the entire projection period is thus the most neutral assumption possible.

Graph 12 Comparison of health care expenditure projections (% of GDP, EU27 average) according to income elasticity and technology scenarios, 2007-2060



Source: based on European Commission and Economic Policy Committee (2009)

Given the lack of reliable historical data on health care spending in Recently Acceded Member States, no individual coefficients have been used for EU15 and EU12, replaced by a single EU27 estimate. Consequently, the projected impact of technology on the two groups of countries does not account for the structural differences between them and the extra increase in spending attributed to the technological progress is similar (93% nominal increase in EU15 against 91% in EU12). Moreover, lack of reliable forecasts on the technological developments across countries does not allow for plausible assumptions being made in the model. In this context, one can envisage both further widening of the gap due to the higher starting point, experience curve effect and economies of scale taking place in the already highly developed economies of EU15, and the opposite process resulting from the spread of new technologies to lower technology-intensive sectors and countries due to the completion of internal market, spillover effects and other positive externalities. In the face of such broad uncertainties, the presented neutral approach seems to be the most reasonable solution.

5.6. Reference scenario

The *reference scenario* which presents a combined effect of a number of factors, mostly on the demand side (demographic changes, health status, and income elasticity) projects an average growth in public health care spending of 1.7% of GDP in the EU27 Member States, which equals approximately 25% of the initial (2007) level. The relative percentage increase varies considerably across countries, from 11% in Sweden and 15% in France to as much as 45% in Slovakia and 71% in Malta. The relative increase is on average slightly higher in the EU12 (30%) than in the EU15 countries (23%).

As shown in the Table 9 below, the rate of growth in spending is projected to fluctuate over time. The fastest increase is expected for the period 2015-2040, when the post-war baby boom generation will reach the age of 60-70 associated with the highest per capita spending on health care. It is during those decades that between half and two thirds of the overall expenditure increase will be realised. After 2040, expenditure is expected to keep rising, although at considerably slower pace.

The results of the *reference scenario* do not differ considerably from the *pure demographic* scenario. This can be explained by the fact that growing pressure stemming from increasing personal incomes and public expectations on the one hand, and the relaxation of health care needs and demand due to improved health status on the other hand, are likely to cancel each other out. However, since most of supply side effects which tend to aggravate the fiscal risks (costs of medical research, investment in new technologies, and over-regulation of the health care and pharmaceutical markets driving up prices) are not properly modelled in the projection exercise, the results are very likely to be underestimated. Given this reservation, the projection results, and in particular the *reference scenario*, should not be considered as a forecast of future developments in health care spending, but merely as a quantification of the combined impact of a set of measurable variables.

Table 9 Projection results for the *reference scenario*

	Projected spending as % of GDP								*Absolute change in % of GDP*	*% change*			
	2007	2010	2015	2020	2030	2040	2050	2060	*2007-2060*	*2007-2015*	*2015-2040*	*2040-2060*	*2007-2060*
BE	7,6	7,7	7,9	8,1	8,4	8,7	8,8	8,8	*1,2*	*4*	*11*	*1*	*16*
BG	4,7	4,8	4,9	5,0	5,1	5,4	5,5	5,4	*0,7*	*5*	*9*	*1*	*16*
CZ	6,2	6,4	6,7	6,9	7,4	7,8	8,1	8,4	*2,2*	*7*	*18*	*7*	*35*
DK	5,9	6,0	6,2	6,4	6,7	6,8	6,9	6,9	*1,0*	*4*	*11*	*1*	*16*
DE	7,4	7,6	7,9	8,1	8,5	9,0	9,2	9,2	*1,8*	*6*	*14*	*2*	*24*
EE	4,9	5,1	5,2	5,3	5,5	5,8	6,0	6,1	*1,2*	*6*	*10*	*6*	*24*
IE	5,8	5,9	6,0	6,1	6,5	6,9	7,3	7,6	*1,8*	*3*	*16*	*9*	*30*
EL	5,0	5,1	5,3	5,4	5,7	6,0	6,3	6,4	*1,4*	*6*	*14*	*6*	*28*
ES	5,5	5,6	5,7	5,9	6,3	6,8	7,1	7,2	*1,6*	*3*	*20*	*6*	*30*
FR	8,1	8,2	8,4	8,6	8,9	9,2	9,3	9,4	*1,2*	*3*	*10*	*1*	*15*
IT	5,9	5,9	6,1	6,2	6,5	6,9	7,0	6,9	*1,1*	*4*	*13*	*1*	*19*
CY	2,7	2,8	2,8	2,9	3,0	3,1	3,2	3,3	*0,6*	*4*	*11*	*7*	*23*
LV	3,5	3,5	3,6	3,7	3,8	3,9	4,0	4,1	*0,6*	*5*	*9*	*4*	*18*
LT	4,5	4,6	4,7	4,9	5,1	5,3	5,5	5,6	*1,1*	*6*	*13*	*5*	*25*
LU	5,8	5,9	6,1	6,2	6,5	6,8	7,0	7,0	*1,2*	*5*	*13*	*2*	*21*
HU	5,8	5,8	5,9	6,0	6,4	6,7	6,9	7,0	*1,3*	*2*	*13*	*6*	*22*
MT	4,7	4,9	5,3	5,6	6,4	7,2	7,6	8,0	*3,3*	*12*	*36*	*12*	*71*
NL	4,8	4,9	5,1	5,3	5,6	5,8	5,9	5,8	*1,0*	*5*	*13*	*1*	*20*
AT	6,5	6,6	6,8	7,0	7,4	7,8	8,1	8,0	*1,5*	*5*	*15*	*2*	*24*
PL	4,0	4,1	4,3	4,4	4,6	4,8	4,9	5,0	*1,0*	*6*	*13*	*3*	*24*
PT	7,2	7,3	7,5	7,6	8,0	8,5	8,9	9,1	*1,9*	*4*	*14*	*7*	*26*
RO	3,5	3,6	3,7	3,8	4,1	4,4	4,7	4,9	*1,4*	*6*	*19*	*10*	*39*
SI	6,6	6,8	7,1	7,3	7,8	8,2	8,4	8,5	*1,9*	*7*	*16*	*3*	*28*
SK	5,0	5,2	5,4	5,7	6,2	6,7	7,1	7,2	*2,3*	*9*	*23*	*8*	*45*
FI	5,5	5,6	5,8	6,0	6,3	6,5	6,5	6,5	*1,0*	*6*	*12*	*-1*	*17*
SE	7,2	7,3	7,4	7,5	7,7	7,9	8,0	8,0	*0,8*	*3*	*6*	*1*	*11*
UK	7,5	7,6	7,8	8,0	8,4	8,9	9,2	9,4	*1,9*	*4*	*14*	*6*	*26*
NO	5,6	5,7	5,8	6,0	6,5	6,8	6,9	7,0	*1,3*	*3*	*16*	*3*	*24*
EU27	*6,7*	*6,8*	*6,9*	*7,1*	*7,4*	*7,9*	*8,2*	*8,4*	*1,7*	*3*	*14*	*7*	*25*
EU15	*6,9*	*7,0*	*7,2*	*7,3*	*7,7*	*8,1*	*8,4*	*8,5*	*1,6*	*4*	*13*	*4*	*23*
EU12	*4,7*	*4,8*	*4,9*	*5,1*	*5,4*	*5,7*	*5,9*	*6,0*	*1,4*	*5*	*15*	*7*	*30*

Source: based on European Commission and Economic Policy Committee (2009)

6. MAIN POLICY CONCLUSIONS

The results of the long-term budgetary projection exercise show that public spending on health care is driven by the developments in a series of independent drivers and by policy decisions taken individually by the national governments. In this context, one can distinguish three areas where governments must take into account the impact of exogenous factors. First, limited growth in total population size together with a growing proportion of elderly will lead to ever higher demand for health care goods and services bringing about the need for increased financial and human resources. Second, developments in the medical science, technology and treatment techniques will require further investment, but may pay off over the medium and long term in two ways: either directly, by reducing the unit cost of treatment, or indirectly, by diminishing the number of chronically ill people and total spending devoted to them. Third, persisting high discrepancies in the degree of health care provision across the Member States associated with growing uniformity of needs and expectations will undoubtedly exert additional pressure on public expenditures in the countries offering the narrowest and incomplete coverage to their citizens. Although most underlying forces are exogenous to the deliberate government actions, public response to those challenges depends to a high degree on the policy stance at the national level and social preferences in each country about the degree of public provision of health care.

In the context of this complex mix of independent and policy-driven variables facing the financial and health authorities of each country, the following conclusions can be drawn.

First, all EU Member States' governments are heavily involved in the financing and/or provision of health care services, and universal access is virtually assured in all countries. There is, nevertheless, a wide variety of institutional arrangements, making it very difficult to draw general conclusions on detailed factors and policies driving expenditures. What is apparent, however, is that:

- increases in spending on health care as a share of GDP in past decades have not been strongly influenced by demographic developments, but rather by policy decisions to enlarge access, by the demand for better quality health care linked to growing income levels, and (albeit less conclusively) by technology (as falls in unit costs to date appear to have been more than offset by increased demand and quality improvements);

- there are very big differences across Member States in terms of per capita spending on and inputs to health care systems, which do not appear to be correlated with health care outcomes. A priori, this suggests there is considerable scope for efficiency gains. It is, however, difficult to draw conclusions as to whether and how institutional design affects health care outcomes or efficiency.

Second, even if demand for health care (and social care) depends ultimately on the health status and functional ability of (elderly) citizens, and not on age *per se,* ageing populations are expected to exert a strong pressure on higher public spending on health care. Indeed, the pure demographic effect of an ageing population is projected to push up health care spending by between 1 and 2% of GDP in most Member States, i.e. an increase by approximately 25% of current spending level. This will result from the very large projected increase (80%) in elderly cohorts with a higher prevalence of medical conditions, sometimes chronic, that require (expensive) health care services.

Third, demographic change is only one of several factors driving health care spending. Simultaneously, a number of other non-demographic determinants are likely to be of equal if not higher significance in determining future spending levels. On balance, overall public spending looks set to increase in the context of an ageing society. However, there are upside and downside risks (possibly substantial) to the projected increase in public spending on health care as computed in a *pure demographic scenario*. In particular, the different approaches to projecting health care spending underline the critical role played by:

- *the health status of the population*: The projections illustrate that if most of the future gains in life expectancy are spent in good health and free of disability, this could offset more than a half of the projected increases in spending due to an ageing population (*constant health scenario*). Furthermore, a real decrease in the number of years spent in bad health may reduce spending even further. It should, however, be stressed that the projections are not modelled on the basis of a direct indicator of morbidity, but rather on the basis of stylised assumptions. This is an obvious shortcoming as morbidity patterns change over time (multi- and chronic diseases such as cardiovascular problems now outweigh infectious diseases) and demographic changes may possibly lead to new patterns of morbidity and mortality. For example, the increase in the share of persons surviving to very old ages (80+) may lead to an increase in the prevalence of chronic and degenerative diseases (e.g. neuro-degenerative and musculoskeletal diseases);

- *macroeconomic variables*: Changes in per capita income could have an important impact on health care spending, especially if it is viewed as a luxury good. Introducing stylised effect of a 1.1 income elasticity converging to 1 over the whole projection period increases total spending by extra 0.4% over 'pure demographic' effect of ageing. This impact will arguably be stronger in the EU12 Member States which will face a particular challenge in balancing the demands of their citizens for wider access to health care services and for services of similar quality to that in the rest of the EU, with their capacity to pay;

- *relative cost developments in the health care*: The projection results show that spending levels are sensitive to the assumptions on evolution of unit costs in the health care sector. Leaving aside demographic factors, spending on health as a share of GDP could change as a result of several factors, e.g. unit costs (wages, pharmaceutical prices) growing faster than their equivalents in the economy as a whole, public policies to improve access to health or improve quality (reduce waiting lists, increase choice), rising income levels and the impact of technology on total health care spending. The current set of projections is not capable of disentangling the contribution of each factor, which suggests a possible avenue for future work; and,

- *the effective incorporation of technology into health care system*: As empirical evidence suggests, investment in technology is one of the main drivers of costs in health care system. However, obvious advantages resulting from the process of constant progress in medical science and technology (faster, more effective and less invasive, often more cost-efficient treatment, new diseases being treatable) provide an argument for further investment, accompanied by reliable feasibility studies and cost-effectiveness control mechanisms allowing to select the best available solutions.

Fourth, ageing will not only raise a policy challenge in terms of putting pressure for increased spending on health care. Of equal, if not more, relevance is the impact of ageing on the type of health care services that will be needed in the future. Morbidity and disability patterns are changing in the context of an ageing society, infectious diseases are replaced as the most prevalent conditions by chronic and degenerative diseases, and a key challenge for health care systems is to adapt accordingly. There may be a need to rebalance the various types of care (primary and secondary, outpatient and hospital care, classical health care, long-term care and social care).

Fifth, given the foremost need for comparability of data across the Member States, the projection model necessarily abstracts from the organisational and institutional arrangements for the provision of health care services within Member States. As such, the projections do not take into account one of basic determinants of health care spending: behaviour of patients, providers and payers which is driven by the incentives incorporated in the institutional setting and determines size and directions of the financial flows inside the health care system. According to 'a no-policy change' principle, the model should not include factors that can be adjusted through a political process. Nevertheless, given the importance of organisational arrangements and incentive structure in health care, a thorough comparative analysis should be carried out in order to understand the relationships between institutions and trends in expenditure. The same applies to the public preventive actions to tackle obesity, smoking and drug abuse which potentially could have large effects on the health care status of citizens, and thus on future spending needs. However, even in this case, the evidence of the effectiveness of preventive schemes is mixed and warrants further analysis.

Sixth, the present health care projection exercise contributes to the process of understanding the driving forces behind the evolution of public spending on health care by including a series of new approaches which are aimed at quantifying several previously omitted factors such as the health status of the elderly, the elasticity relative to the national income, death-related costs or the role of technology. Caution should be exercised, however, as there is no conclusive evidence on the scale of the likely impact of these factors. Overall, considerable progress has been made in extending the projection methodology for health care on demographic and health factors that tend to lower health care spending. Meanwhile the supply-side, mostly non-demographic driving forces that could potentially increase spending have been investigated to a much lesser extent. Although the analysis of past trends allowed for an approximate estimation of the contribution of technology and other supply-side factors, the question on the future role of respective factors in total health care expenditure remains broadly unanswered.

REFERENCES

Ahn N., J.R.García, J.A.Herce (2005), *Demographic Uncertainty and Health Care Expenditure in Spain*, FEDEA, Documento de Trabajo 2005-07.

Anderson G. and P.Hussey (2000), *Population Aging: A comparison Among Industrialized Countries*, Health Affairs, vol.19(3), pp.191-203.

Bac C. (2004), *Les déterminants macro-économiques des dépenses de santé : comparaison entre quelques pays développés*. Annex to : Alain Vasselle, Projet de loi relatif à l'assurance maladie. Rapport n° 424 (2003-2004), fait au nom de la commission des affaires sociales, déposé le 21 juillet 2004, available at: http://www.senat.fr/rap/l03-424-1/l03-424-112.html

Bac C. and D.Balsan (2001), *Modélisation des dépenses d'assurance maladie*, Document de travail, No.19, Direction de la recherche, des études, de l'évaluation et des statistiques DREES.

Baltagi B. and F. Moscone (2010), *Health care expenditure and income in the OECD reconsidered: Evidence from panel data*, Center for Policy Research Working Paper no.120, Maxwell School of Citizenship and Public Affairs Syracuse University.

Barros P.P. (1998), *The black box of health care expenditure growth determinants*, Health Economics, vol.7(6), pp.533-544.

Batljan I. and M.Lagergren (2000), *Will There be a Helping Hand? Macroeconomic scenarios of future needs and costs of health and social care for the elderly in Sweden, 2000-30*. Annex to The Long-Term Survey 1999/2000, Stockholm.

Batljan I. and M.Lagergren (2004), *Inpatient/outpatient health care costs and remaining years of life. Effect of decreasing mortality on future acute health care demand*, Social Science and Medicine, vol.59(12), pp.2459-2466.

Batljan I. (2005), *Demographics and demand for care. How to incorporate death-related costs in long-term budgetary projections of health care and long-term care?*, presentation in the framework of the Visiting Fellows Programme, European Commission, Brussels, 12 April 2005.

Berthelot J.-M. (2004), *Health-adjusted Life Expectancy (HALE)*, in: J.-M.Robine, C.Jagger, C.D.Mathers, E.M.Crimmins, R.M.Suzman (eds.), *Determining Health Expectancies*, John Wiley and Sons, Chichester, pp.235-246.

Bjornerud S. and J.Oliveira Martins (2005), *Disentangling demographic and non-demographic drivers of health spending: a possible methodology and data requirements*, presentation at the Joint EC/OECD Workshop, Brussels, 21-22 February 2005.

The Boards of Trustees, Federal Hospital Insurance and Federal Supplementary Medical Insurance Trust Funds (2004), *2004 Annual Report of the Boards of Trustees of the Federal Hospital Insurance and Federal Supplementary Medical Insurance Trust Funds*, Washington.

Bokhari F.A.S. (2001), *Managed Care and the Adoption of Hospital Technology: the Case of Cardiac Catherization*, HEW 0110001, Economics Working Paper Archive at WUSTL.

Brockmann H. (2002), *Why is less money spent on health care for the elderly than for the rest of the population? Health care rationing in German hospitals*, Social Science and Medicine vol.55(4), pp.593-608.

Brockmann H. and J.Gampe (2005), *The cost of population aging: forecasting future hospital expenses in Germany*, Max Planck Institute for Demographic Research Working Paper WP 2005-007.

Brody J.A., S.Frells, T.P.Miles (1992), *Epidemiological issues in the developed world*, in J.G.Evans, T.F. Williams (eds.), *Oxford Textbook of Geriatric Medicine*, Oxford Medical Publications, pp.14-20, Oxford.

Busse R., C.Krauth and F.W.Schwartz (2002), *Use of acute hospital beds does not increase as the population ages: results from a seven year cohort study in Germany*, Journal of Epidemiology and Community Health 2002, vol.56(4), pp.289-293

Busse R., G.Wurzburg, M.Zappacosta (2003), *Shaping the Societal Bill: past and future trends in education, pensions and healthcare expenditure*, Futures, vol.35(1), pp.7-24

Busse R., J.Schreyögg, C.Gericke (2007), *Analyzing Changes in Health Financing Arrangements in High-Income Countries: A Comprehensive Framework Approach,* Health, Nutrition and Population (HNP) Discussion Paper, World Bank.

Caisse Nationale de l'Assurance Maladie des Travailleurs Salariés (2003), *Le viellissement de la population et son incidence sur l'évolution des dépenses de santé*, Des tendances de fond aux mouvements de court terme. Point de conjoncture, no.15, Juillet 2003.

Carnes B.A. and S.J. Olshansky (2007), *A realist view of aging, mortality and future longevity*, Population and Development Review, vol.33(2), pp.367-381.

Cislaghi C., F.Tediosi, S.Bartolacci, R.Berni, S.Forni (2002), *Hospital expenditure as function of the distance from birth and death*, Presentation at the 4th European Conference on Health Economics, Université Paris V, 7-10 July 2002.

Comas-Herrera A., R.Wittenberg, L.Pickard (2005), *Making projections of public expenditure on long-term care for the European member states: Methodological proposal for discussion,* paper presented at the Commission-AWG-OECD workshop, Brussels, 21/22 February 2005.

Cutler D. (1995), *Technology, Health Costs and the NIH*, Cambridge MA: Harvard University and NBER, September.

Cutler D.M. and R.S.Huckman (2002), *Technological Development and medical productivity: Diffusion of Angioplasty in New York State*, NBER Working Paper, no.9311.

Cutler D. and M.McClellan (1996), *The determinants of technological change in heart attack treatment*, NBER Working Paper, no.5751.

Cutler D. and E.Meara (1997), *The medical care costs of the young and the old: a forty year perspective*, NBER Working Paper, no.6114.

Cutler D. and E.Meara (1999), *The concentration of medical spending: An update*, NBER Working Paper, no.7279.

Cutler D.M., J.M.Poterba, L.M.Sheiner, L.H.Summers (1990), *An Aging Society: opportunity or Challenge?*, Brookings Papers on Economic Activity, vol.1, pp.1-74.

Cutler D.M., and L.Sheiner (1997), *Managed Care and the Growth of Medical Expenditures*, NBER Working Paper, no.6140.

Docteur E. and H.Oxley (2003), *Health care systems: lessons from the reform experience*, OECD Directorate for Employment, Labour and Social Affairs, DELSA/ELSA/WD/HEA(2003)9 of 5 December 2003.

Dormont B., M.Grignon, H.Huber (2006), *Health expenditure growth: reassessing the threat of ageing*, Health Economics, vol.15(9), pp.947-963.

Economic Policy Committee (2001), *Budgetary challenges posed by ageing populations: the impact on public spending on pensions, health and long-term care for the elderly and possible indicators of the long-term sustainability of public finances*, EPC/ECFIN/655/01-EN.

Economic Policy Committee and European Commission (2005), *The 2005 EPC projections of age-related expenditure (2004-2050) for the EU25 Member States: underlying assumptions and projection methodologies*, European Economy Reports and Studies, No.4, available at: http://ec.europa.eu/economy_finance/publications/european_economy/2005/eespecialreport0405_en.htm

Economic Policy Committee and European Commission (2006), *The impact of ageing on public expenditure: projections for the EU25 Member States on pensions, health care, long-term care, education and unemployment transfers (2004-2050)*, European Economy, Special Report no. 1/2006, available at: http://ec.europa.eu/economy_finance/publications/european_economy/2006/eespecialreport0106_en.htm

Englert M., M.J.Festjens and M.Lopez-Novella (2004), *L'évolution à long terme des dépenses de soins de santé*, Journée d'Etudes: 'Budget 2005', Institut Belge des Finances Publiques.

European Commission (2004a) *Controlling health care expenditures: some recent experiences with reform. Note for the attention of the Economic Policy Committee*, ECFIN/157/04-EN of 16 March 2004.

European Commission (2004b), *Incorporating 'death-related' costs in long-term budgetary projections of health care and long-term care: a review of existing methodologies and results. Note for the attention of the Ageing Working Group attached to the EPC*, ECFIN/C5/DC/BP D(2004).

European Commission (2009), *Sustainability Report 2009*, European Economy, no.9/2009.

European Commission and Economic Policy Committee (2008), *The 2009 Ageing Report: Underlying Assumptions and Projection Methodologies for the EU-27 Member States (2007-2060)*, European Economy, no.7/2008.

European Commission and Economic Policy Committee (2009), *The 2009 Ageing Report: economic and budgetary projections for the EU-27 Member States (2008-2060)*, European Economy, no.2/2009.

European Parliament (1998), *Health Care Systems in the EU. A Comparative Study*, Public Health and Consumer Protection Series, SACO 1001 EN.

Eurostat (2005), *EU population rises until 2025, then falls*, Eurostat press release 448/2005 of April 2005.

Eurostat (2007), *EUROPOP2007 Convergence Scenario: Summary Note*, note for the Joint Working Group on Population Projections and Working Group on Ageing Populations and Sustainability, Luxembourg, 29-30 November 2007, DOC.ESTAT/F1/PRO(2007)02/GL

Fogel R.W. (1994), *Economic Growth, Population theory and Physiology: the Bearing of Long-Term Processes on the making of Economic Policy*, NBER Working Paper, no.4638.

Fogel R.W. (1999), *Catching up with the economy*, American Economic Review, vol.89(1), pp.1-21.

Fogel R.W. (2002), *Biotechnology and the Burden of Age-Related Diseases*, in: OECD, *Healthy Ageing and Biotechnology. Policy Implications of New Research.*

Fries J.F. (1980), *Ageing, natural death, and the compression of morbidity*, The New England Journal of Medicine, Vol.303, pp.130-135.

Fries J.F. (1983*), The compression of morbidity*, Milbank Memorial Fund Quarterly, vol.61(3), pp.397-419.

Fries J.F. (1989), *The compression of morbidity: near or far?*, Milbank Memorial Fund Quarterly, vol.67(2), pp.208-232.

Fries J.F. (1993), *Compression of morbidity: life span, disability, and health care costs*, Facts and Research in Gerontology, vol.7, pp.183-190

Fries J.F. (2003), *Measuring and Monitoring Success in Compressing Morbidity*, Annals of Internal Medicine, vol.139(5), pp.455-459

Fuchs V.R. (1998a), *Provide, provide: the economics of aging*, NBER Working Paper, No.6642

Fuchs V.R. (1998b), *Health care for the elderly: How much? Who will pay for it?*, NBER Working Paper, no.6755

Gabriele S., C.Cislaghi, F.Costantini, F.Innocenti, V.Lepore, F.Tediosi, M.Valerio, C.Zocchetti (2006), *Demographic factors and health expenditure profiles by age: the case of Italy*, ENEPRI Research Report no.18.

Garber A.M., T.E.MaCurdy, M.C.McClellan (1998), *Medical care at the end of life: diseases, treatment patterns, and costs*, NBER Working Paper, no. 6748

Gerdtham U.G. (1992), *Pooling international health care expenditure data*, Health Economics, vol.1(4), pp.217-231.

Gerdtham U.G., J.Søgaard, B.Jönsson, F.Andersson (1992a), *A Pooled Cross-Section Analysis of the Health Care Expenditures of the OECD Countries*, Developments in Health Economics And Public Policy, vol.1, pp.287-310.

Gerdtham U.G., J.Søgaard, F.Andersson, B.Jönsson (1992b), *An Econometric Analysis of Health Care Expenditure: a Cross-Section Study of the OECD Countries*, Journal of Health Economics, vol.11(1), pp.63-84.

Gerdtham U.G., B.Jönsson, M.MacFarlan, H.Oxley (1994), *Factors Affecting Health Spending: a Cross-country Econometric Analysis*, in: H.Oxley and M.MacFarland, *Health Care Reform. Controlling Spending and Increasing Efficiency*, OECD Economics Department Working Papers No.149, OCDE/GD(94)101.

Gerdtham U.G., B.Jönsson, M.MacFarlan, H.Oxley (1998), *The Determinants of Health Expenditure in the OECD Countries: a Pooled Data Analysis*. In: P.Zweifel, ed. *Health, the Medical Profession and Regulation. Developments in Health Economics and Public Policy*, vol.6, 113-34. Kluwer Academic, Boston and Dordrecht.

Gertler P. and J.van der Gaag, 1990, *The Willingness to Pay for Medical Care*, John Hopkins University Press, Baltimore.

Getzen, T.E. (1990), *Macro Forecasting of National Health Expenditures*, Advances in Health Economics and Health Services Research, vol.11, pp.27-48.

Getzen T.E. (1992), *Population Aging and the Growth of Health Expenditures*, Journal of Gerontology, vol. 47(3), pp.98-104.

Getzen T.E. (2000), *Health care is an individual necessity and a national luxury: Applying multilevel decision models to the analysis of health care expenditures*, Journal of Health Economics, vol.19(2), pp.259-270

Getzen T. and J-P.Poullier (1992), *International health spending forecasts: concepts and evaluation*, Social Science and Medicine, vol.34(9), pp.1057-1068.

Grignon M. (2003), *Les conséquences du vieillissement de la population sur les dépenses de santé*, in: Centre de Recherche, d'Etude et de Documentation en Economie de la Santé, Questions d'économie de la santé, No.66.

Gruenberg E.M. (1977), *The failure of success*, Millbank Memorial Fund Quarterly, Vol.55, pp.3-24.

Guralnik J.M. (1991), *Prospects for the compression of morbidity: Evidence from the Alameda County study*, Journal of Aging and Health, vol.3(2), pp.138-153.

Hartwig J. (2008), *What drives health care expenditure? – Baumol's model of 'unbalanced growth' revisited*, Journal of Health Economics, vol.27(3), pp.603-623.

Health Canada (2001), *Health expenditures in Canada by Age and Sex : 1980-81 to 2000-2001.*

Henke K.D. and J.Schreyögg (2004), *Towards sustainable health care systems. Strategies in health insurance schemes in France, Germany, Japan and the Netherlands. A comparative study*, International Social Security Association.

Hitiris T. and J.Posnett (1992), *The determinants and effects of health expenditure in developed countries*, Journal of Health Economics, vol.11(2), pp.173-181.

Holly A., L.Gardiol, Y.Eggli, T.Yalcin, T.Ribeiro (2004), *Health-based risk adjustment in Switzerland : an exploration using medical information from prior hospitalisation*, Institut d'économie et management de la santé, University of Lausanne.

Howse K. (2006), *Increasing life expectancy and the compression of morbidity: a critical review of the debate*, Oxford Institute of Ageing Working Paper, no.206.

Husson M. (2004), *La santé, un bien supérieur ?*, Chronique Internationale de l'IRES, no.91.

Jacobzone S. (2002), *Healthy Ageing and the Challenges of New Technologies. Can OECD Social and Health-Care Systems Provide for the Future?*, in: OECD, *Healthy Ageing and Biotechnology. Policy Implications of New Research.*

Jagger C., C.Gillies, E.Cambois, H.Van Oyen, W.Nusselder, J.-M. Robine and the EHLEIS team (2009), *Trends in Disability-free Life Expectancy at age 65 in the European Union 1995-2001: a comparison of 13 EU countries,* EHEMU Technical report 2009_5.1.

Kanavos P. and E.Mossialos (1996), *The Methodology of International Comparisons of health Care Expenditures: Any lessons for Health Policy?*, Health and Social Care Discussion Paper, no.3, London School of Economics and Political Science.

Kanavos P. and E.Mossialos (1999), *International comparisons of health care expenditures: what we know and what we do not know*, Journal of Health Services Research & Policy, vol. 4(2), pp.122-126.

King A. and P.Hansen (1996), *Aggregate health care expenditure in the United States: evidence from cointegration tests: a comment*, Applied Economics Letters, 1466-4291, vol. 3(1), pp.37–39.

Laditka S.B. and M.D.Hayward (2004), *The Evolution of Demographic Methods to Calculate Health Expectancies*, in: J.M.Robine, C.Jagger, C.D.Mathers, E.M.Crimmins, R.M.Suzman (eds.), *Determining Health Expectancies*, John Wiley and Sons, Chichester, pp.221-234.

Lanzieri G. (2009), *EUROPOP2008: a set of population projections for the European Union*, paper presented at the XXVI International Population Conference of the IUSSP, Marrakech, 27 September-2 October 2009.

Leu R.E. (1986), *The public-private mix and international health care costs*, in A.J. Culyer and B.Jönsson, eds., *Public and Private Health Services: Complementarities and Conflicts*, Blackwell, Oxford and New York, pp.41-63.

L'Horty Y., A.Quinet, F.Rupprecht (1997), *Expliquer la croissance des dépenses de santé: le rôle de niveau de vie et du progrès technique*, Economie et Prévision, no.129-130, pp.255-266.

Lubitz J., J.Beebe, C.Baker (1995), *Longevity and Medicare Expenditures*, The New England Journal of Medicine, vol.332, pp.999-1003.

Lubitz J.D. and G.F.Riley (1993), *Trends in Medicare Payments in the Last Year of Life*, The New England Journal of Medicine, vol.328, pp.1092-1096.

Lutz W. and V.Skirbekk (2005), *Policies addressing the tempo effect in low-fertility countries*, Population and Development Review, vol.31(4), pp.699-720.

Madsen M. (2004), *Methodologies to incorporate 'death-related' costs in projections of health and long-term care based on Danish data*, Ministry of Finance, Denmark.

Mahal A. and P.Berman (2001), *Health Expenditures and the Elderly: A Survey of Issues in Forecasting, Methods Used, and Relevance for Developing Countries*, Harvard Burden of Disease Unit, The Global Burden of Disease 2000 in Aging Populations, Research Paper No. 01.23.

Manton K.G. (1982), *Changing concepts of morbidity and mortality in the elderly population*, Milbank Memorial Fund Quarterly, vol.60(2), pp.183-244.

Manton K.G., E.Stallard, L.Corder (1995); *Changes in morbidity and chronic disability in the U.S. elderly population: Evidence from the 1982, 1984 and 1989 National Long Term Care Surveys*, Journal of Gerontology: Social Sciences, vol.50(4), pp.S194-S204.

Maslow A.H. (1970), *Motivation and Personality*, Longman, New York.

McDonald P. (2000), *The 'Toolbox' of Public Policies to Impact on Fertility – a Global View*, Paper presented at the seminar 'Low fertility, families and public policies' organised by the European Observatory on Family Matters in Sevilla, September 15-16, 2000.

McDonald P. (2002), *Low fertility: unifying the theory and the demography*, Paper prepared for Session 73, Future of fertility in Low Fertility Countries, 2002 Meeting of the Population Association of America, Atlanta, 9-11 May 2002.

Meerding W.J., L.Bonneux, J.J.Polder, M.A.Koopmanschap, P.J.van der Maas (1998), *Demographic and epidemiological determinates of health care costs in the Netherlands.* British Medical Journal, No.317, pp.111-115, appendix *'Cost of illness in the Netherlands 1994'* available at:
http://www2.eur.nl/fgg/mgz/papers.html#Cost%20of%20illness%20in%20the%20Netherlands

Miller T. (2001), *Increasing Longevity and Medicare Expenditures*, Demography, vol.38(2), pp.215-226.

Ministry of Health, Welfare and Sport, The Netherlands (2004), *Health Care in an Ageing Society. A Challenge for all European Countries*, Background Paper of the Netherlands EU Presidency, Informal Health Council, Noordwijk, 9 – 10 September 2004.

Murillo C., C.Piatecki, M.Saez (1993*), Health care expenditure and income in Europe*, Health Economics, vol.2(2), pp.127-138.

Murthy N.R.V. and V. Ukpolo (1994), *Aggregate health care expenditure in the United States: evidence from cointegration tests*, Applied Economics, Vol.26, pp.797-802.

Newhouse J.P. (1977), *Medical care expenditure: a cross national survey*, Journal of Human Resources, vol.12(1), pp.115-125.

Newhouse J.P. (1992), *Medical Care Costs: How Much Welfare Loss?*, Journal of Economic Perspectives, Summer, Vol.6(3), pp.3-21.

Nichols L.M. (2002), *Can Defined Contribution Health Insurance Reduce Cost Growth?*, EBRI Issue Brief, no.246.

Nordhaus W.D. (2006), *Baumol's Disease: A Macroeconomic Perspective*, NBER Working Paper, no.12218.

Nusselder W. (2003), *Compression of Morbidity*, in: J.-M.Robine, C.Jagger, C.D.Mathers, E.M.Crimmins, R.M.Suzman (eds.), *Determining Health Expectancies*, John Wiley and Sons, Chichester, pp.35-58.

Nusselder W., J.Mackenbach (1997), *Rectangularisation of the survival curve in the Netherlands*, Journal of Gerontology: Social Sciences 52b, pp.S145-S154.

O'Connell J.M. (1996), *The Relationship between Health Expenditures and the Age Structure of the Population in OECD Countries*, Health Economics, vol.5(6), pp.573-578.

OECD (1998), *Health Policy Brief. Ageing and Technology*, Working Party on Biotechnology, DSTI/STP/BIO(97)13 of 17 June 1998.

OECD (2004a), *Towards high-performing health systems,* The OECD Health Project.

OECD (2004b), *Towards high-performing health systems. Policy studies,* The OECD Health Project.

OECD (2006), *Projecting OECD health and long-term care expenditures: what are the main drivers?*, Economics Department Working Papers No.477, ECO/WKP(2006)5.

OECD Health Data 2007 and 2008.

Oeppen J. and J.W.Vaupel (2002), *Broken Limits to Life Expectancy*, Science, vol.296(5570), pp.1029-1031.

Okunade A.A and V.N.R.Murthy (2002), *Technology as a 'major driver' of health care costs: a cointegration analysis of the Newhouse conjecture*, Journal of Health Economics, vol.21(1), pp.147-159.

Olshansky S.J., M.A.Rudberg, B.A.Carnes, C.K.Cassel, J.A.Brody (1991), *Trading off longer life for worsening health*, Journal of Aging and Health, vol.3(2), pp.194-216.

Pellikaan F. and E.Westerhout (2004), *Alternative scenarios for health, life expectancy and social expenditure. The influence of living longer in better health on health* *expenditures, pension expenditures and government finances in the EU*, in: The AGIR Project. Ageing, Health and Retirement in Europe, The Hague.

Polder J.J., P.W.Achterberg (2004), *Cost of Illness in the Netherlands*, National Institute for Public Health and the Environment.

Polder J.J., J.J.Barendregt**,** H.van Oers (2006), *Health care costs in the last year of life - The Dutch experience*, Social Science & Medicine, vol.63(7), pp.1720-1731.

Pomp M. and S.Vujić (2008), *Rising health spending, new medical technology and the Baumol effect*, CPB Discussion Paper, no.115.

Productivity Commission (2004), *Economic Implications of an Ageing Australia*, Draft Research Report, Australian Government, Productivity Commission, Canberra.

Raggioneria Generale dello Stato (2004), *How to take account of death related costs in projecting health care expenditure – the evidence for Italy and a proposal for the EPC-WGA.*

Reinhardt U.E. (2000), *Health Care for the Ageing Baby Boom: Lessons from Abroad*, The Journal of Economic perspectives, vol.14(2), pp.71-83.

Reitano M. (2006), *The impact of death-related costs on health-care expenditure. A survey*, ENEPRI Research Report, no.17, AHEAD WP7.

Riedel M., M.M.Hofmarcher, R.Buchegger, J.Brunner (2002), *Nachfragemodell Gesundheitswesen, Teil II,* Institut für Höhere Studien (IHS), Wien.

Roberts J. (1999), *Sensitivity of elasticity estimates for OECD health care spending: analysis of a dynamic heterogeneous data field*, Health Economics, vol.8(5), pp. 459-472.

Robine J.M. and C.D.Mathers (1993), *Measuring the compression or expansion of morbidity through changes in health expectancy*, in: J.M.Robine, C.D.Mathers, M.Bone, I.Romieu (eds.), *Calculation of Health Expectancies: Harmonization, Consensus Achieved and Future Perspectives*, John Libbey Eurotext, Montrouge, pp.269-286.

Robine J.M. and J.W.Vaupel (2002), *Emergence of supercentenarians in low mortality countries*, available at: http://user.demogr.mpg.de/jwv/pdf/AmActJournal2002.pdf

Robine J.M. and J.P.Michel (2004), *Looking Forward to a General Theory on Population Aging*, Journal of Gerontology: Medical Sciences, vol.59A(6), pp.590-597.

Robine J.M., C.Jagger, H.van Oyen (2005), *Interpreting national evidence on the evolution of morbidity and disability prevalence over time and perspectives for extended healthy life expectancy*, presentation at the Joint EU-OECD workshop, February 21-22, 2005.

Rochaix L. and S.Jacobzone (1997), *L'hypothèse de demande induite : un bilan économique,* Economie et Prévision, no.129-130, pp.25-35.

Roos N. P., P.Montgomery, L.L.Roos (1987). *Health care utilization in the years prior to death*. Milbank Quarterly. vol.65(2), pp.231-254.

Schieber G. (1990), *Health expenditures in major industrialized countries, 1960-1987*, Health Care Financing Review, vol.11(4), pp.159-167.

Schulz E. (2005), *The influence of supply and demand dfactors on aggregate health care expenditure with a specific focus on age composition*. ENEPRI Research Report No.16.

Serup-Hansen N., J.Wickstrøm, I.Sønbø Kristiansen (2002) *Future health care costs—do health care costs during the last year of life matter?* Health Policy, vol.62, pp.161–172.

Seshamani M., A.Gray (2004a), *Ageing and health care expenditure: the red herring argument revisited*, Health Economics, vol.13(4), pp.303-314.

Seshamani M. and A.M.Gray (2004b), *A longitudinal study of the effects of age and time to death on hospital costs*, Journal of Health Economics, vol. 23(2), pp.217-235.

Steinmann L., H.Telser, P.Zweifel (2005), *The Impact of Ageing on Future Healthcare Expenditure*, Working Paper no. 0510, Socioeconomic Institute, University of Zürich.

Suhrcke M., M.McKee, R.Sauto Arce, S.Tsolova, J.Mortensen (2005), *The contribution of health to the economy in the European Union*, European Commission, Health and Consumer Protection Directorate General.

Suzman R., F.Kinsella, G.Myers (1992), Demography of older populations in developed countries, in J.G.Evans, T.F. Williams (eds.), *Oxford Textbook of Geriatric Medicine*, Oxford Medical Publications, pp.3-14, Oxford.

U.S. Congress, Office of Technology Assessment (1983), *Diagnosis Related Groups (DRGs) and the Medicare Program: implications for medical Technology* - A Technical Memorandum, OTA-TM-H-17.

Verbrugge L.M. (1984), *Longer life but worsening health? Trends in health and mortality of middle-aged and older persons*, Milbank Memorial Fund Quarterly, vol. 62(3), pp.475-519.

Wanless D. (2002), *Securing our Future Health: Taking a Long-Term View*. Final report, HM Treasury.

Weisbrod B. (1991), *The Health Care Quadrilemma: An Essay on Technological Change, Insurance, Quality of Care and Cost Containment*, Journal of Economic Literature, vol.29(2), pp.523-552.

Westerhout E., F.Pellikaan (2005), *Can we afford to live longer in better health?* CPB Netherlands Bureau for Economic Policy Analysis, CPB Document No.85.

White K.M. (2002), *Longevity advances in high-income countries, 1955-96*, Population and Development Review, vol.28(1), pp.59-76.

World Health Organisation (2003), *International Statistical Classification of Diseases and Related Health Problems.10th Revision. Version for 2003*; available at: http://www3.who.int/icd/vol1htm2003/fr-icd.htm

World Health Organization Regional Office for Europe, European health for all database (HFA-DB), available at: http://data.euro.who.int/hfadb/

Zweifel P., S.Felder, M.Meiers (1999), *Ageing of population and health care expenditure: a red herring?*, Health Economics, vol.8(6), pp.485-496.

ANNEXES

1. METHODOLOGIES USED TO PROJECT HEALTH CARE SPENDING

1.1. Pure demographic scenario

In the *pure demographic scenario*, all gains in life expectancy are assumed to be spent in bad health while the number of years spent in good health remains constant. The extension of lifespan will not affect an average individual's health status at any given age, and consequently his or her age-related expenditure on health care will not change over time. One can approximate this situation by assuming that health care cost per capita for each year of age remains constant in GDP per capita-adjusted terms over the whole projection period. Based on this assumption, the projection is then made in the following manner.

First, for the time horizon of the projection exercise (2007-60), the age-related expenditure profiles (showing the average health care spending per capita for each year of age (from 0 to 100 or less, according to data availability) are assumed to grow in line with the macroeconomic cost driver, i.e. GDP per capita. Therefore:

$$c'_{g,a,n} = c_{g,a} \Delta Ypc_n \qquad [1]$$

where:

$c'_{g,a,n}$ is cost per capita of a person of a given gender *g* and age *a* in a given year *n* of the projection period adjusted to the GDP per capita growth;

$c_{g,a}$ is constant cost per capita of a person of a given gender *g* and age *a*;

ΔYpc_n is GDP per capita rate growth in year *n*,

$$\Delta Ypc_n = \left(\frac{Y_n}{\sum p_{g,a,n}} - \frac{Y_{n-1}}{\sum p_{g,a,n-1}} \right) / \left(\frac{Y_{n-1}}{\sum p_{g,a,n-1}} \right) \qquad [2]$$

Y_n is GDP in year n;

$p_{g,a,n}$ is the projected population of a given gender g and age *a* in a given year *n*.

Second, this unit cost for each year is multiplied by the projected population of each year of age (using the baseline population projection)

$$S_{g,a,n} = c'_{g,a,n} \, p_{g,a,n} \qquad [3]$$

where:

$S_{g,a,n}$ is spending on health care realised by people of a given gender *g* and age *a* in a given year *n*.

Next, the resulting total health care spending is divided by the GDP projected using the rates of change agreed by the Ageing Working Group in order to obtain share of health care expenditure in GDP:

$$T_n = \frac{\sum S_{g,a,n}}{Y_n} \qquad [4]$$

where:

T_n is the share of total health care spending in GDP in a given year *n*.

1.2. High life expectancy scenario

High life expectancy scenario presents the budgetary effects of an alternative demographic scenario which assumes life expectancy to be higher for all ages than in the baseline scenario (gap growing gradually up to 1 year in 2060). In terms of methodology, the scenario does not differ from the *pure demographic scenario*, apart from the fact that the baseline demographic projections (structure of the population evolving over the projection period and the consequent evolution in the macroeconomic assumptions) used as input data are replaced with the alternative, high life expectancy, variant.

1.3. Scenarios on health status: constant health and improved health

To capture possible changes in the health care status (morbidity) of populations over time, an additional assumption is required to run the *constant health scenario* and the *improved health scenario*. This is achieved by 'linking' changes in life expectancy to changes in morbidity (proxied by the age-related expenditure profile). In other words, for each year and for each age/gender, the age-related expenditure profile is shifted outwards – i.e. providing modified values of cost per capita, which are then applied in the same manner as the *pure demographic scenario* described above to the projected population. As regards the scale of the outward shift in the age-related expenditure profile:

For the *constant health scenario*, it is directly proportional to the increase in life expectancy for each cohort;

For the *improved health scenario*, the same outward shift is assumed to be multiplied by a factor of 2.

First, the change in life expectancy in relation to the base year is found for each year of the projections (for example, total life expectancy for a 65-year-old man in Germany is expected to increase from 16.82 years in 2007 to 22.03 years in 2060, thus by 5.21 years)[43]:

---

[43] In the *constant health* scenario the total number of years spent in bad health during a person's life time is assumed to remain the same while life expectancy increases, so the morbidity rate must evolve in line with mortality rate for each age cohort. Thus, if between time *t* and *t+1,* total life expectancy increases by *n* years for a cohort of age *x*, healthy life expectancy for that very same age cohort must also increase by *n* years in order for the dynamic equilibrium hypothesis to be valid. If healthy life expectancy increases by *n* years, then the health status (and consequently health care spending) of this cohort of age *x* at time *t+1* will be the same as the health status (and health care spending) of cohort of age *x-n* at time *t*.

$$\Delta e_{g,a,n} = e_{g,a,n} - e_{g,a,2007} \qquad [5]$$

where:

$e_{g,\ a,\ n}$ is life expectancy of an average person of a given gender g and age a in year n.

Second, for each year of projection, the respective reference age on the original age profile curve is obtained by subtracting the change in life expectancy from the concerned age cohort[44]. This is done only for those sections of the age-profile where the cost per capita is growing[45] (for example for the age cohort of 65 years-old, the value of cost per capita for that age in 2060 will be the same as the value of cost per capita for the age cohort of 65-5.21 = 59.79 ≈ 59.8 years in 2007).

Third, the precise value of cost per capita assigned to that reference age is picked up:

$$c_{g,a,n} = c_{g,a-\Delta e_{g,a,n},2007} \qquad [6]$$

where:

$c_{g,\ a,\ n}$ is cost per capita assigned to a person of a given gender g and age a in a given year n of the projection period;

$c_{g,\ a-\Delta eg,a,n,\ 2007}$ is cost per capita assigned to a person of a given gender and age a-$\Delta e_{g,a,n}$ (specified with a precision to a decimal part of a year) in the base year (2007).

Fourth, the resulting value of cost per capita is used as an input value to the basic calculations presented earlier in equations [1] – [4].

The procedure described above is also used to run the projections according to *improved health scenario,* with a difference that in the latter the shift of the age profile is twice as large as in *constant health scenario*. Thus, equation [6] may be rewritten in the following way:

$$c_{g,a,n} = c_{g,a-2\Delta e_{g,a,n},2007} \qquad [7]$$

1.4. Death-related costs scenario

The methodology to calculate spending on health care taking into account the number of remaining years of life is a further improvement of the methodology used in the pure

---

44 Changes in life expectancy and therefore shifts in the age profile from one year to another are sometimes very small (in a range of a tenth part of a year). However, the data gathered by the Member States does not provide detailed information on costs per capita by single year of age (the most detailed item available is a 5-year average), so an additional calculation needs to be performed. To solve this problem, the intermediate values can be obtained by simple extrapolation/trend-smoothening method from the existing average figures. This way it is possible to assign a concrete value of cost per capita to each tenth part of a year of age.

45 For the young and the oldest old the reference age remains the same over the whole projection period.

demographic scenario. The difference lies in the way the unit cost of health care is calculated.

In the death-related costs scenario, the population of each gender and year of age is divided into subgroups according to the number of remaining years of life using mortality rate as a weighting factor (e.g. number of people aged *n* expected to die within two years from year *t* is calculated as population aged *n* in year *t* multiplied by the probability of dying within two years which is expressed as: probability of surviving year *t* by persons aged *n* times probability of surviving year *t+1* by persons aged *n+1* times probability of dying in year *t+2* by persons aged *n+2*).

Each subgroup is assigned a different unit cost, being an adjustment of the 'normal' unit cost with the ratio of health care expenditure borne by a person of a given age and gender who is in her terminal phase of life to health care expenditure borne by a survivor. The number of people in each subgroup is thus multiplied by its respective cost per capita which gives total spending of each subgroup and the sum of total spending borne by the subgroups is total spending on health care in a given year.

In a formalised way, the methodology can be presented as follows.

First, ***the total population of each gender and age is divided into subgroups, according to the number of remaining years of life***. Consequently, there are z subgroups of decedents (those who are going to die within 0, or 1, or 2, …, or z years) and one group of survivors (those who are going to survive the z^{th} year). In order to obtain the size of each subgroup, the probability of dying in each gender, age and year of projection period are calculated.

The probability that a person of gender g and age a will die in the x^{th} year after a given year n can be expressed by the following equation:

$$d_{g,a,n,x} = \prod_{i=0}^{x-1} (1 - M_{g,a+i,n+i}) \cdot M_{g,a+x,n+x} \qquad [8]$$

where:

$M_{g,a+i,n+i}$ is the mortality rate of people of gender g aged $a+i$ in the i^{th} year after given year n and: $x \in (0,1,2...z)$

where z is the highest number of years considered as time 'close to death' and for which data on costs is available.

The probability that a person of gender g and age a in a given year n will survive z^{th} year can be expressed in a following way:

$$s_{g,a,n} = \prod_{i=0}^{z} (1 - M_{g,a+i,n+i}) \qquad [9]$$

So, number of persons of a given gender *g* and age *a* that are going to die in x^{th} year from a given year *n* can be expressed in the following way:

$$Nd_{g,a,n,x} = d_{g,a,n,x} \cdot p_{g,a,n} \qquad [10]$$

where:

$p_{g,a,n}$ is projected population of a given gender *g* and age *a* in a given year *n*

The number of those who are going to survive x^{th} year is:

$$Ns_{g,a,n} = s_{g,a,n} \cdot p_{g,a,n} \qquad [11]$$

Second, ***the unit health care cost of each person in a population is calculated***. Contrary to the usual approach, per capita cost is not the same for all the individuals, but varies depending on whether a person is in her terminal phase of life. One must find the cost per capita of a person of a given gender *g* and age *a*, who is going to die within *x* years' time from a given year *n*, as well as the cost per capita of a person of the same gender *g* and age *a* surviving the x^{th} year.

The ratio between the two costs is taken as the input data from the country-specific information and background studies and may be expressed as:

$$f_{g,a,x} = \frac{cd_{g,a,x}}{cs_{g,a}} \qquad [12]$$

where:

$cd_{g,a,x}$ is health care cost per capita of a person of a given gender *g* and age *a* dying in the x^{th} year from the current year;

$cs_{g,a}$ is health care cost per capita of a person of the same gender *g* and age *a* surviving the period considered as time 'close to death' from the current year.

To obtain the two costs, one must use the average cost per capita of a person of a given gender *g* and age *a* as given in the 'age-related expenditure profiles' provided to the AWG by Member States. It may be defined as an average of the per capita costs borne by all the subgroups of decedents and survivors, weighted by the size of each subgroup:

$$c_{g,a} = \frac{\sum_{x=0}^{z} cd_{g,a,x} \cdot Nd_{g,a,x,2007} + cs_{g,a} \cdot Ns_{g,a,2007}}{p_{g,a,2007}} \qquad [13]$$

It must be borne in mind that the unit costs of decedents and survivors are calculated for the base year 2007 (thus index *2007* used in the equations) and are kept constant over the whole projection period.

Substituting for $cd_{g,a,x}$ using [12], one gets:

$$c_{g,a} = \frac{\sum_{x=0}^{z} f_{g,a,x} \cdot cs_{g,a} \cdot Nd_{g,a,x,2007} + cs_{g,a} \cdot Ns_{g,a,2007}}{p_{g,a,2007}} \qquad [14]$$

or:

$$c_{g,a} = \frac{cs_{g,a}\left(\sum_{x=0}^{z} f_{g,a,x} \cdot Nd_{g,a,x,2007} + Ns_{g,a,2007}\right)}{p_{g,a,2007}} \qquad [14a]$$

This way, both $cs_{g,a}$ and – coming back to equation [12] - $cd_{g,a,x}$ can be calculated:

$$cs_{g,a} = \frac{c_{g,a} \cdot p_{g,a,2007}}{\sum_{x=0}^{z} f_{g,a,x} \cdot Nd_{g,a,x,2007} + Ns_{g,a,2007}} \qquad [15]$$

$$cd_{g,a,x} = f_{g,a,x} \cdot \frac{c_{g,a} \cdot p_{g,a,2007}}{\sum_{x=0}^{z} f_{g,a,x} \cdot Nd_{g,a,x,2007} + Ns_{g,a,2007}} \qquad [16]$$

As in *pure demographic* scenario and scenarios on health status, for the time horizon of the projection exercise (2007-60) the age-related expenditure profiles (showing the average health care spending per capita for each year of age (from 0 to 100 or less, according to data availability) are assumed to grow in line with the same cost assumption, i.e. GDP per capita). Therefore:

$$cd'_{g,a,x,n} = cd_{g,a,x,n} \cdot \Delta Ypc_n \qquad [17]$$

where:

$cd'_{g,a,x,n}$ is cost per capita of a person of a given gender *g* and age *a* who is going to die within *x* years, in a given year *n* of the projection period adjusted to the GDP per capita growth;

ΔYpc_n is GDP per capita rate growth in year *n*, as in [2]

The same procedure applies to construct $cs'_{g,a,n}$ on the basis of $cs_{g,a,n}$, i.e. to adjust the per capita cost of the subgroup of survivors.

Third, ***by multiplying the size of each subgroup by its respective cost per capita, the total cost can be calculated***. Total expenditure on health care borne by those of a given gender *g* and age *a*, who are going to die within *x* years' time from a given year *n* can be expressed in the following way:

$$ed_{g,a,x,n} = Nd_{g,a,x,n} \cdot cd_{g,a,x,n} \qquad [18]$$

and total expenditure of those of gender *g* and age *a* who are going to survive z^{th} year:

$$es_{g,a,n} = Ns_{g,a,n} \cdot cs_{g,a,n} \qquad [19]$$

Adding total expenditures of all the subgroups (those dying within *0,1,2,..., z* years time plus those surviving z^{th} year) gives total expenditure on health care borne by entire population of gender *g* and age *a* in a given year *n*:

$$E_{g,a,n} = \sum_{x=1}^{z} ed_{g,a,n,x} + es_{g,a,n} \qquad [20]$$

Finally, ***total expenditure on health care borne by entire population in a given year n expressed as a share of the country's GDP is calculated*** as follows:

$$T_n = \frac{\sum_g \sum_a E_{g,a,n}}{Y_n} \qquad [21]$$

1.5. Income elasticity scenario

The projections of health care spending follow similar methodology as the pure demographic scenario with a change in the way cost per capita is evolving over the projection period. Income elasticity is taken into account by replacing equation [1] by the following one:

$$c'_{g,a,n} = c_{g,a} \Delta Ypc_n \varepsilon_n \qquad [22]$$

where:

$c'_{g,a,n}$ is cost per capita of a person of a given gender *g* and age *a* in a given year *n* of the projection period adjusted to the GDP per capita growth;

$c_{g,a}$ is constant cost per capita of a person of a given gender *g* and age *a*;

ΔYpc_n is GDP per capita rate growth in year *n*;

ε_n is income elasticity of demand, converging from ε_{2007} in the base year to ε_{2060} in 2060. Therefore:

$$\varepsilon_n = \varepsilon_{2007} - (n-2007)\cdot\frac{\varepsilon_{2007}-\varepsilon_{2060}}{2060-2007} \qquad [23]$$

In the specific case where income elasticity of demand converges from 1.1 in 2007 to 1 in 2060, the value will be the following

$$\varepsilon_n = 1.1 - (n-2007)\cdot\frac{1.1-1}{2060-2007} \qquad [23a]$$

After unit cost has been calculated, the following equations [3]-[4] do not change.

1.6. Labour intensity scenario

The only difference between this scenario and *pure demographic scenario* is the change in the development pattern of unit costs. GDP per capita is replaced by GDP per worker, thus equation [1] takes the following form:

$$c'_{g,a,n} = c_{g,a}\Delta Ypw_n \qquad [24]$$

where:

ΔYpw_n is GDP per worker rate growth in year *n*,

$$\Delta Ypw_n = \left(\frac{Y_n}{\sum w_{g,a,n}} - \frac{Y_{n-1}}{\sum w_{g,a,n-1}}\right) / \left(\frac{Y_{n-1}}{\sum w_{g,a,n-1}}\right) \qquad [25]$$

$w_{g,a,n}$ is the projected number of people employed of a given gender *g* and age *a* in a given year *n*.

The following equations [3]-[4] do not change.

1.7. EU12 cost convergence scenario

The projections of health care spending follow similar methodology as the *pure demographic* scenario with a change in the way cost per capita is evolving over the projection period. Real convergence between EU15 and RAMS12 countries is assumed by replacing equation [1] by the following one:

$$c'_{g,a,n} = c_{g,a}\Delta Ypc_n f_n \qquad [26]$$

where:

$c'_{g,a,n}$ is cost per capita of a person of a given gender *g* and age *a* in a given year *n* of the projection period adjusted to the GDP per capita growth;

$c_{g,a}$ is constant cost per capita of a person of a given gender *g* and age *a*;

ΔYpc_n is GDP per capita rate growth in year *n*;

f_n is a hypothetical rate of growth of unweighted average EU12 unit cost (calculated in the base year) in a given year *n* with respect to the base year if it was to converge to unweighted average EU15 level by 2060 (calculated in the base year). Therefore:

$$f_n = (n - 2007) \cdot \frac{\overline{c_{g,a,EU15}} - \overline{c_{g,a,RAMS12}}}{2060 - 2007} \qquad [27]$$

where:

$\overline{c_{g,a,EU15}}$ is unweighted EU15 average cost per capita of a given gender *g* and age *a* calculated in the base year;

$\overline{c_{g,a,RAMS12}}$ is unweighted RAMS12 average cost per capita of a given gender *g* and age *a* calculated in the base year.

After unit cost has been calculated the following equations [3]-[4] apply unchanged.

1.8. Fast cost growth scenario

The projection of health care spending follow similar methodology as the *pure demographic scenario*, apart from the fact that the yearly rate of growth in unit costs follows slightly different pattern: during the first ten years of projection period (2008-2017) it increases 1 p.p. faster than GDP per capita and afterwards it comes back to the basic GDP per capita path:

$$c_{g,a,n} = c_{g,a,n-1} \cdot r_n \qquad [28]$$

where:

$c_{g,a,n}$ is part of cost per capita of a person of a given gender *g* and age *a* in a given year *n* of the projection period;

r_n is the rate of change in cost per capita in a given year *n*. It is calculated according to the following method:

$$r_n = \begin{cases} rYpc_n + 0.01 & for \quad 2008 \le n < 2017 \\ rYpc_n & for \quad n \ge 2017 \end{cases} \qquad [29]$$

where:

$rYpc_n$ is GDP per capita rate of growth in year n.

1.9. Technology scenario

Based on the results of econometric exercise analysing past trends in health care expenditure the coefficients illustrating two effects, lower income elasticity and extra yearly increase of unit cost, are estimated. Given the expected process of convergence to a steady state, both effects are assumed to disappear over time: income elasticity reaches the value of 1 and extra unit cost growth goes down to zero. According to two different variants, the year of full convergence is either 2060 (over entire projection period) or 2038 (over 30 years).

Every year, basic unit cost rate of growth is affected by the elasticity coefficient and extra component of growth:

$$c'_{g,a,n} = c_{g,a}(\Delta Ypc_n \varepsilon_n + x_n) \quad [30]$$

where:

$c'_{g,\,a,\,n}$ is cost per capita of a person of a given gender g and age a in a given year n of the projection period adjusted to the assumed rate of growth;

$c_{g,\,a}$ is constant cost per capita of a person of a given gender g and age a;

ΔYpc_n is GDP per capita rate growth in year n;

ε_n is income elasticity of demand, converging from ε_{2007} in the base year to 1 by 2060 or 2038;

x_n is an extra component added to the rate of growth of unit costs, converging from x_{2007} in the base year to 0 by 2060 or 2038.

ε_{2007} and x_{2007} are the outcomes of the econometric specification (see Table 6 and Dybczak and Przywara 2010)

Therefore:

$$\varepsilon_n = \varepsilon_{2007} - (n - 2007) \cdot \frac{\varepsilon_{2007} - 1}{2060 - 2007} \quad [31a]$$

if the convergence is assumed to be completed by 2060, or:

$$\varepsilon_n = \varepsilon_{2007} - (n - 2007) \cdot \frac{\varepsilon_{2007} - 1}{2038 - 2007} \quad [31b]$$

if the convergence is assumed to be completed by 2038.

Simultaneously:

$$x_n = x_{2007} - (n - 2007) \cdot \frac{\varepsilon_{2007}}{2060 - 2007} \quad [32a]$$

if the convergence is assumed to be completed by 2060, or:

$$x_n = x_{2007} - (n - 2007) \cdot \frac{x_{2007}}{2038 - 2007} \quad [32b]$$

if the convergence is assumed to be completed by 2038.

After unit cost has been calculated, the following procedure is the same as in the pure demographic scenario and equations [3]-[4] apply accordingly.

2. DETAILED RESULTS OF THE PROJECTIONS ON HEALTH CARE

Table 10 Pure demographic scenario : projected spending on health care as % of GDP

	2007	2010	2015	2020	2025	2030	2035	2040	2045	2050	2055	2060	*Change 2007-2060*
BE	7,6	7,7	7,9	8,0	8,2	8,5	8,7	8,8	8,9	9,0	9,0	9,1	*1,5*
BG	4,7	4,8	4,8	4,9	4,9	5,0	5,2	5,3	5,4	5,4	5,4	5,4	*0,7*
CZ	6,2	6,3	6,6	6,8	7,1	7,3	7,6	7,8	8,0	8,2	8,4	8,5	*2,3*
DK	5,9	6,0	6,2	6,4	6,6	6,8	6,9	6,9	7,0	7,1	7,1	7,1	*1,2*
DE	7,4	7,6	7,8	8,1	8,3	8,6	8,8	9,1	9,3	9,4	9,4	9,4	*2,0*
EE	4,9	5,0	5,1	5,2	5,3	5,4	5,5	5,7	5,8	6,0	6,1	6,2	*1,2*
IE	5,8	5,9	6,0	6,1	6,3	6,5	6,8	7,0	7,3	7,5	7,7	7,8	*2,0*
EL	5,0	5,1	5,2	5,3	5,5	5,6	5,8	6,0	6,2	6,3	6,4	6,4	*1,5*
ES	5,5	5,6	5,7	5,8	6,0	6,3	6,6	6,9	7,1	7,2	7,3	7,3	*1,8*
FR	8,1	8,2	8,4	8,6	8,7	9,0	9,2	9,3	9,4	9,5	9,5	9,5	*1,4*
IT	5,9	5,9	6,1	6,2	6,4	6,6	6,8	6,9	7,0	7,1	7,1	7,1	*1,2*
CY	2,7	2,8	2,8	2,9	3,0	3,1	3,2	3,2	3,3	3,4	3,5	3,6	*0,9*
LV	3,5	3,5	3,5	3,6	3,6	3,7	3,8	3,9	4,0	4,0	4,1	4,1	*0,7*
LT	4,5	4,5	4,7	4,8	4,9	5,0	5,2	5,3	5,5	5,5	5,6	5,7	*1,2*
LU	5,8	5,9	6,0	6,1	6,3	6,5	6,7	6,8	6,9	7,0	7,1	7,1	*1,3*
HU	5,8	5,8	5,9	6,1	6,3	6,5	6,8	7,0	7,1	7,3	7,4	7,5	*1,7*
MT	4,7	4,9	5,3	5,7	6,1	6,5	7,0	7,4	7,6	7,9	8,1	8,5	*3,8*
NL	4,8	4,9	5,1	5,3	5,4	5,6	5,7	5,8	5,9	5,9	5,9	6,0	*1,1*
AT	6,5	6,6	6,8	7,0	7,3	7,5	7,7	7,9	8,1	8,2	8,2	8,2	*1,7*
PL	4,0	4,1	4,2	4,4	4,5	4,7	4,8	5,0	5,1	5,2	5,3	5,4	*1,3*
PT	7,2	7,3	7,5	7,7	7,9	8,1	8,4	8,6	8,9	9,1	9,2	9,4	*2,2*
RO	3,5	3,5	3,6	3,7	3,9	4,0	4,2	4,4	4,5	4,7	4,8	4,9	*1,4*
SI	6,6	6,7	7,0	7,2	7,4	7,7	7,9	8,2	8,3	8,4	8,5	8,6	*1,9*
SK	5,0	5,1	5,3	5,6	5,8	6,1	6,4	6,6	6,9	7,1	7,2	7,3	*2,3*
FI	5,5	5,6	5,8	6,0	6,3	6,5	6,6	6,7	6,8	6,8	6,8	6,9	*1,4*
SE	7,2	7,2	7,4	7,5	7,6	7,7	7,8	7,9	8,0	8,0	8,1	8,1	*0,9*
UK	7,5	7,6	7,8	7,9	8,2	8,4	8,7	9,0	9,2	9,4	9,6	9,7	*2,2*
NO	5,6	5,7	5,8	6,1	6,3	6,6	6,8	6,9	7,0	7,2	7,2	7,3	*1,6*
EU27	*6,7*	*6,8*	*6,9*	*7,1*	*7,2*	*7,5*	*7,7*	*8,0*	*8,2*	*8,4*	*8,5*	*8,6*	1,9
EU15	*6,9*	*7,0*	*7,1*	*7,3*	*7,5*	*7,7*	*8,0*	*8,2*	*8,4*	*8,5*	*8,6*	*8,7*	1,8
EU12	*4,7*	*4,7*	*4,8*	*5,0*	*5,2*	*5,4*	*5,6*	*5,7*	*5,9*	*6,0*	*6,2*	*6,3*	1,6

Source: European Commission and Economic Policy Committee (2009)

Table 11 High life expectancy scenario : projected spending on health care as % of GDP

	2007	2010	2015	2020	2025	2030	2035	2040	2045	2050	2055	2060	*Change 2007-2060*
BE	7,6	7,7	7,9	8,1	8,4	8,6	8,8	9,0	9,2	9,2	9,3	9,3	*1,7*
BG	4,7	4,8	5,0	5,0	5,2	5,3	5,4	5,6	5,6	5,7	5,7	5,7	*1,0*
CZ	6,2	6,4	6,7	7,0	7,3	7,6	7,9	8,2	8,4	8,6	8,7	8,9	*2,7*
DK	5,9	6,0	6,2	6,5	6,7	6,9	7,0	7,1	7,2	7,2	7,3	7,3	*1,4*
DE	7,4	7,6	7,9	8,2	8,5	8,8	9,0	9,3	9,5	9,7	9,7	9,7	*2,3*
EE	4,9	5,1	5,3	5,4	5,5	5,7	5,9	6,1	6,2	6,4	6,5	6,6	*1,7*
IE	5,8	5,9	6,0	6,2	6,4	6,7	6,9	7,2	7,4	7,7	7,9	8,0	*2,2*
GR	5,0	5,1	5,3	5,5	5,6	5,8	6,0	6,2	6,4	6,5	6,6	6,7	*1,7*
ES	5,5	5,6	5,7	5,9	6,2	6,5	6,8	7,0	7,3	7,4	7,5	7,5	*2,0*
FR	8,1	8,3	8,5	8,7	8,9	9,1	9,3	9,5	9,6	9,7	9,8	9,8	*1,7*
IT	5,9	5,9	6,1	6,3	6,5	6,7	6,9	7,1	7,2	7,2	7,3	7,2	*1,4*
CY	2,7	2,8	2,8	2,9	3,0	3,1	3,2	3,3	3,4	3,5	3,6	3,6	*0,9*
LV	3,5	3,5	3,6	3,7	3,8	3,9	4,0	4,1	4,2	4,2	4,3	4,3	*0,9*
LT	4,5	4,6	4,8	5,0	5,1	5,2	5,4	5,6	5,7	5,8	5,9	6,0	*1,5*
LU	5,8	5,9	6,1	6,3	6,5	6,7	6,9	7,1	7,2	7,3	7,3	7,4	*1,6*
HU	5,6	5,9	6,0	6,3	6,5	6,8	7,0	7,2	7,4	7,5	7,7	7,8	*2,2*
MT	4,6	4,9	5,3	5,7	6,2	6,7	7,2	7,6	7,8	8,1	8,3	8,7	*4,1*
NL	4,8	4,9	5,1	5,3	5,5	5,7	5,8	5,9	6,0	6,1	6,1	6,1	*1,3*
AT	6,5	6,6	6,9	7,1	7,4	7,6	7,8	8,1	8,3	8,4	8,4	8,4	*1,9*
PL	4,0	4,2	4,3	4,5	4,7	4,9	5,1	5,2	5,3	5,4	5,5	5,6	*1,6*
PT	7,2	7,3	7,5	7,7	8,0	8,2	8,5	8,8	9,1	9,3	9,5	9,7	*2,5*
RO	3,5	3,7	3,8	4,0	4,1	4,3	4,5	4,7	4,9	5,1	5,2	5,3	*1,8*
SI	6,6	6,8	7,1	7,4	7,7	7,9	8,2	8,5	8,7	8,8	8,9	8,9	*2,3*
SK	5,0	5,2	5,5	5,8	6,1	6,4	6,7	7,0	7,2	7,4	7,5	7,6	*2,6*
FI	5,5	5,7	5,9	6,1	6,3	6,5	6,7	6,8	6,9	6,9	7,0	7,0	*1,5*
SE	7,2	7,3	7,4	7,6	7,7	7,9	8,0	8,1	8,2	8,3	8,3	8,3	*1,1*
UK	7,5	7,6	7,9	8,1	8,3	8,6	9,0	9,2	9,4	9,7	9,9	10,0	*2,6*
NO	5,7	5,8	5,9	6,1	6,2	6,3	6,4	6,4	6,4	6,5	6,5	6,5	*0,8*
EU27	*6,7*	*6,8*	*7,0*	*7,2*	*7,4*	*7,7*	*7,9*	*8,2*	*8,4*	*8,5*	*8,6*	*8,7*	2,0
EU15	*6,9*	*7,0*	*7,2*	*7,4*	*7,6*	*7,9*	*8,1*	*8,4*	*8,6*	*8,7*	*8,8*	*8,8*	2,0
EU12	*4,6*	*4,8*	*5,0*	*5,2*	*5,4*	*5,6*	*5,8*	*6,0*	*6,1*	*6,3*	*6,4*	*6,5*	1,9

Source: European Commission and Economic Policy Committee (2009)

Table 12 Constant health scenario : projected spending on health care as % of GDP

	2007	2010	2015	2020	2025	2030	2035	2040	2045	2050	2055	2060	*Change 2007-2060*
BE	7,6	7,7	7,7	7,7	7,8	7,9	8,0	8,1	8,1	8,0	8,0	7,9	*0,3*
BG	4,7	4,7	4,7	4,7	4,6	4,6	4,7	4,7	4,8	4,8	4,7	4,7	*0,0*
CZ	6,2	6,3	6,4	6,5	6,6	6,8	6,9	7,0	7,1	7,2	7,3	7,3	*1,1*
DK	5,9	6,0	6,0	6,1	6,2	6,3	6,3	6,3	6,3	6,3	6,3	6,2	*0,3*
DE	7,4	7,5	7,7	7,8	7,9	8,0	8,2	8,3	8,4	8,5	8,4	8,3	*0,9*
EE	4,9	5,0	5,0	5,0	5,0	5,0	5,0	5,1	5,2	5,2	5,3	5,3	*0,4*
IE	5,8	5,8	5,8	5,9	6,0	6,1	6,2	6,4	6,5	6,6	6,7	6,8	*1,0*
EL	5,0	5,0	5,1	5,2	5,2	5,3	5,4	5,5	5,6	5,7	5,7	5,7	*0,7*
ES	5,5	5,6	5,6	5,6	5,7	5,9	6,1	6,3	6,4	6,5	6,5	6,5	*1,0*
FR	8,1	8,2	8,2	8,3	8,4	8,5	8,6	8,6	8,6	8,6	8,6	8,5	*0,4*
IT	5,9	5,9	5,9	6,0	6,1	6,2	6,3	6,4	6,5	6,5	6,4	6,3	*0,5*
CY	2,7	2,7	2,7	2,7	2,7	2,7	2,7	2,7	2,8	2,8	2,8	2,8	*0,1*
LV	3,5	3,5	3,4	3,4	3,4	3,4	3,4	3,4	3,4	3,5	3,5	3,5	*0,1*
LT	4,5	4,5	4,5	4,5	4,5	4,5	4,6	4,7	4,7	4,8	4,8	4,8	*0,3*
LU	5,8	5,8	5,8	5,9	6,0	6,1	6,1	6,2	6,3	6,3	6,2	6,2	*0,4*
HU	5,8	5,7	5,6	5,6	5,7	5,7	5,8	5,8	5,9	6,0	6,0	6,0	*0,2*
MT	4,7	4,9	5,1	5,3	5,6	5,9	6,2	6,4	6,5	6,6	6,7	6,9	*2,2*
NL	4,8	4,9	5,0	5,1	5,2	5,3	5,3	5,4	5,4	5,4	5,3	5,3	*0,4*
AT	6,5	6,6	6,7	6,8	6,9	7,0	7,1	7,2	7,3	7,4	7,3	7,2	*0,7*
PL	4,0	4,0	4,0	4,0	3,9	3,9	3,9	3,8	3,7	3,6	3,5	3,5	*-0,6*
PT	7,2	7,3	7,3	7,3	7,4	7,5	7,6	7,8	7,9	8,0	8,1	8,1	*0,9*
RO	3,5	3,5	3,5	3,5	3,6	3,7	3,7	3,8	3,9	4,0	4,1	4,2	*0,7*
SI	6,6	6,7	6,8	6,9	7,0	7,2	7,3	7,5	7,6	7,6	7,6	7,6	*1,0*
SK	5,0	5,1	5,2	5,3	5,4	5,6	5,7	5,8	6,0	6,1	6,2	6,2	*1,2*
FI	5,5	5,6	5,6	5,7	5,8	5,8	5,9	5,9	5,8	5,8	5,7	5,7	*0,2*
SE	7,2	7,2	7,2	7,2	7,3	7,3	7,3	7,3	7,3	7,3	7,3	7,2	*0,0*
UK	7,5	7,6	7,6	7,6	7,7	7,8	8,0	8,2	8,3	8,4	8,5	8,5	*1,0*
NO	5,6	5,6	5,7	5,8	5,9	6,1	6,2	6,2	6,3	6,3	6,3	6,3	*0,6*
EU27	*6,7*	*6,7*	*6,8*	*6,8*	*6,9*	*7,0*	*7,1*	*7,3*	*7,4*	*7,5*	*7,6*	*7,6*	*0,8*
EU15	*6,9*	*6,9*	*7,0*	*7,0*	*7,1*	*7,2*	*7,4*	*7,5*	*7,6*	*7,7*	*7,7*	*7,6*	*0,8*
EU12	*4,7*	*4,7*	*4,7*	*4,7*	*4,7*	*4,8*	*4,8*	*4,8*	*4,9*	*4,9*	*4,9*	*4,9*	*0,3*

Source: European Commission and Economic Policy Committee (2009)

Table 13 Improved health scenario : projected spending on health care as % of GDP

	2007	2010	2015	2020	2025	2030	2035	2040	2045	2050	2055	2060	*Change 2007-2060*
BE	7,6	7,6	7,5	7,4	7,4	7,4	7,4	7,4	7,3	7,2	7,1	7,0	*-0,6*
BG	4,7	4,7	4,6	4,5	4,3	4,3	4,2	4,2	4,2	4,2	4,2	4,1	*-0,6*
CZ	6,2	6,2	6,2	6,2	6,2	6,2	6,3	6,3	6,3	6,4	6,4	6,4	*0,2*
DK	5,9	5,9	5,9	5,9	5,9	5,9	5,8	5,8	5,7	5,6	5,6	5,5	*-0,5*
DE	7,4	7,5	7,5	7,5	7,5	7,6	7,6	7,7	7,7	7,7	7,6	7,4	*0,0*
EE	4,9	4,9	4,9	4,8	4,7	4,6	4,6	4,6	4,6	4,6	4,6	4,7	*-0,3*
IE	5,8	5,8	5,7	5,6	5,6	5,7	5,7	5,8	5,8	5,9	5,9	6,0	*0,1*
EL	5,0	5,0	5,0	5,0	5,0	5,0	5,0	5,1	5,1	5,1	5,1	5,1	*0,1*
ES	5,5	5,5	5,4	5,4	5,4	5,5	5,6	5,7	5,8	5,9	5,9	5,9	*0,3*
FR	8,1	8,2	8,1	8,0	8,0	8,0	8,0	8,0	8,0	7,9	7,7	7,7	*-0,5*
IT	5,9	5,9	5,8	5,8	5,8	5,8	5,9	5,9	5,9	5,9	5,8	5,7	*-0,1*
CY	2,7	2,7	2,6	2,5	2,5	2,4	2,4	2,4	2,3	2,3	2,3	2,3	*-0,4*
LV	3,5	3,4	3,3	3,3	3,2	3,1	3,1	3,1	3,1	3,1	3,1	3,1	*-0,3*
LT	4,5	4,4	4,3	4,3	4,2	4,2	4,2	4,2	4,2	4,2	4,2	4,2	*-0,3*
LU	5,8	5,8	5,7	5,7	5,6	5,6	5,7	5,7	5,7	5,6	5,5	5,4	*-0,3*
HU	5,8	5,6	5,4	5,3	5,2	5,2	5,1	5,1	5,1	5,1	5,1	5,1	*-0,7*
MT	4,7	4,8	4,9	5,0	5,2	5,4	5,6	5,7	5,7	5,7	5,7	5,8	*1,1*
NL	4,8	4,9	4,9	4,9	4,9	5,0	5,0	5,0	4,9	4,9	4,8	4,7	*-0,1*
AT	6,5	6,5	6,5	6,5	6,5	6,6	6,6	6,6	6,7	6,6	6,5	6,4	*-0,1*
PL	4,0	3,9	3,7	3,3	3,0	2,7	2,4	2,1	1,8	1,7	1,7	1,8	*-2,2*
PT	7,2	7,2	7,1	7,0	7,0	7,0	7,0	7,1	7,1	7,2	7,2	7,2	*0,0*
RO	3,5	3,5	3,4	3,4	3,3	3,4	3,4	3,4	3,5	3,5	3,6	3,6	*0,1*
SI	6,6	6,6	6,7	6,7	6,7	6,7	6,8	6,9	6,9	6,9	6,8	6,8	*0,2*
SK	5,0	5,0	5,0	5,0	5,0	5,1	5,1	5,1	5,2	5,3	5,3	5,3	*0,4*
FI	5,5	5,5	5,4	5,4	5,4	5,4	5,4	5,4	5,3	5,2	5,1	5,0	*-0,5*
SE	7,2	7,2	7,1	7,0	7,0	6,9	6,9	6,8	6,7	6,6	6,6	6,5	*-0,7*
UK	7,5	7,5	7,4	7,4	7,3	7,3	7,4	7,5	7,6	7,6	7,6	7,5	*0,1*
NO	5,6	5,6	5,5	5,5	5,6	5,6	5,7	5,6	5,6	5,6	5,5	5,4	*-0,2*
EU27	*6,7*	*6,7*	*6,6*	*6,6*	*6,6*	*6,6*	*6,6*	*6,6*	*6,7*	*6,7*	*6,6*	*6,6*	*-0,2*
EU15	*6,9*	*6,9*	*6,8*	*6,8*	*6,8*	*6,8*	*6,9*	*6,9*	*6,9*	*6,9*	*6,9*	*6,8*	*-0,1*
EU12	*4,7*	*4,6*	*4,4*	*4,3*	*4,1*	*4,0*	*3,9*	*3,8*	*3,8*	*3,7*	*3,8*	*3,8*	*-0,8*

Source: European Commission and Economic Policy Committee (2009)

Table 14 Death-related costs scenario : projected spending on health care as % of GDP

	2007	2010	2015	2020	2025	2030	2035	2040	2045	2050	2055	2060	*Change 2007-2060*
BE	7,6	7,5	7,7	7,8	8,0	8,2	8,4	8,6	8,7	8,7	8,7	8,8	*1,2*
BG	4,7	4,7	4,7	4,8	4,8	5,0	5,1	5,2	5,3	5,3	5,3	5,3	*0,6*
CZ	6,2	6,2	6,4	6,6	6,9	7,1	7,4	7,6	7,8	7,9	8,1	8,2	*2,0*
DK	5,9	5,9	6,0	6,2	6,4	6,6	6,7	6,7	6,8	6,8	6,9	6,9	*0,9*
DE	7,4	7,4	7,6	7,9	8,1	8,3	8,5	8,8	8,9	9,0	8,9	8,9	*1,5*
EE	4,9	4,9	5,0	5,1	5,1	5,2	5,4	5,5	5,7	5,8	5,9	6,0	*1,0*
IE	5,8	5,8	5,9	6,0	6,2	6,4	6,6	6,8	7,0	7,2	7,4	7,5	*1,7*
EL	5,0	4,9	5,1	5,2	5,3	5,5	5,7	5,8	6,0	6,1	6,2	6,2	*1,2*
ES	5,5	5,5	5,6	5,7	5,9	6,1	6,4	6,6	6,8	7,0	7,0	7,0	*1,5*
FR	8,1	8,1	8,2	8,4	8,5	8,7	8,9	9,0	9,1	9,2	9,2	9,2	*1,1*
IT	5,9	5,8	5,9	6,1	6,2	6,4	6,6	6,7	6,8	6,9	6,9	6,9	*1,0*
CY	2,7	2,7	2,8	2,8	2,9	3,0	3,1	3,1	3,2	3,3	3,4	3,5	*0,7*
LV	3,5	3,4	3,5	3,5	3,6	3,6	3,7	3,8	3,9	4,0	4,0	4,0	*0,6*
LT	4,5	4,4	4,6	4,7	4,8	4,9	5,0	5,2	5,3	5,4	5,5	5,5	*1,0*
LU	5,8	5,7	5,8	6,0	6,1	6,3	6,5	6,6	6,7	6,7	6,8	6,8	*1,0*
HU	5,8	5,6	5,7	5,9	6,1	6,3	6,5	6,6	6,7	6,9	7,0	7,1	*1,3*
MT	4,7	4,8	5,0	5,4	5,7	6,1	6,4	6,5	6,7	6,8	7,0	7,3	*2,6*
NL	4,8	4,8	5,0	5,1	5,3	5,5	5,6	5,7	5,7	5,7	5,8	5,8	*0,9*
AT	6,5	6,5	6,7	6,9	7,1	7,3	7,5	7,7	7,8	7,9	7,9	7,8	*1,4*
PL	4,0	4,0	4,1	4,3	4,4	4,6	4,7	4,8	5,0	5,1	5,2	5,2	*1,2*
PT	7,2	7,2	7,3	7,4	7,6	7,8	8,1	8,3	8,5	8,7	8,8	8,9	*1,7*
RO	3,5	3,4	3,5	3,6	3,8	3,9	4,1	4,3	4,4	4,5	4,7	4,7	*1,2*
SI	6,6	6,6	6,8	7,0	7,2	7,5	7,7	7,9	8,0	8,1	8,2	8,2	*1,6*
SK	5,0	5,0	5,2	5,4	5,7	5,9	6,2	6,4	6,6	6,8	6,9	7,0	*2,0*
FI	5,5	5,5	5,7	5,9	6,1	6,3	6,4	6,5	6,5	6,5	6,6	6,6	*1,1*
SE	7,2	7,1	7,2	7,3	7,4	7,5	7,6	7,7	7,8	7,8	7,9	7,9	*0,7*
UK	7,5	7,4	7,5	7,6	7,8	8,0	8,3	8,4	8,5	8,6	8,6	8,6	*1,1*
NO	5,6	5,5	5,7	5,9	6,1	6,4	6,5	6,7	6,8	6,9	7,0	7,0	*1,4*
EU27	*6,7*	*6,6*	*6,7*	*6,9*	*7,0*	*7,2*	*7,5*	*7,7*	*7,8*	*8,0*	*8,1*	*8,1*	*1,4*
EU15	*6,9*	*6,8*	*7,0*	*7,1*	*7,3*	*7,5*	*7,7*	*7,9*	*8,0*	*8,1*	*8,1*	*8,2*	*1,3*
EU12	*4,7*	*4,6*	*4,7*	*4,9*	*5,0*	*5,2*	*5,4*	*5,6*	*5,7*	*5,8*	*6,0*	*6,0*	*1,4*

Source: European Commission and Economic Policy Committee (2009)

Table 15 Income elasticity scenario : projected spending on health care as % of GDP

	2007	2010	2015	2020	2025	2030	2035	2040	2045	2050	2055	2060	*Change 2007-2060*
BE	7,6	7,7	8,0	8,2	8,4	8,7	8,9	9,1	9,3	9,4	9,4	9,5	*1,8*
BG	4,7	4,8	5,0	5,1	5,2	5,4	5,5	5,7	5,8	5,8	5,9	5,9	*1,2*
CZ	6,2	6,4	6,7	7,1	7,4	7,7	8,0	8,3	8,5	8,7	8,9	9,0	*2,8*
DK	5,9	6,0	6,3	6,5	6,7	6,9	7,1	7,2	7,3	7,3	7,4	7,4	*1,5*
DE	7,4	7,6	7,9	8,3	8,5	8,8	9,1	9,4	9,6	9,7	9,8	9,8	*2,4*
EE	4,9	5,1	5,3	5,4	5,6	5,7	5,9	6,1	6,3	6,4	6,5	6,6	*1,7*
IE	5,8	5,9	6,1	6,2	6,5	6,7	7,0	7,3	7,6	7,8	8,0	8,1	*2,3*
EL	5,0	5,1	5,3	5,5	5,7	5,9	6,1	6,3	6,5	6,6	6,7	6,8	*1,8*
ES	5,5	5,6	5,8	6,0	6,2	6,5	6,8	7,1	7,4	7,5	7,6	7,6	*2,1*
FR	8,1	8,3	8,5	8,7	8,9	9,2	9,4	9,6	9,7	9,8	9,9	9,9	*1,8*
IT	5,9	6,0	6,1	6,3	6,5	6,7	7,0	7,1	7,3	7,3	7,3	7,3	*1,5*
CY	2,7	2,8	2,9	3,0	3,1	3,2	3,3	3,4	3,5	3,6	3,7	3,8	*1,1*
LV	3,5	3,6	3,7	3,8	3,8	3,9	4,1	4,2	4,3	4,3	4,4	4,4	*1,0*
LT	4,5	4,6	4,8	5,0	5,2	5,3	5,5	5,7	5,9	6,0	6,0	6,1	*1,6*
LU	5,8	5,9	6,1	6,3	6,5	6,8	7,0	7,2	7,3	7,4	7,4	7,5	*1,7*
HU	5,8	5,8	6,0	6,3	6,6	6,8	7,1	7,3	7,5	7,7	7,9	8,0	*2,2*
MT	4,7	4,9	5,4	5,8	6,3	6,8	7,3	7,7	8,0	8,2	8,5	8,9	*4,2*
NL	4,8	4,9	5,1	5,3	5,6	5,7	5,9	6,0	6,1	6,2	6,2	6,2	*1,3*
AT	6,5	6,6	6,9	7,2	7,4	7,7	7,9	8,2	8,4	8,5	8,5	8,5	*2,1*
PL	4,0	4,2	4,4	4,5	4,8	5,0	5,2	5,3	5,4	5,6	5,7	5,7	*1,7*
PT	7,2	7,4	7,6	7,8	8,1	8,3	8,7	9,0	9,2	9,5	9,6	9,8	*2,6*
RO	3,5	3,6	3,8	3,9	4,1	4,3	4,5	4,7	4,9	5,0	5,2	5,3	*1,8*
SI	6,6	6,8	7,1	7,4	7,7	8,0	8,3	8,6	8,8	8,9	9,0	9,0	*2,4*
SK	5,0	5,2	5,5	5,9	6,2	6,5	6,8	7,1	7,4	7,6	7,7	7,8	*2,9*
FI	5,5	5,7	5,9	6,2	6,4	6,7	6,9	7,0	7,0	7,1	7,1	7,2	*1,7*
SE	7,2	7,3	7,5	7,6	7,8	7,9	8,1	8,2	8,3	8,4	8,4	8,5	*1,3*
UK	7,5	7,6	7,9	8,1	8,4	8,7	9,0	9,3	9,5	9,8	10,0	10,1	*2,6*
NO	5,6	5,7	5,9	6,2	6,4	6,7	6,9	7,1	7,3	7,4	7,5	7,5	*1,9*
EU27	*6,7*	*6,8*	*7,0*	*7,2*	*7,4*	*7,7*	*8,0*	*8,3*	*8,5*	*8,7*	*8,9*	*9,0*	*2,3*
EU15	*6,9*	*7,0*	*7,2*	*7,4*	*7,7*	*7,9*	*8,2*	*8,5*	*8,7*	*8,8*	*8,9*	*9,0*	*2,1*
EU12	*4,7*	*4,8*	*5,0*	*5,2*	*5,4*	*5,7*	*5,9*	*6,1*	*6,3*	*6,4*	*6,6*	*6,7*	*2,0*

Source: European Commission and Economic Policy Committee (2009)

Table 16 EU12 cost convergence scenario : projected spending on health care as % of GDP

	2007	2010	2015	2020	2025	2030	2035	2040	2045	2050	2055	2060	*Change 2007-2060*
BG	4,7	4,9	5,1	5,3	5,6	5,9	6,3	6,8	7,2	7,7	8,3	8,9	*4,2*
CZ	6,2	6,4	6,6	6,9	7,2	7,5	7,8	8,1	8,4	8,6	8,9	9,1	*2,9*
EE	4,9	5,1	5,3	5,5	5,7	6,0	6,4	6,7	7,1	7,5	7,9	8,3	*3,4*
CY	2,7	2,9	3,1	3,5	3,8	4,2	4,6	5,1	5,7	6,3	6,9	7,6	*4,9*
LV	3,5	3,6	3,8	4,1	4,4	4,8	5,3	5,8	6,4	7,0	7,7	8,6	*5,1*
LT	4,5	4,6	4,9	5,1	5,4	5,8	6,2	6,7	7,1	7,6	8,1	8,7	*4,2*
HU	5,8	5,8	6,0	6,3	6,6	6,9	7,3	7,6	7,9	8,2	8,5	8,8	*3,1*
MT	4,7	5,0	5,5	6,0	6,6	7,2	7,8	8,3	8,7	9,1	9,6	10,1	*5,4*
PL	4,0	4,2	4,5	4,8	5,2	5,6	6,1	6,5	7,0	7,6	8,2	8,9	*4,9*
RO	3,5	3,6	3,9	4,3	4,6	5,1	5,6	6,2	6,7	7,4	8,1	8,8	*5,3*
SI	6,6	6,8	7,0	7,3	7,5	7,8	8,1	8,4	8,7	8,9	9,0	9,2	*2,6*
SK	5,0	5,1	5,4	5,8	6,1	6,5	6,9	7,4	7,8	8,2	8,6	9,1	*4,1*
EU12	*4,7*	*4,8*	*5,0*	*5,4*	*5,7*	*6,1*	*6,5*	*6,9*	*7,4*	*7,9*	*8,4*	*9,0*	*4,3*

Source: European Commission and Economic Policy Committee (2009)

Table 17 Labour intensity scenario : projected spending on health care as % of GDP

	2007	2010	2015	2020	2025	2030	2035	2040	2045	2050	2055	2060	*Change 2007-2060*
BE	7,6	7,6	7,6	7,9	8,3	8,7	9,0	9,2	9,4	9,5	9,7	9,7	*2,1*
BG	4,7	4,5	4,5	4,6	4,8	5,0	5,2	5,5	5,8	6,1	6,2	6,3	*1,6*
CZ	6,2	6,3	6,5	6,8	7,3	7,6	8,0	8,4	8,9	9,4	9,8	10,0	*3,8*
DK	5,9	6,0	6,3	6,7	7,0	7,3	7,5	7,6	7,6	7,6	7,6	7,7	*1,7*
DE	7,4	7,5	7,5	7,8	8,2	8,7	9,1	9,6	9,8	10,0	10,1	10,2	*2,8*
EE	4,9	4,8	5,0	5,2	5,4	5,6	5,7	6,0	6,3	6,7	7,0	7,2	*2,3*
IE	5,8	5,9	6,0	6,1	6,4	6,6	6,9	7,2	7,7	8,1	8,5	8,7	*2,9*
EL	5,0	5,0	5,1	5,2	5,4	5,7	6,1	6,5	6,8	7,1	7,3	7,3	*2,4*
ES	5,5	5,5	5,5	5,5	5,8	6,1	6,5	7,0	7,6	8,0	8,2	8,1	*2,6*
FR	8,1	8,3	8,4	8,7	9,0	9,4	9,7	10,0	10,1	10,2	10,3	10,3	*2,1*
IT	5,9	5,9	5,9	6,0	6,2	6,4	6,8	7,2	7,5	7,7	7,7	7,7	*1,8*
CY	2,7	2,7	2,7	2,8	2,9	3,1	3,2	3,3	3,4	3,6	3,8	3,9	*1,2*
LV	3,5	3,3	3,4	3,6	3,7	3,8	4,0	4,2	4,4	4,7	5,0	5,1	*1,6*
LT	4,5	4,4	4,4	4,5	4,8	5,1	5,4	5,7	6,0	6,3	6,7	6,9	*2,5*
LU	5,8	5,5	5,2	5,4	5,6	6,0	6,3	6,5	6,6	6,7	6,8	6,9	*1,1*
HU	5,8	5,8	5,8	5,9	6,2	6,5	6,9	7,3	7,7	8,1	8,5	8,8	*3,0*
MT	4,7	4,9	5,2	5,7	6,2	6,6	7,1	7,5	7,9	8,4	9,0	9,7	*5,0*
NL	4,8	4,9	5,0	5,3	5,7	6,0	6,3	6,5	6,5	6,5	6,6	6,6	*1,8*
AT	6,5	6,6	6,7	7,0	7,4	7,8	8,1	8,5	8,7	8,9	9,0	9,1	*2,6*
PL	4,0	3,9	4,0	4,2	4,4	4,6	4,9	5,1	5,4	5,8	6,1	6,4	*2,4*
PT	7,2	7,3	7,4	7,5	7,7	8,0	8,4	8,9	9,3	9,8	10,1	10,3	*3,1*
RO	3,5	3,5	3,6	3,7	3,9	4,2	4,5	4,8	5,2	5,6	6,0	6,2	*2,7*
SI	6,6	6,7	7,0	7,4	7,8	8,4	8,9	9,5	10,0	10,4	10,6	10,7	*4,1*
SK	5,0	5,0	5,0	5,1	5,5	5,8	6,3	6,7	7,3	7,8	8,3	8,6	*3,7*
FI	5,5	5,6	5,9	6,2	6,5	6,9	7,1	7,2	7,2	7,3	7,4	7,5	*2,0*
SE	7,2	7,3	7,4	7,6	7,9	8,1	8,3	8,4	8,5	8,6	8,8	8,9	*1,7*
UK	7,5	7,7	7,8	8,1	8,4	8,8	9,1	9,3	9,5	9,7	10,0	10,3	*2,8*
NO	5,6	5,7	5,9	6,2	6,6	7,1	7,4	7,7	7,9	8,0	8,1	8,3	*2,6*
EU27	*6,7*	*6,7*	*6,8*	*7,0*	*7,3*	*7,6*	*8,0*	*8,4*	*8,7*	*9,0*	*9,2*	*9,4*	*2,7*
EU15	*6,9*	*6,9*	*7,0*	*7,2*	*7,5*	*7,9*	*8,3*	*8,6*	*8,9*	*9,1*	*9,3*	*9,4*	*2,5*
EU12	*4,7*	*4,6*	*4,7*	*4,9*	*5,1*	*5,4*	*5,7*	*6,0*	*6,4*	*6,9*	*7,2*	*7,5*	*2,8*

Source: European Commission and Economic Policy Committee (2009)

Table 18 Fast cost growth scenario : projected spending on health care as % of GDP

	2007	2010	2015	2020	2025	2030	2035	2040	2045	2050	2055	2060	*Change 2007-2060*
BE	7,6	7,9	8,4	8,6	8,8	9,1	9,3	9,5	9,6	9,6	9,7	9,7	*2,1*
BG	4,7	4,9	5,2	5,2	5,3	5,4	5,5	5,7	5,7	5,8	5,8	5,8	*1,1*
CZ	6,2	6,5	7,0	7,3	7,6	7,9	8,1	8,4	8,6	8,8	9,0	9,1	*2,9*
DK	5,9	6,2	6,6	6,8	7,1	7,2	7,4	7,4	7,5	7,6	7,6	7,6	*1,7*
DE	7,4	7,8	8,4	8,7	8,9	9,2	9,5	9,7	9,9	10,0	10,1	10,1	*2,7*
EE	4,9	5,2	5,5	5,5	5,6	5,7	5,9	6,1	6,2	6,4	6,5	6,6	*1,6*
IE	5,8	6,1	6,4	6,6	6,8	7,0	7,3	7,5	7,8	8,0	8,2	8,4	*2,5*
EL	5,0	5,2	5,6	5,7	5,9	6,0	6,2	6,4	6,6	6,7	6,8	6,9	*1,9*
ES	5,5	5,8	6,1	6,2	6,5	6,7	7,0	7,3	7,6	7,7	7,8	7,8	*2,3*
FR	8,1	8,5	9,0	9,2	9,4	9,6	9,8	10,0	10,1	10,1	10,2	10,2	*2,1*
IT	5,9	6,1	6,5	6,7	6,8	7,0	7,2	7,4	7,5	7,6	7,6	7,6	*1,7*
CY	2,7	2,8	3,0	3,1	3,2	3,3	3,4	3,5	3,6	3,7	3,8	3,8	*1,1*
LV	3,5	3,6	3,8	3,8	3,9	4,0	4,1	4,2	4,2	4,3	4,3	4,4	*0,9*
LT	4,5	4,7	5,0	5,1	5,2	5,3	5,5	5,7	5,8	5,9	6,0	6,1	*1,6*
LU	5,8	6,0	6,4	6,6	6,8	7,0	7,1	7,3	7,4	7,5	7,6	7,6	*1,8*
HU	5,8	5,9	6,3	6,5	6,7	7,0	7,2	7,4	7,6	7,8	7,9	8,1	*2,3*
MT	4,7	5,1	5,6	6,1	6,5	7,0	7,5	7,9	8,2	8,4	8,7	9,1	*4,4*
NL	4,8	5,1	5,4	5,6	5,8	6,0	6,1	6,2	6,3	6,4	6,4	6,4	*1,5*
AT	6,5	6,8	7,3	7,5	7,8	8,0	8,3	8,5	8,7	8,8	8,8	8,8	*2,3*
PL	4,0	4,2	4,5	4,7	4,8	5,0	5,2	5,3	5,4	5,6	5,7	5,7	*1,7*
PT	7,2	7,5	8,0	8,2	8,4	8,7	9,0	9,2	9,5	9,7	9,9	10,0	*2,8*
RO	3,5	3,6	3,9	4,0	4,1	4,3	4,5	4,7	4,8	5,0	5,1	5,2	*1,7*
SI	6,6	6,9	7,5	7,7	7,9	8,2	8,5	8,7	8,9	9,0	9,1	9,2	*2,5*
SK	5,0	5,2	5,7	6,0	6,2	6,5	6,8	7,1	7,3	7,5	7,7	7,7	*2,8*
FI	5,5	5,8	6,2	6,5	6,7	6,9	7,1	7,2	7,2	7,3	7,3	7,3	*1,8*
SE	7,2	7,5	7,9	8,0	8,1	8,3	8,4	8,5	8,5	8,6	8,7	8,7	*1,5*
UK	7,5	7,8	8,4	8,5	8,7	9,0	9,4	9,6	9,8	10,0	10,2	10,4	*2,9*
NO	5,6	5,9	6,3	6,5	6,8	7,0	7,2	7,4	7,6	7,7	7,7	7,8	*2,2*
EU27	*6,7*	*7,0*	*7,4*	*7,6*	*7,8*	*8,0*	*8,3*	*8,5*	*8,8*	*9,0*	*9,1*	*9,2*	*2,5*
EU15	*6,9*	*7,2*	*7,6*	*7,8*	*8,0*	*8,2*	*8,5*	*8,8*	*9,0*	*9,1*	*9,2*	*9,3*	*2,4*
EU12	*4,7*	*4,8*	*5,2*	*5,4*	*5,5*	*5,7*	*5,9*	*6,1*	*6,3*	*6,5*	*6,6*	*6,7*	*2,0*

Source: European Commission and Economic Policy Committee (2009)

Table 19 Technology scenario (convergence over 30 years) : projected spending on health care as % of GDP

	2007	2010	2015	2020	2025	2030	2035	2040	2045	2050	2055	2060	*Change 2007-2060*
BE	7,6	8,1	8,8	9,5	10,2	10,8	11,2	11,4	11,6	11,6	11,7	11,8	*4,1*
BG	4,7	4,8	5,1	5,3	5,6	5,9	6,1	6,2	6,3	6,4	6,4	6,4	*1,7*
CZ	6,2	6,5	7,1	7,7	8,3	8,8	9,3	9,6	9,8	10,0	10,2	10,4	*4,2*
DK	5,9	6,3	7,0	7,6	8,2	8,7	8,9	9,1	9,1	9,2	9,3	9,3	*3,3*
DE	7,4	7,9	8,8	9,5	10,3	10,9	11,4	11,7	12,0	12,1	12,1	12,1	*4,7*
EE	4,9	5,0	5,4	5,7	6,0	6,2	6,5	6,7	6,9	7,0	7,1	7,3	*2,3*
IE	5,8	6,2	6,7	7,2	7,8	8,3	8,7	9,1	9,4	9,6	9,9	10,1	*4,2*
GR	5,0	5,2	5,7	6,1	6,5	6,9	7,3	7,5	7,7	7,9	8,0	8,0	*3,1*
ES	5,5	5,9	6,4	6,9	7,4	7,9	8,4	8,7	9,0	9,2	9,3	9,3	*3,8*
FR	8,1	8,7	9,5	10,2	10,9	11,5	11,9	12,1	12,3	12,3	12,4	12,4	*4,3*
IT	5,9	6,3	6,9	7,4	7,9	8,4	8,8	9,0	9,2	9,2	9,2	9,2	*3,4*
CY	2,7	2,9	3,1	3,4	3,6	3,8	4,0	4,1	4,2	4,4	4,5	4,5	*1,8*
LV	3,5	3,5	3,7	3,9	4,1	4,3	4,4	4,6	4,7	4,7	4,8	4,8	*1,4*
LT	4,5	4,6	4,8	5,1	5,5	5,7	6,0	6,2	6,4	6,5	6,6	6,6	*2,2*
LU	5,8	6,1	6,5	7,0	7,5	8,0	8,3	8,5	8,7	8,8	8,8	8,9	*3,1*
HU	5,8	6,0	6,5	7,0	7,5	7,9	8,3	8,6	8,8	9,0	9,2	9,3	*3,5*
MT	4,7	5,1	5,9	6,6	7,4	8,1	8,8	9,3	9,6	9,9	10,3	10,7	*6,0*
NL	4,8	5,1	5,7	6,3	6,8	7,2	7,5	7,6	7,7	7,7	7,8	7,8	*2,9*
AT	6,5	6,9	7,6	8,3	9,0	9,5	10,0	10,3	10,5	10,6	10,6	10,7	*4,2*
PL	4,0	4,2	4,5	4,9	5,2	5,5	5,8	5,9	6,1	6,2	6,3	6,4	*2,4*
PT	7,2	7,7	8,4	9,1	9,7	10,3	10,8	11,1	11,4	11,7	11,9	12,1	*4,9*
RO	3,5	3,6	3,8	4,0	4,3	4,6	4,9	5,1	5,3	5,4	5,6	5,7	*2,2*
SI	6,6	6,9	7,5	8,1	8,7	9,3	9,8	10,1	10,3	10,4	10,5	10,6	*4,0*
SK	5,0	5,1	5,5	6,0	6,5	7,0	7,4	7,7	8,0	8,2	8,4	8,4	*3,5*
FI	5,5	5,8	6,5	7,1	7,7	8,2	8,5	8,6	8,7	8,7	8,7	8,8	*3,3*
SE	7,2	7,6	8,2	8,8	9,4	9,8	10,1	10,2	10,3	10,4	10,5	10,5	*3,3*
UK	7,5	8,0	8,7	9,4	10,0	10,7	11,2	11,6	11,8	12,1	12,3	12,5	*5,0*
NO	5,6	6,0	6,6	7,3	7,9	8,5	8,9	9,1	9,3	9,4	9,5	9,6	*3,9*
EU27	*6,7*	*7,1*	*7,8*	*8,4*	*9,0*	*9,5*	*10,0*	*10,3*	*10,5*	*10,6*	*10,8*	*10,8*	*4,1*
EU15	*6,9*	*7,3*	*8,0*	*8,7*	*9,3*	*9,8*	*10,3*	*10,6*	*10,8*	*10,9*	*11,0*	*11,1*	*4,2*
EU12	*4,7*	*4,8*	*5,2*	*5,6*	*6,0*	*6,3*	*6,6*	*6,8*	*7,0*	*7,2*	*7,3*	*7,5*	*2,8*

Source: European Commission and Economic Policy Committee (2009)

Table 20 Technology scenario (convergence by 2060) : projected spending on health care as % of GDP

	2007	2010	2015	2020	2025	2030	2035	2040	2045	2050	2055	2060	*Change 2007-2060*
BE	7,6	8,1	8,8	9,7	10,5	11,4	12,2	12,9	13,4	13,8	14,0	14,1	*6,5*
BG	4,7	4,8	5,1	5,4	5,7	6,1	6,5	6,8	7,1	7,4	7,5	7,5	*2,8*
CZ	6,2	6,5	7,1	7,7	8,5	9,3	10,0	10,7	11,3	11,8	12,2	12,4	*6,2*
DK	5,9	6,3	7,0	7,8	8,5	9,2	9,8	10,2	10,6	10,9	11,0	11,1	*5,2*
DE	7,4	7,9	8,8	9,7	10,6	11,6	12,5	13,3	13,9	14,4	14,6	14,6	*7,2*
EE	4,9	5,0	5,4	5,7	6,1	6,5	6,9	7,4	7,8	8,1	8,4	8,6	*3,6*
IE	5,8	6,2	6,7	7,4	8,0	8,8	9,5	10,2	10,8	11,4	11,8	12,1	*6,3*
GR	5,0	5,2	5,7	6,2	6,7	7,3	7,9	8,5	8,9	9,3	9,5	9,6	*4,7*
ES	5,5	5,9	6,4	7,0	7,6	8,3	9,1	9,8	10,4	10,9	11,1	11,2	*5,6*
FR	8,1	8,7	9,5	10,4	11,3	12,2	13,0	13,7	14,2	14,6	14,8	14,9	*6,8*
IT	5,9	6,3	6,9	7,5	8,2	8,9	9,6	10,2	10,7	11,0	11,1	11,1	*5,3*
CY	2,7	2,9	3,2	3,4	3,7	4,0	4,3	4,6	4,9	5,1	5,3	5,4	*2,7*
LV	3,5	3,5	3,7	3,9	4,2	4,5	4,8	5,1	5,3	5,5	5,6	5,7	*2,3*
LT	4,5	4,6	4,8	5,2	5,6	6,0	6,5	6,9	7,3	7,6	7,8	7,9	*3,4*
LU	5,8	6,1	6,5	7,1	7,8	8,4	9,1	9,6	10,0	10,3	10,5	10,6	*4,8*
HU	5,8	6,0	6,5	7,0	7,7	8,3	8,9	9,5	10,0	10,4	10,8	11,0	*5,2*
MT	4,7	5,2	5,9	6,7	7,6	8,6	9,6	10,4	11,1	11,7	12,2	12,8	*8,1*
NL	4,8	5,1	5,7	6,4	7,0	7,6	8,2	8,6	8,9	9,2	9,3	9,3	*4,5*
AT	6,5	6,9	7,7	8,5	9,3	10,1	10,9	11,6	12,2	12,6	12,7	12,8	*6,3*
PL	4,0	4,2	4,5	4,9	5,3	5,8	6,2	6,6	7,0	7,3	7,5	7,6	*3,6*
PT	7,2	7,7	8,5	9,3	10,1	10,9	11,6	12,4	13,1	13,6	14,1	14,3	*7,1*
RO	3,5	3,6	3,8	4,1	4,4	4,8	5,2	5,6	6,0	6,3	6,5	6,7	*3,2*
SI	6,6	6,9	7,6	8,2	9,0	9,8	10,6	11,3	11,9	12,3	12,6	12,7	*6,1*
SK	5,0	5,1	5,5	6,1	6,7	7,3	7,9	8,5	9,1	9,6	9,9	10,0	*5,1*
FI	5,5	5,9	6,5	7,2	7,9	8,6	9,2	9,7	10,0	10,3	10,4	10,5	*5,0*
SE	7,2	7,6	8,3	9,0	9,7	10,4	11,0	11,5	11,9	12,2	12,5	12,6	*5,4*
UK	7,5	8,0	8,8	9,5	10,4	11,3	12,2	13,0	13,6	14,2	14,6	14,9	*7,4*
NO	5,6	6,0	6,6	7,4	8,2	9,0	9,7	10,3	10,8	11,1	11,4	11,5	*5,8*
EU27	*6,7*	*7,1*	*7,8*	*8,5*	*9,3*	*10,1*	*10,9*	*11,6*	*12,1*	*12,6*	*12,8*	*13,0*	*6,3*
EU15	*6,9*	*7,3*	*8,1*	*8,8*	*9,6*	*10,4*	*11,2*	*11,9*	*12,5*	*12,9*	*13,2*	*13,3*	*6,4*
EU12	*4,7*	*4,8*	*5,2*	*5,6*	*6,1*	*6,6*	*7,1*	*7,6*	*8,0*	*8,4*	*8,7*	*8,9*	*4,2*

Source: European Commission and Economic Policy Committee (2009)

Table 21 Reference scenario : projected spending on health care as % of GDP

	2007	2010	2015	2020	2025	2030	2035	2040	2045	2050	2055	2060	*Change 2007-2060*
BE	7,6	7,7	7,9	8,1	8,2	8,4	8,6	8,7	8,8	8,8	8,8	8,8	*1,2*
BG	4,7	4,8	4,9	5,0	5,0	5,1	5,3	5,4	5,4	5,5	5,5	5,4	*0,7*
CZ	6,2	6,4	6,7	6,9	7,1	7,4	7,6	7,8	8,0	8,1	8,3	8,4	*2,2*
DK	5,9	6,0	6,2	6,4	6,6	6,7	6,8	6,8	6,9	6,9	6,9	6,9	*1,0*
DE	7,4	7,6	7,9	8,1	8,3	8,5	8,8	9,0	9,2	9,2	9,2	9,2	*1,8*
EE	4,9	5,1	5,2	5,3	5,4	5,5	5,6	5,8	5,9	6,0	6,1	6,1	*1,2*
IE	5,8	5,9	6,0	6,1	6,3	6,5	6,7	6,9	7,1	7,3	7,5	7,6	*1,8*
EL	5,0	5,1	5,3	5,4	5,5	5,7	5,9	6,0	6,2	6,3	6,3	6,4	*1,4*
ES	5,5	5,6	5,7	5,9	6,1	6,3	6,6	6,8	7,0	7,1	7,2	7,2	*1,6*
FR	8,1	8,2	8,4	8,6	8,7	8,9	9,1	9,2	9,3	9,3	9,4	9,4	*1,2*
IT	5,9	5,9	6,1	6,2	6,4	6,5	6,7	6,9	7,0	7,0	7,0	6,9	*1,1*
CY	2,7	2,8	2,8	2,9	2,9	3,0	3,1	3,1	3,2	3,2	3,3	3,3	*0,6*
LV	3,5	3,5	3,6	3,7	3,7	3,8	3,9	3,9	4,0	4,0	4,1	4,1	*0,6*
LT	4,5	4,6	4,7	4,9	5,0	5,1	5,2	5,3	5,4	5,5	5,6	5,6	*1,1*
LU	5,8	5,9	6,1	6,2	6,4	6,5	6,7	6,8	6,9	7,0	7,0	7,0	*1,2*
HU	5,8	5,8	5,9	6,0	6,2	6,4	6,5	6,7	6,8	6,9	7,0	7,0	*1,3*
MT	4,7	4,9	5,3	5,6	6,0	6,4	6,9	7,2	7,4	7,6	7,7	8,0	*3,3*
NL	4,8	4,9	5,1	5,3	5,4	5,6	5,7	5,8	5,8	5,9	5,8	5,8	*1,0*
AT	6,5	6,6	6,8	7,0	7,2	7,4	7,6	7,8	8,0	8,1	8,0	8,0	*1,5*
PL	4,0	4,1	4,3	4,4	4,5	4,6	4,7	4,8	4,9	4,9	5,0	5,0	*1,0*
PT	7,2	7,3	7,5	7,6	7,8	8,0	8,3	8,5	8,7	8,9	9,0	9,1	*1,9*
RO	3,5	3,6	3,7	3,8	3,9	4,1	4,3	4,4	4,6	4,7	4,8	4,9	*1,4*
SI	6,6	6,8	7,1	7,3	7,5	7,8	8,0	8,2	8,3	8,4	8,5	8,5	*1,9*
SK	5,0	5,2	5,4	5,7	6,0	6,2	6,5	6,7	6,9	7,1	7,2	7,2	*2,3*
FI	5,5	5,6	5,8	6,0	6,1	6,3	6,4	6,5	6,5	6,5	6,4	6,5	*1,0*
SE	7,2	7,3	7,4	7,5	7,6	7,7	7,8	7,9	7,9	8,0	8,0	8,0	*0,8*
UK	7,5	7,6	7,8	8,0	8,1	8,4	8,7	8,9	9,1	9,2	9,3	9,4	*1,9*
NO	5,6	5,7	5,8	6,0	6,2	6,5	6,6	6,8	6,9	6,9	7,0	7,0	*1,3*
EU27	*6,7*	*6,8*	*6,9*	*7,1*	*7,2*	*7,4*	*7,7*	*7,9*	*8,1*	*8,2*	*8,4*	*8,4*	*1,7*
EU15	*6,9*	*7,0*	*7,2*	*7,3*	*7,5*	*7,7*	*7,9*	*8,1*	*8,3*	*8,4*	*8,4*	*8,5*	*1,6*
EU12	*4,7*	*4,8*	*4,9*	*5,1*	*5,2*	*5,4*	*5,5*	*5,7*	*5,8*	*5,9*	*6,0*	*6,0*	*1,4*

Source: European Commission and Economic Policy Committee (2009)