BIO-DEMOGRAPHIC ASPECTS OF POPULATION AGEING

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BIO-DEMOGRAPHIC ASPECTS OF POPULATION AGEING

ENEPRI RESEARCH REPORT NO. 1/JUNE 2004

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1. Introduction

Ageing affects individuals and nations everywhere. But a precise definition of what ageing is cannot be provided easily with regard to health aspects, social conventions and lifestyles that are intertwined with the ageing process. As a first step, the AGIR project has attempted to describe this process in EU countries by observing as many dimensions as possible related to it.

Under Work Package 1 (WP1) of the AGIR project, teams were asked to produce comprehensive data on population, mortality, longevity, life-courses and morbidity for as many EU countries as possible and the WP1 leader team (FEDEA) was asked to summarise and elaborate on these data in various ways. Data has come mostly from national sources and from the European Community Household Panel (ECHP), but we have also used data from the Human Mortality Database (www.mortality.org). [1] Data has been arranged in a database in Excel format following the criteria explained below. It will be documented and made available once completely checked. The countries covered are Belgium, Denmark, Germany, Spain, Finland, France, Ireland (partially), Italy, Sweden and the United Kingdom.

The five areas in which WP1 data have been divided are:

- **Population** – that is, the longest possible time series of historical and projected population (2050) data at 31 December by year gender and age (0 to 100 or more); annual number of births by gender is also specified.

[*] J. A. Herce and Namkee Ahn are based at FEDEA while R. Gènova is based at the Instituto de Salud Carlos III in Madrid. Joaquín Pereira, also based at the Instituto de Salud Carlos III, died before seeing the final version of this report and we wish to dedicate the best of our efforts to his memory. The authors wish to thank all WP1-AGIR team members and Terkel Christiansen for providing the data upon which this comparative analysis is based as well as for their comments during discussions. Thanks are also due to J. Mortensen and R. Sauto at CEPS for their help and encouragement. Only the authors are responsible for any shortcomings remaining in this version of the report.

[1] Most of the data comes from the national statistical offices of the countries included in this study, although the AGIR teams have been responsible for gathering, documenting and manipulating the raw data. Where needed, these data has been completed with data from the Human Mortality Database of University of California, Berkeley (USA), and Max Planck Institute for Demographic Research (Germany) (available at www.mortality.org or www.humanmortality.de). Finally, data from the database *La conjoncture des pays développés en chiffres* of the Institut National d'Études Démographiques (available at http://www.ined.fr/bdd/demogr/#) has provided us with valuable data for all the countries included here.

- **Mortality** – mortality rates for the same years as previously noted, by gender, year of birth and age; complete life-tables are shown for both genders (survivors) for as many years (historical and projected) as possible.
- **Longevity** – are shown for the same years previously noted (projections where possible) with a series of longevity indicators by gender, including
  - life expectancy at birth, at age 65 and at age 80;
  - the record age (age of the oldest person who passed away in any given year);
  - median duration (age at which only 50% of a generation is still alive);
  - modal duration (age at which the largest number of theoretical mortalities occur); and
  - life endurance (age at which 90% of a generation has passed away).
- **Life-courses** – indicators about these, year by year and by gender, include (average) age at which schooling ends, age at first job, age at leaving the parental home/emancipation, age at forming a first household (by first marriage or other reasons), age at first childbirth, age at widowhood, age at invalidity, age at retirement, life expectancy at 65 and health- or disability-adjusted life expectancy at age 65.
- **Morbidity** – survey data on self-perceived health status and disability by age and gender has also been gathered.

Teams working on individual countries have produced a report on the data set available for these countries containing a detailed description of the data and a thorough elaboration of different indicators. Data have been made available to WP1 team leader (FEDEA).

European and other Western countries, which completed their major demographic transition of the modern era well before the middle of the 20th century, initiated almost without interruption a "second demographic transition" (van de Kaa, 1987) that has lasted for almost half a century. This second transition can be characterised by a sharp decline in fertility as a rapid change in lifestyles and family/work arrangements took place after the baby-boom after the Second World War. A pronounced population ageing trend is now on course in these nations so that the age structure of the population as well as any other indicators concerning basic individual and aggregate lifecycle landmarks display a dramatic change, which is most likely to continue in the coming decades. These trends, in turn, will trigger profound adaptation among individuals existing institutions, resulting in behavioural changes to cope with new challenges, risks and opportunities.

In this report we summarise and compare the demographic experience of ten EU countries since the mid-20th century on the basis of the detailed data gathered within the AGIR project of ENEPRI. Concerning demography, we are interested in population dynamics as defined by births and mortalities. We also deal in more detail with survival and longevity, as experienced in Europe in the last half century in order to ascertain whether an increase in the absolute limit to human life or, rather, the fact that more and more people reach extreme ages is what drives the current population ageing process.

Two other phenomena draw our interest when focusing on the circumstances among which ageing is taking place at present. On the one hand, there is the fact that typical life-courses in Western countries are witnessing seemingly contradictory developments concerning, for instance, life duration and early retirement or other lifecycle landmarks. On the other hand, and most importantly, there is the issue of how healthy and/or disability-free people live extra years as life expectancy increases.

All these areas (populations, mortality, longevity, life-courses and morbidity) are extremely intertwined and their interactions happen within a context of uninterrupted economic and technological advancement with which the former also interact. Our aim thus is to identify, out of the abundant data on the areas just mentioned, those facts, patterns and trends that better characterise the demographic process of Western Europe during the last half century.

We have organised this report into three major sections, after a short discussion on the bio-demographic aspects of ageing: demography (section 3), life-courses (section 4) and morbidity (section 5). These sections help to organise the summary description of our database and the discussion of the major findings and its comparative dimension. A final section 6 tries to tentatively answer some of the questions raised by merely putting together part of the data we have collected from separate sources. These questions can be summarised into three very relevant ones indeed: What does living longer mean? Is living longer and working less mutually compatible? Does living longer mean living better? It turns out, ironically, that how we define ageing depends on the answers we may give to these questions.[2]

2. Bio-demographic aspects of ageing

We are interested in bio-demography in as much as some of its definitions and methods provide insight for the prospective analysis of the economic consequences of ageing, namely, health and pensions expenditure and retirement decisions. We want in particular to explore the fact that individuals live longer and possibly in better health in order to, on the one hand, ascertain the prospects for longer active lives and, on the other, to push the arguments in favour of policies influencing balanced work/retirement decisions, renewed public programmes and pro-health related behaviours in Europe. Past developments, of course, are also of primary interest for us.

This section is thus devoted to a very general discussion of the issues that recent bio-demographic research has brought to the forefront. We do not restrict ourselves to those aspects immediately related to our objective under WP1. On the contrary, we think that a wider perspective will help us to draw a broader and more useful picture of the implications of present demographic trends for the labour market or the welfare state.

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[2] The word 'ageing' will be used throughout most of this report with its standard meaning concerning the increased average age of a given population, or of its aged-persons ratio computed at around age 65. Ageing, however, can be defined on the basis of a given general health and ability status of a representative individual, which would result in a completely different picture. Further content is given to this critical concept in the next section.

Longevity and the limit to life

As a result of continuous developments in public health, medical technology and care delivery protocols, individuals, on average, live longer and in better health. These developments, per se, would not raise the observed limit of human lives, but are actually allowing more and more individuals to approach this limit and yet we can count the number of those that have reached 120 years by the fingers of our hands, no one so far, since records have been kept, having lived longer than 122 years (and 164 days, Jeanne Calment, a French woman who in passed away in 1997). Whether genetic science developments would allow a significant portion of individuals to live longer than that limit is still a matter of discussion, but for some scholars the knowledge and the technology needed for that is already there. A matter of discussion is also whether a limit exists at all for human life. As for the present state of art on this issue, rather than an indefinite limit there would be an indeterminate or, simply said, unknown limit (Carey and Judge, 2001). Further increases of life expectancy depend mostly of lower mortality at very old ages (Vaupel, 2001).

Different terms bear strong relationship with the term longevity, in particular the terms 'mortality' and 'senescence'. Mortality is the portion of individuals of age x that die before reaching age x+1. For Carey and Judge, "senescence is a product of natural selection in its competition between survival and reproduction" (Carey and Judge, 2001, p. 16) and accounts for the fact that mortality rates are related to (increase with) age. Evidence, even if scattered, of lower mortality rates at older ages, among not only insects but also among humans, puts into question the conventional definition of senescence and leads one to think that there is no limit to the human life.

Longevity, finally, is the time span that separates birth and mortality of a given individual. It is currently measured through different indicators: i) life expectancy at birth, or after 30 days or at other ages; ii) life endurance, or age at which 90% of individuals in a given cohort have deceased, or median duration, if 50% limit is taken; iii) modal life duration, or age of the modal frequency in the distribution of mortalities in a given year; and iv) maximum duration of life, or record age; etc. These different measures of longevity, however, do not always move in the same direction. Life expectancy is currently preferred.

Human longevity has many determinants and, to a certain extent, is influenced by evolution (Carey and Judge, 2001). Leaving aside biological and physiological determinants of longevity, three groups of factors immediately determine longevity: i) socio-economic factors (income, education), ii) physical fitness, sport and nutrition, and iii) alcohol and smoking. In addition, there seems to be a positive feed-back of higher longevity. As for genetically determined or hereditary longevity, fathers' age at conception is negatively correlated with daughters' longevity and fathers' longevity has a non linear positive relationship with children's longevity (Gavrilov and Gavrilova, 2001), but a general hereditary pattern of longevity does not clearly emerges from the literature or, if at all, this literature shows a rather weak case for it (Carey and Judge, 2001). Among other 'established facts', that of females living longer than males has been shown not to be necessarily always the case (insects or humans centuries ago).

Increases in longevity, however measured, are the norm everywhere. Centenarians accounted for five in every million in 1960 in developed countries, and for 50 per million in 1990 (Kannisto, 1994). Since 1950, one can actually speak of an “explosion of centenarians”, particularly females. Higher longevity would rather be owing to compression of morbidity (rectangularisation of the survival curves) (Robine, 2001) at older ages than to an extension of the absolute limit of life. Local concentration of life duration around an old age (increasing with time) is also compatible with an increasing age of modal mortality as a result of a less-perceptible compression of morbidity. The issue here is to show clearly that greater longevity correlates with the concentration of the distribution of life duration around certain ages It seems that after removing certain causes of mortality from the data that concentration does not occur – individuals simply live longer owing to an overall improvement in morbidity.

Morbidity

Morbidity is a term difficult to define with precision as it tries to capture the many dimensions of sickness (illness, disability, handicap and other states of ill-health either physical, social or mental) (Murray and Chen, 1992). Given that continuous change in policies, medical research and practice, public health and other factors produce simultaneous changes in morbidity and mortality, advances in those fields should lead to less morbidity and to lover overall mortality. However, changing self-perceptions of morbidity by individuals or better measurements in observed morbidity have produced divergent evolutions in morbidity and mortality through time leading some scholars to characterise cases of increases in morbidity as statistical artefacts.

On the other hand, the difficulty of disentangling the factors and biases behind the observed co-movements in morbidity (either perceived or observed) and mortality makes even more difficult to properly characterise ‘health transitions’ which without doubt have occurred in the past decades in both developed and developing countries. The nature of these health transitions is thus still unclear (Murray and Chen, 1992). Note that research on “epidemiologic transitions” (Omran, 1971) can produce rather clear-cut answers as for the varying causes of death at different ages with time, while research on “health transitions” (Murray and Chen, 1992) faces the much more challenging task of explaining changes in such an elusive concept as morbidity. In the words of Murray and Chen (1992), “Health transition is a ... concept ... meant to capture the changing pattern of morbidity and mortality, the socioeconomic determinants of such change, and the response of the health care system”.

As we cannot dismiss every case of increased morbidity (self-assessed or diagnosed) as a mere artefact owing to the fact that people are either more aware of their health status or are better diagnosed about it, we should accept that it is actually possible to live longer and have poorer health although the conventional wisdom states that individuals are, almost everywhere, living longer and better from a wide health perspective (lower or improved morbidity).

Life-courses

As mortality declines and life expectancies at different ages increase, many other aspects of individual and collective life are affected by that. Changes in the duration, organisation and quality of life-courses have important implications for the labour market and the welfare state, for instance, increasing the capacity of individuals to a better performance in the labour market when adults or reducing their overall dependency upon the pension or health systems when they are older.

Life-courses, from an economical point of view, may be coarsely divided into three phases: i) childhood and education, ii) active life in the labour market and iii) retirement. Of course, many other landmarks of an individual life (forming a household, parenthood, etc.) are relevant for interdisciplinary research, and we also note that even a significant proportion of individuals never transit through the labour market, but these three phases could capture these features adequately if we adopt proper conventions. Thus, for most individuals, one can locate the episodes forming an independent household for the first time and having a first child at the transition between phases i) and ii). One could equally adopt a household perspective to cope with the fact that some of its members do not work at all, etc. Average ages for this transition, as we shall see, have been steadily increasing in the last few decades in developed countries.

Morbidity considerations, on the other hand, have historically set the transition age between phases (ii) and (iii) at 60 to 65 years, and have even given rise to the welfare state, more than one hundred years ago. At present, after a process of declining morbidity in the last decades, these considerations do not determine any more retirement ages that otherwise should be increasing. However, declining morbidity at pre and post-retirement ages opens a new window of opportunities both for individuals and for the welfare state. On the other hand, morbidity at older ages, of a type rarely experienced in the past, pose new problems for the health system.

Disability-free life expectancy

Once some form of morbidity is taken into account the analysis of how individuals perform the different tasks associated to different phases of their entire life-courses takes on different perspectives, disciplines other than demography (sociology, psychology and economics in particular) may greatly benefit from an interdisciplinary approach.

Disability adjusted life expectancy (DALE) indices provide, among other purposes, a convenient way to combine morbidity and mortality measures into a single measure (Sullivan, 1971). Of course, morbidity is defined here in a limited way as there are many concepts of health that could be used to define a correspondingly large set of adjusted life expectancies (Robine et al, 1999 and 2001). Section 5 is devoted to a detailed discussion of this point.

Health evolution: What is an 'old' person?

One is old because he or she expects to live longer or because approaches old age? What is old age? Was being 65 in 1900 the same as being 65 in 2000? Of course not. But then, what is ageing?

From an aggregated point of view, ageing is taken to consist in an increase of the aged dependency ratio, that is, the ratio of the number of persons aged 65 and more to the number of persons aged between 15 and 64. There are many reasons to stick to this simple ratio as an indicator of ageing of a given population. To start with, 65 is the legal retirement age in most social security schemes and also the upper limit to the statistical definition of working age population. This age has been used as a dividing criterion for more than one hundred years when hardly 25% of a representative generation reached that age and not precisely in a healthy state. Today almost 90% of a generation would pass that threshold showing a much better health.

From an individual perspective, however, age cannot be treated apart from health status when it comes to the characterisation of ageing. Institutional arrangements classify individuals as aged persons once they reach, say, 65, which makes them eligible for benefits in cash or in kind from the welfare state. And yet overall health and activity status of different persons at that same age can vary enormously.

On average, long-term health evolutions imply that ageing is, on effective terms, a much slower process than implied by simply fixing the dividing age at any particular level. However, finding a proper definition of what is effective ageing is not easy.

3. Demographic trends in the EU since 1950

Western populations, as it is well known, have experienced a considerable change in the last half century. In EU countries, with few exceptions, population has not ceased to increase albeit at lower and lower rates because of the resulting effect of two compensating driving forces, that is, fewer births and increased life years. To this balance, immigration has been contributing on the plus side in most countries. Of course, each country has experienced different population dynamics, basically owing to different timing in their baby-booms and intensity of immigration flows, but all of them are now witnessing a considerable 'ageing' of their populations – a process that will change to higher gears in the coming decades.

3.1 Population

Table 1 shows population figures (first column) and derived population indicators for ten EU countries and selected years 1950, 1975 and 2000. It can be seen that population growth has diminished everywhere although countries such as France or the United Kingdom have succeeded in keeping a relatively high population growth through sustained fertility and immigration whereas Spain has most recently experienced high immigration flows and Ireland has both kept high fertility and reversed migration flows.

Although in a typical year, everywhere, more boys are born than girls, the different mortality probabilities that affect each group cause that with few exceptions the gender balance in a given population tips towards the female side. This is apparent in Table 1 (third column) in the four largest countries of the EU, although Nordic countries and Ireland have kept in the last decades a closer balance among genders that has been nevertheless tipping recently towards the more standard female bias (Figure 3).

Table 1. Population indicators for (selected) EU countries 1950-2000

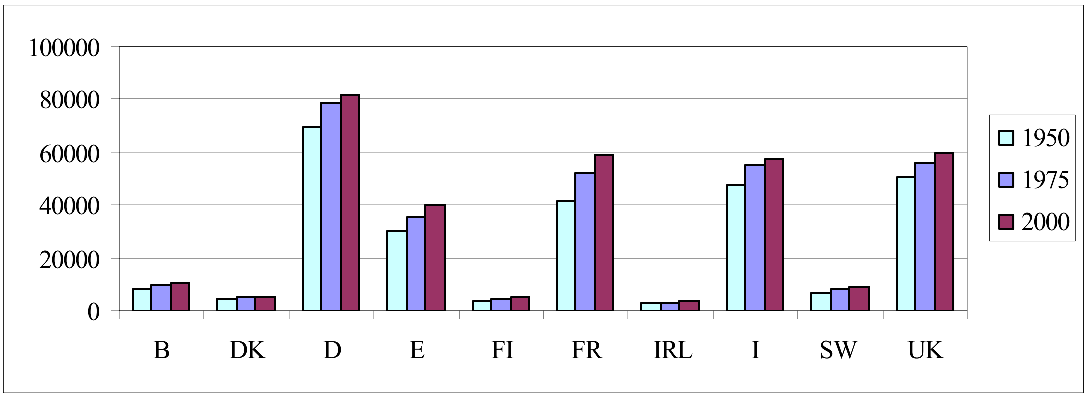
	Year	Total population (a)	Annual Population growth (%)	Females to males ratio	Support ratio (b)	Aged Ratio (c)	Average age
Belgium	1950	8,645	0.30	1.033	6.10	11.12	35.45
	1975	9,807	0.24	1.043	4.59	13.96	35.82
	2000	10,263	0.24	1.045	3.89	16.85	39.30
Denmark	1950	4,252	0.96	1.016	7.24	8.96	32.54
	1975	5,055	0.38	1.019	4.83	13.26	35.40
	2000	5,368	0.36	1.023	4.50	14.83	38.76
Germany	1950	69,346	0.63	1.170	6.90	9.73	34.64
	1975	78,465	-0.53	1.109	4.26	14.97	36.56
	2000	82,038	-0.15	1.054	4.17	16.32	40.36
Spain	1950	30,583					
	1975	35,813	1.11	1.044	5.91	10.52	32.68
	2000	40,122	0.98	1.043	4.04	16.93	39.35
Finland	1950	3,986	1.31	0.988	9.61	6.64	29.74
	1975	4,720	0.22	0.974	6.26	10.77	33.95
	2000	5,181	0.19	1.007	4.46	15.00	38.88
France	1950	41,614	0.87	1.081	5.83	11.36	34.81
	1975	52,606	0.55	1.041	4.67	13.40	34.52
	2000	58,754	0.41	1.054	4.18	15.61	37.79
Ireland	1950	2,961	-0.31	0.965			
	1975	2,978	8.21	0.991	5.20	11.08	31.67
	2000	3,787	1.51	1.014	5.99	11.16	34.54
Italy	1950	47,516	0.53	1.043	8.01	8.20	31.48
	1975	55,293	0.66	1.047	5.34	11.93	34.50
	2000	57,680	0.12	1.060	3.76	17.97	40.86
Sweden	1950	6,978	0.91	1.009	6.58	10.14	34.36
	1975	8,193	0.39	1.011	4.10	15.69	37.74
	2000	8,872	0.16	1.023	3.64	17.71	40.26
United Kingdom	1950	50,490	0.70	1.083	6.13	10.93	35.19
	1975	56,231	-0.01	1.056	4.44	14.13	35.97
	2000	59,756	0.43	1.028	4.20	15.59	38.32

(a) As of 31 December, in thousands
(b) Number of persons of between 15 and 64 years of age per person of 65 or more.
(c) Number of persons of 65 or more per 100 persons of any age.
Note. Data in this table come from the following sources: national statistical offices (provided by the AGIR-WP1 teams), INED (www.ined.fr/bdd/demogr/) and the *Human Mortality Database* [University of California, Berkeley (US) and Max Planck Institute for Demographic Research (Germany). Available at www.mortality.org or www.humanmortality.de (data downloaded on May 2003)].

As for total population, Figure 1 shows more eloquently how in general population size has been growing less rapidly since 1975 after when the oil crisis almost stopped migration flows and fertility started to decline dramatically. More recently, many

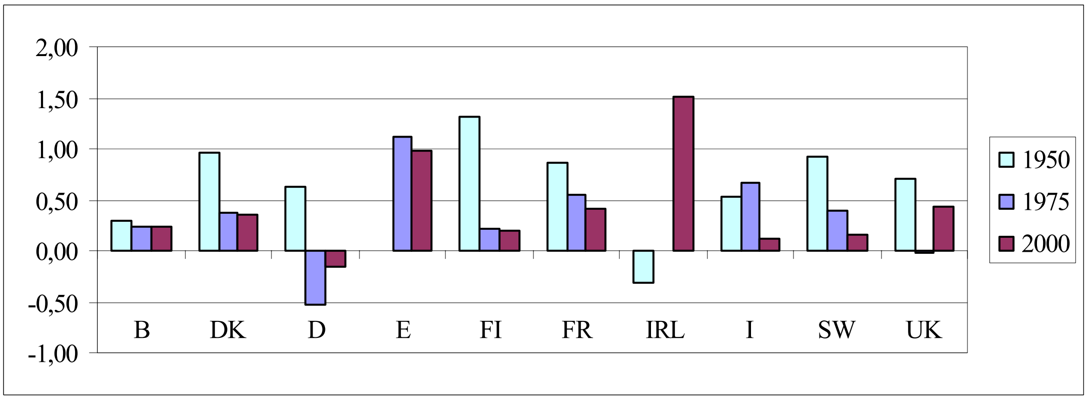
European Union countries have been experiencing intense immigration flows, which has resulted in a stimulus to population growth, as can be seen in Figure 2.

Figure 1. Total population of (selected) EU countries 1950-2000 (as of 31 December, x1000)



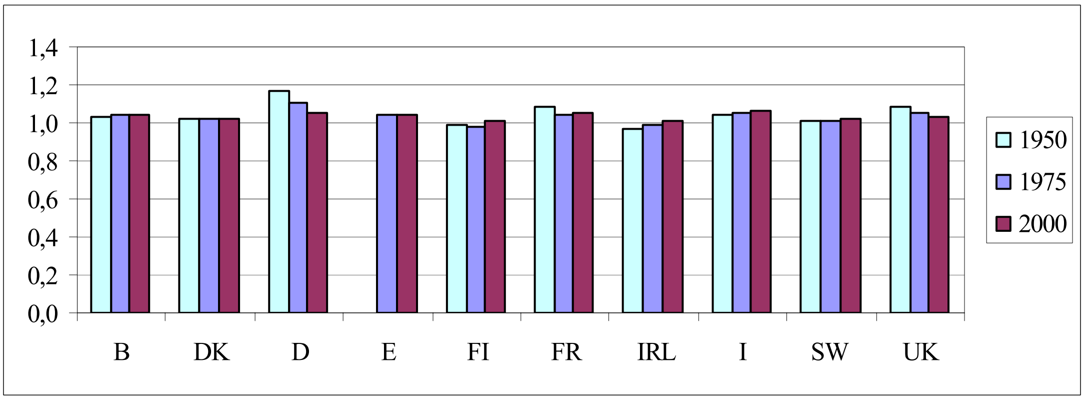
Source: Table 1.

Figure 2. Population growth of (selected) EU countries 1950-2000 (in %)



Source: Table 1.

Figure 3. Females to males ratio in (selected) EU countries 1950-2000



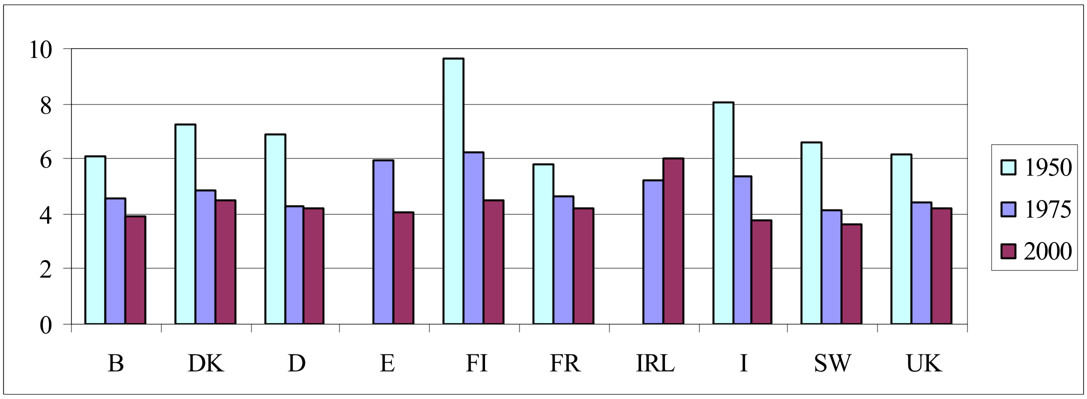
Source: Table 1.

The dynamics of total population hides, however, the dramatic developments that have been the norm in EU countries concerning the age structure of the population. Table 1 (columns fourth to sixth) shows three of these indicators: the 'support ratio', which is the inverse of the aged dependency ratio, the 'aged (persons) ratio' and the average age of the population.[3]

Two different trends can be observed around these indicators, which are also pictured separately in Figures 4 to 6.

Support ratios diminished appreciably everywhere between 1950 and 1975. That is, the number of persons of working age to those aged 65 or more fell from six to between four and five, and fell again between 1975 and 2000 to around four. In countries such as Belgium, Sweden and Italy this ratio is now well below four, whereas in Ireland it has increased to a very high level of six.

Figure 4. Support ratio in (selected) EU countries 1950-2000

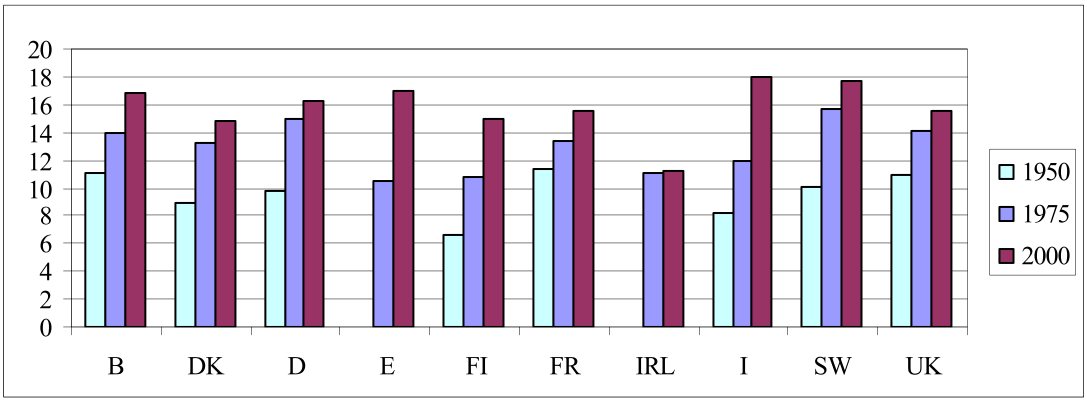


Source: Table 1 (see Table 1 also for definition).

Ageing however, has advanced in a different and more mixed fashion as can be seen in Figure 5. With the exception of Ireland, the share of persons aged 65 and more in total population has doubled from around eight (with a large variance, however) in 1950 till now. This development has been more rapid in the 1960s and 1970s than afterwards in Denmark, Germany, Sweden or the United Kingdom whereas in the rest of the countries considered the pace has been more regular and particularly intense during the last 25 years in Italy or Spain. Ireland has hardly experienced that kind of ageing in the recent decades.

[3] See notes to Table 1 for definitions.

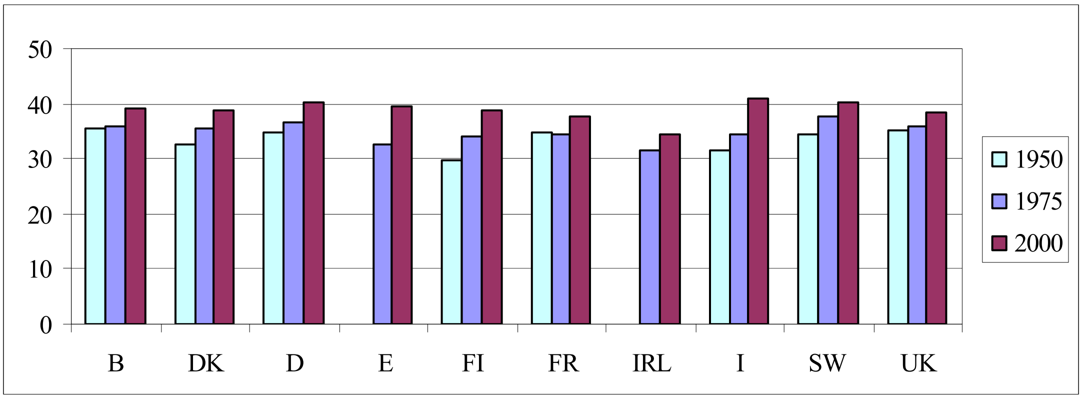
Figure 5. Aged ratio in (selected) EU countries 1950-2000 (in %)



Source: Table 1 (see Table 1 also for definition).

When we define ageing through average age of the population, we observe that it has been happening particularly since 1975. In 1950, average age of the population in most countries stayed around 33.5 years, increased to almost 35 years in 1975 and more than doubled this increase in the period 1975-2000 to reach at almost 39 years observed at present. This is probably the single best indicator of how a given population ages through time in the sense expressed before that ageing is just getting older in terms of pure age.

Figure 6. Average age of the population in (selected) EU countries 1950-2000



Source: Table 1.

Whereas age ratios may have a more complex dynamics depending on the cutting age at which the line is drawn, average age computations give every age the corresponding cohort weight and thus captures in a continuous fashion the passage of generations of different age. We will come back later to this point when discussing population projections.

3.2 Births and fertility

Setting apart migrations, which we are not considering in this report, births and mortalities determine the natural movement of populations. Both developments have suffered dramatic changes in EU countries since 1950.

Clearly, the demographic transition that Western countries initiated in the first half of the 20^{th} century has been unparalleled by the developments since 1950, but what has been different is the fact that fertility rates fell below replacement levels around 1970. This development holds the key to the aggregate population ageing process that will accelerate in the near decades in European Union countries, although unexpected changes in mortality will undoubtedly continue to affect ageing in the longer term.

Table 2 shows the absolute numbers of births and derived indicators for our ten EU countries in 1950, 1975 and 2000. Most countries initiated their baby-booms just after World War II and finished them around 1970 (first column). Almost in every country male births exceeded female ones by about 5.5% and the evidence shows that this fact is became an even stronger profile in a majority of countries (third column, and Figure 9).

Birth rates suffered in that period most of their decline and nearly stabilised afterwards (second column). Fertility rates, correspondingly, also fell below the replacement level around 1970 (fourth column).

Figure 7 allows a closer look with regard to differences between countries. Of course, the absolute numbers of births tell us immediately about 'large' and 'small' countries in the European Union in terms of population, but above all tell us about the timing of the birth-booms in every country.

Belgium Germany, Finland, France and the United Kingdom had ended their booms well before 1975 keeping afterwards stable number of total births. Spain initiated its baby-boom in the mid-1960s and ended it after 1975 to start a fast decline in fertility, which almost halved the size of new born cohorts in less than 20 years. Italy too has followed a similar pattern of recent decline in fertility although joined the European Union baby-boom just described much earlier. Two groups of fertility transitions can thus be discerned: fertility drops before 1975 in every country but in Italy, Spain and Ireland.

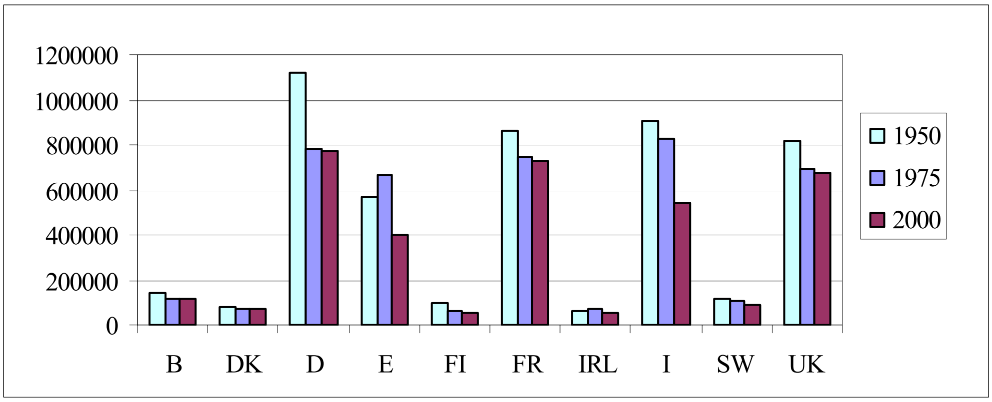
Table 2. Births and fertility indicators for (selected) EU countries 1950-2000

	Year	**Births**	**Birth rate (a)**	**Males to females ratio**	**Fertility rate**
Belgium	1950	145,672	16.85	1.055	2.34
	1975	119,693	12.20	1.059	1.74
	2000	114,883	11.19	1.048	1.66
Denmark	1950	79,558	18.71	1.049	2.57
	1975	72,071	14.26	1.044	1.92
	2000	67,081	12.59	1.055	1.77
Germany	1950	1,116,701	16.10	1.074	2.1
	1975	782,310	9.97	1.061	1.48
	2000	770,744	9.38	1.058	1.36
Spain	1950	565,378	20.11	1.055	2.48
	1975	669,378	18.69	1.072	2.80
	2000	397,632	9.91	1.071	1.24
Finland	1950	98,065	24.60	1.055	3.16
	1975	65,719	13.92	1.060	1.68
	2000	56,742	10.95	1.064	1.73
France	1950	862,310	20.60	1.051	2.93
	1975	745,065	14.10	1.051	1.93
	2000	726,768	13.20	1.055	1.89
Ireland	1950	63,565	21.4		3.41
	1975	67,178	21.7		3.43
	2000	54,239	14.4		1.89
Italy	1950	908,622	18.12	1.058	2.5
	1975	827,852	14.97	1.061	2.17
	2000	538,999	9.34	1.064	1.23
Sweden	1950	115,414	16.5	1.070	2.28
	1975	103,632	12.65	1.057	1.77
	2000	90,441	10.19	1.064	1.54
United Kingdom	1950	818421	16.2	1.062	
	1975	697,518	12.40	1.062	1.81
	2000	679,029	11.4	1.053	1.65

(a) Number of births per 1000 population

Note. Data in this table come from the following sources: national statistical offices (provided by the AGIR-WP1 Teams), INED (http://www.ined.fr/bdd/demogr/) and the *Human Mortality Database* [University of California, Berkeley (USA) and Max Planck Institute for Demographic Research (Germany). Available at www.mortality.org or www.humanmortality.de (data downloaded on May 2003)].

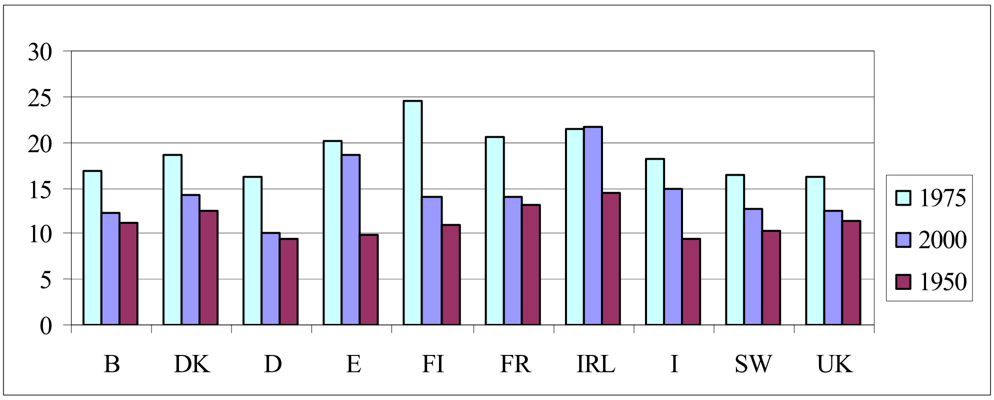
Figure 7. Total births in (selected) EU countries 1950-2000



Source: Table 2.

Around 1950, birth rates were well above 15 births per thousand inhabitants with countries such as Spain, Finland, France and Ireland above the level of 20. Fifty years later, birth rates in most countries stand around ten per thousand with the exception of France and Ireland, which are closer to 15 rather. Again, in most countries, the larger part of this development happened before 1975 except in Spain, Ireland and Italy, where it took place mostly in recent decades.

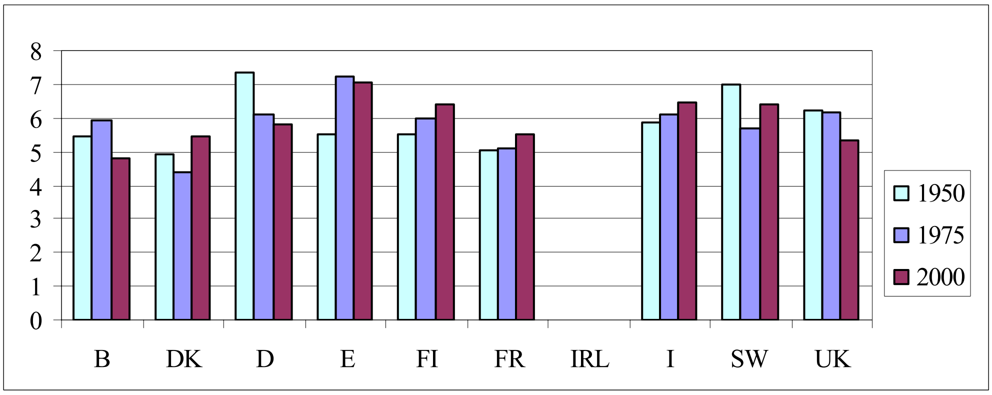
Figure 8. Birth rate in (selected) EU countries 1950-2000



Source: Table 2 (see also Table for definition).

Everywhere male births exceed female ones by between 5% and 7%, despite the fact that within the whole population women are more numerous than men owing to gender related mortality risks. Although not everywhere, this gap has been growing steadily in the last 50 years. The exceptions, among the countries considered, are Belgium, Germany, Sweden and the United Kingdom (Figure 9).

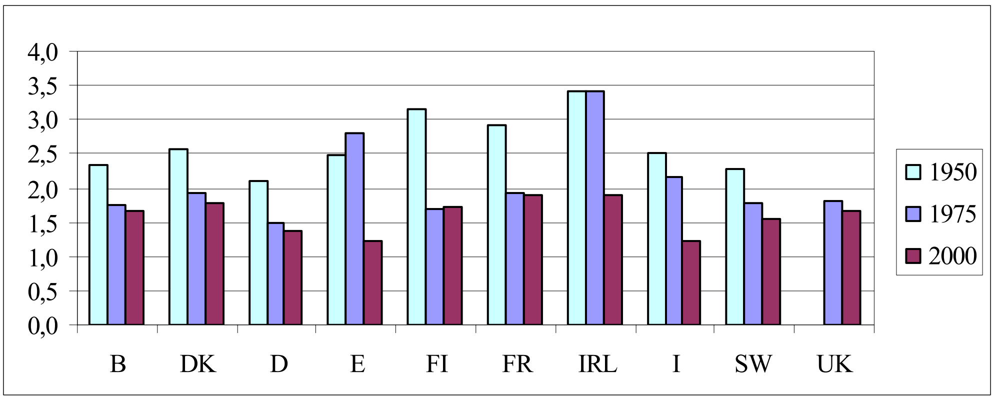
Figure 9. Male vs. female births in (selected) EU countries 1950-2000 (in %)



Source: Table 2.

The sharpest differences however can be seen when comparing fertility ratios. Again, in almost every country the fertility ratios fell from an (unweighted) average level of 2.5 in 1950 to 2.0 in 1975 (just below the replacement level) to 1.6 in 2000. What seems a steady decline however hides the fact that countries such as Spain and Ireland kept or even increased their fertility rates all through the 1950-1975 period while the rest actually decreased their fertility rates rapidly in the same period. In Spain and Italy, the fertility rate bottomed at nearly one child per woman during the 1990s. Again, the Spanish, Irish and Italian cases explain the fall in average fertility for the whole group in the 1975-2000 period since fertility rates did not change much in the rest of the countries.

Figure 10. Fertility ratio in (selected) EU countries 1950-2000



Source: Table 2.

3.3 Mortality

Falling mortality rate has been, jointly with lower fertility, the driving force of the demographic transition that has taken place in Western Europe since the 1950s. While fertility rates more or less stabilised during the last two decades, mortality rate continues to diminish everywhere at almost all ages. Mortality is measured in different ways.

Measured as the number of mortalities per thousand in the population or the mortality rate, mortality could go up as population grows older simply because of a composition effect thus hiding more genuine developments. In this section we will approach the clear-cut phenomenon of falling mortality looking first at observed mortality risks by age and its evolution through time and later we will analyse survival probabilities computed for different EU countries out of their respective life tables.

Until up to the 1960s, falling infant mortality was the mayor cause of longer survival among individuals. More recently increased survival at high or even extreme ages has taken the lead. Even since 1975 observed mortality risk at almost any age has fallen by a significant amount everywhere. We compute this risk as the number of observed mortalities of given age over total population of that age in any particular year. However, in order to make meaningful comparisons between countries and through time we use the ratio between observed risks at two extreme years in a given period of time (2000 vs. 1975) to summarise in a single indicator. Table 3 shows this ratio computed for nine EU countries and selected ages and Figure 11 displays the age profile of this ratio. Remember that a value of, say, 0.7 for the ratio at age 17 means that the mortality probability of an individual of that age has fallen in 2000 down to a 70% of its value in 1975. In particular, it can be seen that in the last 25 years, infant mortality risk has fallen in most EU countries to a third of what it was in 1975, or that adult mortality risk (ages 20 to 50) has fallen in the same period by between 30% and 35%. Mortality risk at higher ages (60 to 80) has fallen even more than at middle-age reaching nearly 60% of its level in 1975.

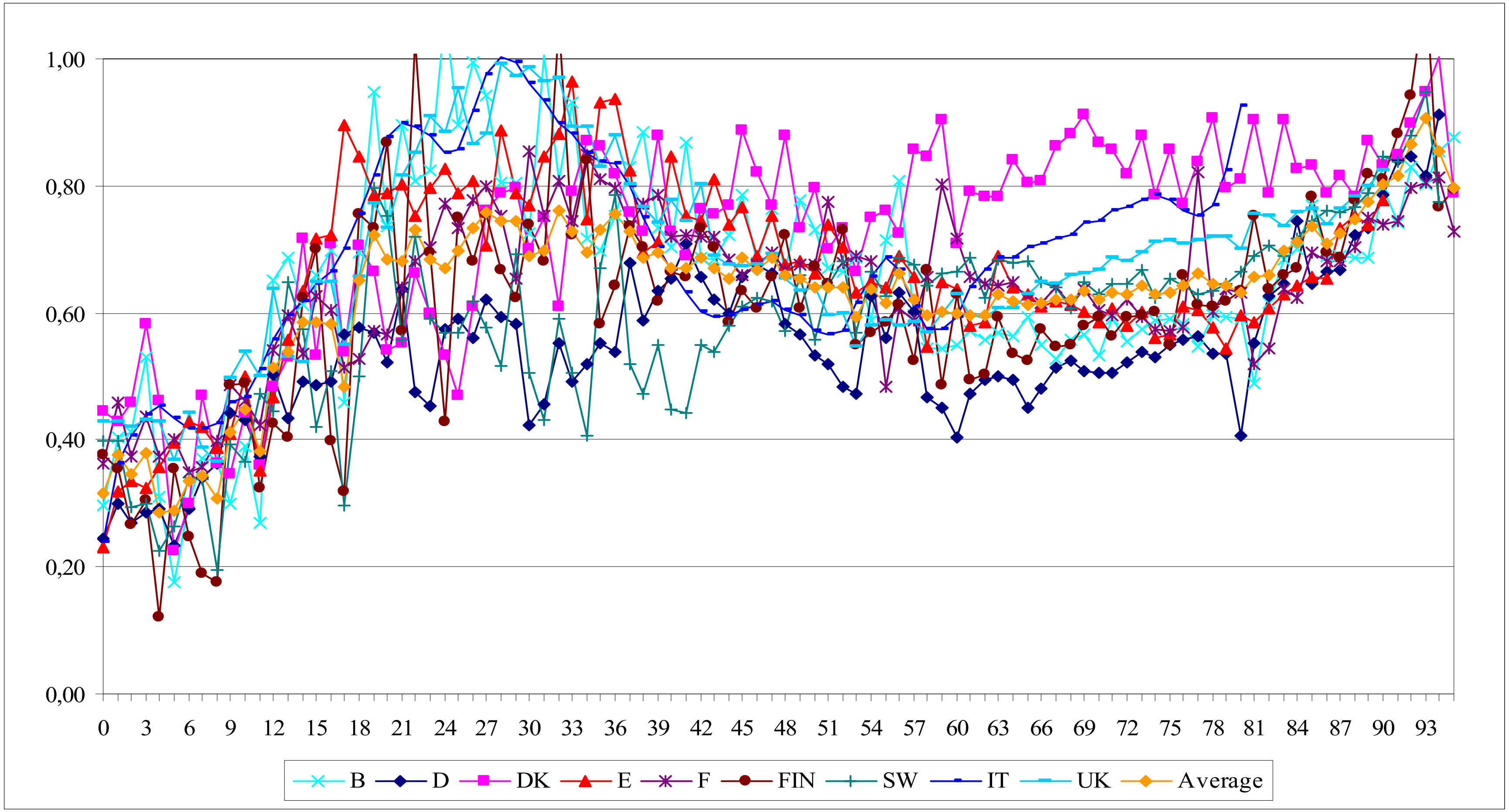
Table 3. Mortality risk in 2000 relative to its value in 1975 for selected ages – EU countries

	B	DK	D	E	F	FIN	IT	SW	UK	Average
0	0.30	0.45	0.24	0.23	0.36	0.38	0.24	0.40	0.43	0.32
5	0.18	0.22	0.23	0.39	0.40	0.36	0.43	0.26	0.37	0.29
10	0.39	0.44	0.43	0.50	0.46	0.49	0.47	0.36	0.54	0.45
20	0.74	0.54	0.52	0.79	0.57	0.87	0.88	0.75	0.73	0.68
30	0.72	0.70	0.42	0.77	0.85	0.74	0.96	0.50	0.99	0.69
40	0.70	0.73	0.66	0.85	0.72	0.66	0.67	0.45	0.78	0.67
50	0.73	0.80	0.53	0.66	0.68	0.67	0.57	0.56	0.64	0.64
60	0.55	0.71	0.40	0.64	0.72	0.63	0.59	0.67	0.63	0.60
70	0.53	0.87	0.51	0.59	0.60	0.59	0.74	0.63	0.67	0.62
80	0.59	0.81	0.41	0.60	0.63	0.63	0.93	0.67	0.70	0.63

Source: Own computations based on data from national statistical offices completed with data from www.mortality.org.

Figure 11 allows a better perspective of the age pattern of the mortality risk ratios for each country. It is apparent that major gains have been the norm at ages below 10 and between 50 and 80. At extreme ages, computations lack precision owing to the rarity of cases to be dealt with, but from the figure we can infer that as age increases gains in decreased mortality risk become smaller and smaller. This is an indication of very limited 'expansion' of human life at extreme ages whereas the observed gains at ages 50 to 80 is strong evidence of 'compression' of the survival curve. In other words, populations age not because the observed limit to human life increases, but because more and more people reach extreme ages.

Figure 11. Mortality risk in 2000 vs. mortality risk in 1975 for EU countries (a value of 1 means no change)



Source: Own computations based on data from national statistical offices completed with data from www.mortality.org.

At low ages, improvements in survival seem to have been impressive in the last decades, but one has to take into account the fact that at 1975 infant mortality was already very low. It was even lower at ages between 25 and 34 and thus improvements in survival have been more modest although some noticeable gains can be documented. It has been at ages between 50 and 80 where survival gains can be interpreted as impressive given the relatively large mortality risk affecting people of those ages in 1975.

Countries where gains of the sort described above have taken place in a more marked way are Germany, Finland and Sweden, while Denmark, the United Kingdom and Italy have performed more poorly on this account. Spain or Belgium have had mixed results performing below average (fewer gains) at ages until 45 and above average (more gains) after that age.

Survivors

The significant gains in mortality have also had a parallel development in what concerns the increase of persons of ages above 50 years everywhere. We have used the life tables of EU countries, available many of them since mid past century, to compute a simple ratio of theoretical survivors (out of a generation of 100,000 individuals of both genders) of any age in 2000 with respect to the survivors at same ages in 1975 or 1950, given data availability. These ratios are shown in Table 4 and in Figure 12 for selected ages.

Table 4. Survivors ratio (2000 vs. 1975 or 1950) by selected age – EU countries

	Ratios 2000 vs. 1950						Ratios 2000 vs. 1975				
	B	DK	D (West)	F	SW	Average	E	FI	IT	UK	Average
1	1.03	1.03	1.04	1.05	1.02	1.03	1.01	1.01	1.02	1.01	1.01
10	1.06	1.03	1.04	1.06	1.02	1.04	1.02	1.01	1.02	1.01	1.01
20	1.07	1.04	1.05	1.07	1.03	1.05	1.02	1.01	1.02	1.01	1.02
30	1.08	1.04	1.06	1.08	1.04	1.06	1.02	1.02	1.03	1.01	1.02
40	1.10	1.05	1.07	1.09	1.05	1.07	1.02	1.02	1.03	1.01	1.02
50	1.14	1.06	1.08	1.13	1.06	1.09	1.03	1.04	1.04	1.02	1.03
60	1.21	1.08	1.13	1.20	1.11	1.15	1.06	1.08	1.08	1.05	1.07
70	1.40	1.15	1.27	1.39	1.24	1.29	1.14	1.22	1.16	1.12	1.16
80	1.95	1.46	1.87	2.08	1.75	1.82	1.44	1.56	1.40	1.23	1.41
90	3.84	3.18	4.75	5.17	4.02	4.19	2.42	2.55	2.25	1.43	2.16
100	6.83	15.31	21.33	14.32	14.25	14.41		3.15	7.74		5.44

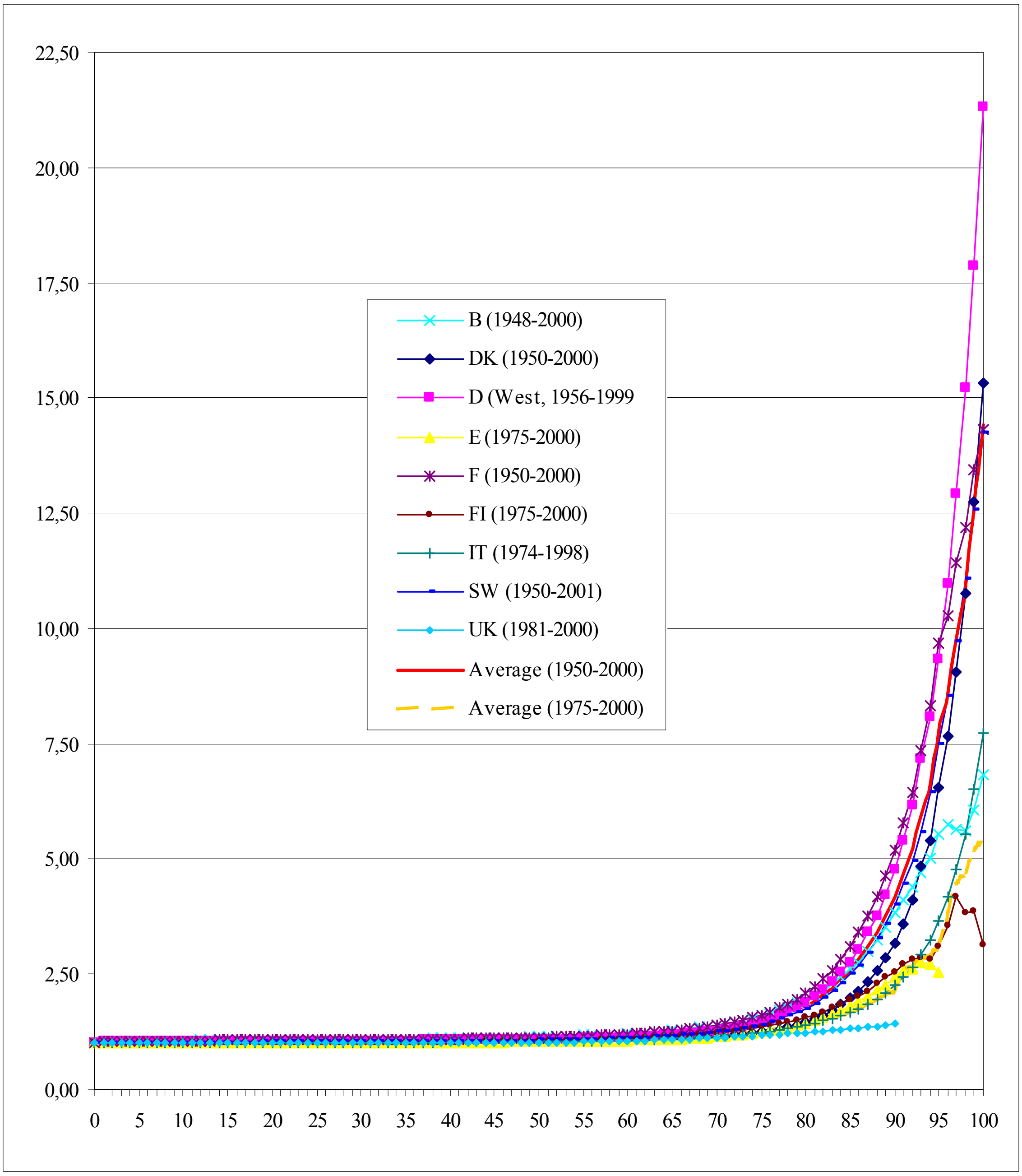
Note. Ratios computed at extreme ages should be interpreted with caution given the small numbers on which their computation is based.

Source: Own computations based on data from national statistical offices completed with data from www.mortality.org.

Given that mortality risk is typically low at ages below 60, even significant decreases do not make the number of survivors to increase dramatically. In fact below that age, it is hard to see that survivors of a typical generation born today would increase above 10 (20%) of those estimated for a typical generation born 25 (50) years ago. As time goes by, improvements at those ages would naturally become less and less relevant.

Nevertheless, above 60 years of age, the survivors' ratio may still increase dramatically. Fifty years ago, typically, only 30% of a theoretical generation was expected to be alive at age 80. For a generation born today up to 60% of its members could reach that age. This means a factor of 2, or a factor of 4 for age 90, and so on. Of course, as we approach the age limit of a human life, the ratio would collapse. This is what Figure 12 tells us rather eloquently.

Figure 12. Survivors in 2000 vs. survivors in 1975 or 1950 for EU countries (theoretical generations)



Source: Own computations based on data from national statistical offices completed with data from www.mortality.org.

After certain ages the survivors' ratio increases in an exponential way, even through more recent periods. Again, of course, the fact that more and more people survive close to the age limit, means that one should not expect any further dramatic increase in survivors' ratios in the coming decades unless we consider the very high ages. Yet, the coming decades could witness similar developments in what concerns survival at very high ages to those seen in the recent past, even in a conventional scenario. France, Belgium and (West) Germany have pioneered, in general, these developments.

3.4 Longevity

After having looked at mortality and survival developments in EU countries during the last few decades, we turn to the description and analysis of various indicators of longevity. Representative individuals in Western countries live longer and longer as it is well documented through the data so far discussed in this report. Moreover, it is also apparent that so far rather than a higher age limit of human life, what causes the ageing of the population is the fact that more and more people reach extreme ages below that limit.

There are a number of ways in which we can approach longevity, that is, the growing in ages of representative individuals. One important corollary of the causes of population ageing discussed before is that the distribution of the duration of individual life for the members of a given generation is becoming more 'egalitarian' with the extreme case being all members of a theoretical generation living exactly until the limiting age. This, however, as discussed before, is still far from being the case.

In order to discuss this issue as documented from the data gathered under the AGIR project, we have obtained several measures of longevity. These are presented and defined in Table 5 and Figures 13 to 18. In order to provide a compact presentation, Table 5 only shows selected years, whilst each graph refers to one indicator at a time for those same selected years except Figure 18 that refers to the whole period 1950-2000 for record age. It has been argued already that more and more people reach extreme ages. Thus the discussion in this section is a bit different and refers to the evolution of those extreme ages irrespective of the number of people that reach them.

The most generally accepted measure of longevity is life expectancy, at birth or at later ages. It can be seen in Table 5 that this indicator has not ceased to increase during the last decades everywhere. Nevertheless this indicator, like most of those we will define later on, is computed out of life tables for theoretical generations born in any year. There is no apparent deceleration in this trend for, on average, life expectancy has increased by five years for every 25 years of time.

Table 5. Longevity indicators 1950-2000 – EU countries

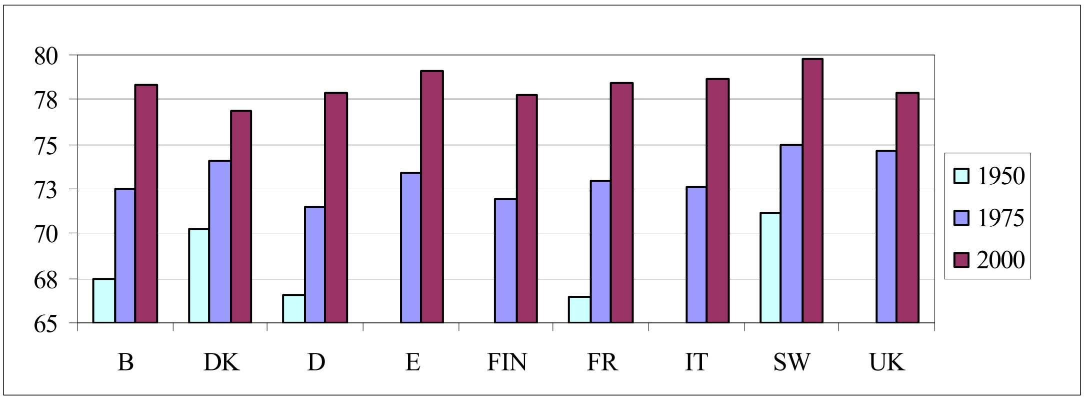
	Year	Life expectancy at birth (a)	Median duration (b)	Modal duration (c)	Life endurance (d)	Record Age (e)
Belgium	1950	67.4	73.4	76	87.0	
	1975	72.5	76.1	79	88.7	106
	2000	78.3	81.7	86	93.1	110
Denmark	1950	70.3	75.3	77	87.3	102
	1975	74.1	77.5	82	90.4	108
	2000	76.8	79.5	80	92.3	110
Germany	1950	66.6	74.0	77	86.0	
	1975	71.5	76.0	79	88.0	107
	2000	77.9	81.0	83	93.0	112
Spain	1950					
	1975	73.4	77.5	79	89.4	109
	2000	79.1	82.6	87	93.4	110
Finland	1950					101
	1975	71.9	75.5	78	88.4	107
	2000	77.7	81.2	85	92.4	110
France	1950	66.4	73.0	78	86.7	107
	1975	72.9	76.9	82	89.8	108
	2000	78.5	82.3	87	93.9	122
Italy	1950					104
	1975	72.6	76.0	81	88.0	108
	2000	78.6	81.0	82	92.5	110
Sweden	1950	71.1	75.6	80	87.5	105
	1975	75.0	78.3	82	90.3	109
	2000	79.7	82.6	86	93.4	110
United Kingdom	1950					
	1975	74.6	78.1	83	90.4	110
	2000	77.9	81.8	84	90.6	115

(a) Average number of years that an individual born in a particular year is expected to live.
(b) Age at which 50% of the generation numbers born in a given year will remain alive
(c) Age at which the maximum number of mortalities of a generation born in a particular year would occur (excluding infant mortality)
(d) Age at which 10% of the generation numbers born in a given year will remain alive
(e) Highest age among observed mortalities in a given year

Sources: Own computations based on data from national statistical offices completed with data from www.mortality.org.

Figure 13 shows Sweden and Spain to have the highest life expectancies at birth (in 2000) and Denmark, Finland and the UK to have the lowest. Progress on that account has also been pronounced during the 1980s and 1990s in most European Union countries. Of course, this development does not means that in the future life expectancies would augment as rapidly as in the past, for as the absolute limit of a human life remains unchanged, one should expect less and less margin to be left for further increases. Nevertheless, this absolute limit is not well known; yet if were we to place it at around 120 years of age, there still remains a considerable term before life expectancies show a clearly decelerating pattern. It is against this general background that most of the longevity indicators can be discussed, whose description follows.

Figure 13. Life expectancy at birth (years) 1950, 1975 and 2000 for EU countries

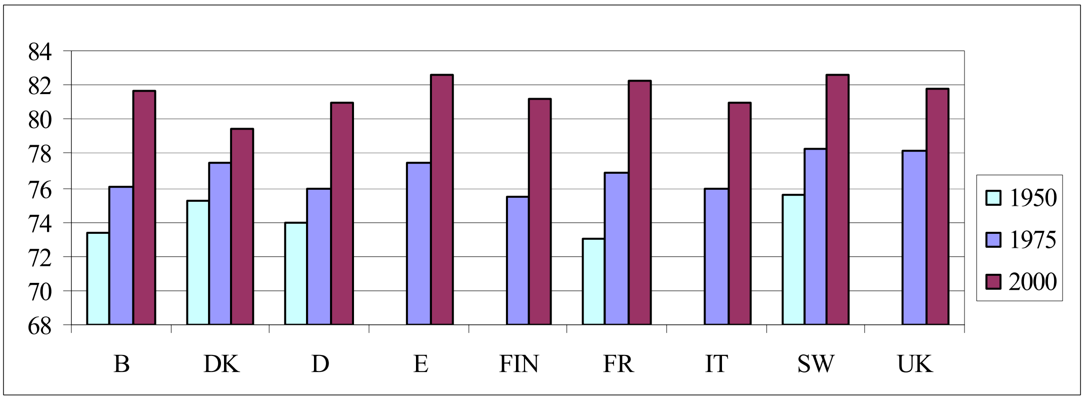


Source: Own computations based on data from national statistical offices completed with data from www.mortality.org.

A typical generation born in 1950 in Western European countries would have exhausted half its numbers at age 74 or, put differently, individuals of that generation reaching their 74th birthday would amount to half those born 74 years before. This is known as the 'median duration' of a given generation. For a generation born in 1975, the corresponding age is estimated to be about three years higher than for the 1950 birth cohort and almost four years higher for the birth cohort 2000 with respect to the 1975 cohort. This can be seen for different EU countries in Figure 14.

Again, these are theoretical estimates rather than observed ones since all these cohorts are still young. All in all they show that survival, as discussed before, is improving considerably at mature ages. Median duration, on average, has been growing faster in the recent decades than earlier almost everywhere.

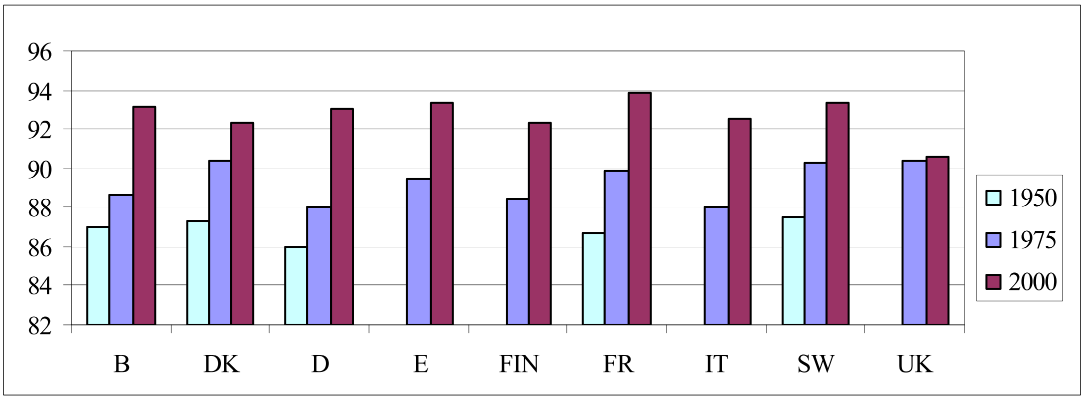
Figure 14. Median duration (age) 1950, 1975 and 2000 for EU countries



Source: Own computations based on data from national statistical offices completed with data from www.mortality.org.

Almost as marked seems to have been the evolution of a more demanding indicator of generational duration – which is 'life endurance', where the survival limit is 10% of a given generation. The average age at which this limit is trespassed has risen from 87 years of age in 1950 to 89.5 in 1975 and again to 92.5 in 2000 on average for those countries where data has been available to the AGIR teams – a further indication of (mildly) accelerated compression at the high end of the survivors' line. This can be seen in Figure 15, where the cases of Belgium and Germany, on the one hand and Denmark, on the other, stand at the extremes whereas France (reckon the ages involved) clearly shows a considerable relative compression of its survival pattern.

Figure 15. Life endurance (age) 1950, 1975 and 2000 for EU countries



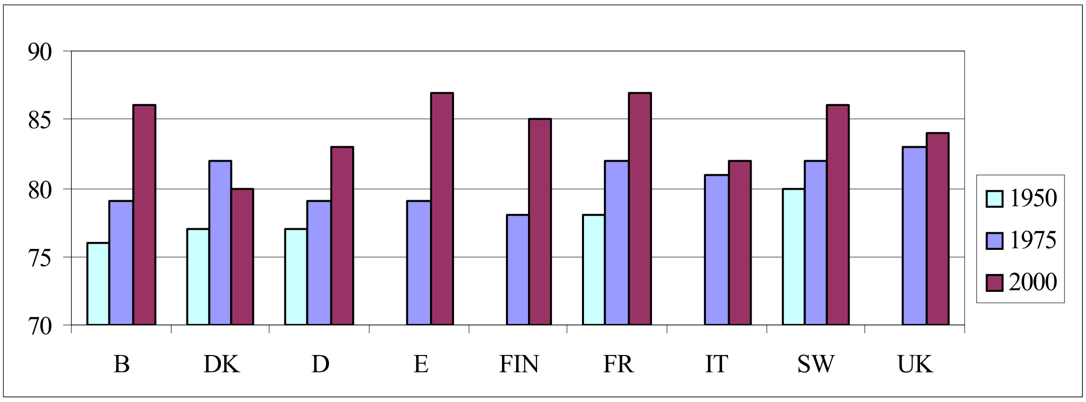
Source: Own computations based on data from national statistical offices completed with data from www.mortality.org.

Also based on life tables, the age at which most of the theoretical motalities (excluding infant mortalities) happen in a given generation, so-called 'modal duration' has been steadily growing in the last decades. This can be seen in Figure 16 where the same pattern of acceleration could be observed but for few exceptions.

It has to be said that this age can be very volatile as theoretical mortalities are after all based on one year observed mortalities whose numbers can be affected by many different circumstances. Nevertheless, modal duration stood near 78 years of age in 1950, rose to slightly above 80 in 1975 and lies close to 85 years in 2000.

Coming now to observed mortalities, a suggestive indicator, albeit fraught with problems when it comes to actual value concerning average longevity, is the age of the oldest person dead in any year. This is called the 'record age' and, of course, varies enormously for only a handful of individuals, often just one, even in large countries, happen to reach that very extreme.

Figure 16. Modal duration (age) 1950, 1975 and 2000 for EU countries

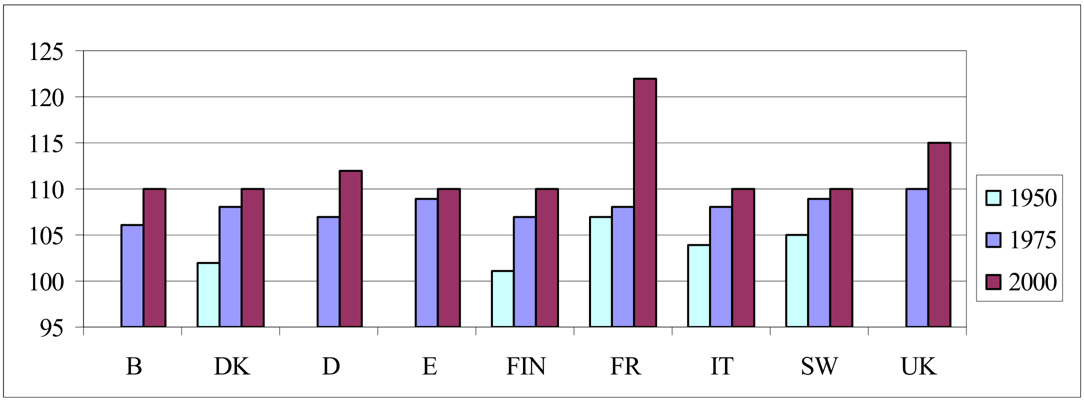


Source: Own computations based on data from national statistical offices completed with data from www.mortality.org.

Record ages for EU countries are shown in Figure 17 either for 1950-2000 or 1975-2000 and can be seen to have grown everywhere. France holds the record (in 1997) with Jeane Calment dead at 122. On average, record age has increased from 104 years in 1950 (roughly the same as in 1900) to 108 in 1975 and 110 in 2002. The later figure, however, is biased downwards by the fact that available mortality records in many countries collapse at age '110 or plus' thus biasing the whole average.

As said before, just a handful of individuals reach the highest age recorded at mortality in every country, but the number of centenarians is increasing rapidly year after year in every country. Yet it would be simply wrong to infer from the above estimates of record ages that the age limit for a human being is actually increasing, let alone to provide the answer to the 'million euro question': What is the age limit for a human life?

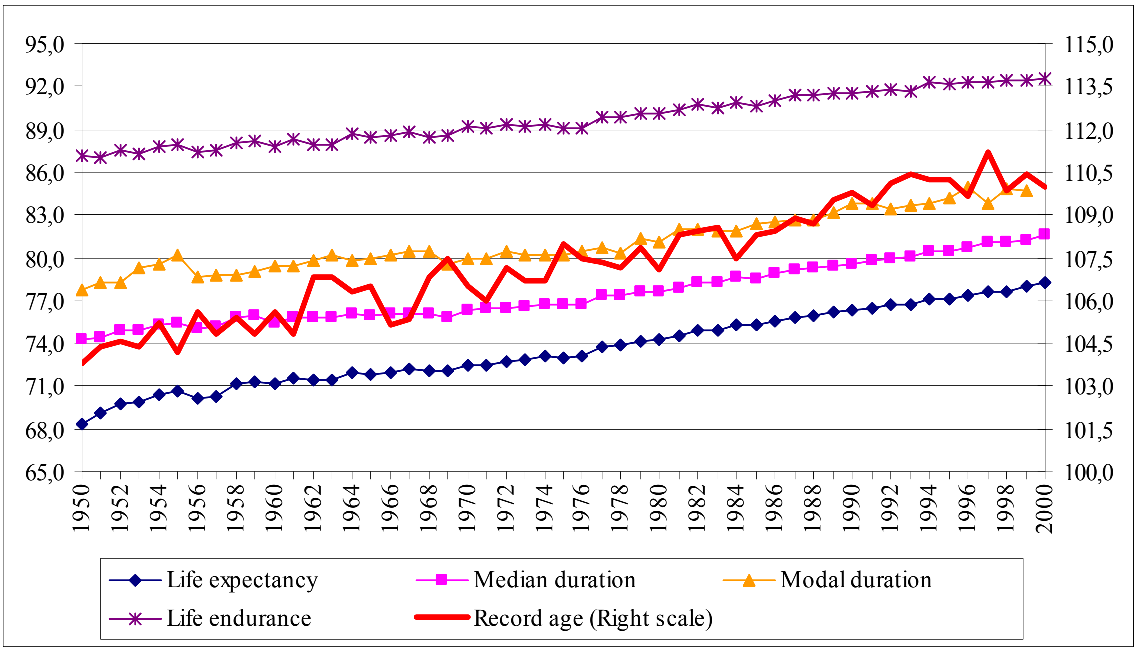
Figure 17. Record age 1950, 1975 and 2000 for EU countries



Source: Own computations based on data from national statistical offices completed with data from www.mortality.org.

All the previously discussed indicators of longevity can be put together as rough EU averages for the period to 2000, as done in Figure 18. All in all, only progress in longevity can be observed to the last fifty years in Europe. Indeed, although the dramatic developments achieved prior to 1950 seemed to have left only a small margin for further improvements, gains have been happening nevertheless at steady if not faster pace during the second half of the 20th century.

Figure 18. Measuring longevity in the EU from 1950 to 2000



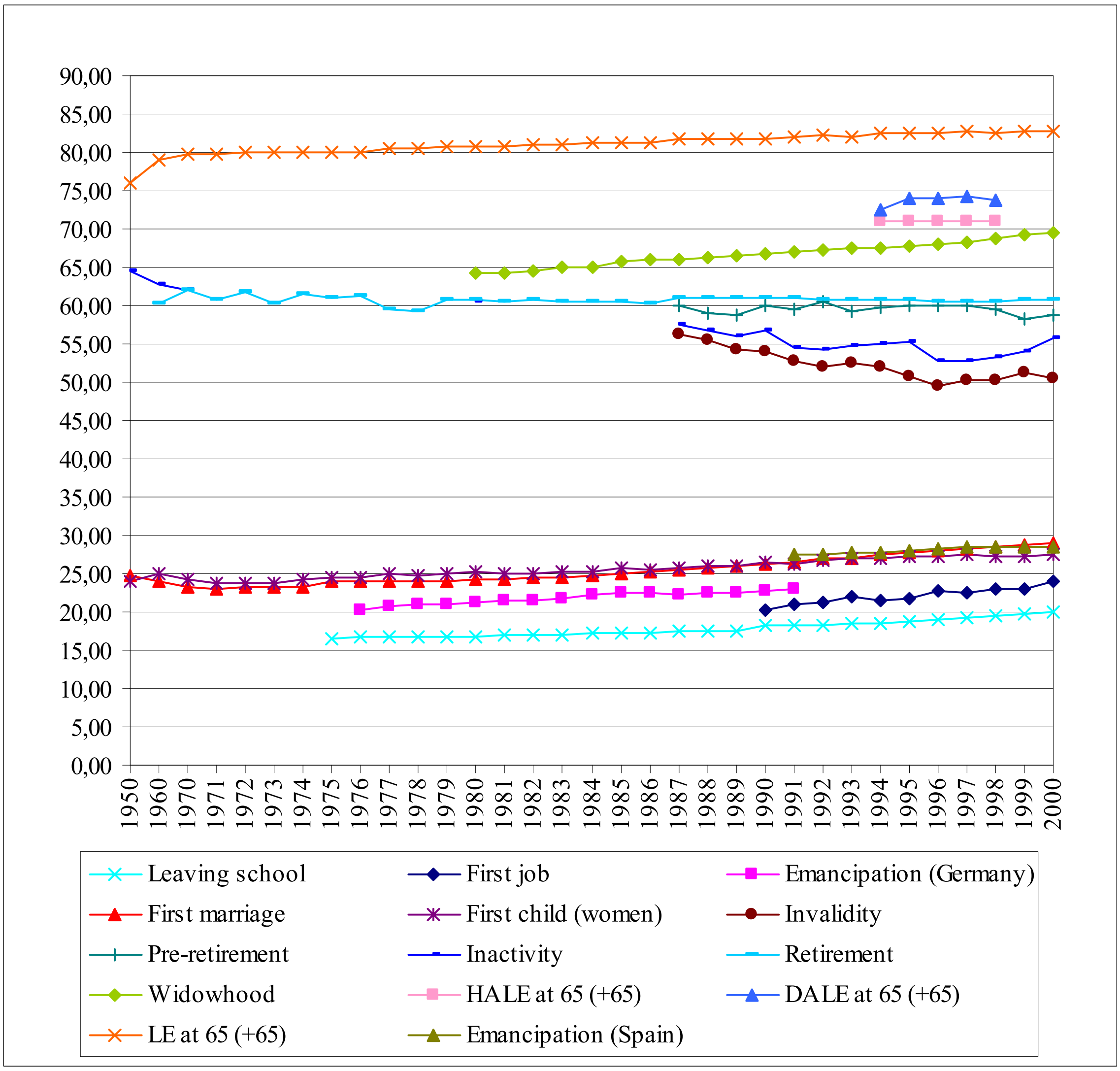
Source: Own computations based on data from national statistical offices completed with data from www.mortality.org.

4. Life-courses

One of the aims of the team in charge of gathering demographic data within the AGIR project was to initiate the collection of data on what we have termed life-courses, that is, those landmarks in a typical life cycle that mark the passage from one state to another, for instance, from school to the labour market, or from work to inactivity. One can think of quite a large set of such landmarks and we have chosen those shown in Figure 19. Given that we were not able to collect data for all countries and all years, the averages have been computed only for the countries with data available.

Further, it has to be taken into account that we are not talking about true cohorts when discussing about how different indicators relate to each other in any particular year. In fact, the figures discussed at a particular moment in time refer to strictly different generations. Those events happen to representative individuals of the concerned age that obviously do not belong to the same generation. If at all we could see the whole set of landmarks shown at any particular year as descriptive of a synthetic or theoretical generation.

Figure 19. Life-courses in the EU – 1950 to 2000



Source: Own computations based on data from national statistical offices and Eurostat, also completed with data from www.mortality.org.

The story Figure 19 tells is as follows. Irrespective of gender, Europeans have been leaving school at higher ages, finding their first job later and thus leaving their parents' home or getting married for the first time at later ages as well. They have, correspondingly, had their first babies at higher and higher ages. So far, this meant delayed entering into activity and household formation.

Once in the labour force and effectively working, as it is well known, effective working periods have been far from being continuous for many workers across Europe, owing to unemployment spells. Near retirement, invalidity and other pre-retirement have increasingly prevented a significant share of the workforce from working while retirement through old-age has shown a slightly declining trend around the age of 60.

Together with delayed entrance in the labour market, unemployment, pre-retirement through invalidity or workforce adjustments and declining old age retirement have meant increasingly reduced effective work spans for the average worker in the last decades.

After retirement, individuals and household face a totally different life span. Widowhood intervenes typically several years after retirement, at younger ages for women than for men, and the age at widowhood has increased substantially from at around the age of 65 in 1980 to almost 70 years nowadays. On average, life expectancy at 65 years (both genders) has also increased from ten more years in 1950 to 18 more years of life at present.

Nevertheless, that considerably enlarged post-retirement span cannot be said to be free of troubles, for roughly the second half of it will be marked by some sort of health problem for the average individual as indicated by the 'health adjusted life expectancies' or HALE indicators that we have computed out of the European Community Household Panel. Focusing on 'disability adjusted life expectancy' or DALE, we find that, on average, even if these impairments would typically subtract less years to the total remaining life span after age 65 than general health troubles, the available data suggests an increased absolute morbidity due to disability. We explain below how these adjusted measures of remaining life years are however fraught with problems arising from the health and disability surveys themselves and other difficulties concerning their interpretation.

5. Morbidity

5.1 Introduction

As life expectancy has increased substantially over the decades, there are increasing interests in measuring life expectancy that consider the health status of the population. A crucial question is that as we live longer, in what state of health do we live? Measuring health status of a population and comparing it with other populations has intrinsic interest as health is one of the most important factors that determines human well-being. Moreover, health has important implications in broad areas of economics, from productivity and labour supply to health care costs and the sustainability of public health care system. In this project, we attempt to measure and compare health status and health expectancies in European countries using survey data.

5.2 Data

One of the main data sources of self-assessed health status in Europe is European Community Household Panel survey (ECHP), which started in 1994 across 12 European countries. Sampling and survey questions are carefully prepared to insure maximum comparability across countries. A further advantage of the ECHP is that surveyed countries share more or less similar culture and development levels as well as geographical proximity. One of the questions included in the survey regarding health status is "How is your health in general?" with possible responses, "very good", "good", "fair", "bad" and "very bad". Another question addresses chronic illness or disability, "Are you hampered in your daily activities by any chronic physical or mental health problem?" with possible responses, "Yes, severely", "Yes, to some extent", and "No". We analyze the responses to these two questions to compare health status and health-adjusted life expectancy across European countries.

We examine only the first wave (1994) of the survey to avoid the problems of attrition.[4] First, it is useful to check the internal consistency of self-assessed health status by examining the correlation between the two indices of health status that we will analyse. We expect a strong correlation between general health status and disability status: those who suffer from disability are likely to report worse health status. Indeed, as we can see in the table below, there exists a strong correlation between the two variables. The proportion that suffers some degree of disability increases substantially as the declared health status worsens: the disability proportion decreases from 92% to 83%, 41%, 8% and to 3% as the declared health status moves from 'very bad' to 'bad', 'fair', 'good', and to 'very good'. When we examine each country, we find the same pattern without exception. This result is comforting as it provides some evidence for internal consistency at least at individual level.

Table 6. Proportion with disability and annual medical consultation for each health status – ECHP 1994

	General health status					
	Very Bad	Bad	Fair	Good	Very Good	Total
% with disability	91.79	83.43	40.66	8.35	2.59	22.23
Number of annual medical consultations	8.54	7.55	5.28	3.14	2.34	3.91
Numbers observed	3166	9716	29,423	52,250	32,181	126,736

Another check of internal consistency is performed by examining the correlation between health status and the use of health care services. Medical consultation frequencies increase significantly as individuals' health status worsens.

Another data source on health that we have available is national health survey carried out in various countries more or less regularly. Some advantages of the data from national health surveys are that sometimes the sample size is large to provide precision in health estimates of the population as well as permitting a higher level of disaggregation of the data, that in some countries it is carried out regularly over time to allow us to examine possible trend in health status of the population and that national health surveys usually include a wide variety of information concerning health status,

[4] Attrition problem is likely to be serious in the analysis of health status as health could be a cause of attrition. Indeed, among the respondents aged 65 and more in the first wave of the ECHP, the proportion missing in the second wave were 14.3%, 11,6%, 13.8%, 16.3% and 24.4% respectively corresponding to the first-wave reported health status 'very good', 'good', 'fair', 'bad' and 'very bad'.

self-assessed as well as diagnosis based, the use of health care facilities and health behaviour of the population. Table 7 presents the summary characteristics of the survey data available to us from various EU countries.

Table 7. National health surveys

Country	Year	Survey Title	Sample Size
Spain	1987	Health Survey	40,000
	1993	=	26,000
	1995	=	8400
	1997	=	8400
	1999	Disability Survey	70,000
Italy	1990-91	Health Conditions and Use of Health Services	67,000
	1994	=	62,000
	1999-2000	=	140,000
Denmark	1987	Health Survey	4700
	1994	=	4700
	2000	=	17,000
Sweden	1990	Health Survey	
	1995	=	
	2000	=	
Belgium	1997	Health Survey	10,000+
	2001	=	
France	1999	Living Condition Survey	
Germany	1998	Health Survey	7100

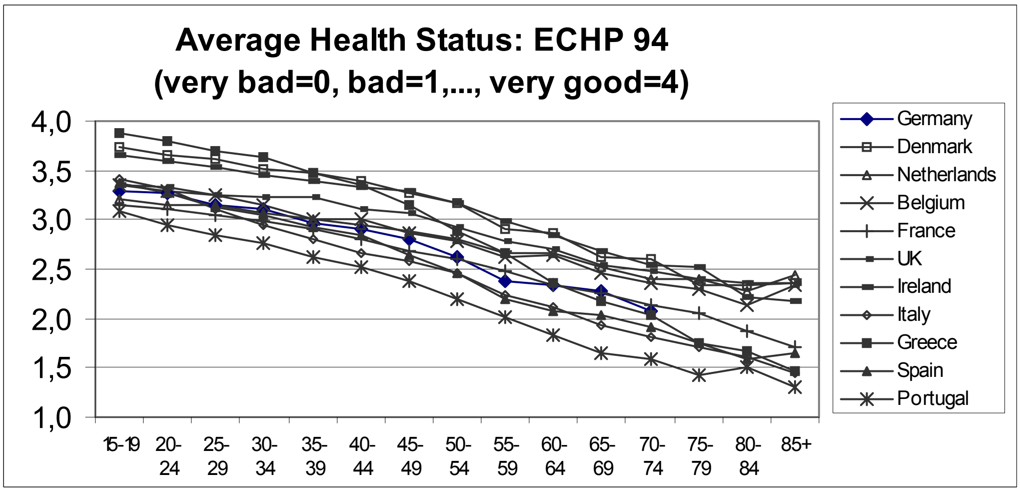
5.3 General health status from ECHP

The general health status question is based entirely on respondents' own perception. The question asked is not concrete in terms of reference time period or in the description of each category of health status, therefore leaving a large room for interpretation variability by interviewees. Second, the possible responses are ordered qualitatively. Comparing the responses between groups of people is not straightforward.

We begin with simple 'averages' of the responses after assigning a cardinal value for each response ('very bad'=0, 'bad'=1 and 'very good'=4). The simple average provides a health index (the bigger the average, the better health), which is comparable across the populations if we are willing to assume the linearity across responses. The 'average' health status by five years age interval for 11 European countries is presented in Figure 20. Luxembourg is excluded for its small sample size (Appendix A presents sample size for each country by five year age intervals.)

The first impression we receive from the figure is that self-assessed health status becomes worse with age by a similar gradient across countries. More importantly, there are large differences in health status for given ages among the countries. For most age groups, Denmark and Ireland report best health status while Portugal, Italy and Spain report worst health status.

Figure 20. Average health status ECHP 94



Peculiarly, Greece report best health among the young (less than 40) population but relatively worse health among the elderly (over 70) population. The differences among the countries is surprisingly large and the ranking is not completely convincing as judged by other health measures, such as life expectancy.[5]

Given that the comparison of 'average' health status analysed above is valid only in the case that the response categories can be assigned with linearly aligned values, the index loses substantive meaning in general. For the comparisons that suffer less from this arbitrary assignment of values, we compare the proportions who report good or very good health status as well as the proportions with bad or very bad health status.

In the case of good or very good health, the proportion varies substantially between countries even among the young population and the difference widens with age. The cross-country differences are too large to accept as genuine differences. For example, the proportion in good health among the population aged 65-69 is less than 20% in Portugal while it is close to 60% in Ireland and Denmark.

In the case of bad or very bad health, the differences across countries are even larger among the middle and old age population. For example, Ireland and The Netherlands have the proportion in bad or very bad health at lower than 10% among the population aged 65-69, while the corresponding proportion is higher than 30% in Portugal, Spain and Italy.

[5] According to WHO (2000), life expectancy at birth is longest in France, Italy and Spain and shortest in Ireland, Portugal and Denmark with the differences of about 2.5 years between the two groups.

Figure 21. Proportion in good or very good health: ECHP 94

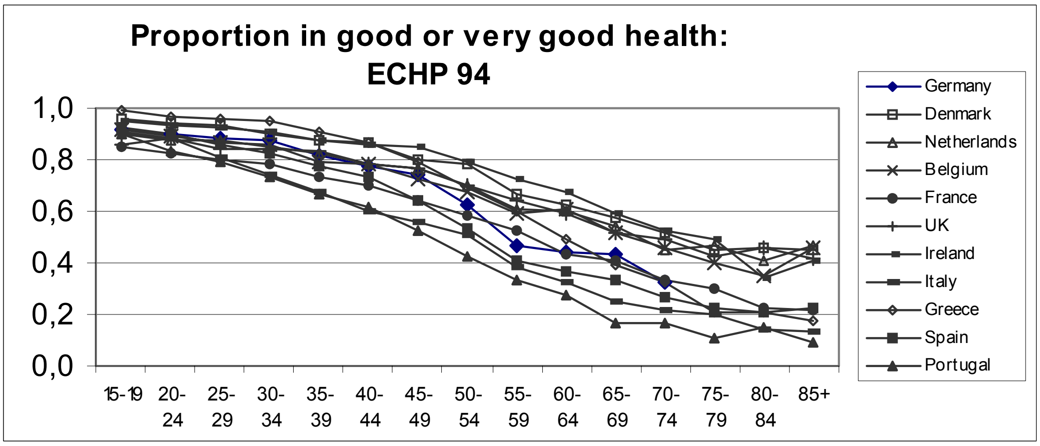
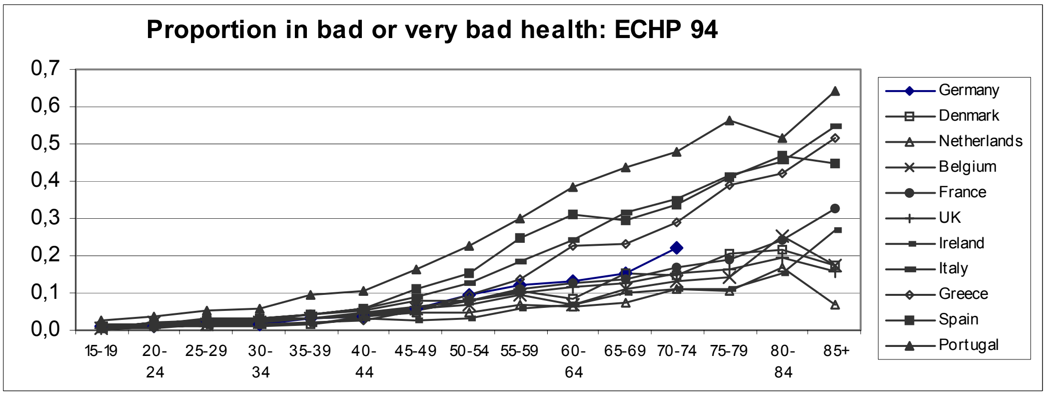


Figure 22. Proportion in bad or very bad health ECHP 94



5.4 Disability status from ECHP

The second question we analyse is disability status. In principle, we think that disability status would suffer less from the cultural or social environment bias, as the question is more concrete and less subjective. Given that the response categories are "none", "to some extent" and "severely", we consider the proportion with severe or moderate disability as well as that with only severe disability.

The age profile of disability is as expected: older people suffer more often from disability. Cross-country differences are somewhat smaller than in the case of general health status. Nevertheless, the differences between countries are again substantial enough to lead us to be reluctant in accepting them as genuine differences across countries. For example, the proportion with some disability among the population aged 16-24 is less than 5% in Spain and Greece while it is higher than 12% in The Netherlands. Among the population aged 55-59, as another example, the disability rate is less than 25% in Ireland and Greece while it is almost 40% in Germany and Portugal. If we examine the proportion with severe disability, the cross-country differences are proportionally larger, especially among the elderly population. Here, France stands out for its high prevalence of severe disability. For example, at ages 65 to 69, the severe disability rate is 22% in France while that in UK, Ireland and Spain is only 10%. Moreover, the country ranking of disability rate is widely different from that of general health status. A part of cross-country differences at old ages may be because of the differences in the proportion of institutionalised population, which is not included in the ECHP.

Figure 23. Proportion with a disability: ECHP 94

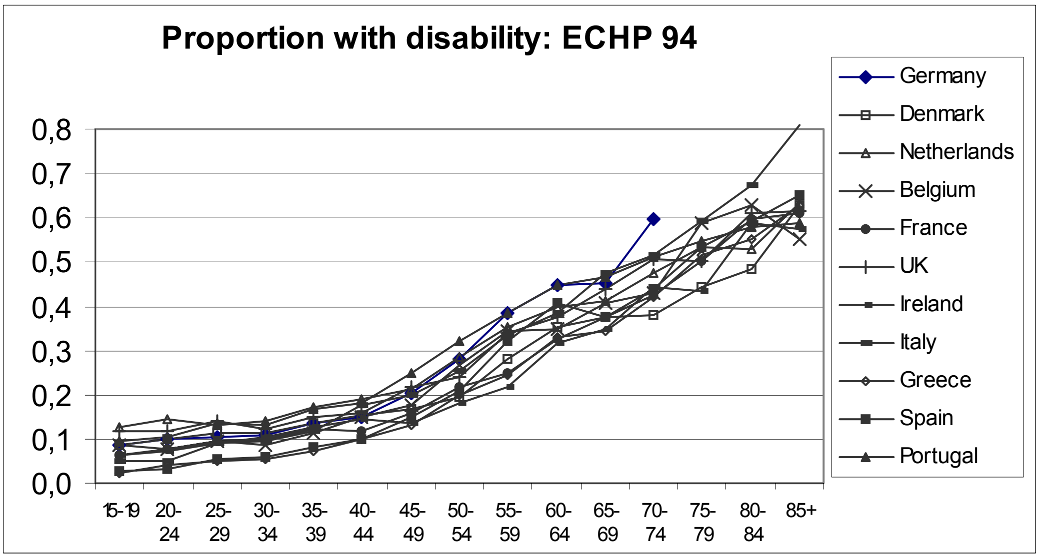
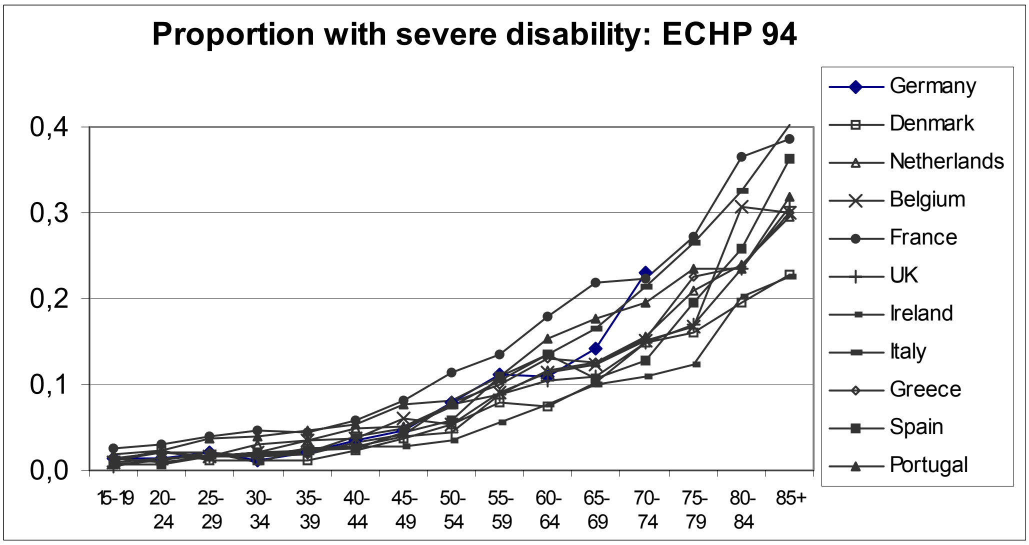


Figure 24. Proportion with a severe disability: ECHP 94



One potential factor that may contribute to cross-country differences in the perception of health status is the time (month) of year when the survey is carried out. Indeed, there were considerable variations between countries in the month of year when the surveys are carried out. It is possible that people enjoy different health status according to the season owing to seasonal variation of physical exercise. Mental health and mood may also vary according to the season. To explore this possibility, we estimated individual health status (ordered logit regression for health status and logit regression for disability status) including month and country dummies. The results indicate that month dummies are in general not significant and therefore not a factor that can explain the observed cross-country differences in self-assessed health status.

In summary, self-assessed general health status and disability status vary widely across European countries. The differences are so large and often the country rankings change across different measures or do not coincide with other health measures (such as life expectancy) that we have to be careful in the interpretation of the cross-country differences.

5.5 Cross-country comparisons using national health surveys

Given the low reliability of the ECHP data in comparing health status across countries, we ask whether we can we use national health surveys of different countries to compare health status across countries. Cross-country comparisons of health status using national health surveys are in general less reliable than those using the ECHP owing to the differences in sample design across country.

One advantage, however, is that in many countries the sample size of national health survey is much larger than that of ECHP, thus providing greater statistical precision in their estimates. In this section, we compare health status of Spain and Italy using the national health surveys from the two countries. The benefit of using these two countries is that they share similar language, culture and geo-demographic situation. For example, the life expectancy in 2001 according to WHO (2002) was 79.3 in Italy and 78.9 in Spain.

We compare health status between Spain and Italy using two large sample surveys during the similar time period. For Spain, we use 1999 Disability Survey where the sample size is 70,000, while for Italy we use 1999-2000 *Health Conditions and Use of Health Service Survey,* which includes 140,000 individuals. The survey question regarding general health status is the same: “How is your health in general?” The possible responses are exactly same except for the middle category, which is “regular” in the Spanish survey and “*discretamente*” in the Italian survey.

The proportion in good health is in general higher in Spain than in Italy. The difference becomes larger with age. The differences are substantial even among young population. For example, at ages 20-29 the proportion in good health is higher in Spain by almost 10 percentage points than in Italy, and, at ages over 40, the difference is almost 20 percentage points reaching more than 25 percentage points at ages 80 or more.

Figure 25. Proportion in good health: Italy vs. Spain

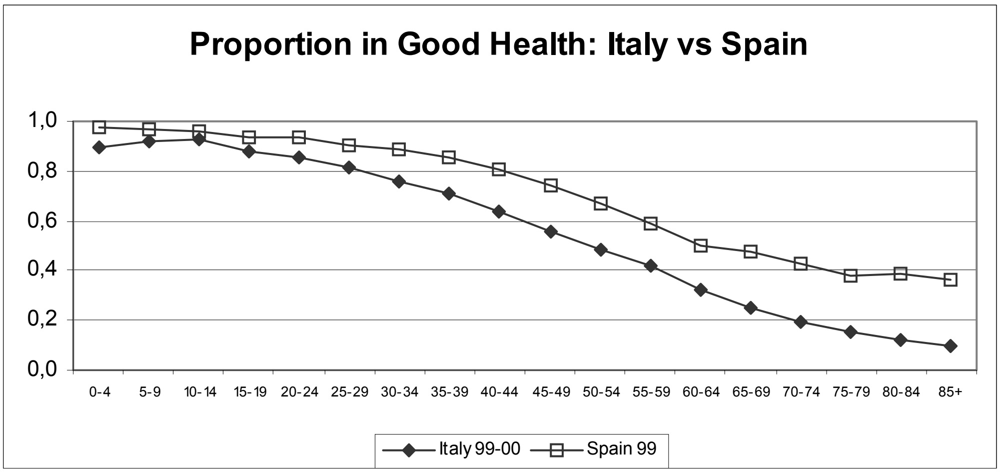
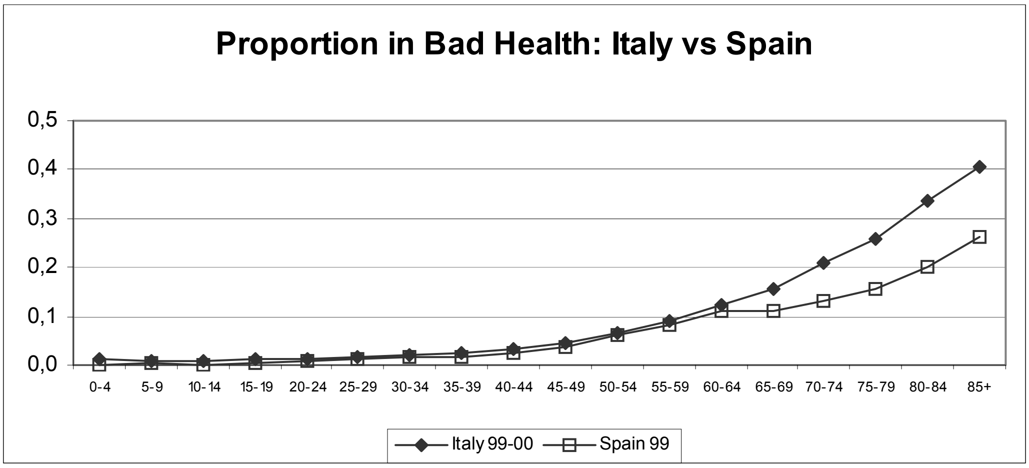


Figure 26. Proportion in bad health: Italy vs. Spain



With respect to the proportion in bad health the difference between the two countries is much smaller especially among the non-elderly population. In fact, the proportion is almost the same between the two countries at all ages up to 64. At ages over 64, the differences are again substantial with an increasing gap with age between the two countries. This result suggests that, even using large surveys from two countries who share similar cultural and demographic situation, the health status outcomes exhibit substantial differences hard to explain.

5.6 Health trends according to ECHP (1994-2000)

Given that we have now seven waves of the ECHP survey, we may attempt to examine the trend in self-assessed health status in Europe during the period between 1994 and 2000.

To obtain comparable estimates across time, we used 11 countries who participated from the first wave of the survey (again Luxembourg is excluded for its small sample size). To obtain the average health status we applied population weights (by country and age group) in 1995 for all the waves of the survey. The main advantage of applying the fixed population weights for different years is that the obtained averages are not affected by the changes in the population composition over the examined period. Therefore, the changes in average health status are exclusively owing to the changes in health status of the population.

At the outset we must take into account that the data suffers from attrition bias whose magnitude is impossible to know. Furthermore, we should not expect any substantial changes in health status over such a short time period. Hence, any jumps in the average health status should be taken with caution. Rather, we expect a smooth and low-gradient (if any) evolution over time.

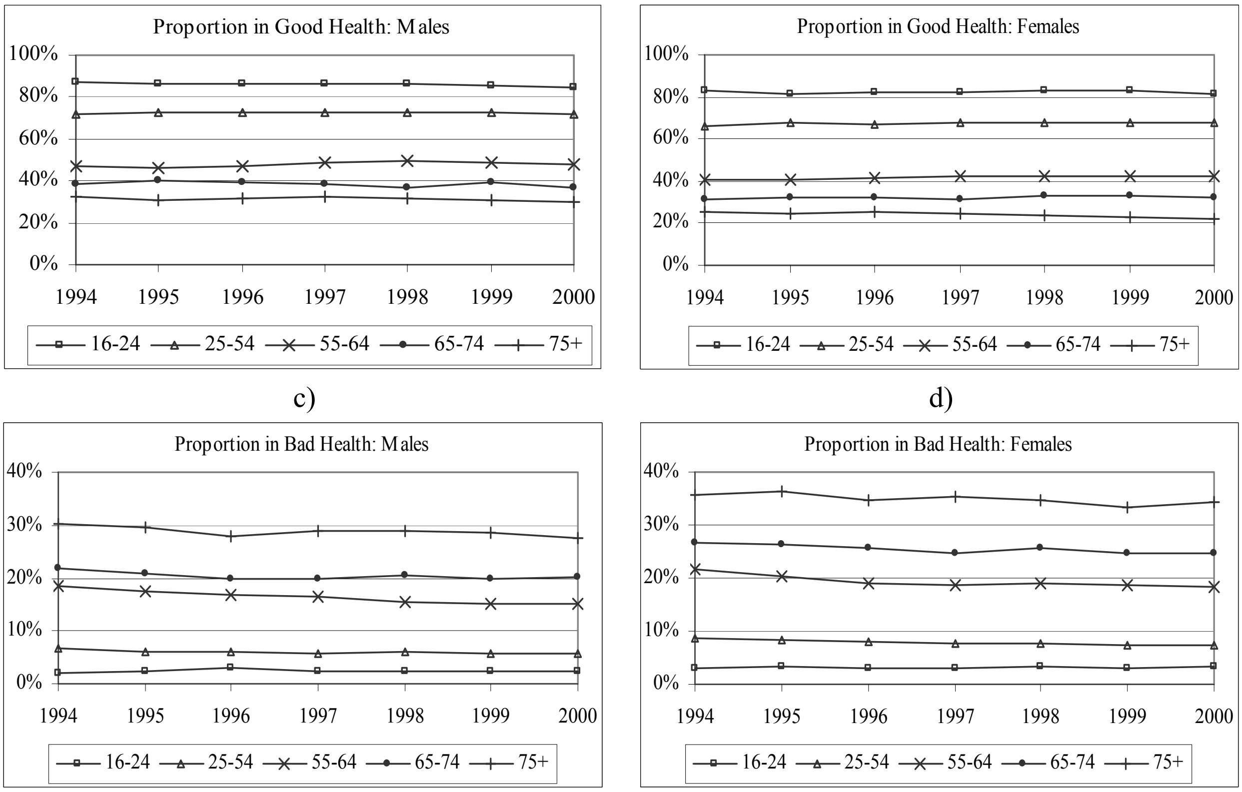
We present evolutions in four types of self-perceived health status: in good (or very good) health, in bad (or very bad) health, with moderate or severe disability, and with severe disability. We present separately by gender and by 5 age groups, 16-24, 25-54, 55-64, 65-74 and 75+.

There were two irregularities to be resolved in the data. First, German Socio-Economic Panel survey, which is the data source for Germany did not include information on disability for 1994. Instead of excluding Germany, we opted to use the same disability rates as in 1995 for 1994. Second, in the UK the response categories for the general health status differed in 1999 from other years 'excellent', 'very good', 'good', 'fair' and 'poor' in 1999 compared to 'excellent', 'good', 'fair', 'poor', 'very poor' in all other years). To correct for this inconsistency we opted to use the average of 1998 and 2000 for 1999.

As we expected, average health status stays almost at the same level over the period. This is especially true for the proportions in good health. On the other hand, we observe a slight decrease in the proportion in bad health among the population older than 54 years. The maximal change is observed for the age group 55-64 with a drop of 3 percentage points over the six-year period. For the younger age groups (54 and younger) we observe almost no change. This can be seen in Figures 27a to 27d below.

Figure 27. Health trends according to ECHP

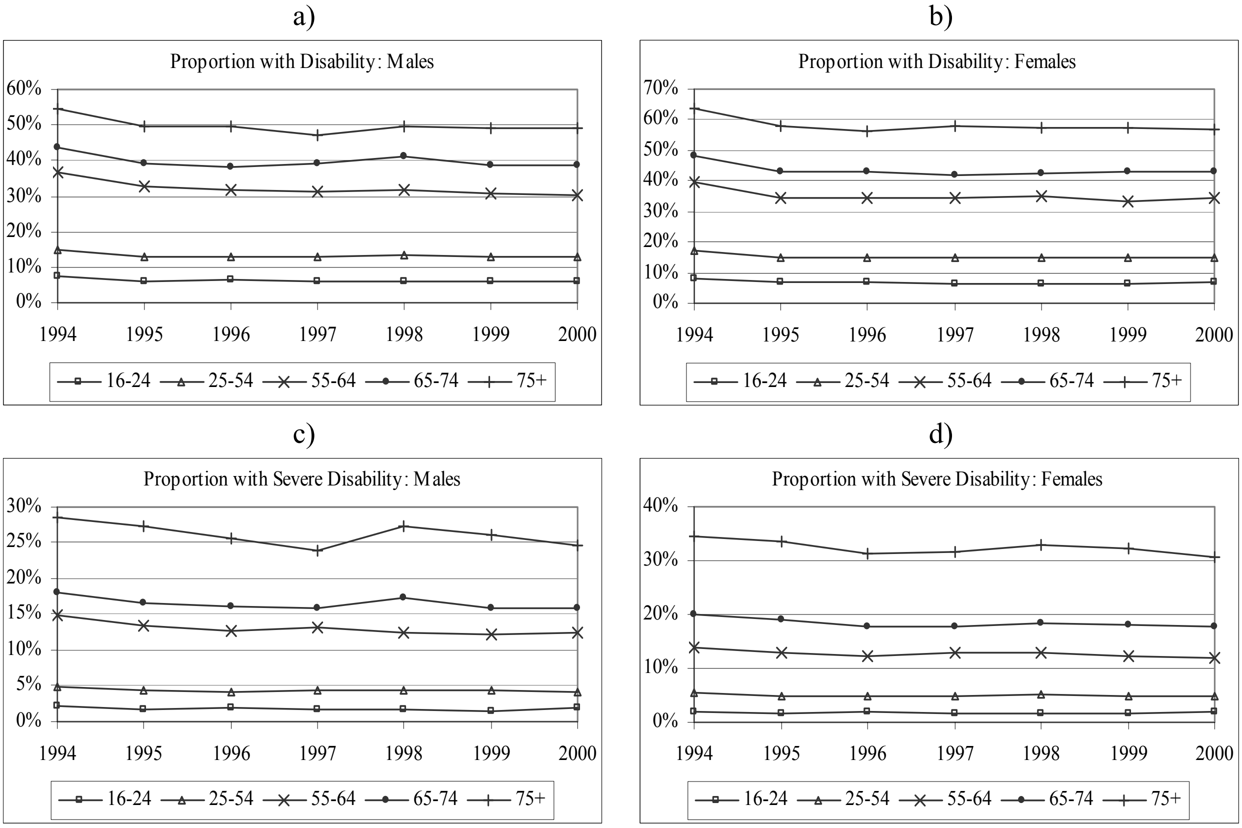
a) b)



With respect to disability rates, we observe, in Figures 28a and 28b, a significant drop for those over 54 years old between 1994 and 1995 and a stable pattern afterwards for all age groups, with few exceptions. That rather large improvement in only one year and almost no change thereafter lead us suspect its veracity. Severe disability rates show some increase at ages above 64 for both men and women 1996 and 1998, as shown in Figures 28b and 28c, and, again, a stable pattern for the rest of ages or years (or both).

Our tentative conclusion is that there has been almost no change or if at all a slight improvement for those aged 55 and more in health and disability status over the observed period. This seems reasonable if we consider the short time period examined.

Figure 28. Health trends according to ECHP



5.7 Health trends from national health surveys

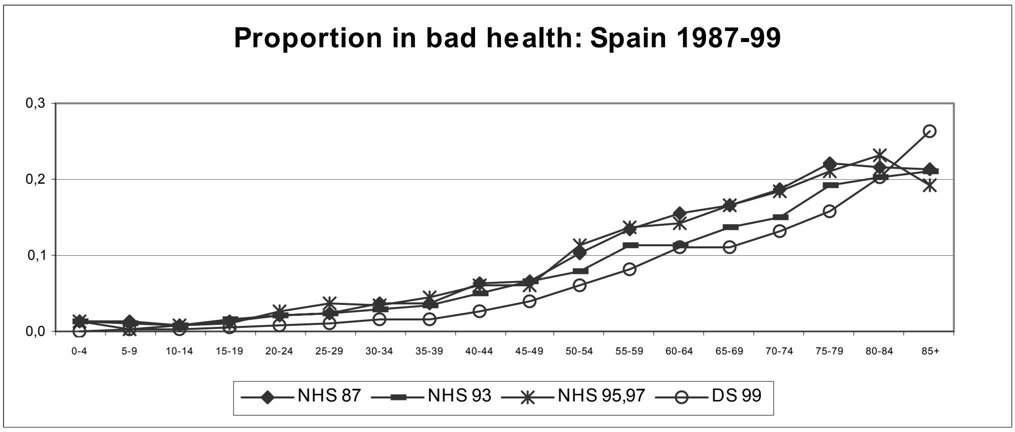
For the purpose of assessing health trend, the ECHP surveys are not entirely appropriate since they cover only a short time period (1994-2000) and they suffer from attrition bias as it is probable that attrition probability is intrinsically related to health status. Instead, to assess possible trend we use the data from national health surveys for the countries where the surveys are available for different years.

Given the wide differences in terms of survey design and definitions of health status between the surveys of different countries, we restrain ourselves from doing cross-country comparisons of health trend. Rather, we limit ourselves at comparing the health surveys of different years within the same country.

Spain

Morbidity data in Spain are obtained from the national health survey (NHS) and disability survey (DS). Currently, we have available four cross-section data from NHS carried out in 1987, 1993, 1995 and 1997 and one cross-section data from DS carried out in 1999. The NHS is carried out mainly to assess health status, personal behaviours or lifestyles and health care service utilisation of the population, while the DS includes an extensive list of disability status. Both include a question regarding self perceived general health status where response categories are 'very good', 'good', 'regular', 'bad' and 'very bad'. The sample sizes of the four NHS surveys are about 40,000 in 1987, 26,000 in 1993, and 8400 in 1995 and 1997 each, and the sample size of the 1999 DS is close to 70,000 individuals. In Figure 29 we compare the proportion who report bad or very bad health by five-year age intervals.

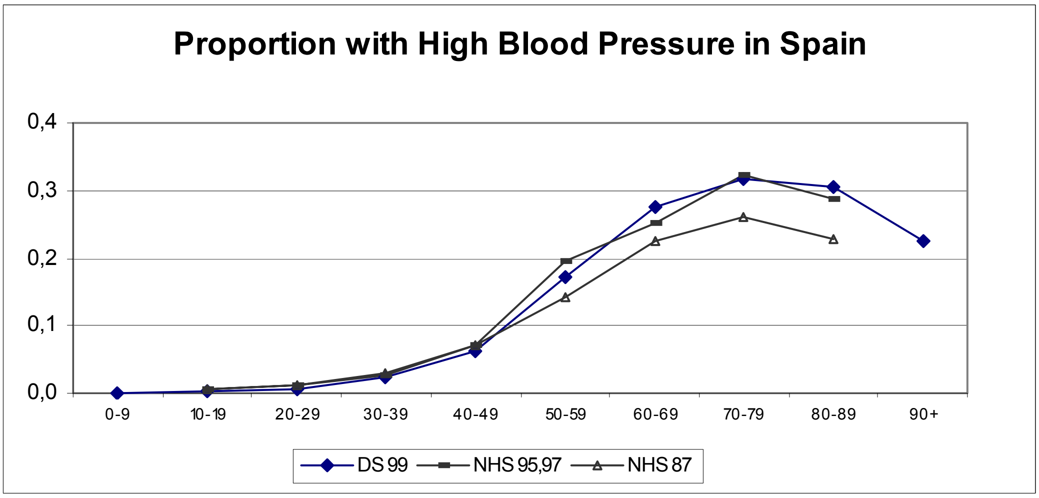
Figure 29. Proportion in bad health: Spain 1987-99



Between 1987 and 1993, there was a substantial drop in the proportion who reported bad health at ages over 50, while at ages below 50 there was no difference. Between 1993 and 1995-7, we observe a substantial increase in the proportion of bad health, converging, in consequence, at the 1987 level. Between the period 1995-7 and 1999, there has been a substantial drop in the bad health proportion for all age groups. A part of the differences between 1999 and other years is that the reference period in the 1999 survey was "in general" while it was "during the last 12 months" in other years. What do these differences by year tell us about trend? It is hard to say anything except that we should be very careful in interpreting the differences as trend.

Another source of information on health status that we have available in the National Health Survey is the prevalence of chronic diseases. In principle, we think that chronic disease status would suffer less from the cultural or social norm bias, as the questions are more concrete and less subjective than the questions regarding general health status. However, we have to be aware that the prevalence rate of any chronic disease is conditioned by the medical consultation by individuals. A potential bias exists owing to the differential frequencies of medical examination over time or between populations. This problem is similar to the perception bias in the case of self-assessed health status. That is, the population who aspire better health would check their health more frequently with doctors, and therefore more diseases are likely to be detected. We examine the prevalence rate of High Blood Pressure as a representative example of chronic diseases (Figure 30).

Figure 30. Proportion with high blood pressure in Spain

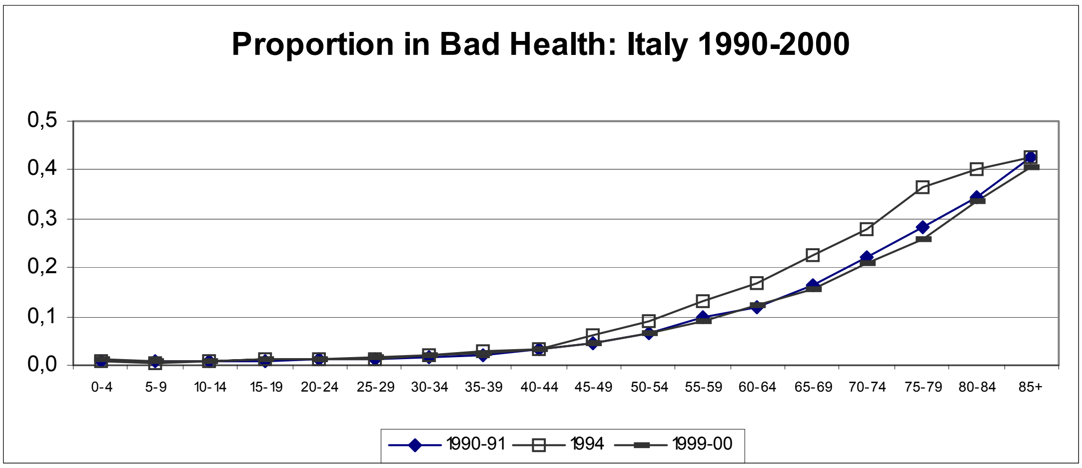


Over time we observe an increasing prevalence rate of high brood pressure, especially among the elderly population. It should be noted, however, that this inter-temporal increase might be due to examination frequency bias as discussed above. Further studies are needed. A similar increasing trend of prevalence is observed for other chronic diseases such as Cholesterol, Diabetes and Heart problems.

Italy

Morbidity data from Italy is obtained from the *National Survey of Health Conditions and Use of Health Services* carried out by National Statistics Institute. We have three cross-section surveys carried out in 1990-91, 1994 and 1999-2000. One main advantage of the Italian health surveys is that the sample sizes are relatively large: about 67,000 persons for the 1990-91 survey, 62,000 for the 1994 survey and 140,000 for the 1999-2000 survey. We examine the trend using the general health status question: "How is your health in general?". Results are shown in Figure 31.

Figure 31. Proportion in bad health: Italy 1990-2000

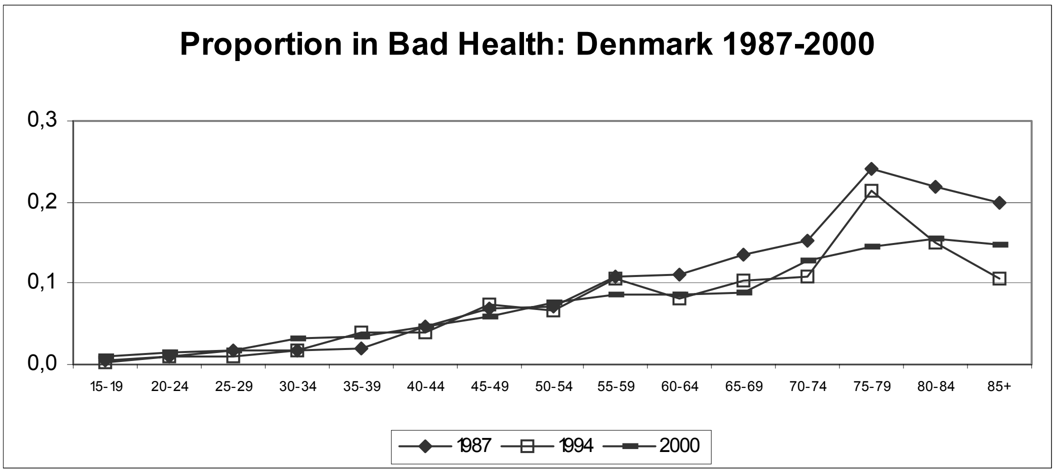


According to Italian data, we observe worsening health status during the first half of 1990s and improving health status during the second half of 1990s. The early worsening and the later improvement were of a similar magnitude to be offset almost exactly. Should we interpret these differences between years as genuine worsening and genuine improvement of population health in Italy? We think not. Further studies are needed.

Denmark

The sample size of Danish data is about 4700 for 1987 and 1994 each and about 17,000 for 2000. Figure 32 shows the patterns for those three years.

Figure 32. Proportion in bad health: Denmark 1987-2000



First, we can observe a higher volatility in the first two surveys due to their small sample size and a much smother age profile for 2000 most probably due to its large sample size.

Over time, we observe a substantial health improvement between 1987 and 1994 at all ages over 60. Between 1994 and 2000 there is no clear trend. If we interpret the results literally, health status of Danish elderly population has improved during the first period (1987-1994) but has not improved during the second period (1994-2000). To ascertain or reject this interpretation we need further evidence.

Sweden

For Sweden we have available three different years (1990, 1995 and 2000) of health status data. The proportion in bad or very bad health is calculated separately for men and women and shown in Figures 33a and 33b.

Figure 33a. Proportion in bad health: Swedish men 1990-2000

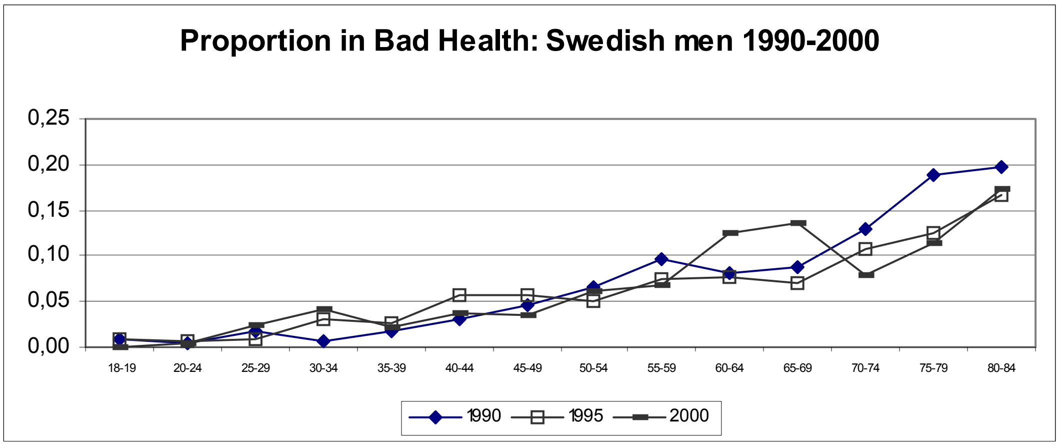
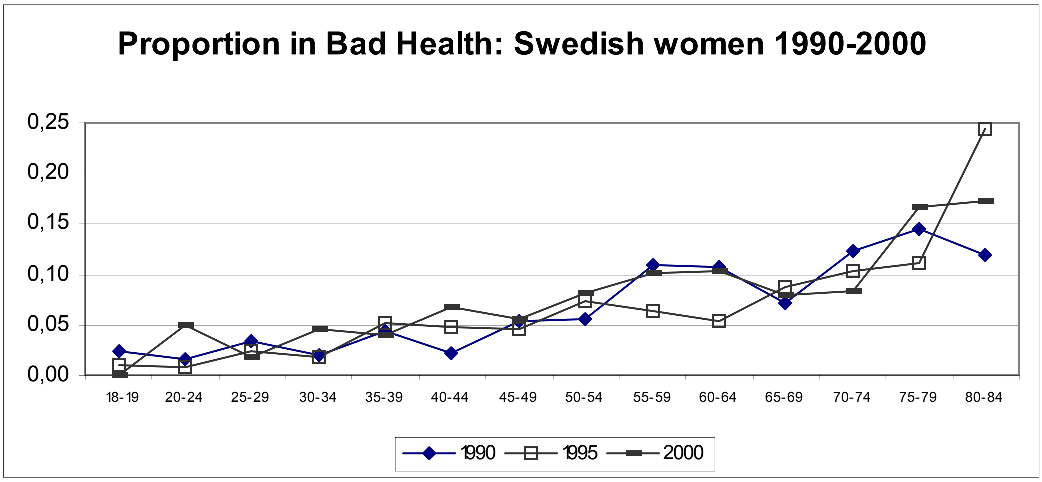


Figure 33b. Proportion in bad health: Swedish women 1990-2000



First, we can see highly volatile age profiles in all years probably due to small sample size. The comparison over time is difficult owing to high volatility; at some ages there is improvement but for other ages worsening and the trend varies between the period 90-95 and 95-2000 depending on ages. We think it is extremely unreliable to interpret any trend using the Swedish data.

5.8 Health and education in the EU

Many studies have found a positive association between health and socioeconomic status (income, wealth, education and occupation level and employment status). Yet the direction of causation between them is difficult to establish, and is most likely that it runs both ways (see Bound, 1991; Dwyer and Mitchell, 1999 and the survey by Smith, 1999). For example, those with better health are likely to be more productive and enjoy therefore greater earning potentials. On the other hand, greater wealth allows easier access to and better quality of health care therefore providing better health outcome. It is also possible that there are unobserved factors that affect both wealth and health in a same direction, thus leading to the observed positive relation between the two. For example, those who are far sighted are likely to take more care of their health and therefore more productive and also save more, therefore leading to the observed positive association.

Education level suffers less from endogeneity problems than other socioeconomic variables since most people complete their schooling relatively early (before age 25) when their health status is in most cases good enough not to interfere with their schooling. For example, as we could observe earlier, the proportion with bad or very bad health among those aged less than 35 is less than 5% in all the ECHP countries. Many studies have shown education as the single most important socioeconomic characteristic in determining various measures of health (see for example, Elo and Preston, 1996, in mortality and Freedman and Martin, 1999, in function limitations).

Effect of education on general health status

We first examine the effect of education on general health status. In Table 8 we present regression results of health status for the 11 European countries in ECHP. Three schooling levels are distinguished, low (omitted category), medium and high.

Table 8. Effect of education level (relative to low education level) on health status (ordered logit coefficients in parenthesis are not significant at 5% level)

	Ages 25-44		Ages 45-64		Ages 65+	
	Medium	High	Medium	High	Medium	High
Germany	0.176	0.508	0.292	0.757	0.385	0.421
Denmark	0.551	0.903	0.769	0.988	0.258	0.553
Netherlands	0.299	0.708	0.402	0.669	0.391	0.638
Belgium	0.269	0.644	0.371	0.600	(0.363)	0.618
France	0.304	0.405	0.355	0.613	0.322	0.588
UK	0.322	0.778	0.473	0.869	0.449	0.754
Ireland	0.675	0.904	0.485	0.991	0.759	1.145
Italy	0.342	0.672	0.444	0.610	0.548	1.008
Greece	0.172	0.300	0.597	0.832	0.433	1.062
Spain	0.365	0.599	0.824	1.145	1.038	0.817
Portugal	0.701	1.055	1.209	0.969	1.282	0.998

The results are encouraging. Among the 66 estimated coefficients, only one (medium education level for ages 65+ in Belgium) is not significant at 5% level. We can see persistently substantial effects of education on self-assessed health status across countries and for all age groups, suggesting that genuine beneficial effects of education exists in health. This hypothesis is supported by the fact that even when we include other socioeconomic variables, such as employment status and household income, the education coefficients maintain almost entirely their magnitude and statistical significance.

Effect of education on disability

Education again stands out as an important factor in determining the probability of disability across countries and in all age groups. In most cases, education lowers substantially the probability of suffering disability. This difference by education level is greater among younger people than those over 64 years. Among those 65 or older, only those with high education level enjoy significantly lower rates of disability and this effect of high education is greater among the southern European countries than other countries (Table 9).

Table 9. Effect of education level (omitted: low) on disability status (logit coefficients in parenthesis are not significant at 5% level)

	25-44		45-64		65+	
	Medium	High	Medium	High	Medium	High
Germany	(0.045)	-0.366	(-0.083)	-0.447	(-0.101)	(-0.142)
Denmark	-0.848	-1.014	-0.675	-0.896	(-0.150)	(-0.281)
Netherlands	-0.281	-0.640	-0.341	-0.693	(-0.102)	(-0.259)
Belgium	-0.272	-0.952	-0.379	-0.386	(-0.193)	-0.386
France	-0.374	-0.900	-0.324	-1.169	-0.250	-0.512
UK	-0.223	-0.607	-0.279	-0.542	(-0.145)	-0.345
Ireland	-0.824	-1.082	-0.632	-1.198	(-0.154)	-0.933
Italy	-0.390	-0.992	-0.629	-0.835	-0.285	-0.870
Greece	-0.453	-0.518	-0.586	-0.996	(-0.187)	-1.028
Spain	-0.676	-1.222	-0.791	-1.441	-0.800	-0.677
Portugal	-0.671	-0.730	-0.863	-0.524	-0.938	-0.498

Educational composition to explain cross-country health status differences

Given the persistent effect of education level on individual health status for all countries analysed, we may ask whether it is the difference in educational composition that explain cross-country differences in health status. Indeed, education level shows substantial differences among the countries across the age groups. For example, the proportion of people with a high level of education is close to 40% in Belgium and Denmark while it is less than or close to 10% in Portugal and Italy among those aged 25 to 44. Similar differences exist for other age groups as seen in Table 10.

Table 10. Educational composition : ECHP 94

	Ages 25-44		Ages 45-64		Ages 65+	
	% medium	% high	% medium	% high	% medium	% high
Belgium	34.98	39.14	27.49	26.65	22.57	13.42
Denmark	40.88	39.11	35.06	31.21	24.09	14.40
France	46.21	24.30	31.50	15.67	15.27	7.00
Germany	55.31	23.49	46.55	21.52	38.21	14.30
Greece	31.40	28.12	15.24	11.21	9.03	4.16
Ireland	42.40	16.63	27.36	10.80	12.89	5.63
Italy	42.63	10.12	20.78	6.34	13.17	3.80
Netherlands	63.10	21.39	56.58	18.07	43.61	9.91
Portugal	12.69	6.62	3.17	3.43	1.41	1.17
Spain	20.20	24.81	6.92	9.18	3.88	3.94
UK	38.61	26.11	27.85	19.98	18.49	10.72

To contrast the hypothesis, we examine the health status by education level for three age groups as defined earlier as shown in the following Figure 34a to 34c. If the individuals in the same education category but in different countries show similar levels of health status, cross-country health status differences could be attributed to the compositional differences in education.

Figure 34a. Average health status by education: ECHP 94 – ages 25-44

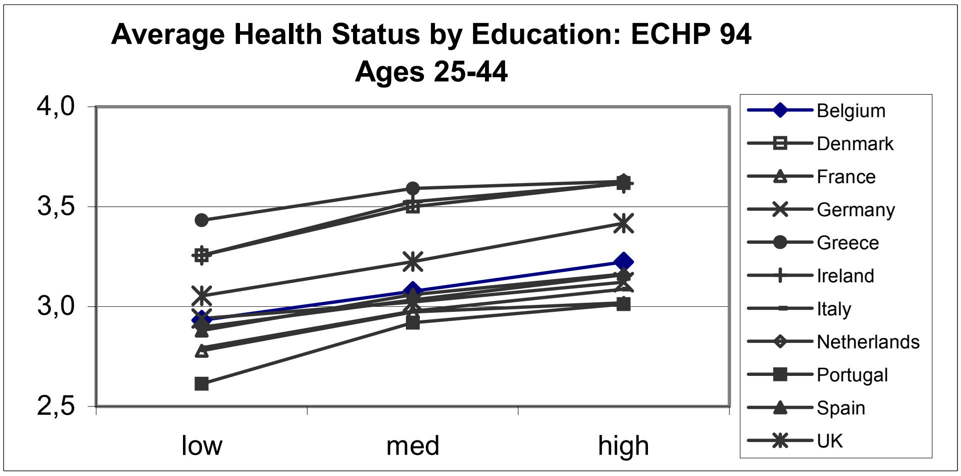
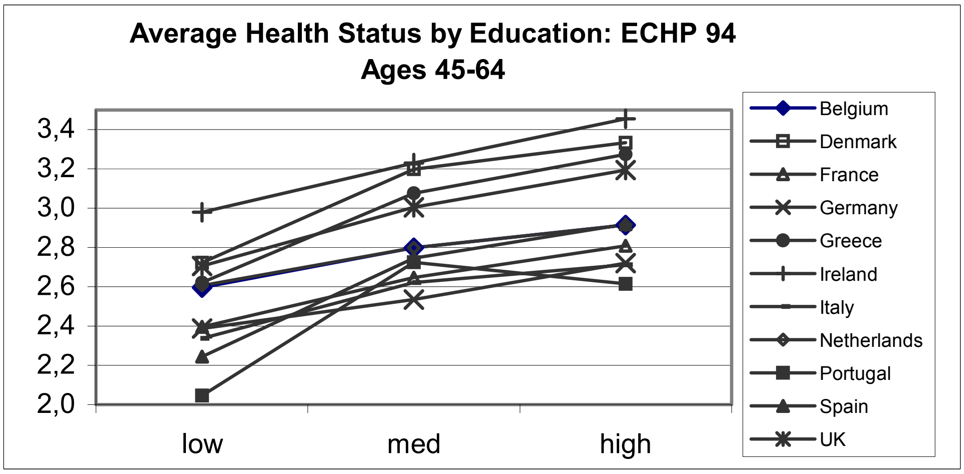
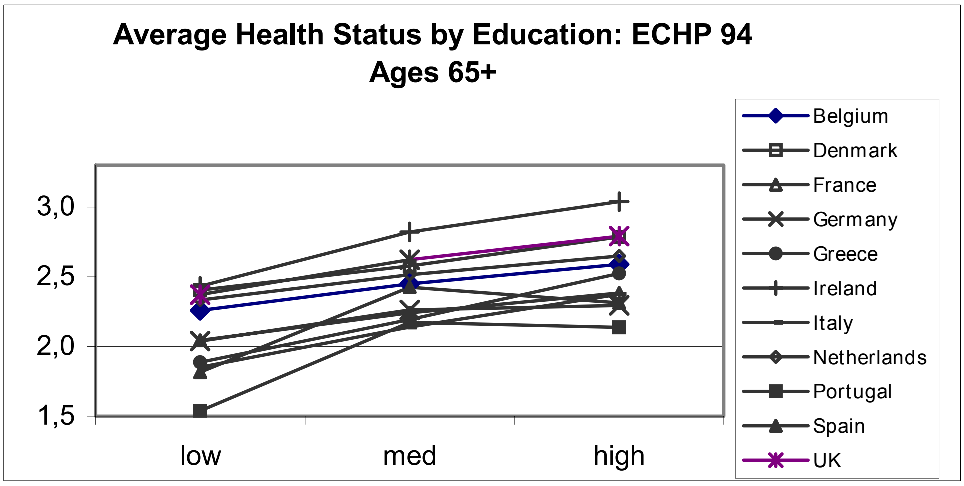


Figure 34b. Average health status by education: ECHP 94 – ages 45-64



The hypothesis can be rejected clearly. Education level affects significantly individual health status in all countries as shown in the positive slope. Nevertheless, education profiles of health status are parallel between countries for most countries.

Figure 34c. Average health status by education: ECHP 94 – ages 65+



Cross-country health status variations at each level of education are much greater than the variations by education within each country. Therefore, the differences in health status between countries are attributed more to the country specific effects than to the educational composition.

6. Health-adjusted life expectancies: Trends and projections

6.1 Concept and illustration

Health expectancies are summary measures of population health that estimate the mean time (in years) that a person can expect to live in a specific health state. Health expectancy is a generic term used for any life expectancy lived in a specific health state, which includes good health (i.e. disability-free) or poor health (i.e. disabled).

Since the late 1980s, an international group called 'REVES' headed by J.-M' Robine has developed and promoted the concepts and methodology for the calculation of these indicators, which are currently widely calculated and used by different countries for the evaluation of population health status (Mathers et al., 1993). In a wider perspective, the World Health Organisation has published in recent years different indicators of health expectancies (WHO, 2000, 2001 and 2002) for all member states.

When using health expectancies, the years lived are not equally considered independently of the health state as it occurs when calculating life expectancy, but the distinction is made between years lived in perfect health and years lived with some type of health problem. Health expectancy indicators thus constitute an attractive instrument for the long term follow-up of population health tendencies. They can be easily interpreted as an extension of the life expectancy concept.

Yet, for them to be really useful, these indicators must be comparable among populations and through time. This means, on one hand, using homogenous concepts and definitions of health and, on the other hand, using comparable tools to obtain the information about the population health status. Finally, several methods to calculate health expectancies have been developed. A key issue in health expectancy calculation is the need to define what is understood by health, in other words, under what criteria the health status of a population is established. For all these reasons, it is not a surprise that there are as many possible health expectancy measures as health concepts and methods to calculate them (Robine et al., 1999).

Conceptual background

The most frequently used method for calculating health expectancy measures is Sullivan's method. It uses disability prevalence data or population health status data to distinguish between hypothetical years of life lived with or without disability for a fictitious cohort derived from a period mortality table. The main limitations of this methodology are: comparability between populations (can only be partially achieved using common standardised models of protocols and questionnaires); the lack of information about the transition or reversibility of different health states or disabilities; and that they offer stock information, that is, accumulated results of the consequences of incidence of diseases and injuries that did not necessarily occur at the same year in which the survey took place.

The main advantages of Sullivan's method lie in the simplicity of the calculations and the relative easiness to obtain required information: it only requires a mortality table and health state prevalence of the population, which can be obtained easily from health or disability surveys. In some cases, data can even be obtained from some census questionnaires. Table 11 shows health expectancy calculated using Sullivan's method with Spanish data from the national health survey in 1997.

Table 11. An illustrative example of health expectancy calculation

Use of Sullivan method to calculate health expectancy in good health and bad health, Spain, 1997, both sexes.								
Age	Life table			% persons in Bad health	Years in		Life expectancy in	
	l(x)	nL(x)	E(x)		Bad health	Good health	Bad health	Good health
0-4	100,000	497,232	78.79	14.7%	73,093	424,139	23.8	55.0
5-14	99,371	992,918	74.28	7.2%	71,490	921,428	23.2	51.0
15-24	99,203	989,699	64.40	15.7%	155,383	834,316	22.6	41.8
25-44	98,695	1,952,508	54.70	19.1%	372,929	1,579,579	21.1	33.6
45.64	96,140	1,848,692	35.85	42.0%	776,451	1,072,242	17.8	18.1
65-74	86,196	795,833	18.53	56.3%	448,054	347,779	10.8	7.7
75 +	70,950	801,677	11.30	60.6%	485,816	315,861	6.8	4.5
Sources: Spanish National Health Survey 1997. Ministry of Health. Population projections 1991-2050. INE. MNP (Vital Statistics). Mortalities by age. INE.								

The most common data on health states or disability prevalence come from health surveys (i.e. national health surveys, carried out in many countries) or disability surveys (based on the definitions and recommendations of International Classification of Impairments, Disabilities and Handicaps (ICIDH).

Another source is the International Classification of Functioning, Disability and Health (ICF), which has just recently appeared. Some countries also have health-related questions included in their census questionnaire. There is more than one question included in these surveys that is potentially useful to calculate HE.

Thus, from these sources one can calculate age-specific perceived health state prevalence (proportion of population by health status), age-specific disability prevalence (proportion of population with disability), age-specific handicap prevalence (proportion of population handicapped), and so on. These prevalence rates can also be disaggregated by severity.

Some estimates from the WHO

World Health Organisation has calculated health expectancies for all member countries in its *World Health Report* of recent years. Estimates for year 2000 (WHO, 2001) for the countries of European Union are presented in Table 12 and Figures 35 (at birth) and 36 (at age 60).

Table 12. Health-adjusted life expectancy

Country	At Birth		At 60 years		Loss of Healthy life (at birth) Years		as % of LE	
	Men	Women	Men	Women	Men	Women	Men	Women
France	68,5	72,9	16,6	19,4	6,7	10,2	8,9%	12,2%
Italy	69,5	72,8	16,3	18,8	6,4	9,6	8,5%	11,6%
Sweden	70,1	72,7	16,8	18,7	7,2	9,2	9,3%	11,3%
Spain	68,7	72,5	15,8	18,3	6,6	9,8	8,8%	11,9%
Austria	68,1	72,5	15,2	18,4	6,8	8,9	9,0%	10,9%
Greece	69,7	72,3	16,0	17,6	5,7	8,5	7,6%	10,5%
Luxembourg	67,6	72,0	14,9	18,4	6,3	8,7	8,5%	10,8%
Germany	67,4	71,5	14,8	17,6	6,9	9,2	9,3%	11,4%
Finland	66,1	71,5	14,8	17,9	7,6	9,5	10,3%	11,7%
United Kingdom	68,3	71,4	15,3	17,4	6,5	8,5	8,7%	10,6%
The Netherlands	68,2	71,2	15,2	17,8	7,3	9,7	9,6%	12,0%
Belgium	67,7	71,0	15,3	18,0	6,9	9,9	9,2%	12,2%
Ireland	67,8	70,9	14,3	16,9	6,3	8,8	8,5%	11,0%
Denmark	68,9	70,1	15,7	16,5	5,3	8,4	7,2%	10,7%
Portugal	63,9	68,6	13,6	16,0	7,8	10,7	10,9%	13,5%

Source: World Health Organisation, *The World Health Report 2001*, Statistical Annex, Table 5, WHO, Geneva.

Figure 35. Health-adjusted life expectancy at birth – EU countries, 2000

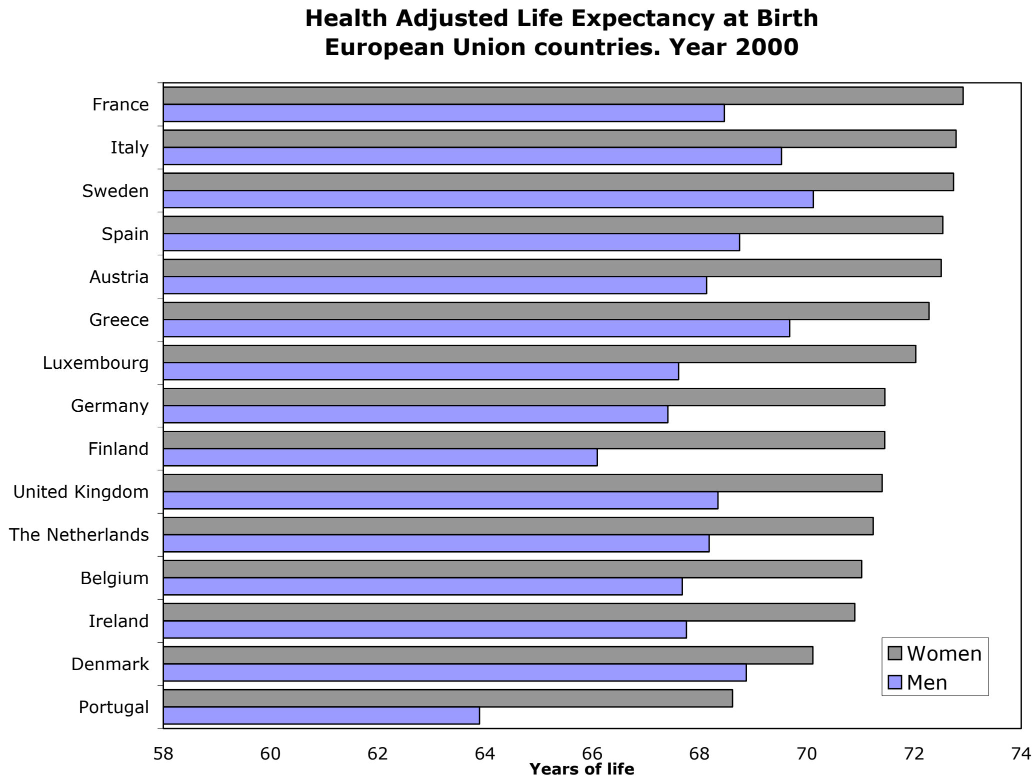
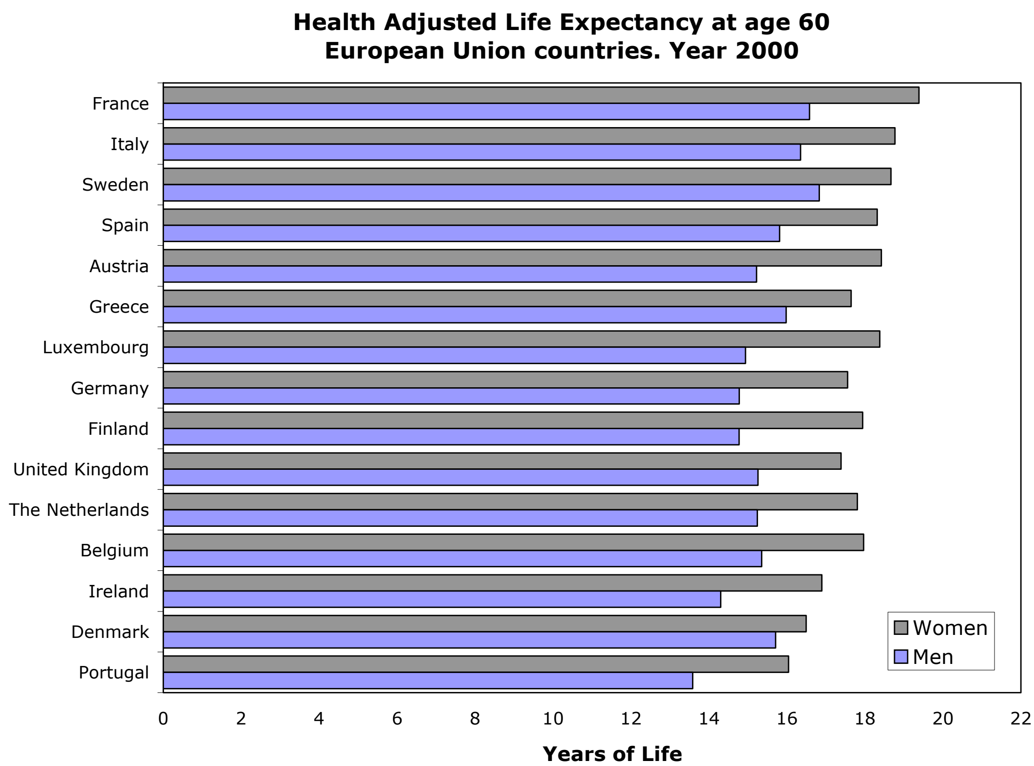


Figure 36. Health-adjusted life expectancy at age 60 – EU countries, 2000



Both at birth and at age 60 French women and Swedish men are on the top of the ranking while Portuguese men and women rank in the worst position. Differences between sexes are the highest in Finland and Luxembourg and the lowest Denmark.

Health expectancies using ECHP

There is one statistical source common for all EU countries. The European Community Household Panel (ECHP) is a survey (conducted yearly since 1994) based on a standardised questionnaire that involves annual interviewing of a representative panel of households and individuals in each country, covering a wide range of topics. Main questions regarding health and disability in ECPH are related to self perceived health and disability. Although the questionnaire (questions and scale of responses) is virtually the same in all countries, it became apparent from these surveys that standardised instruments did not solve the problems of comparability across countries. These problems relate much more fundamentally to unmeasured differences in expectations and norms for health. Mathers (2003) and Sadana et al (2002) also highlight this problem.

After calculating disability-free life expectancies (DFLE) in the EU countries with the Sullivan method using data from the ECHP 1994 and life tables supplied by Eurostat, Robine et al. (2001) evaluate the advantages of this source, but also point to some problems such as different versions of questionnaire, different rate of response and the exclusion of institutionalised population in the sample.

According to 1994 wave ECHP, Greece is the population with a highest level of DFLE at birth (measured in years of life without disability, both for men and women. The worst figures belong to Portugal. At ages 65, Italy (men) and Germany (women) have the worst situation, and France and Luxembourg the best one. As a proportion of total life expectancy, the ranking is not exactly the same (because the differences in LE are not always the same as of the DFLE), but quite similar: Portugal, Italy, Germany and The Netherlands in the group with low proportions, and Greece, Luxembourg, Ireland and Denmark in the group with high proportions.

ECHP database also permits to calculate DFLE by level of severity. The years lived with disability are discomposed between 'moderate disability' and 'severe disability'. For all countries except France, a higher proportion of disability belongs to 'moderate disability'. For the elderly population, the proportion of severe disability tends to increase and often becomes a dominating proportion of disability years in the last open-age interval (85+).

Figure 37. Life expectancy (...) women

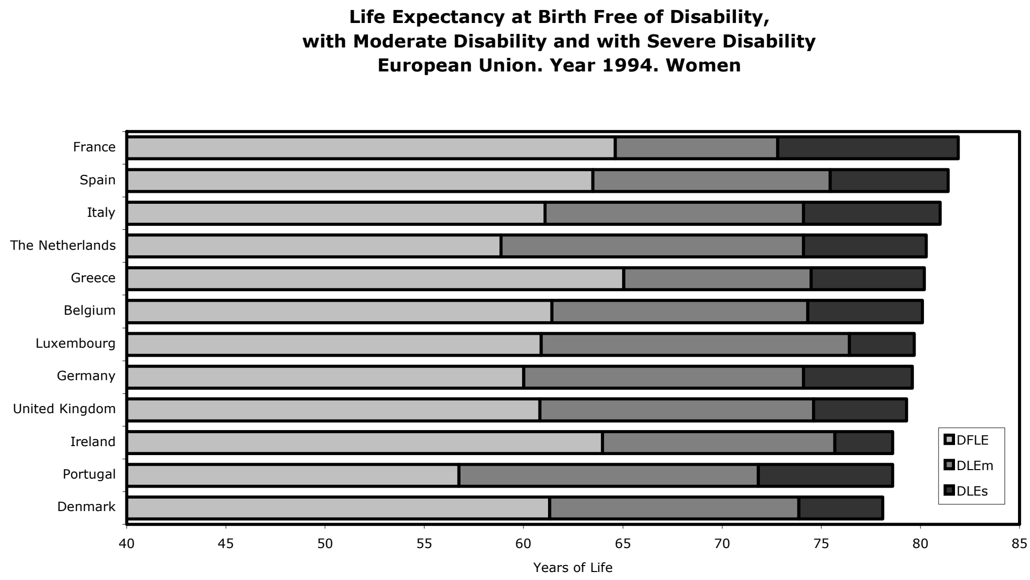


Figure 38. Life expectancy (...) men

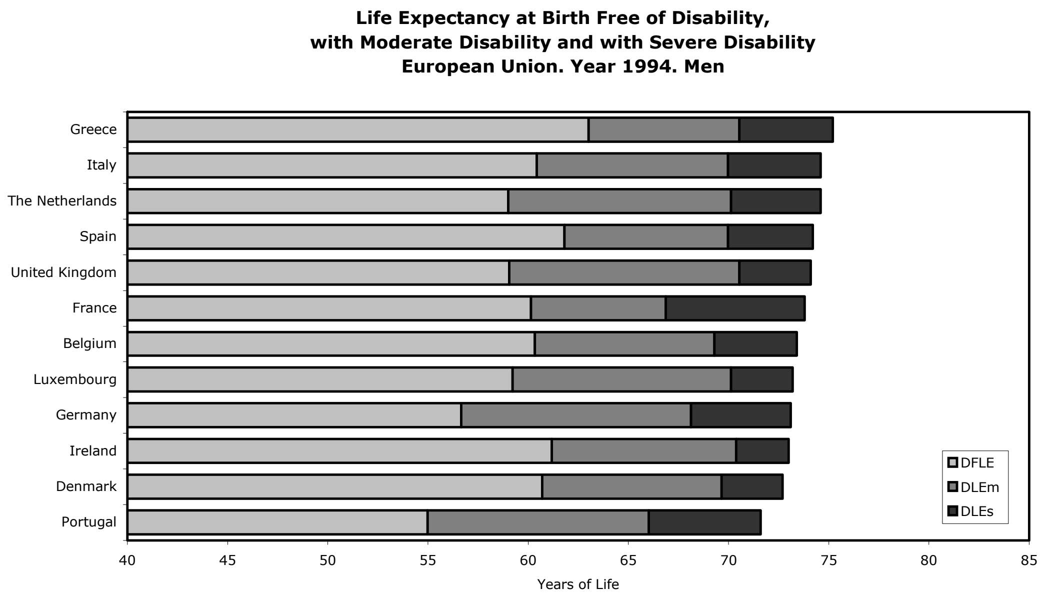


Figure 39. Life expectancy (…) women

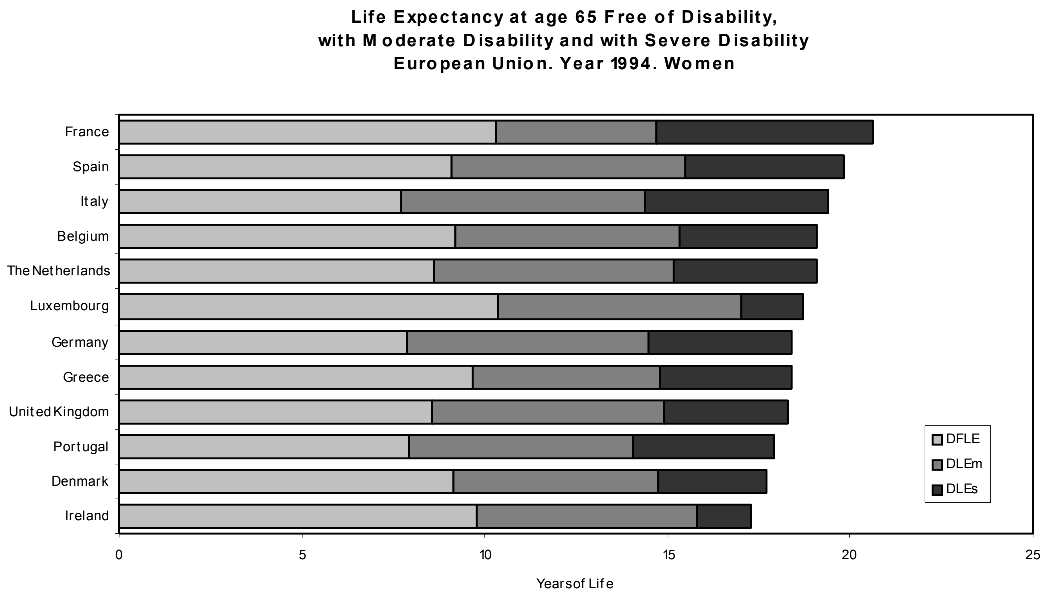


Figure 40. Life expectancy (…) men

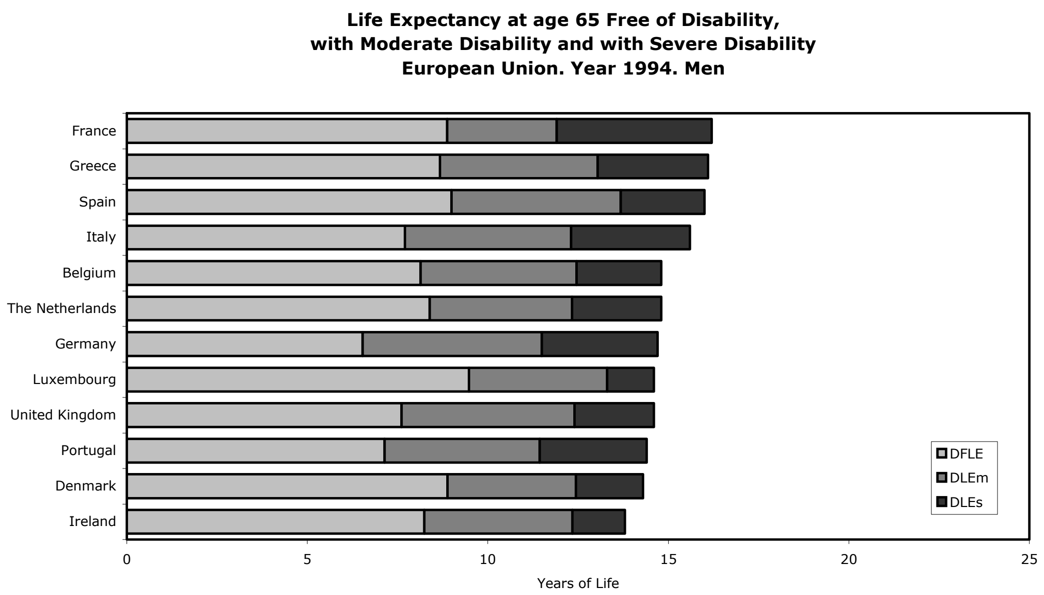


Table 13. Life expectancy at birth and at age 65 (...) both sexes

Life Expectancy at birth and at age 65 Free of Disability,
with Moderate Disability and with Severe Disability
European Union. Year 1994. Both Sexes

At birth	Women DFLE	DLEm	DLEs	LE	At birth	Men DFLE	DLEm	DLEs	LE
France	64,6	8,2	9,1	81,9	Greece	63,0	7,5	4,7	75,2
Spain	63,5	12,0	5,9	81,4	Italy	60,4	9,5	4,6	74,6
Italy	61,1	13,0	6,9	81,0	The Netherlands	59,0	11,1	4,5	74,6
The Netherlands	58,9	15,3	6,2	80,3	Spain	61,8	8,2	4,2	74,2
Greece	65,0	9,5	5,7	80,2	United Kingdom	59,1	11,5	3,6	74,1
Belgium	61,4	12,9	5,8	80,1	France	60,1	6,7	6,9	73,8
Luxembourg	60,9	15,5	3,3	79,7	Belgium	60,3	9,0	4,1	73,4
Germany	60,0	14,1	5,5	79,6	Luxembourg	59,2	10,9	3,1	73,2
United Kingdom	60,8	13,8	4,7	79,3	Germany	56,7	11,5	5,0	73,1
Ireland	64,0	11,7	2,9	78,6	Ireland	61,2	9,2	2,6	73,0
Portugal	56,7	15,1	6,8	78,6	Denmark	60,7	8,9	3,1	72,7
Denmark	61,3	12,6	4,2	78,1	Portugal	55,0	11,0	5,6	71,6

Age 65	Women DFLE	DLEm	DLEs	LE	Age 65	Men DFLE	DLEm	DLEs	LE
France	10,3	4,4	5,9	20,6	France	8,9	3,0	4,3	16,2
Spain	9,1	6,4	4,3	19,8	Greece	8,7	4,4	3,1	16,1
Italy	7,7	6,7	5,0	19,4	Spain	9,0	4,7	2,3	16,0
Belgium	9,2	6,1	3,8	19,1	Italy	7,7	4,6	3,3	15,6
The Netherlands	8,6	6,5	4,0	19,1	Belgium	8,1	4,3	2,3	14,8
Luxembourg	10,4	6,6	1,7	18,7	The Netherlands	8,4	3,9	2,5	14,8
Germany	7,9	6,6	3,9	18,4	Germany	6,5	5,0	3,2	14,7
Greece	9,7	5,1	3,6	18,4	Luxembourg	9,5	3,8	1,3	14,6
United Kingdom	8,5	6,4	3,4	18,3	United Kingdom	7,6	4,8	2,2	14,6
Portugal	7,9	6,1	3,9	17,9	Portugal	7,1	4,3	3,0	14,4
Denmark	9,2	5,6	2,9	17,7	Denmark	8,9	3,6	1,9	14,3
Ireland	9,8	6,0	1,5	17,3	Ireland	8,2	4,1	1,5	13,8

Source: Eurostat. European Community Household Panel.

6.2 Data

Health data

European Community Household Panel surveys provide health data from 1994 to 2000 for 11 countries: Belgium, Denmark, Germany, Ireland, Greece, Spain, France, Italy, The Netherlands, Portugal and the United Kingdom.

There are some problems in the use of this survey for cross-country comparison purposes and even to compare the results for a country in different years. These questions are extensively discussed in the previous section will not be commented upon here. With these problems in mind, we try to describe here the main tendencies found in the period 1994-1998.

The health related items from the ECPH questionnaire are:

a) self-assessed health status: How is your health in general? (very good/good/fair/bad/very bad);

b) disability:

i) only in 1994: "Are you hampered in your daily activities by any chronic, physical or mental health problem, illness or disability?" (Yes, severely/Yes, to some extent/No);

ii) from 1995 to 2000: Do you have any chronic, physical or mental health problem, illness or disability? (yes/no); and

iii) from 1995 to 2000: "Are you hampered in your daily activities by this chronic, physical or mental health problem, illness or disability?" (Yes, severely/Yes, to some extent/No).

Four types of health status have been estimated using these questions:

a) good health (= very good + good);
b) bad health (= bad + very bad);
c) disability (any level) (= Yes, severely +Yes, to some extent);
d) severe disability (= Yes, severely).

Health and disability prevalence age groups range from 16 to 85+ years old by 5 year intervals. Prevalence for the first age group, 16-19, have been applied to the 15-19 population group, in order to obtain an HE at age 15. No HE data at younger ages (0-14) have been estimated.

We have also estimated trends in HE using national sources, when available. Countries with national data on self-assessed health for more than one year of observation are Belgium, Italy, Spain, Denmark and Sweden.

Belgium. HE data have been directly taken from the Federal Planning Bureau calculations, which used data from the National Institute of Statistics – *Institut Pasteur* – national health surveys, 1997 and 2001.

Italy. Prevalence data on self assessed health are taken from the *Indagine multiscopo sulle famiglie, condizioni di salute e ricorso ai servizi sanitari* produced by the National Statistical Office (ISTAT), for the years 1990-91, 1994 and 1999-2000. ISTAT also provides the life table series. We have used the 1998 LT (the last available year) to compute the HE for 1999-2000 health data.

Spain. Prevalence data on self assessed health are taken from the national health survey (Ministry of Health), for the years 1987, 1993, 1995 and 1997. LT have been calculated using data on population and mortalities by age and sex for selected years provided by National Statistics Institute.

Denmark. Prevalence data on self assessed health are taken for the years 1987, 1994 and 2000. LT data have been calculated using data on population and mortalities by age and sex for selected years.

Sweden. Prevalence data on self assessed health are taken from the ULF survey, carried out by the Statistical Central Bureau, for the years 1990, 1995 and 2000. We do not have published LT nor raw data (population and mortalities by age and sex) to calculate them for desired years, so we have used the Eurostat Swedish LT available at Newcronos database.

Mortality data

The Sullivan method has been used to calculate HE. Prevalence of health status (self-assessed health, disability) has been combined with life tables (LT) information, namely survivors at exact ages –l(x)-, stationary population –L(x)- and life expectancy –e(x)-) for selected years. Mortality age groups range from 15 to 85+ years old. Health and disability prevalence age groups range from 16 to 85+ years old. Prevalence for the first age group, 16-19, have been applied to the 15-19 population group, in order to get a HE at age 15. No HE data at younger ages (0-14) have been estimated.

For years 1994 to 1999 we have used Eurostat LT available at Newcronos database. This common source guarantees no methodological biases in the mortality base for computation of HE. Probabilities between exact ages –q(x)- and life expectancies –e(x)- are the only LT series provided by Newcronos. We have calculated the rest of series (survivors at exact ages –l(x)-, stationary population –L(x)-) needed to apply the Sullivan method for computation of HE.

This mortality information, however, is not available for all countries for all years. This includes the year 1998 (only available for France and Spain), and 1996-99 for Italy. In order to fill this hole we have calculated LTs using the information on mortalities by sex and age, and population by sex and age provided by Eurostat's Newcronos database. We have used the actuarial method of construction of LT (regular distribution of mortalities between exact ages, except the first age, to which we have applied a fixed ratio equal to 0.15–0.85. We were not able to know the precise methodology used by Eurostat to construct their LT. For this reason, our LT being a fine replication of these are not however an exact replica. Differences are nevertheless negligible and do not affect to the HE calculations.

For the year 2000 (1999 and 2000 for Italy) we have used the LT projected by Eurostat and available at the Newcronos database.

6.3 Trends in health expectancies 1994-2000

Data in the ECHP allows us thus to compute the basic health expectancy indicators for EU countries. This is what we do in this section through four different indicators for men and women and at age 65, that is, LEGH or life expectancy in good health, LEBH or life expectancy in bad health, DFLE or disability-free life expectancy and SDFLE or severe disability-free life expectancy. As explained before when discussing health status for EU countries, comparisons among countries are not straightforward owing to several factors. On the other hand, for any given country, comparisons of results through time are equally flawed because of attrition, among other causes.

Life expectancy in good health (LEGH).

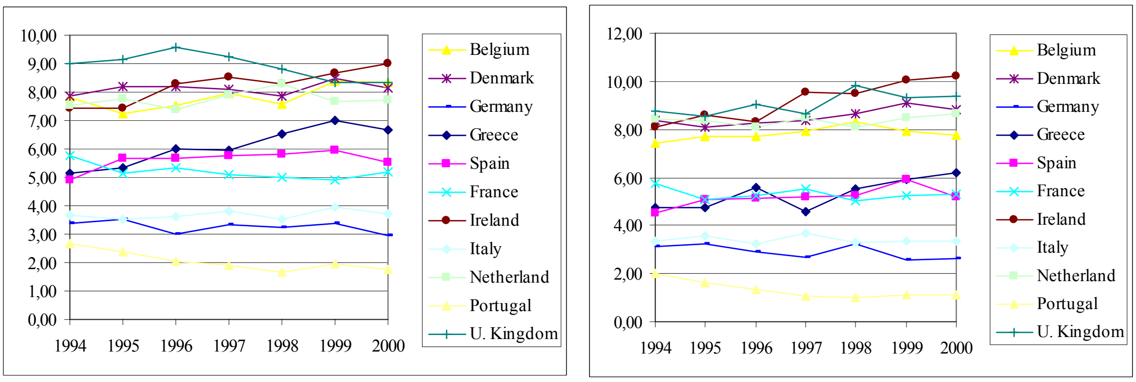
As shown in Figures 41 and 42, the level of LEGH is not the same between countries. We can organise them in groups, including: IRE, UK, NET, DEN and BEL (with highest values of LEGH), GRE, SPA and FRA and ITA, GER and POR that has the lowest LEGH. These groups remain the same both for males and females.

Values of LEGH at 65 in 2000 range for females from 10.21 years in Ireland to 1.11 in Portugal, which is amazingly low, and from 8.89 in Ireland to 1.77 in Portugal for males in that same year. In relative term as a proportion of life expectancy at age 65 the above figures mean that aged Irish men will still expect to live a 63.1% of their remaining lifetime in good health, while Portuguese men will enjoy a mere 12.4% of their remaining life years in good health. For Irish or Portuguese women these percentages are 56.7% and 6.2% respectively.

The expected years of life in good health have clearly increased during the period, for men, in Ireland, Greece, Spain and The Netherlands if we disregard the decrease observed in 1996. France and Portugal show an evident decrease of this indicator. The rest of the countries, Belgium, Denmark, Germany, Italy and the UK, show an erratic pattern with a no clear-cut trend in the 1994 to 2000 period. As for women, data allows to form the same country groups than for men when we look at the general level of LEGH. Concerning trends, however Belgium and Ireland show a clear increase of female LEGH with time. Spain, the UK, Germany and Denmark show some global improvement but with some oscillations. Portugal and France show a clear decrease through the period. The rest of the countries do not have a clear pattern.

Figure 41. Life expectancy in good health at age 65

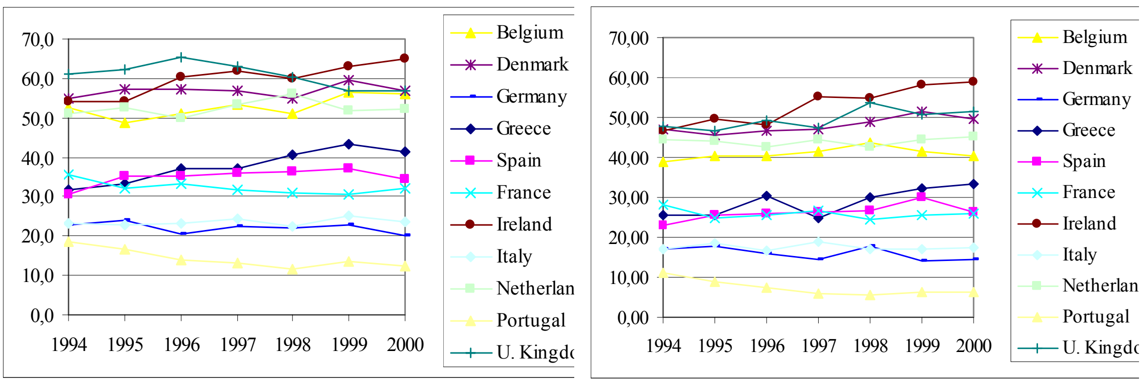
Men *Women*



Source: ECHP and own computations.

Figure 42. Life expectancy in good health at age 65 (as % of life expectancy)

Men *Women*



Source: ECHP and own computations.

Life expectancy in bad health (LEBH)

Trends in LEBH are shown in Figures 43 and 44 below and are, in general, symmetric to the good health ones (as the former increases, the latter decreases). But there are some exceptions because of the fact that neither grouping contains the 'fair' grade of health that has a prevalence that differs among countries or changes across time (or both).

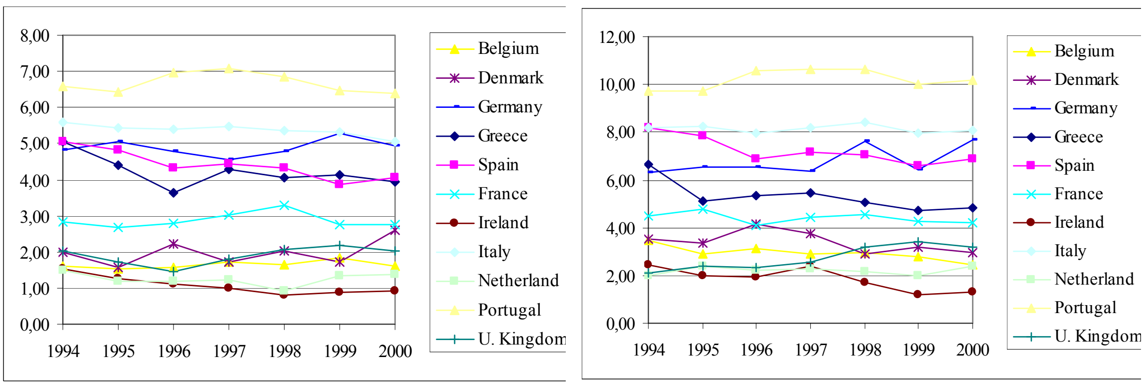
Both the number of years lived in bad health and the percentages of these over total life expectancy at 65 are in general greater for females than for males. The range of values for different countries is extremely wide. LEBH for year 2000 for females of age 65 is 10.17 in Portugal and 1.32 for Ireland. Concerning men, figures for that same year are 6.39 and 0.98, respectively. Portugal and Ireland represent the opposite extremes of the distribution in the level of self-assessed health status according to the ECPH data. Nevertheless, these are the two countries with the lowest life expectancies in the EU, both for males and females. Correlations between LE and health status indicators thus are not easy to establish contrary to what one would guess at first glace.

The highest LEBH for men is found in Portugal; an intermediate group includes Italy, Germany, Spain, Greece and France. Finally, the United Kingdom, Denmark, Belgium, the Netherlands and Ireland are the countries with the best relative position in LEBH. For the women groupings are similar to the just discussed, although not so clear-cut.

Time trends for men concerning LEBH show that for Portugal, France and Denmark the number of years lived in bad health is increasing. For Ireland, Spain, Greece and Italy, however, there is a clear, strong decrease. The rest of countries have an erratic or stable behaviour. On the other hand, LEBH time trends for women show an increase in Portugal and the United Kingdom, a clear decrease in Spain, Greece and Ireland, a certain decrease in Belgium, Italy and Denmark and an erratic or stable behaviour in Germany, the Netherlands and France.

Figure 43. Life expectancy in bad health at age 65

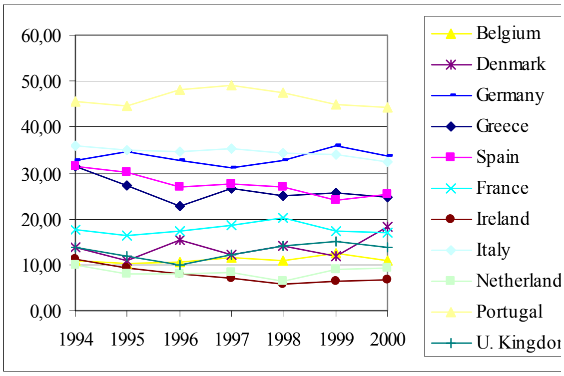
Men *Women*



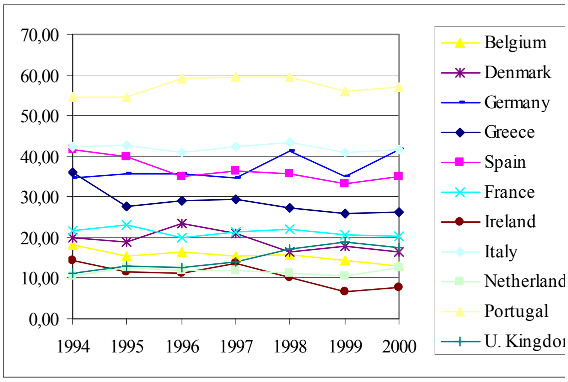
Source: ECHP and own computations.

Figure 44. Life expectancy in bad health at age 65 (as % of life expectancy)

Men



Women



Source: ECHP and own computations.

Disability-free life expectancy (DFLE).

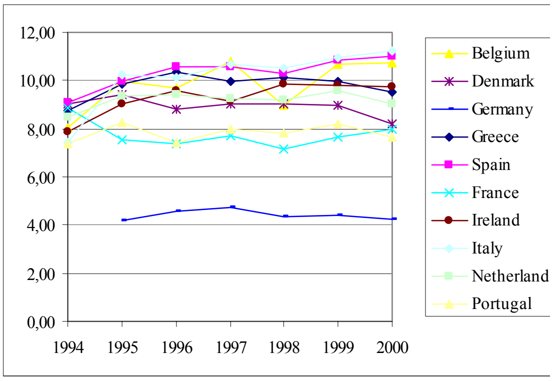
Globally speaking, distances among countries in what concerns DFLE are smaller than for LEGH or LEBH, with the exception of Germany, clearly below the rest for all years. The UK does not appear in this series. This can be seen in Figures 45 and 46 below.

Most of countries display an increase in DFLE. But some problems seem to exist with data for 1994 compared with the rest of years in the period analysed. Both for males and females, values in 1994 are quite smaller than for the rest of years. Only France has the opposite situation: 1994 data are higher than for the other years. We must remember here there was a change in the questionnaire just for this item in 1995 in relation to 1994.

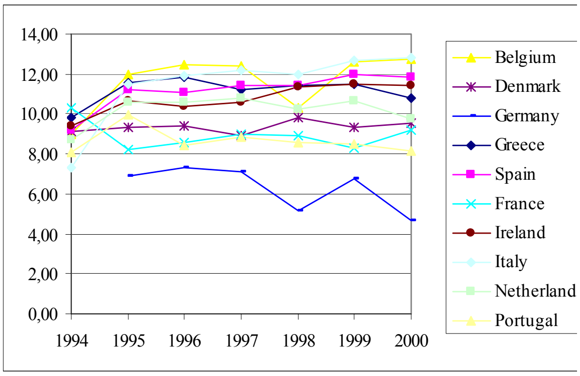
For the five years of the period, DFLE tends to increase in most of countries, unless France. But if we don't take in account this first year 1994, trends in DFLE become more complex. Both for males and females, Spain, Greece, Ireland and Italy show an increase of the years lived without disability. Denmark, Belgium, Portugal and France tend to decrease the DFLE.

Figure 45. Life expectancy free of disability at age 65

Men



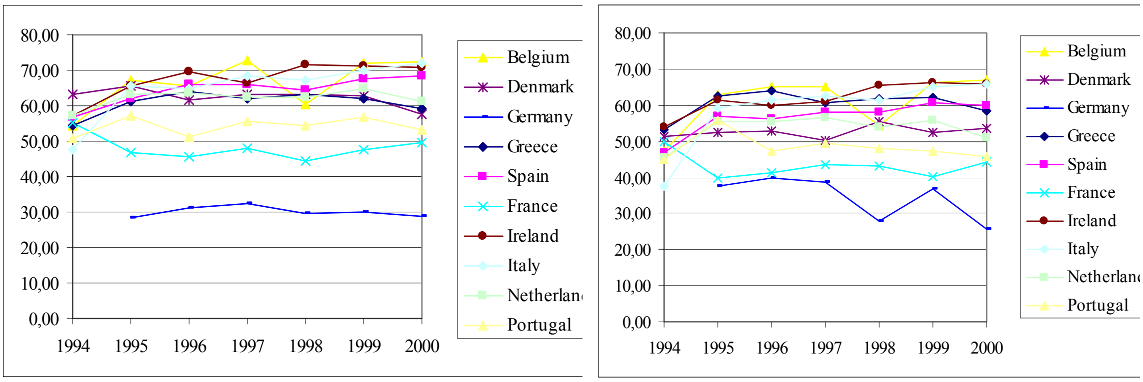
Women



Source: ECHP and own computations.

Figure 46. Life expectancy free of disability at age 65 (as % of life expectancy)

Men *Women*



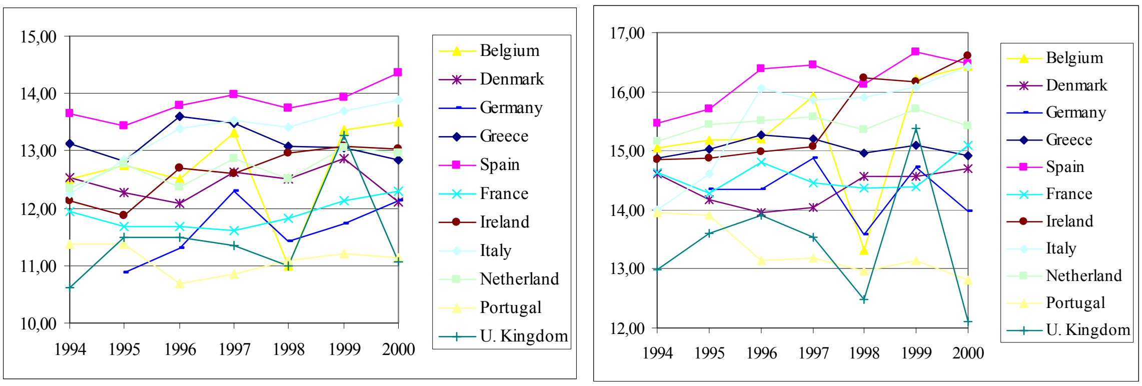
Source: ECHP and own computations.

Severe disability-free life expectancy (SDFLE).

Figures 47 and 48 show how SDFLE has in general more erratic trends than DFLE. According to ECPH, Spain is the country with the highest number of years free of severe disability after age 65 during the whole period (1994-00) and both for males and females. On the other hand, the UK, Portugal and Germany have the least years free of severe disability at age 65 of all countries. Both for males and females, SDFLE in Ireland, Spain and Italy tend to increase while for France, Belgium, Portugal and the UK the number of years lived without severe disability tend to decrease. In Germany, the Netherlands and Denmark this indicators does not show a clear pattern.

Figure 47. Life expectancy free of severe disability at age 65

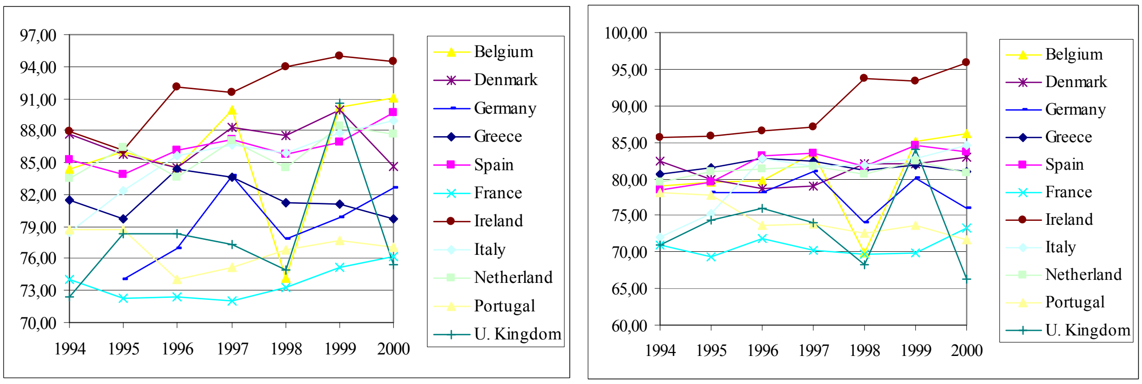
Men *Women*



Source: ECHP and own computations.

Figure 48. Life expectancy free of severe disability at age 65 (as % of life expectancy)

Men *Women*



Source: ECHP and own computations.

Summing up

Globally speaking, we find a great divergence of trends between countries and few clear trends. We may distinguish, however, certain groups of countries. Spain, Ireland, Greece and Italy seem to improve their health (increase of DFLE and LEGH, decrease of LEBH), while Portugal and France show a deteriorating trend in their health. We do not know whether this is a genuine picture of the health status of the EU population, or the results of other factors such as culture, social norm and measurement errors imbedded in health data. We think it is difficult under this circumstance to establish any coherent set of hypothesis for projections of health status based on past trends.

To be sure, when considering the considerable gains in life expectancy that European and other developed nations have witnessed in the last one hundred years one has to reckon with formidable advances in public health policies and health care systems to be able to explain that change. Although certain maladies have receded, new forms of morbidity are increasingly hitting people reaching high ages. Unless we have longer and more precise longitudinal evidence on the many aspects of morbidity we will not be able to discern how such health transitions are actually occurring. The ECHP is a very valuable tool for this purpose, but its evidence concerning morbidity is so far just too short on longitudinal terms. Moreover, the ECHP has not been specifically targeted for measuring morbidity the same way as national health surveys (NHS) have. Let us now revise the evidence we have been able to gather based on NHS data.

Trends in health expectancy according to data from national sources

We dispose of national sources of information on health for more than one year only for five countries: Belgium, Denmark, Sweden, Italy and Spain. For these countries we examine time trends in health expectancy.

The period covered varies from 4 years for Belgium (1997-2001) to 13 years for Denmark (1987-2000). The other three countries have a period of ten years: Spain for 1987-1997, Sweden for 1990-2000 and Italy for1990-2000. Since it is not suitable to compare the results across countries, we summarise the main trends found for each country.

Sweden. LEGH tend to increase, both for males and females and both at 15 and at 65 years of age. At age 65, the LEGH decreased during the first half of 1990s but increased during the second half of the same decade. Years lived in bad health tend to remain stable or increase slightly over time.

Denmark. A remarkable improvement of health status over time is observed. Years lived in good health have increased even faster than the life expectancy. This is observed at both young (15) and old (65) ages. LE in bad health has decreased in both absolute numbers of years and as a proportion of the life expectancy.

Italy. Trends in Italy appear irregular. For the first observed year (1990), LEGH is just a little higher than LEBH, but in second (1994) and third (2000) observed years health becomes worse. Changes are too large relative to the short time period and thus difficult to attribute them as a genuine change.

Belgium. We have only two time references for Belgium, and they are too close (only 4 years) one another to even attempt to examine trends. Reading the results literally, we can see LEGH has increased in absolute number of year, but decreased in proportion to life expectancy at age 65 for men.

Spain. Health Expectancies in Spain show a light improvement over time except for the period 1993-1995.

In summary, our examination of the data from the national health surveys leads us to conclude that it is impossible to establish any trend of health status and health expectancies using these data.

6.4 Relationship between life expectancy and health expectancy

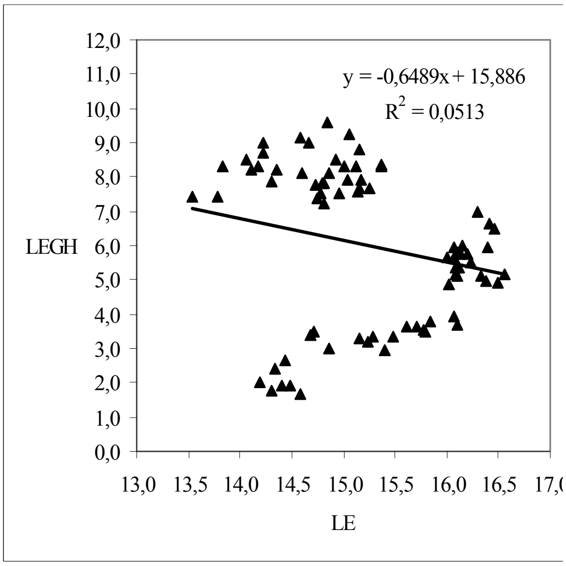
In this section we examine the relationship between life expectancy and health expectancy for the years 1994-1998 for which we have data for health status (ECHP). The purpose of this exercise is to see if there is any consistent and reasonable relationship between the two that can be used for the projection of the health expectancy. Life expectancy data for the years 1994 to 1998 are obtained from Eurostat Newcronos database. Health expectancies for each year are computed combining the life expectancy and health prevalence data from ECHP by Sullivan method. We computed the HE at age 15. We compare life expectancy with several measures of health expectancy, in good health, disability-free and severe disability-free. For each comparison, we have 55 data points (11 countries for five years, 1994-1998).

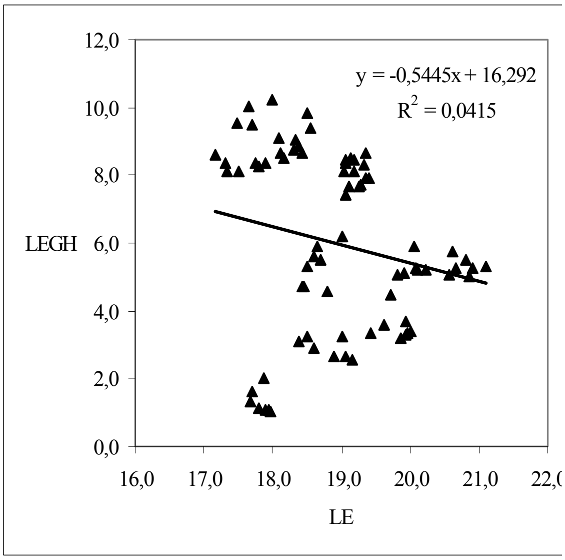
Life expectancy in good health vs. LE

As shown in Figure 49, there is a big dispersion of the observations and if at all a negative correlation between LE and LEGH is negative although the former explains an insignificant variation of the latter as measured by the squared R. If we interpret literally the regression results, a one year increase in LE at age 65 would decrease life expectancy in good health by 0.65 years for men and by 0.54 for women. Of course, this pooling of data needs to be controlled in many ways in order to yield interpretable results and evidence, something we do not attempt here.

Figure 49. Correlation between LE and LEGD at age 65 in the EU 1994-2000

Men / *Women*





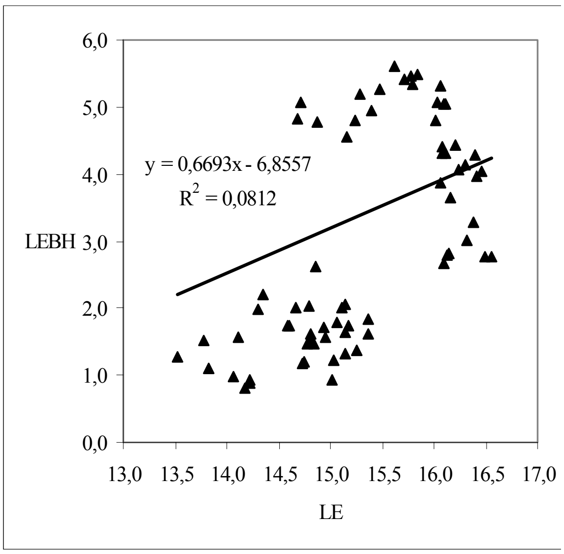
Source: ECHP and own computations.

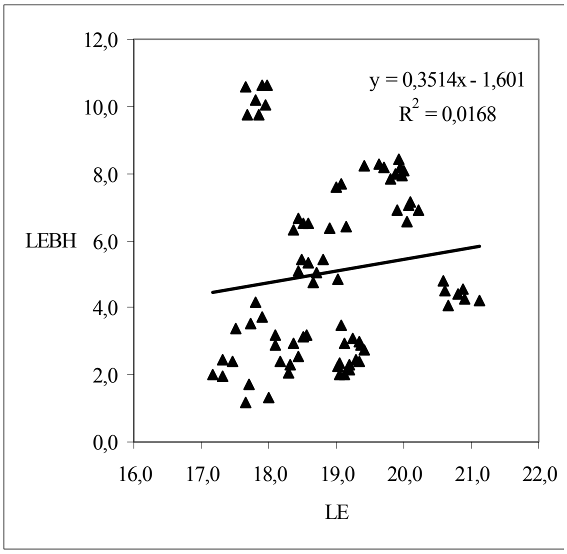
Life expectancy in bad health vs. life expectancy

Life expectancy in bad health has a positive correlation with LE as shown in Figure 50 below. Again, the variation on the former that is explained by the latter is extremely low and thus this crude evidence is not to be taken too literally. When so interpreted it would mean that for every year gained to LE at 65 men would spend 0.65 years in bad health while women would spend 0.35 years.

Figure 50. Correlation between LE and LEBD at age 65 in the EU 1994-2000

Men / *Women*





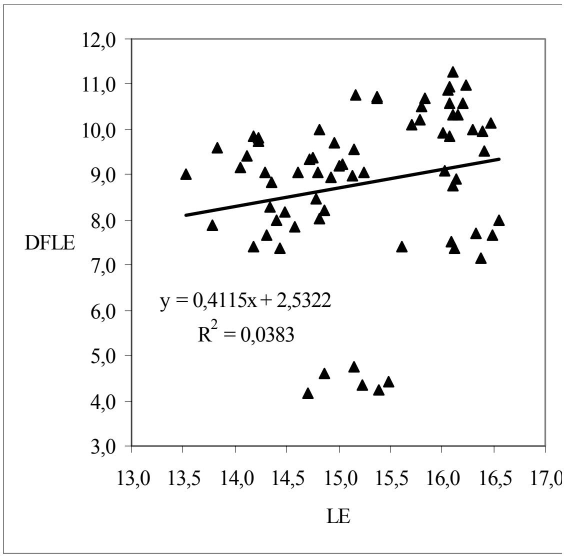
Source: ECHP and own computations

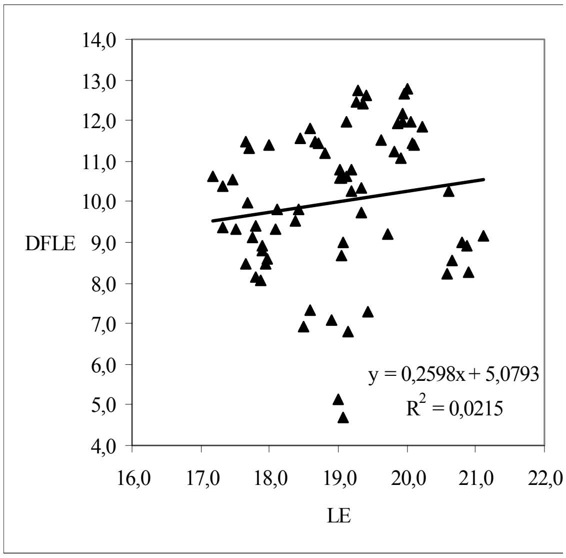
Disability-free life expectancy vs. life expectancy

As shown in Figure 51, there is again a big dispersion of the observations concerning this correlation as well as an almost null explanatory power of the independent variable LE. Both men and women would live a positive fraction of LE gains free of disability with that of men being larger than for women.

Figure 51. Correlation between LE and DFLE at age 65 in the EU 1994-2000

Men *Women*





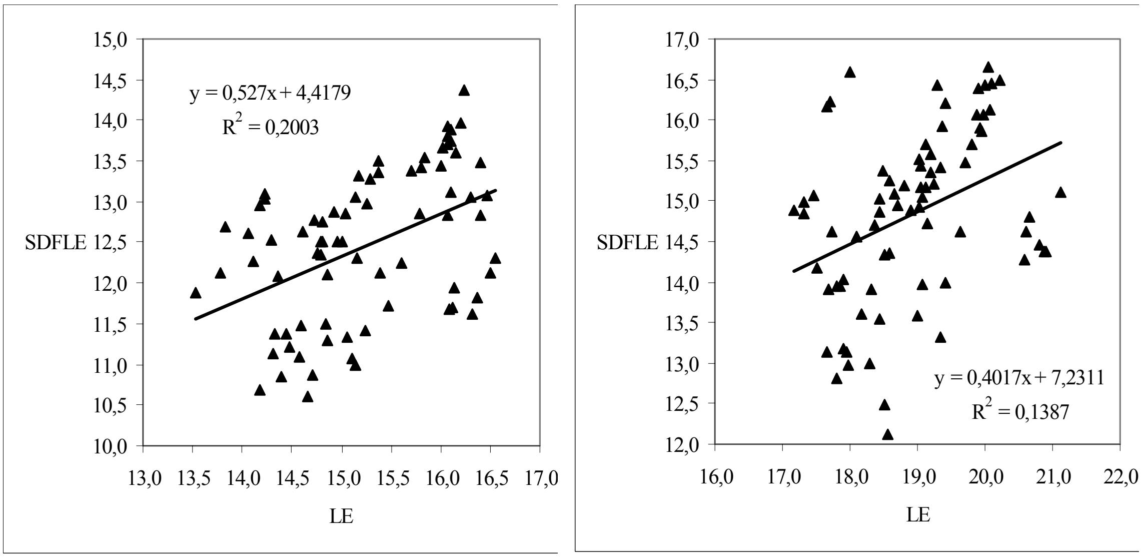
Source: ECHP and own computations.

Severe disability-free life expectancy vs. life expectancy

As shown in Figure 52, finally, both men and women have a positive correlation between LE and life expectancy lived free of severe disability. In this case, clearly, the variation of SDFLE is better explained by LE than for the previously analysed indicators, although in a limited way. The interpretation of the slopes shown and the coefficients is similar to the cases above, that is an extra year in LE at 65 would mean 0.53 years lived free of severe disability for men and 0.4 years for women.

Figure 52. Correlation between LE and SDFLE at age 65 in the EU 1994-2000

Men *Women*



Source: ECHP and own computations.

6.5 Conventional scenarios for health-adjusted life expectancy

Given the absence of sensible patterns among health and life expectancies out of the ECHP data, a simple but consistent procedure is used to create health expectancy scenarios for EU countries. We define three indicators of HE: in good health, disability-free and severe disability-free. Computations are made at ages 15 and 65.

With respect to trend in health status in the future, we explore two variants. The first one assumes that the proportion of HE over LE stays constant at the average level of the period 1994-1998. This we call this 'constant relative morbidity' hypothesis. The second one assumes that the years in an unhealthy state (not in good health or with disability) remain constant at the average level of the period 1994-1998[6] or 'constant absolute morbidity' hypothesis. The first assumption implies that any indicator of health expectancy either for men or women, at age 15 or 65, increases in the same proportion as life expectancy for any gender and age, thus keeping constant the ratio between HE and LE. The second assumption implies that HE increases by the same number of years as LE does, thus implying that any gain in life years is free of health and disability problems. These two scenarios, which we would not properly call projections, would likely capture the lower and upper trends one could expect concerning future advances in healthy life expectancies. The results for EU countries present in the ECHP (except Luxembourg) are shown in Tables 14 and 15, where figures for 1996 have been computed out of observed data, as previously discussed. As such these scenarios keep on average the country differences in health adjusted life expectancies observed in the 1990s (1994-1998).

[6] ECHP waves 1999 and 2000 have not been taken into account for these projections to avoid excessive attrition in the data pooling.

Table 14. Scenarios for health expectancies: Constant relative morbidity hypothesis

		Females Age 15				Females Age 65			
		LE 15 F	LEGH 15 F	DFLE 15 F	DFLES 15 F	LE 65 F	LEGH 65 F	DFLE 65 F	DFLES 65F
	1996	66,03	43,77	54,77	60,65	19,26	7,69	12,45	15,20
BEL	2010	68,25	45,38	54,07	61,81	20,52	8,34	11,99	15,94
	2025	69,80	46,41	55,30	63,21	21,64	8,80	12,65	16,81
	1996	63,80	45,90	47,24	58,60	17,80	8,27	9,41	13,96
DEN	2010	65,56	47,45	47,99	59,85	19,04	8,93	9,96	15,25
	2025	67,09	48,57	49,11	61,26	20,07	9,41	10,50	16,08
	1996	65,42	27,88	39,29	58,52	18,59	2,92	7,34	14,35
GER	2010	67,81	29,49	40,05	60,66	20,12	3,28	7,13	15,40
	2025	69,35	30,16	40,96	62,04	21,26	3,47	7,53	16,27
	1996	66,14	47,28	55,77	61,61	18,59	5,58	11,82	15,26
GRE	2010	68,09	47,15	55,95	62,87	20,02	5,42	12,02	16,22
	2025	69,59	48,19	57,18	64,26	21,16	5,73	12,70	17,15
	1996	67,26	40,39	53,79	62,46	19,91	5,13	11,08	16,39
SPA	2010	68,97	40,60	54,16	63,49	21,04	5,31	11,49	16,93
	2025	70,10	41,27	55,05	64,53	21,86	5,52	11,93	17,58
	1996	67,52	35,97	48,57	59,24	20,66	5,26	8,55	14,81
FRA	2010	69,75	37,34	50,69	60,61	22,04	5,68	9,57	15,44
	2025	71,34	38,19	51,84	61,99	23,15	5,97	10,06	16,23
	1996	64,22	49,04	52,84	61,01	17,31	8,34	10,40	14,99
IRE	2010	66,52	51,01	54,09	63,38	19,07	9,66	11,46	16,66
	2025	68,27	52,35	55,51	65,04	20,34	10,31	12,22	17,77
	1996	67,15	34,75	55,92	62,48	19,87	3,21	11,91	16,06
ITA	2010	69,05	35,75	55,80	63,26	21,06	3,65	11,69	16,30
	2025	70,51	36,50	56,97	64,59	22,17	3,84	12,31	17,15
	1996	65,92	44,61	48,43	59,59	19,03	8,12	10,58	15,51
NET	2010	67,57	45,49	49,01	61,14	20,14	8,75	10,73	16,25
	2025	69,11	46,53	50,13	62,53	21,25	9,24	11,32	17,14
	1996	64,38	27,53	47,31	57,06	17,67	1,34	8,45	13,15
POR	2010	66,39	28,35	48,86	59,10	18,78	1,49	9,25	14,15
	2025	68,19	29,12	50,18	60,70	20,05	1,59	9,88	15,11
	1996	65,04	42,26	56,08		18,32	9,04	13,91	
UK	2010	67,18	44,11	57,25		19,70	9,62	14,29	
	2025	69,06	45,34	58,85		21,10	10,31	15,30	

		Males Age 15				Males Age 65			
		LE 15M	LEGH 15M	DFLE 15M	DFLES 15M	LE 65M	LEGH 65M	DFLE 65M	DFLES 65M
	1996	59,48	45,34	50,63	55,71	14,96	7,55	9,71	12,52
BEL	2010	62,76	47,63	52,25	58,35	16,78	8,53	10,63	13,91
	2025	64,79	49,17	53,94	60,24	18,10	9,20	11,46	15,00
	1996	58,72	46,49	48,14	55,33	14,35	8,20	8,83	12,09
DEN	2010	61,53	48,83	50,20	58,36	15,95	8,89	10,03	13,71
	2025	63,43	50,34	51,76	60,17	17,18	9,58	10,80	14,77
	1996	59,17	29,41	37,77	53,71	14,87	2,98	4,59	11,30
GER	2010	62,21	31,97	39,71	56,61	16,57	3,64	4,95	12,73
	2025	64,20	32,99	40,98	58,43	17,87	3,93	5,34	13,73
	1996	60,95	47,49	52,83	57,20	16,15	6,00	10,34	13,60
GRE	2010	63,48	48,57	53,76	59,07	17,53	6,25	10,59	14,27
	2025	65,39	50,03	55,37	60,85	18,82	6,71	11,36	15,32
	1996	60,14	41,01	51,00	56,59	16,08	5,65	10,58	13,80
SPA	2010	61,70	41,51	51,50	57,73	16,82	5,81	10,56	14,35
	2025	63,27	42,57	52,81	59,20	17,77	6,14	11,16	15,16
	1996	59,73	37,18	45,74	53,35	16,12	5,35	7,38	11,69
FRA	2010	62,43	38,75	47,96	55,55	17,65	5,74	8,42	12,79
	2025	64,44	40,00	49,50	57,33	18,84	6,12	8,99	13,65
	1996	58,90	47,85	50,33	56,75	13,83	8,30	9,59	12,69
IRE	2010	61,44	49,71	51,47	58,88	15,36	8,85	10,08	13,79
	2025	63,36	51,26	53,07	60,72	16,67	9,61	10,94	14,96
	1996	60,77	37,02	52,59	57,78	15,71	3,64	10,12	13,38
ITA	2010	63,20	38,41	53,62	59,51	17,30	3,98	10,75	14,38
	2025	65,24	39,65	55,35	61,43	18,66	4,29	11,59	15,50
	1996	60,34	45,45	48,38	56,18	14,75	7,36	9,39	12,36
NET	2010	62,59	47,41	49,50	58,31	16,23	8,49	9,96	13,72
	2025	64,31	48,72	50,86	59,91	17,43	9,12	10,70	14,74
	1996	57,06	31,13	44,88	51,58	14,19	2,04	7,41	10,69
POR	2010	59,76	32,22	46,80	54,00	15,25	2,27	8,24	11,74
	2025	61,97	33,41	48,54	56,00	16,55	2,46	8,94	12,74
	1996	60,03	43,62	52,74		14,85	9,59	11,49	
UK	2010	62,59	45,24	54,61		16,26	10,02	12,23	
	2025	64,45	46,58	56,23		17,54	10,82	13,20	

Source: Own computations based on data from the ECHP.

Table 15. Scenarios for health expectancies: Constant absolute morbidity hypothesis

		Females	Age 15			Females	Age 65		
		LE 15 F	LEGH 15 F	DFLE 15 F	DFLES 15 F	LE 65 F	LEGH 65 F	DFLE 65 F	DFLES 65F
	1996	66,03	43,77	54,77	60,65	19,26	7,69	12,45	15,20
BEL	2010	68,25	46,15	54,55	62,03	20,52	9,11	12,53	16,23
	2025	69,80	47,70	56,10	63,58	21,64	10,23	13,65	17,35
	1996	63,80	45,90	47,24	58,60	17,80	8,27	9,41	13,96
DEN	2010	65,56	47,79	48,31	59,96	19,04	9,58	10,55	15,50
	2025	67,09	49,33	49,85	61,50	20,07	10,60	11,57	16,52
	1996	65,42	27,88	39,29	58,52	18,59	2,92	7,34	14,35
GER	2010	67,81	30,78	40,99	60,90	20,12	4,49	8,07	15,74
	2025	69,35	32,32	42,53	62,44	21,26	5,63	9,20	16,87
	1996	66,14	47,28	55,77	61,61	18,59	5,58	11,82	15,26
GRE	2010	68,09	47,74	56,29	63,02	20,02	6,46	12,59	16,49
	2025	69,59	49,25	57,79	64,52	21,16	7,60	13,73	17,63
	1996	67,26	40,39	53,79	62,46	19,91	5,13	11,08	16,39
SPA	2010	68,97	41,28	54,52	63,62	21,04	6,15	11,99	17,15
	2025	70,10	42,41	55,65	64,75	21,86	6,96	12,81	17,96
	1996	67,52	35,97	48,57	59,24	20,66	5,26	8,55	14,81
FRA	2010	69,75	38,35	51,28	60,89	22,04	6,67	10,33	15,84
	2025	71,34	39,94	52,87	62,48	23,15	7,78	11,45	16,96
	1996	64,22	49,04	52,84	61,01	17,31	8,34	10,40	14,99
IRE	2010	66,52	51,55	54,53	63,49	19,07	10,49	12,13	16,87
	2025	68,27	53,30	56,27	65,23	20,34	11,76	13,40	18,14
	1996	67,15	34,75	55,92	62,48	19,87	3,21	11,91	16,06
ITA	2010	69,05	36,70	56,18	63,42	21,06	4,73	12,27	16,59
	2025	70,51	38,16	57,63	64,88	22,17	5,83	13,38	17,70
	1996	65,92	44,61	48,43	59,59	19,03	8,12	10,58	15,51
NET	2010	67,57	46,02	49,45	61,29	20,14	9,34	11,22	16,45
	2025	69,11	47,55	50,99	62,83	21,25	10,45	12,33	17,56
	1996	64,38	27,53	47,31	57,06	17,67	1,34	8,45	13,15
POR	2010	66,39	29,41	49,35	59,30	18,78	2,37	9,74	14,39
	2025	68,19	31,21	51,14	61,10	20,05	3,65	11,01	15,66
	1996	65,04	42,26	56,08		18,32	9,04	13,91	
UK	2010	67,18	44,84	57,57		19,70	10,32	14,67	
	2025	69,06	46,71	59,44		21,10	11,72	16,06	

		Males	Age 15			Males	Age 65		
		LE 15M	LEGH 15M	DFLE 15M	DFLES 15M	LE 65M	LEGH 65M	DFLE 65M	DFLES 65M
	1996	59,48	45,34	50,63	55,71	14,96	7,55	9,71	12,52
BEL	2010	62,76	48,42	52,80	58,58	16,78	9,42	11,29	14,22
	2025	64,79	50,45	54,83	60,61	18,10	10,73	12,61	15,53
	1996	58,72	46,49	48,14	55,33	14,35	8,20	8,83	12,09
DEN	2010	61,53	49,39	50,70	58,50	15,95	9,56	10,59	13,92
	2025	63,43	51,30	52,61	60,41	17,18	10,80	11,82	15,16
	1996	59,17	29,41	37,77	53,71	14,87	2,98	4,59	11,30
GER	2010	62,21	33,40	40,77	56,88	16,57	4,92	6,11	13,11
	2025	64,20	35,39	42,76	58,87	17,87	6,23	7,41	14,41
	1996	60,95	47,49	52,83	57,20	16,15	6,00	10,34	13,60
GRE	2010	63,48	49,14	54,12	59,24	17,53	7,08	11,10	14,51
	2025	65,39	51,04	56,03	61,15	18,82	8,36	12,38	15,80
	1996	60,14	41,01	51,00	56,59	16,08	5,65	10,58	13,80
SPA	2010	61,70	41,97	51,74	57,82	16,82	6,29	10,83	14,46
	2025	63,27	43,54	53,30	59,39	17,77	7,24	11,79	15,41
	1996	59,73	37,18	45,74	53,35	16,12	5,35	7,38	11,69
FRA	2010	62,43	39,74	48,56	55,84	17,65	6,71	9,18	13,19
	2025	64,44	41,75	50,57	57,84	18,84	7,90	10,37	14,38
	1996	58,90	47,85	50,33	56,75	13,83	8,30	9,59	12,69
IRE	2010	61,44	50,20	51,89	58,99	15,36	9,48	10,59	13,94
	2025	63,36	52,12	53,81	60,91	16,67	10,79	11,89	15,24
	1996	60,77	37,02	52,59	57,78	15,71	3,64	10,12	13,38
ITA	2010	63,20	39,35	53,98	59,65	17,30	5,18	11,34	14,64
	2025	65,24	41,39	56,02	61,69	18,66	6,53	12,69	15,99
	1996	60,34	45,45	48,38	56,18	14,75	7,36	9,39	12,36
NET	2010	62,59	47,92	49,94	58,45	16,23	9,14	10,49	13,94
	2025	64,31	49,64	51,66	60,17	17,43	10,34	11,69	15,13
	1996	57,06	31,13	44,88	51,58	14,19	2,04	7,41	10,69
POR	2010	59,76	33,28	47,30	54,22	15,25	3,01	8,64	11,94
	2025	61,97	35,50	49,52	56,44	16,55	4,30	9,93	13,23
	1996	60,03	43,62	52,74		14,85	9,59	11,49	
UK	2010	62,59	45,94	54,93		16,26	10,56	12,58	
	2025	64,45	47,79	56,79		17,54	11,84	13,87	

Source: Own computations based on data from the ECHP.

6.6 Education: The key to better future health status of population

The previous exercise of building HE scenarios based on rather crude hypotheses, avoided the shortcomings that using observed trends would have otherwise caused. But even if limiting the extent of our ignorance on this matter it is still unsatisfactory. In order to exploit further the information contained in the ECHP to advance in this direction, we recall the analysis previously made on education and health as a very convenient way to establish some estimates about the composition effects of a more educated population on the future health status of EU members' populations

As better educated younger generations replace older generations with lower levels of education, the health status of the population would improve in the future. The magnitude of the improvement will depend on the differences in education levels between generations and the differences in health status by education levels.

Given that most individual's education levels do not change after age 30, we can project the educational composition of the future population for those who are currently 30 years or older. Assuming that the mortality rate is the same regardless of education level, the educational composition of the population in age 'X' ten years from now will be the same as that of the population in age 'X-10' now. Multiplying the health status by age and education with the age-education distribution of the future population, we obtain the projection of the health status of future population. We examine the future health status of three age groups, 55-64, 65-74 and 75-84. Assuming that the age-education specific health status remains at the level observed in ECHP 1994, we examine the health status of the three age groups in 2004 and 2014.

As seen in Table 16, the potential health improvement owing to educational composition is highest among the 55-64 age group and lowest among the 75-84 age group, irrespective of the country considered.

There are also substantial variations among countries. With respect to the proportion in good health, among the population aged 55-64 it increases by 8 and 9 percentage points in Spain and Greece during the period 1994-2014 while it increases by only 1 percentage point in Belgium and the Netherlands. For the age group 65-74, the improvement is most (5 percentage points) in Denmark while it is least (1 percentage point) in Portugal. Among those aged 75-84, the improvement is relative small.

Table 16. Proportion in good health in 1994 (observed), 2004 and 2014 (projected) in the EU

	Ages 55-64			Ages 65-75			Ages 75-84		
	1994	2004	2014	1994	2004	2014	1994	2004	2014
Denmark	0,648	0,683	0,698	0,549	0,572	0,599	0,455	0,472	0,490
Netherlands	0,607	0,623	0,633	0,501	0,515	0,524	0,444	0,454	0,463
Belgium	0,598	0,624	0,634	0,486	0,497	0,526	0,374	0,378	0,389
France	0,479	0,517	0,529	0,374	0,386	0,415	0,257	0,264	0,278
UK	0,617	0,642	0,659	0,506	0,520	0,540	0,435	0,442	0,457
Ireland	0,701	0,713	0,728	0,562	0,591	0,607	0,430	0,436	0,458
Italy	0,387	0,405	0,430	0,268	0,272	0,293	0,210	0,211	0,213
Greece	0,542	0,583	0,633	0,364	0,372	0,400	0,208	0,211	0,219
Spain	0,385	0,410	0,464	0,301	0,308	0,328	0,215	0,220	0,224
Portugal	0,298	0,310	0,326	0,165	0,166	0,174	0,125	0,130	0,131
Source: Eurostat-ECHP and own computations									

Similar cross-country differences can be observed in the proportion with disability; Spain and Greece improve most among the population group 55-64, Belgium and France for the 65-75 age group, and Denmark for the oldest age group as shown in Table 17.

Table 17. Proportion with disability in 1994 (observed), 2004 and 2014 (projected) in the EU

	Ages 55-64			Ages 65-75			Ages 75-84		
	1994	2004	2014	1994	2004	2014	1994	2004	2014
Denmark	0,315	0,285	0,271	0,377	0,366	0,354	0,460	0,437	0,425
Netherlands	0,373	0,363	0,356	0,440	0,432	0,426	0,519	0,511	0,503
Belgium	0,344	0,335	0,329	0,421	0,414	0,396	0,614	0,614	0,612
France	0,281	0,255	0,249	0,389	0,378	0,350	0,537	0,534	0,528
UK	0,335	0,325	0,318	0,449	0,444	0,438	0,520	0,518	0,512
Ireland	0,260	0,248	0,231	0,392	0,383	0,376	0,493	0,490	0,478
Italy	0,322	0,304	0,280	0,444	0,441	0,427	0,580	0,584	0,581
Greece	0,289	0,266	0,238	0,375	0,368	0,350	0,532	0,533	0,526
Spain	0,366	0,350	0,315	0,403	0,398	0,383	0,557	0,554	0,552
Portugal	0,423	0,413	0,401	0,489	0,488	0,478	0,563	0,561	0,561
Source: Eurostat-ECHP and own computations									

These results clearly point to a general improvement of the proportion of life years lived in either good health or free of disability beyond the doubts that emerged when we tried to extend observed trends so far. Although we have not tried to estimate figures for HE based on this approach, we believe this is a sound way to overcome the limitations of the simple procedures attempted before. Moreover, the results just commented upon are compatible with the scenarios also discussed previously.

7. Living longer, working less… keeping better?

On the basis of the comparison of the different data sets, we have concluded that population ageing is a process that all countries have been experiencing, with different degrees and starting points, since the last few decades and that will continue, given current trends, in the coming decades.

Population ageing is a result of both longer average life expectancies and fewer births. Life expectancy has been increasing dramatically since the past 100 years, and this has been compatible with both the *expansion* (more and more people reaching extreme ages) and the *compression* (more and more people surviving at all ages) of mortality. Nevertheless, in the last three decades, compression of mortality has been dominant in the process of population ageing rather than expansion for most countries. Expansion on the other hand, means a higher limit for the human life if strictly defined, which is not the case being observed. Relatively few people reach extreme ages, which with only rare exceptions surpasses 110 years of age, while the share of survivors (for a given generation) at 80, for instance, have typically increased from 30% to 60% or more in the last 30 years.

Life-course indicators have allowed us to document, with varying accuracy for different countries, a general trend in the EU towards longer years in school, delayed entrance to the labour market, delayed emancipation from the parental home, delayed household formation and first parenthood, earlier retirement and longer post-retirement spans. Some of these trends, as it is well known, clash with each other as is the case of shorter working lives and longer post-retirement spans.

Morbidity (health status or disability) puts a check on the quality with which longer lives can be lived. Data on these issues have not yet been comprehensively analysed owing to the rarity and lack of homogeneity of health and disability surveys in different countries. Nevertheless, the ECHP has allowed us to document health and disability status and to use this information to compute adjusted life expectancies either for years lived in good health or free of disability. Although some indications for several countries point to the fact that longer lives do not necessarily mean that these are lived in better health or with a lower prevalence of disabilities, when the recent past is analysed with the ECHP data, in general, we can establish a trend whose projection forward implies greater proportions of increased post-retirement or adult lives lived either in better health or free of disability. Health and disability status is, however, self-reported and this makes data fraught with problems and hard to compare among countries. We have shown that using the ECHP data requires being extremely careful as to making country comparisons on this matter.

All in all, European countries have had, since the mid-past century, what van de Kaa has termed a "second demographic transition" concerning the evolution of fertility and mortality. It is not easy to say whether the absolute limit to a human life has increased, but what is more than certain is that survival at high or even extreme ages has experienced a dramatic increase in the last few decades in Europe. Not less dramatic is the change in lifestyles and behaviours, if we trust the life-course indicators that warn us about the possibility of unsustainable combinations of trends, which will have to be contained before society discovers too late that liabilities are much higher than assets of any kind. Activity seems to be the most abundant and most wasted resource in Western countries, whereas health and disability problems seem to be checked as post-retirement life spans increase, although not everywhere.

Population ageing will continue in the future even at an accelerated speed, at least when defined in the rather strict manner in which we customarily define it (age 65 and over). Health and disability limitations are likely to advance less rapidly than age, thus allowing expectations for healthier life, but this is not necessarily to be taken for granted as the available data still lacks enough conclusiveness. Despite the enormous advancement in health in developed countries, the process of ageing critically exposes people to new forms of morbidity. Perhaps some future day we could speak of a 'third demographic transition' in Europe (and everywhere), which includes a more balanced equilibrium between age spans within the life cycle, healthier lifestyles, more active and less-dependent life in old age and improved options as for the transition from work to retirement.

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Annex 1. Structure of the database within WP1 of the AGIR project

	5 Areas	Files (.xls)	Detail
AGIR-WP1 DATABASE	Population	Births (all countries in one file)	Gender, year
		Historic population (one file for each country)	Age, gender, year
		Projections (one file for each country)	Age, gender, year
	Mortality	Mortalities (one file for each country)	Age, gender, year
		Survivors (life tables, one file for each country)	Age, gender, year
	Longevity	Longevity indicators (all countries in one file)	Gender, year, country, category (up to 5 categories)
	Life-courses	Life-course indicators (all countries in one file)	Gender, year, country, category (up to 11 categories)
	Morbidity	Morbidity (one file for each country)	Age group, gender, year, category (up to 3 categories), grade

Sources: National sources, www.mortality.org, REVES, Eurostat, ECHP, WHO and OECD.

AGIR – Ageing, Health and Retirement in Europe

AGIR is the title of a major study on the process of population ageing in Europe and its future economic consequences. This project was motivated by an interest in verifying whether people are not only living longer but also in better health. It aims at analysing how the economic impact of population ageing could vary when not only demographic factors, but also health developments are taken into consideration. The project started in January 2002 for a period of three years.

The **principal objectives** of the study are to:

- document developments in the health of the elderly, ideally since 1950, based on a systematic collection of existing national data on the health and morbidity of different cohorts of the population;
- analyse retirement decisions and the demand for health care as a function of age, health and the utility of work and leisure;
- combine these results, and on that basis to elaborate scenarios for the future evolution of expenditure on health care and pensions; and
- analyse the potential macroeconomic consequences of different measures aiming at improving the sustainability of the European pension systems.

The **AGIR** project is carried out by a consortium of nine European research institutes, most of which are members of ENEPRI:

- **CEPS** (Centre for European Policy Studies), Brussels
- **CEPII** (Centre d'Etudes Prospectives et d'Informations Internationales), Paris
- **CPB** (Netherlands Bureau for Economic Policy Analysis), The Hague
- **DIW** (Deutsches Institut für Wirtschaftsforschung), Berlin
- **ETLA** (the Research Institute of the Finnish Economy), Helsinki
- **FEDEA** (Fundación de Estudios de Economía Aplicada), Madrid
- **FPB** (Belgian Federal Planning Bureau), Brussels
- **NIESR** (National Institute for Economic and Social Research), London
- **LEGOS** (Laboratoire d'Economie et de Gestion des Organisations de Santé, Université de Paris-Dauphine), Paris

It has received finance from the European Commission, under the Quality of Life Programme of the 5th EU Research Framework Programme. The project is coordinated by Jorgen Mortensen, Associate Senior Research Fellow at CEPS. For further information, contact him at: jorgen.mortensen@ceps.be.

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While the European construction has made gigantic steps forward in the recent past, the European dimension of research seems to have been overlooked. The provision of economic analysis at the European level, however, is a fundamental prerequisite to the successful understanding of the achievements and challenges that lie ahead. **ENEPRI** aims to fill this gap by pooling the research efforts of its different member institutes in their respective areas of specialisation and to encourage an explicit European-wide approach.

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