Mortality in the 10 New EU Member States and 2 Accession Countries

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Past and Future Patterns and Trends at National Level

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1. Introduction

In October 2002 Eurostat commissioned the Netherlands Interdisciplinary Demographic Institute (NIDI) to compile long –term population scenarios by sex and age for the 10 new EU Member States and 2 Accession Countries at both national and regional (NUTS -2) level. The population scenarios should be consistent with the 1997 -based long-term population scenarios of the European Economic Area (EEA), and therefore should be prepared in a similar way.
The basic projection methodology comprised:

1. the use of a deterministic cohort -component model (four components: fertility, mortality, international migration and interregional migration);
2. the application of a top-down approach concerning both the analyses of past trends and the extrapolation of future developments (first time series analysis and assumptions at national level, subsequently the production of regional assumptions based on an assessment of recently observed regional differences);
3. the compilation of three different scenarios: Baseline (most realistic/plausible future), Low (pessimistic, stagnation of processes of convergence), and High (optimistic, further convergence).

Few extensions were requested such as the introduction of a longer age span (the highest open age group should be 100+ instead of 90+), a slightly longer projection period (2002/3-2070 instead of 1995-2050), and a more thorough assessment of the quality and utility of the demographic time series currently available in Eurostat's database NewCronos.

For each demographic component the following activities were planned:

1. Assessment of the quality and utility of these data; and, if necessary/feasible, collection and procession of more detailed statistics from national statistical institutes and other, international organisations (e.g. UN/ECE).
2. Analysis of principal trends during the 1980s and 1990s, with special attention to the impact of cultural, economic and political changes.
3. Collection and quality assessment of latest population forecasts produced by national statistical institutes in the countries concerned.
4. Evaluation of the use of the 2000 -based population projections compiled by the United Nations (Population Division, New York).
5. Preparation of draft assumptions of future trends for the 12 EU candidate countries that are consistent with the 1995 -based set of long-term population scenarios for the EEA countries, by using results of the explanatory analysis.

This paper summarises the results of activities 2 and 5 for the component mortality at national level. The document is organised as follows. Section 2 describes the principal mortality trends in the countries concerned since 1960. Section 3 presents the current geographic differences and recent changes in sex and age specific mortality, followed by a limited set of snapshots of contemporary differences in mortality by main causes of death (section 4). Section 5 reviews the most important explanatory factors found in recent scientific literature, and more in particular attempts to assess the impact of cultural, economic and political changes. Finally, section 6 briefly presents the methodology for the compilation of a set of long-term mortality assumptions, consistent with the 1997-based population scenarios for the EEA. It also contains a set of graphs on the future life expectancies at birth.

As a starter for the story on past and future trends we first present 3 pictures showing the national differences in life expectancy at birth by sex in 2002 (see *Figures I-III*). They clearly demonstrate the significant differences in life chances between the people living in the "old" and in the "new" EU Member States: for males the maximum difference (between Sweden and Latvia) amounts around 12 years, whilst for females the extremes (between Spain and Romania) differ well over 10 years. The maximum gap between female and male life expectancy at birth in 2002 is reported by Estonia (almost 12 years), whereas Sweden measured a sex gap of no more than 4.2 years. Finally we can already read from these classements that both Cyprus and Malta are very close to EU-15 levels. That's why in the following section relatively little attention is paid to the time trends in mortality of these new Member States in Southern Europe.


I. Life expectancy at birth, males 2002
Latvia
Estonia
Lithuania
Romania
Hungary
Bulgaria
Slovak Republic
Poland
Czech Republic
Slovenia
Portugal
Denmark
eu25
Finland
Luxembourg
Belgium
Ireland
Greece
France
Spain
Austria
eu15
Malta
Germany
United Kingdom
Netherlands
Cyprus
Italy
Sweden
60
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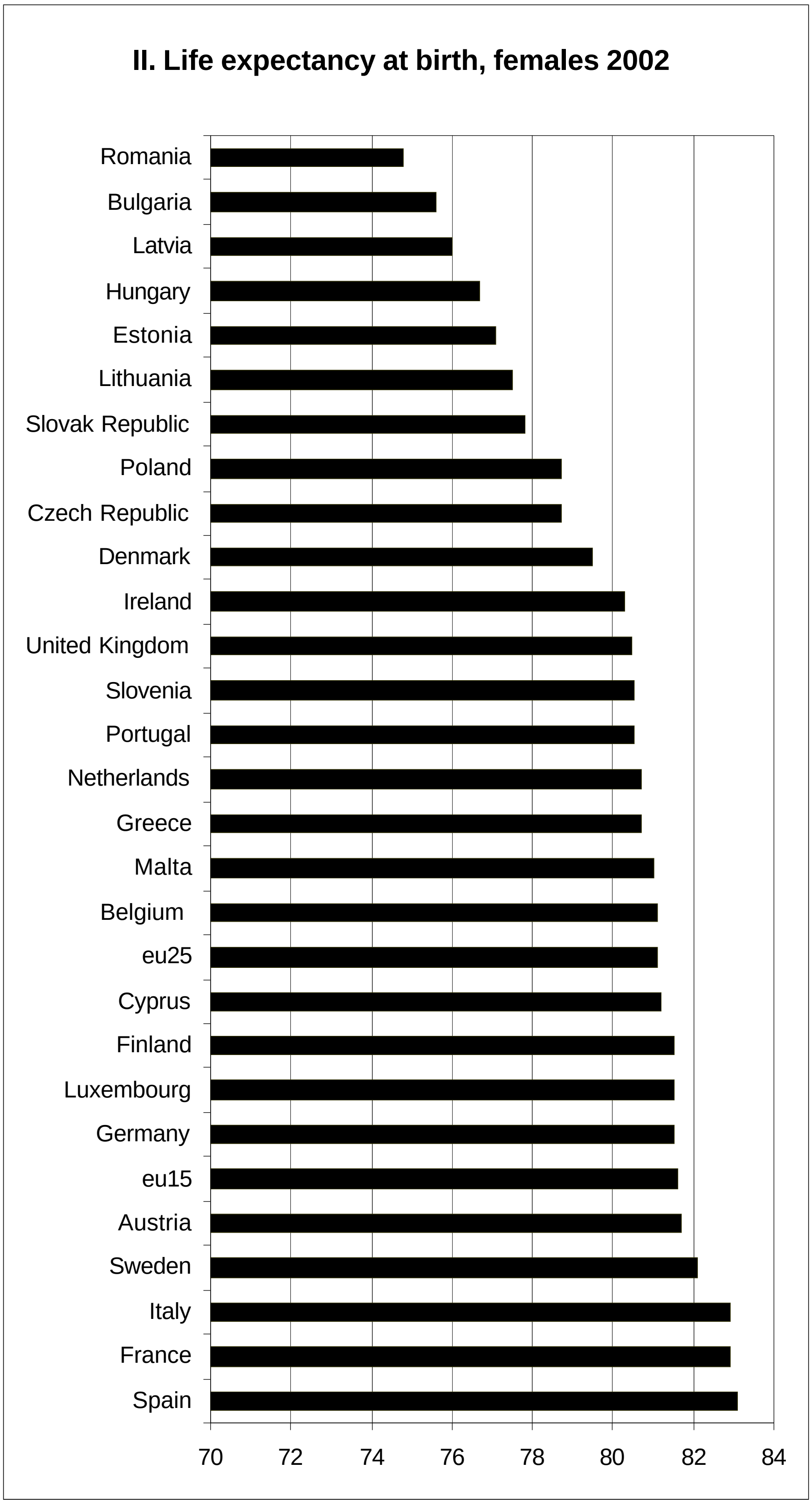
70
75
80


II. Life expectancy at birth, females 2002
Romania
Bulgaria
Latvia
Hungary
Estonia
Lithuania
Slovak Republic
Poland
Czech Republic
Denmark
Ireland
United Kingdom
Slovenia
Portugal
Netherlands
Greece
Malta
Belgium
eu25
Cyprus
Finland
Luxembourg
Germany
eu15
Austria
Sweden
Italy
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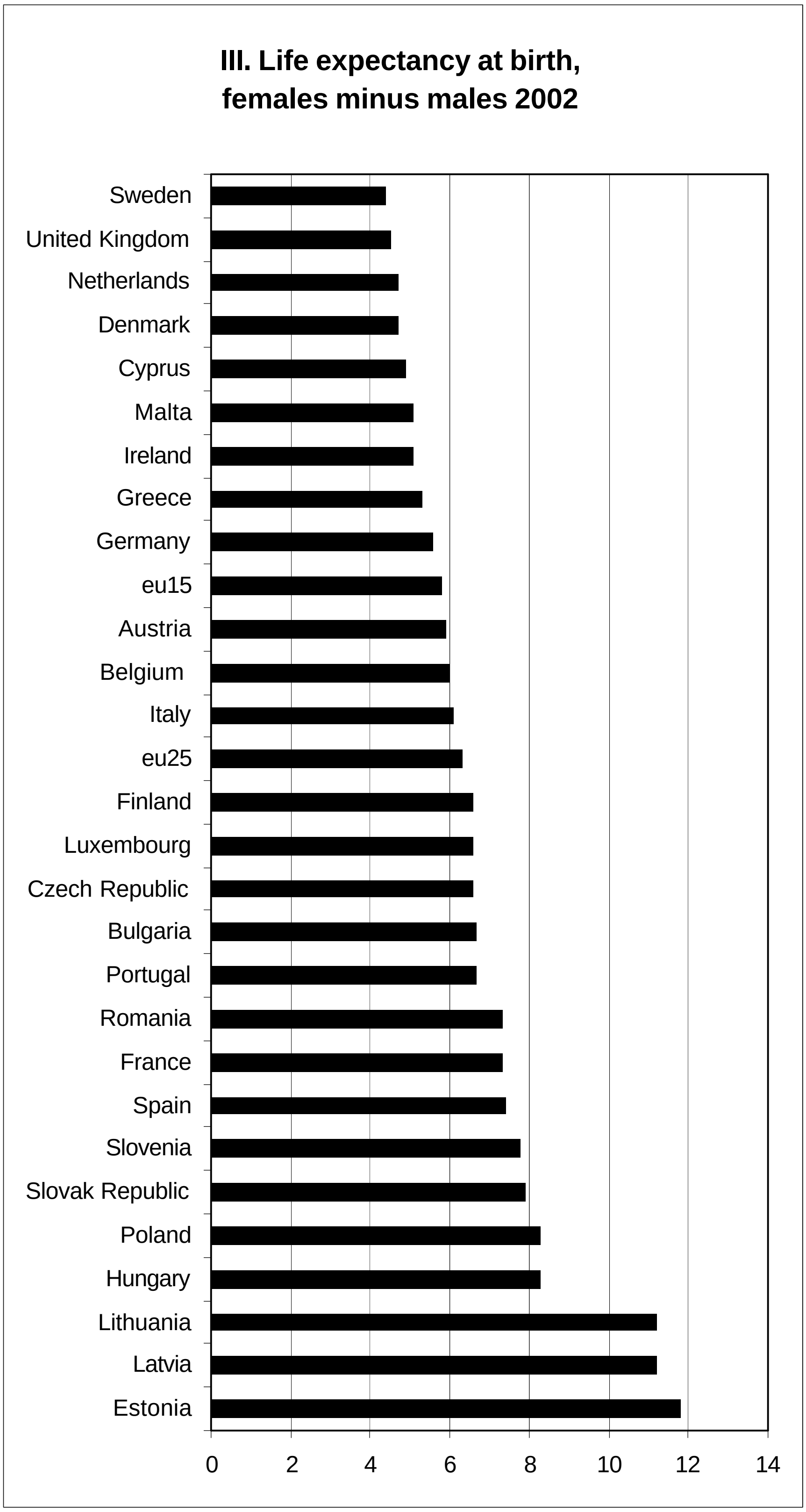
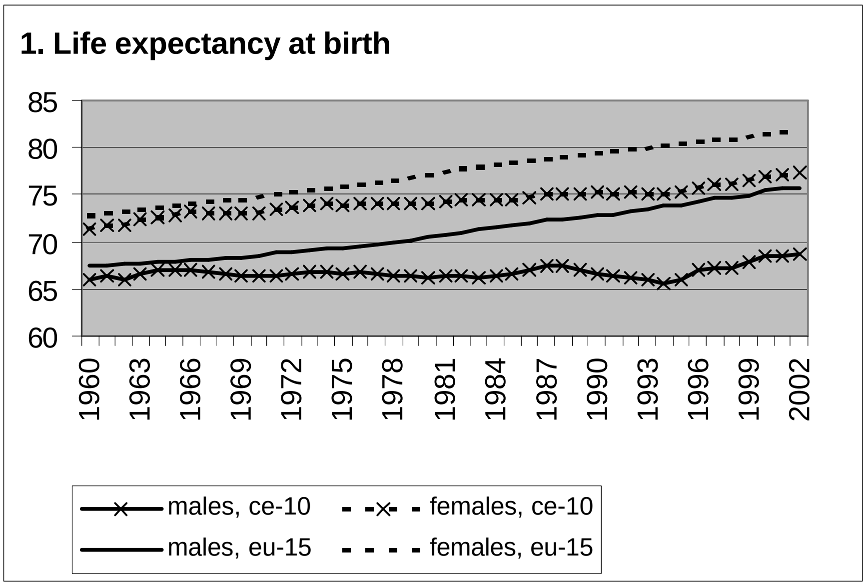

III. Life expectancy at birth,
females minus males 2002
Sweden
United Kingdom
Netherlands
Denmark
Cyprus
Malta
Ireland
Greece
Germany
eu15
Austria
Belgium
Italy
eu25
Finland
Luxembourg
Czech Republic
Bulgaria
Portugal
Romania
France
Spain
Slovenia
Slovak Republic
Poland
Hungary
Lithuania
Latvia
Estonia
0
2
4
6
8
10
12
14

2. Principal mortality trends since 1960

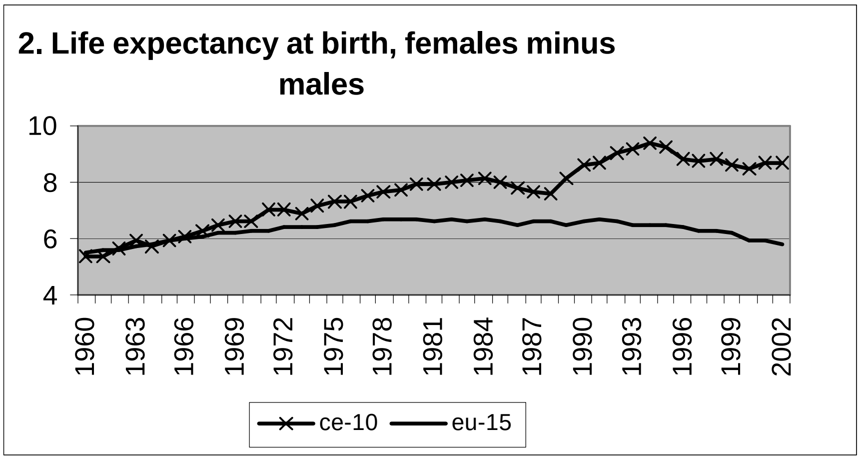
Life expectancies at birth have moved away from EU -15 averages, but there are some first signs of recovery

Graph 1 illustrates that in the first half of the 1960s the life chances of people living in one of the 10 Central and Eastern European Countries (CE -10) that recently or shortly will join the EU were on average slightly lower than those living in the EU -15 (around 1 year). However, since around 1968 life expectancies have diverged, and for both males and females the gap reached in 1994 a maximum of well over 8 and 5 years respectively. In 2002 these differences had decreased somewhat (around 1 year less), so one could speak of a new, but rather weak trend of convergence.



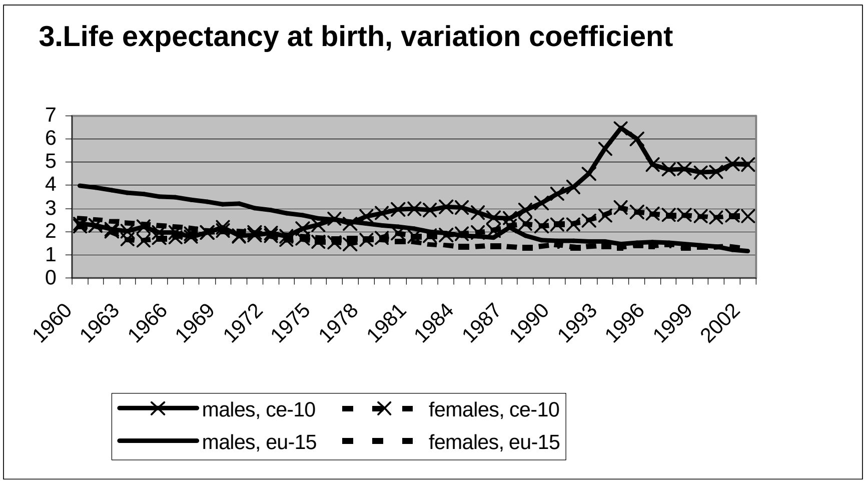
Gap between male and female life expectancy at birth increased considerably

Graph 2 shows another important difference of the mortality trends in the EU15 compared with those in the CE10: in the old Member States male excess mortality halted to increase at the end of 1970s and started to decrease at the end of the 1980s, whereas the sex gap in CE almost continuously has gone up. Only in the second half of the 1980s and mid 1990s a small reduction occurred, but on the other hand during the first half of the 1900s – the first years of the political and economic transition period – an acceleration upwards was observed. Looking at the levels at the beginning and at the end of the period, the gap barely increased in the EU15, whereas in the CE10 recently estimated figures are almost twice as high as in the early 1960s.



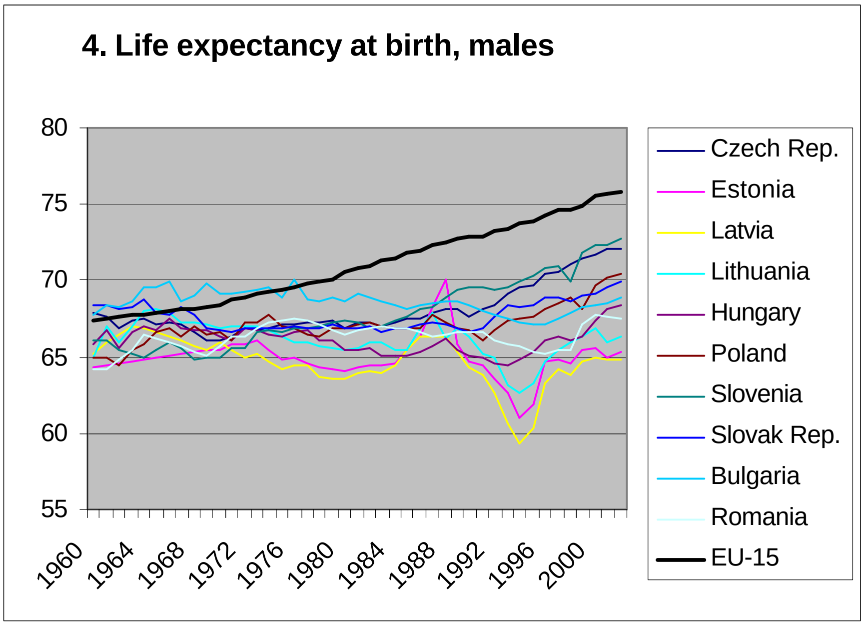
Differences in life expectancy at birth between countries increased drastically

The third overall, striking trend is the increasing mortality differences between the 10 countries concerned (see *Graph 3*). Especially for male life expectancy at birth there was very strong increase of national differences in the first half of the 1990s. However, after the peak year 1994, we see first a significant decline followed by a period of no clear convergence or divergence. The differences within the EU15 region, on the contrary, were almost continuously diminishing. This latter, still ongoing trend of convergence has led to a rather homogeneous situation with respect of life chances within the old EU region: compared with the early 1960s for males about 75% of the differences disappeared, and for females the reduction is around 50%. On the other hand, the differences within the CE10 region have increased with well over 100% for males and about 30% for females.



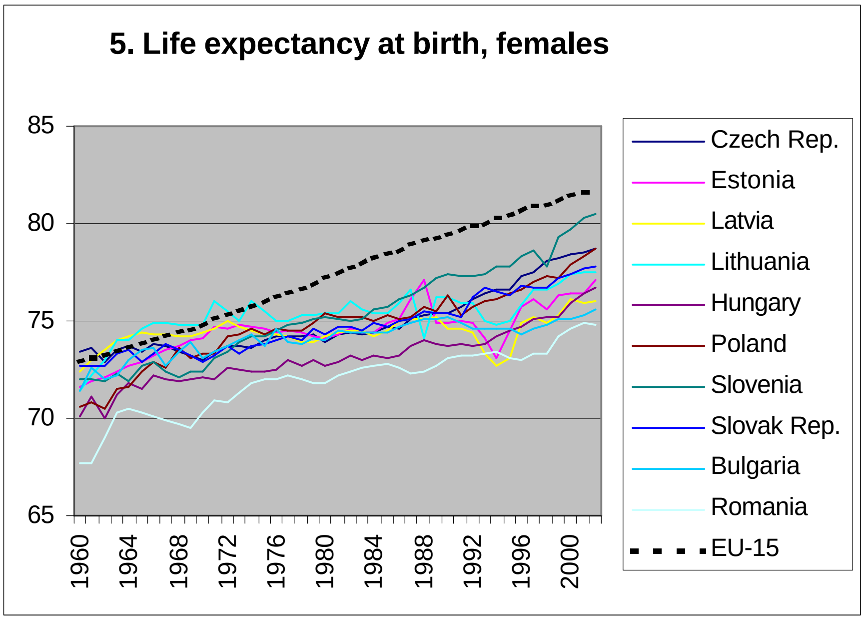
In some countries male life expectancy at birth fluctuated strongly

Naturally, the trends concerning inter -national differences in life expectancy at birth within the CE region can be better understood if we look at national time trends. *Graph 4* shows male life expectancies since 1960s. Striking are the different developments in the first phase of transition: during the period 1989 -1996 countries such as Czech Republic, Slovak Republic, Poland and Slovenia experienced hardly any fluctuation on the prevailing trend of improving life expectancy, whereas especially the Baltic States moved first steeply down and thereafter strongly up. Furthermore we can learn from this picture that even the CE countries that reported a somewhat higher level in the early 1960s (Bulgaria, Czech Republic and Slovak Republic), moved away from the EU15 average. Finally, it is obvious that over the last 4 decades the positions of some countries have drastically changed. For example, men living in Bulgaria had the highest life expectancy at birth in the CE region, but are now somewhere in the middle.



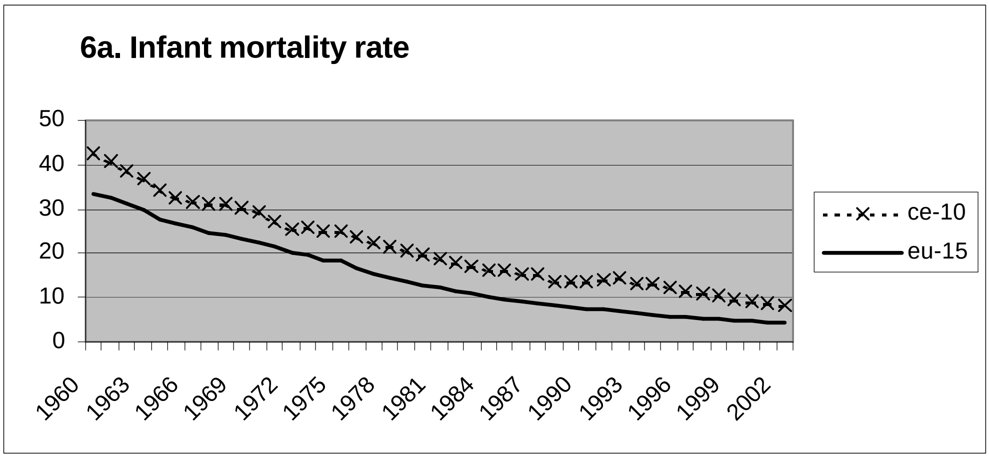
Female life expectancy at birth was much less volatile

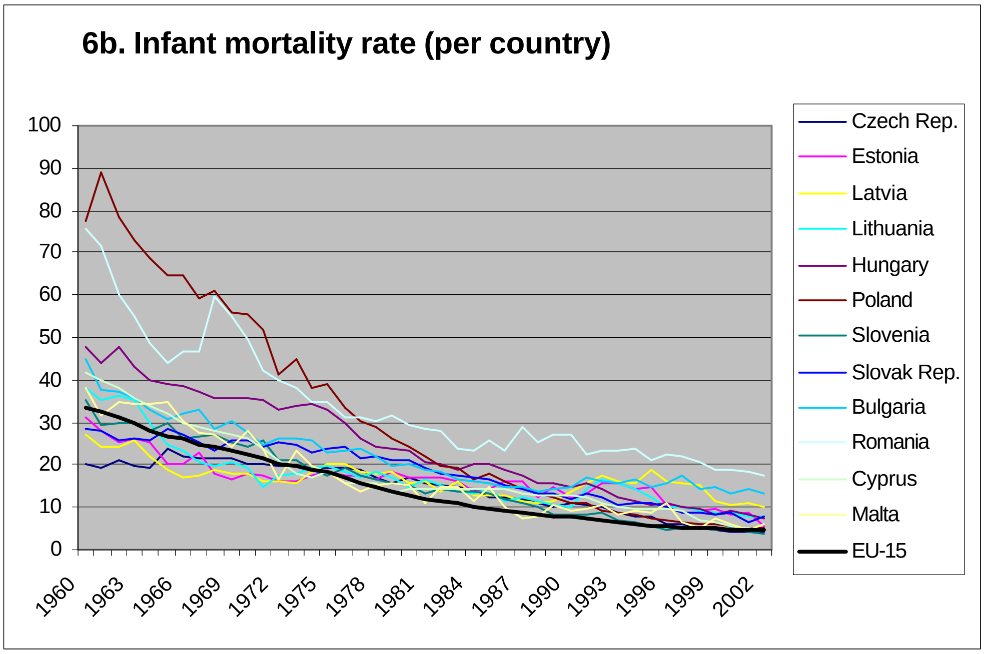
Graph 5 illustrates that female life expectancy at birth was much less affected during the first phase of the transition period (1989 -1996). Therefore, the inter -national differences did not dramatically increase during these years. Nevertheless as we have already seen in graph 3, the inter-national differences within the CE region are now significan tly bigger than 40 years ago. Some countries with a relatively high level of longevity at the beginning of the 1960s, in fact quite close to the EU15 level (e.g. Latvia) lost their vanguard position, whereas other countries in the region climbed up (e.g. S lovenia). On the other hand, the highest and lowest positions were almost always occupied by the same countries: Czech Republic and Romania respectively.



Infant mortality rates diminished considerably

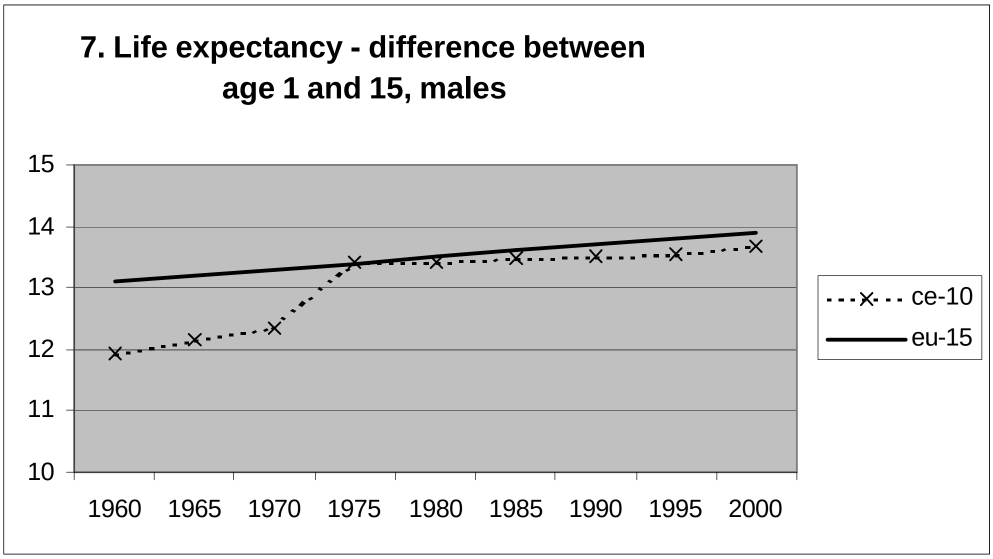
Graph 6a demonstrates that both in the EU15 and CE10 the infant mortality rate continued to decrease during the last 4 decades. However, the curve for the CE10 comprises more years of slackening and acceleration. In absolute terms the difference between EU15 and CE10 averages became smaller, in relative terms a slight increase of the gap can be noted.
Graph 6b shows that all CE10 countries were successful in diminishing infant mortality rate. Especially Poland managed to reduce this rate drastically over the past 42 years. On the other hand, we can state that all countries that had in the early 1960s an infant mortality rate lower than the average EU15 are reporting since the end of the 1970s a level that is somewhat higher than that of EU15.





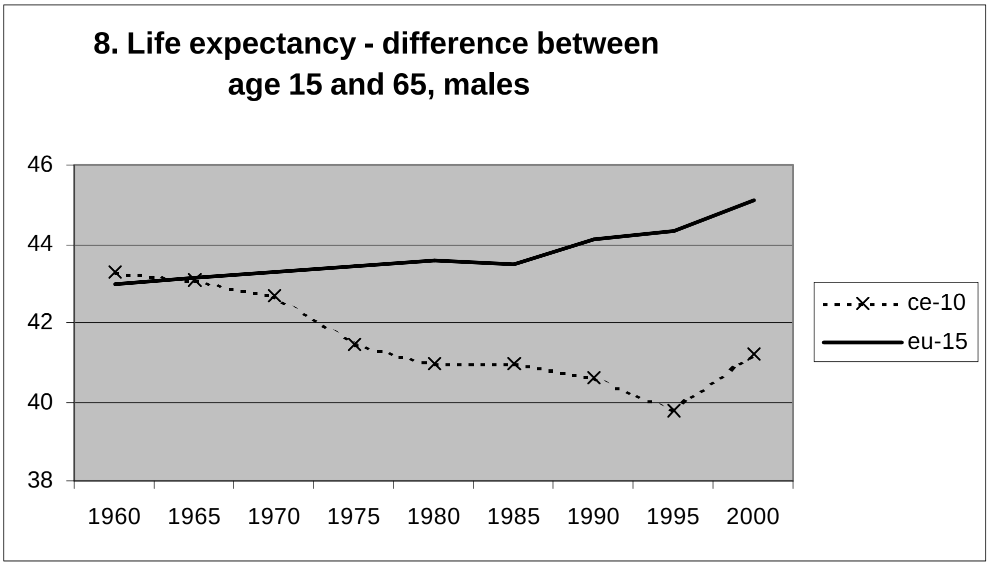
Mortality among children improved steadily

By taking the difference between life expectancy at the ages 1 and 15 one can approximate what has happened with life chances among children aged 1 -15. For boys (the picture for girls is similar), we may conclude that in Europe mortality rates continued to improve over the last 42 years (see *Graph 7)*. In terms of life expectancies this group gained on average almost 1 year within the EU15 and almost 2 years in the group of CE10 countries. In 2002 levels are close to the theoretical maximum (i.e. 14 years of nobody would die). A striking observation is that in the first half of the 1970s the CE10 countries were able to gain more than 1 full year, bridging the gap with the EU15.



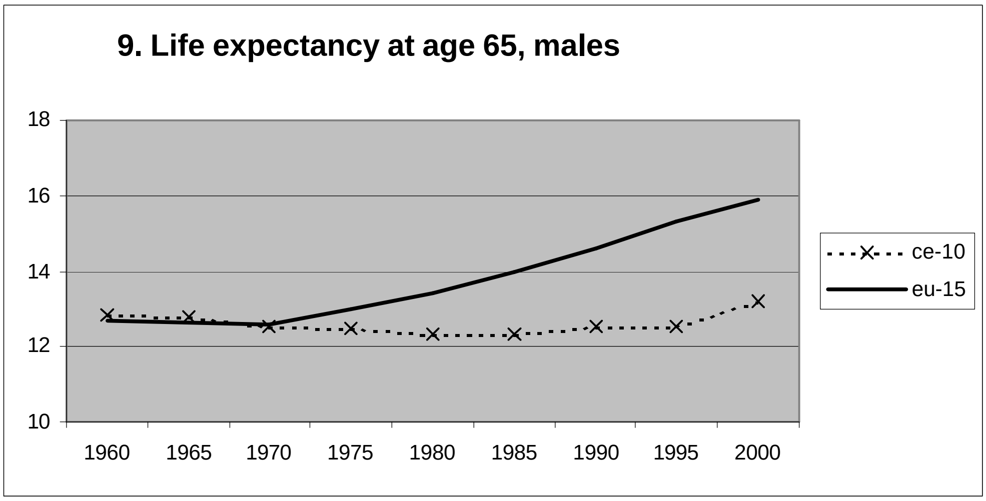
Mortality among males aged 15 -64 increased

Graph 8 provides insight in the mortality trends among the males aged 15 -65. It shows a dramatic development in the CE10 region: between the early 1960s and mid 1990s men in the working age lost on average more than 3 years of (potential) life. In the same period similar generations living in the EU15 gained more than 1 year. Only since mid 1990s the CE10 shows an increasing and converging trend. Therefore, one can state that already before the transition period the mortality of the male working age population detoriated.



Mortality among elderly men first stagnated but recently decreased

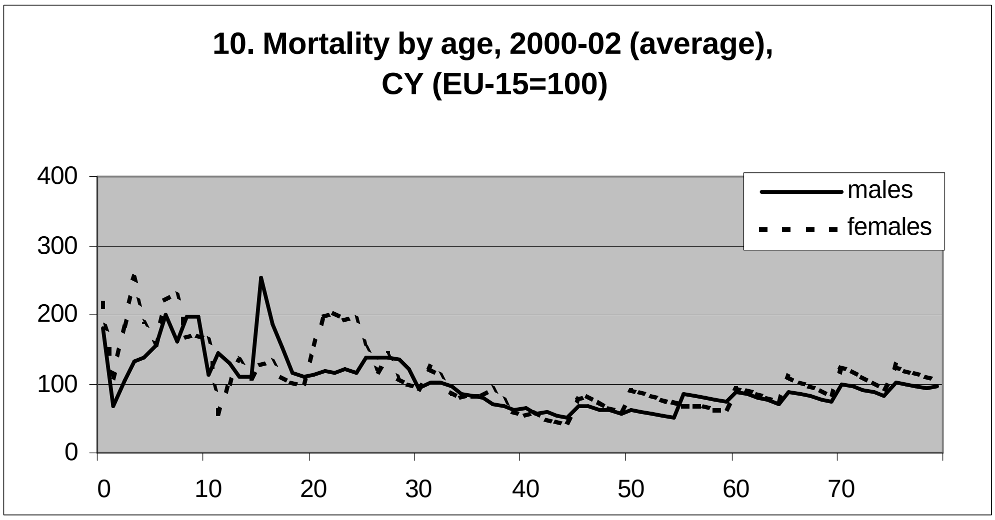
Not only the mortality levels of men aged 15 -65 moved away from EU15 levels, also those for the group 65 and over diverged during the period 1960 -1995 (see *Graph 9*). In stead of a more or less linearly increasing trend observed in the EU15 since 1970, the ECE10 average male life expectancy of elderly did not change much during the period 1970 -1995. Only in the second half of the 1990s we see a moderate increase, bringing the leve l back to that of the early 1960s. Departing from more or less similar levels in 1960 (almost 13 years), the men aged 65 in the CE10 have now on average almost 3 years less to live than their age companions in the EU15.

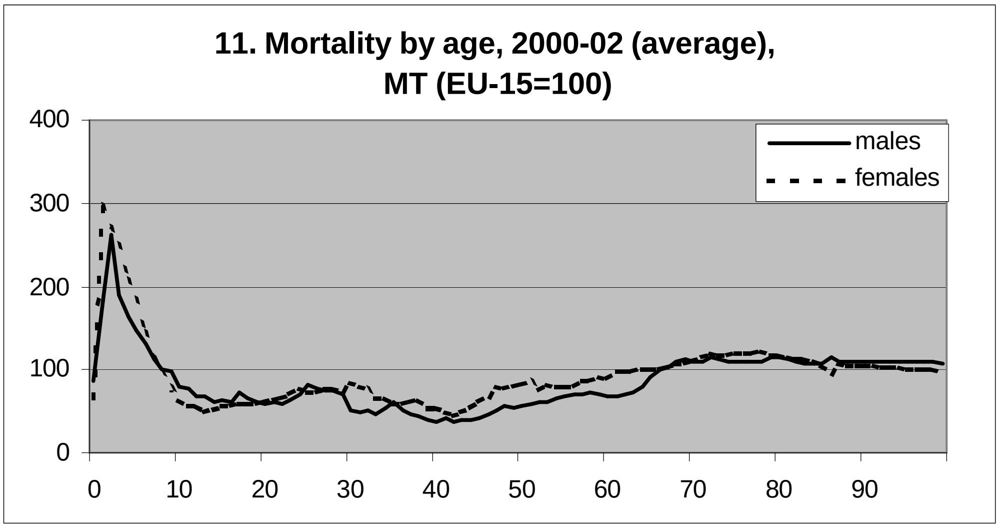


3. Current differences and r ecent changes in age and sex specific mortality

Cluster 1: Cyprus and Malta – close to EU-15 (difference in life expectancies in 2002: less than 1 year)

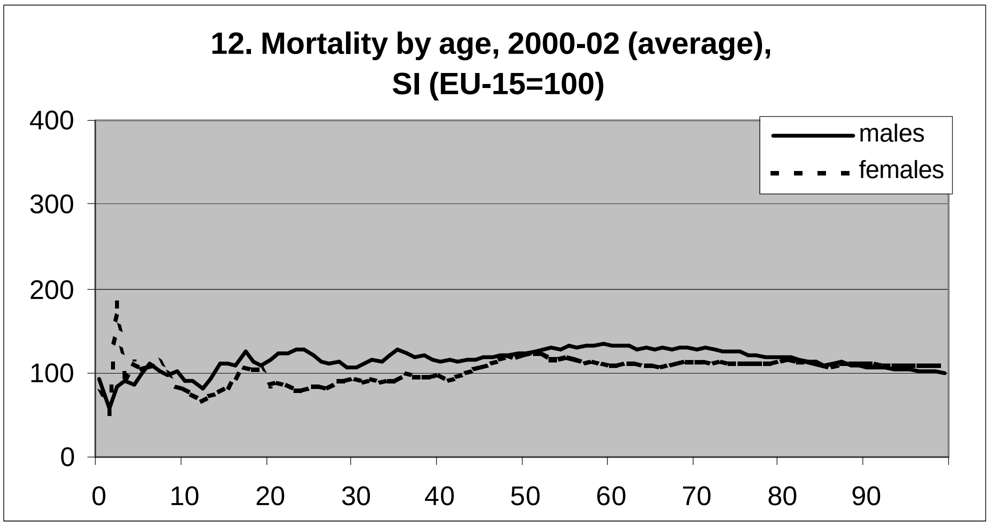
As already mentioned in section 1, both Cyprus and Malta are fairly close to the current EU15 average mortality levels. This does not mean that all sex and age specific mortality are similar to those of EU15. On the contrary, *graphs 10 and 11* illustrate that both countries currently posses some discrepancies. For Cyprus the somewhat higher mortality level s among young people (up to age 30) are noticeable, whilst those aged 35 -65 seem to have somewhat lower mortality risks (for the group 80+ there were no mortality series available). For Malta the children aged 1 -8 are facing significantly higher mortality risks, whilst the group of people aged 10 -60 experiences considerably lower death rates (due to absence of reliable data for the period 1997 -1999, no recent reduction patterns could be quantified).

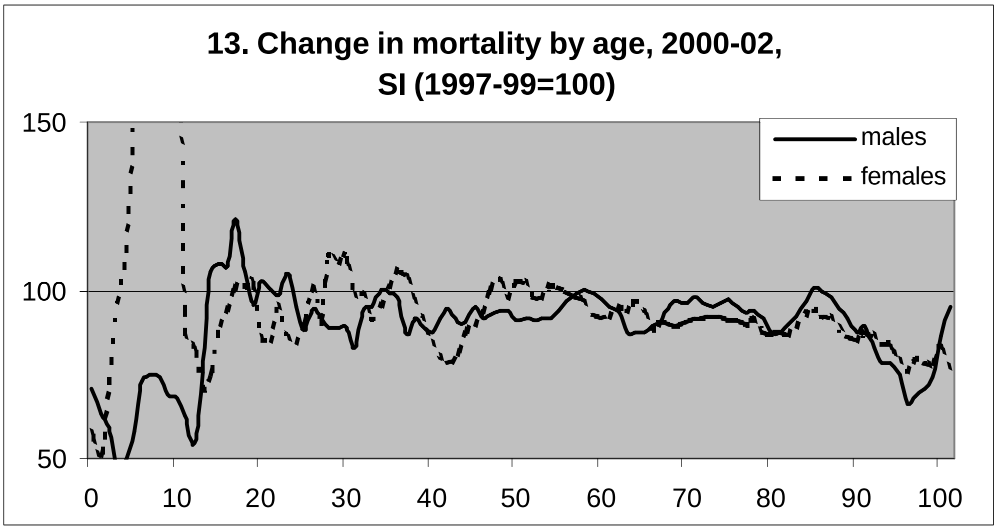




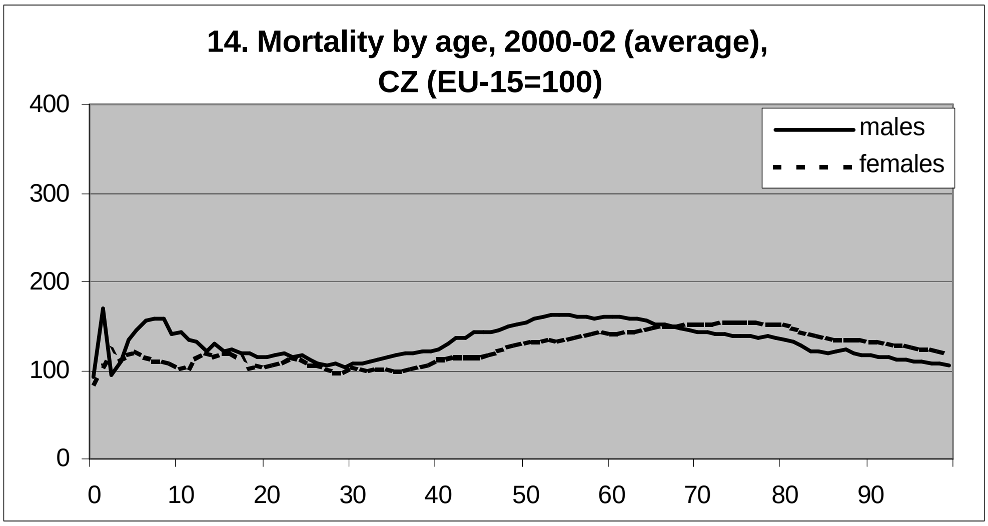
Cluster 2: Slovenia and Czech Republic – not far from EU-15 (difference in total life expectancy 2002: between 2 and 4 years)

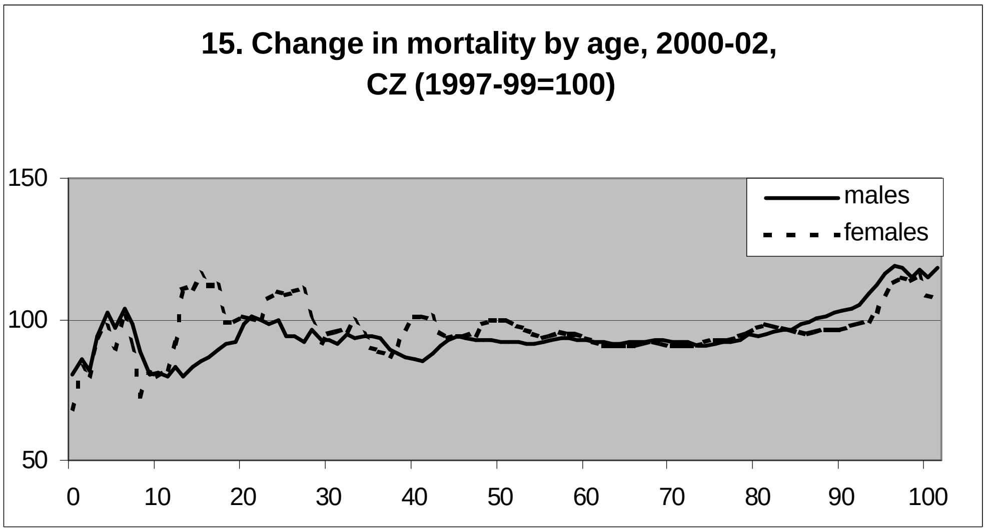
One could say that this cluster of countries is on its way to average EU15 levels. *Graphs 12-13* demonstrate that especially the women living in Slovenia are fastly approaching EU -15 average life chances: recently observed age specific mortality rates are already fairly close to those estimated for the old EU and recently observed mortality reduction patterns by age generally look promising. Also young boys living in Slovenia are very close to EU levels but men aged 20 -80 need still several years of extra reduction to bridge the gap with similar generations living in the EU15.





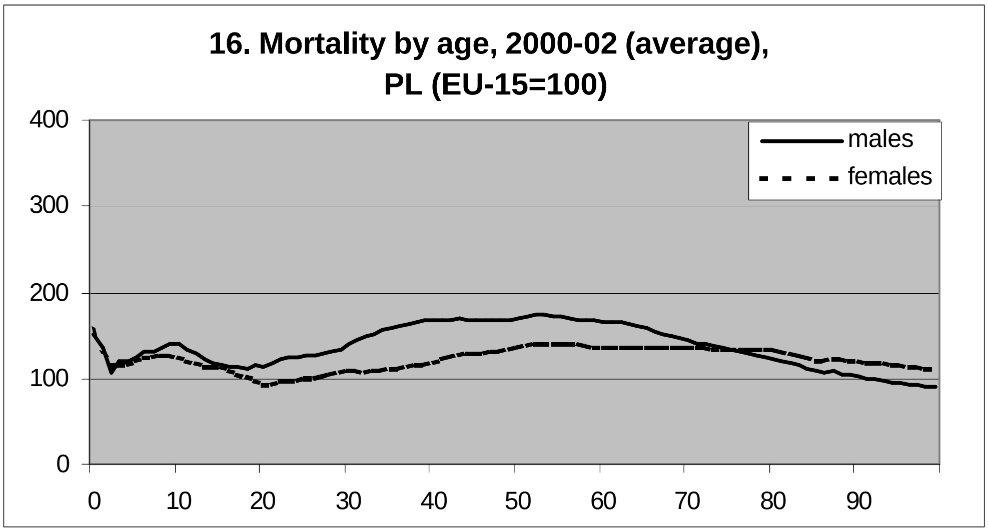
The Czech Republic is somewhat more behind the EU15, but since the early 1990s this country decreased its distance in life expectancy at birth with 1.5 years and 1 year for males and females respectively. The recently observed age specific mortality patterns show that only for the people aged 40 and over there still exists a significant gap (see *Graph 14*). The recently observed reduction patterns however look relatively favourable for these generations (see *Graph 15*).

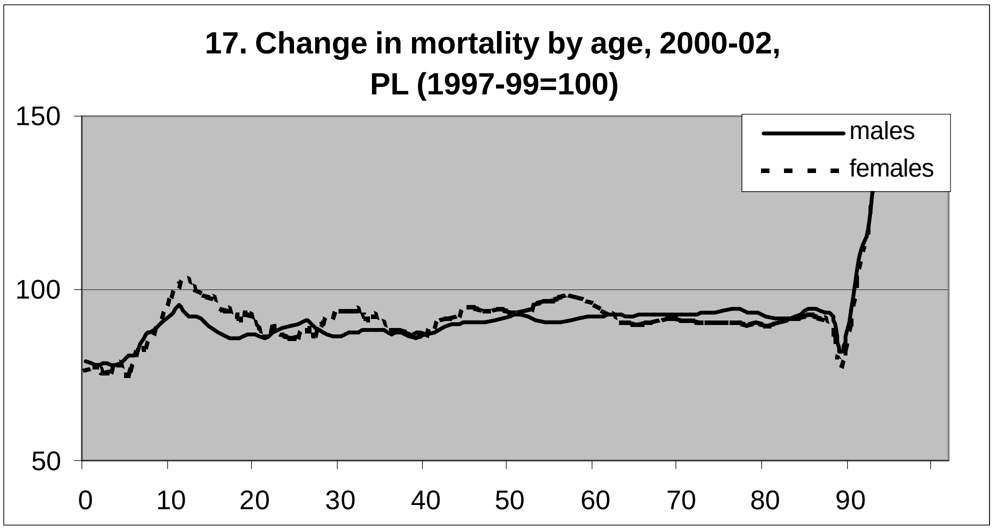


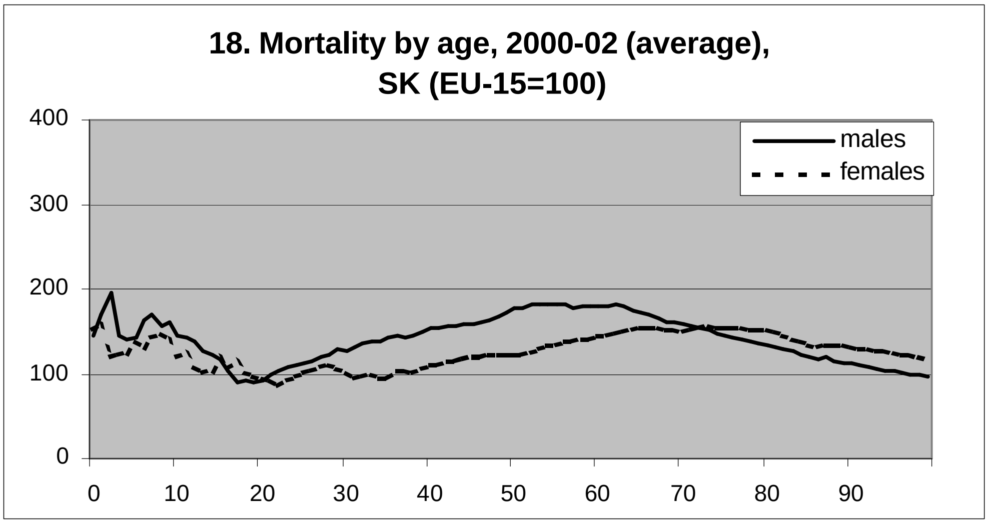


Cluster 3: Poland, Slovak Republic – quite behind EU-15 (difference in total life expectancy 2002 between 4 and 6 years)

Graphs 16 and 18 indicate that both Poland and Slovak Republic are currently substantially above EU15's mortality levels. Only women aged 15-35 approach the EU15 death rates. On the other hand, life chances of men aged 40-70 and in Slovak Republic also those of young children and elderly women are at considerable distance from EU15 values. However, during the 1990s both countries managed to diminish the gap with EU15 somewhat. Indeed the relatively strong, recent decreases in mortality rates by age, especially for Poland they look impressive, fuel the hope for a continuation of this trend of convergence in the near future (see *Graphs 17 and 19*).






18. Mortality by age, 2000-02 (average), SK (EU-15=100)
400
300
200
100
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0
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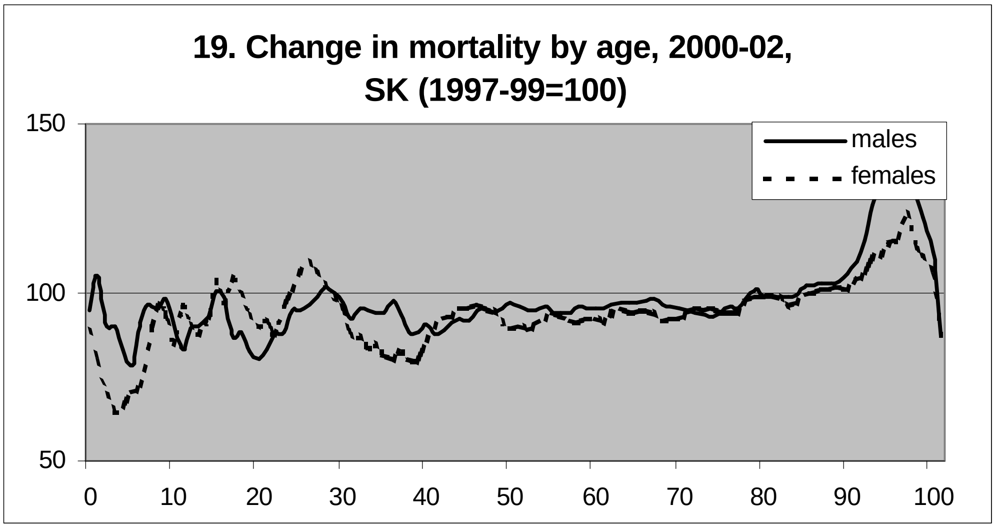
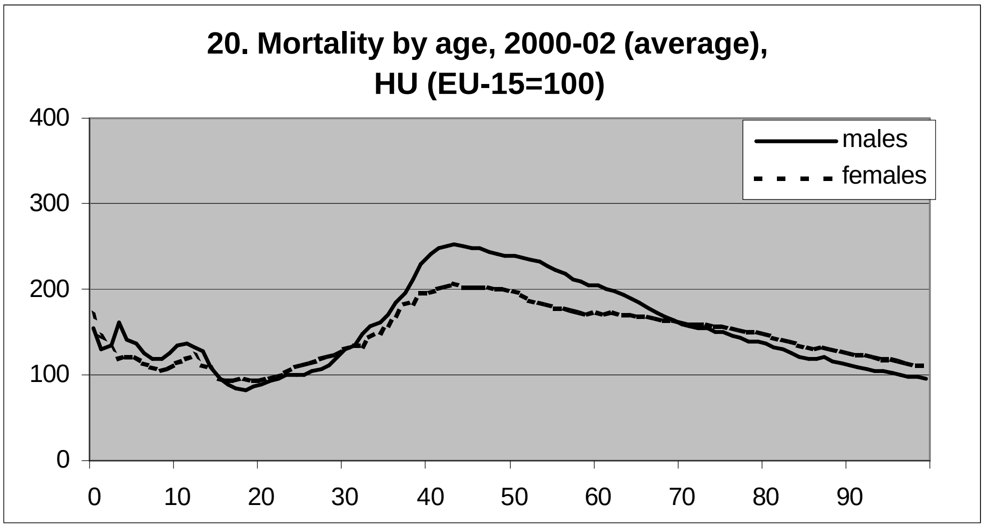
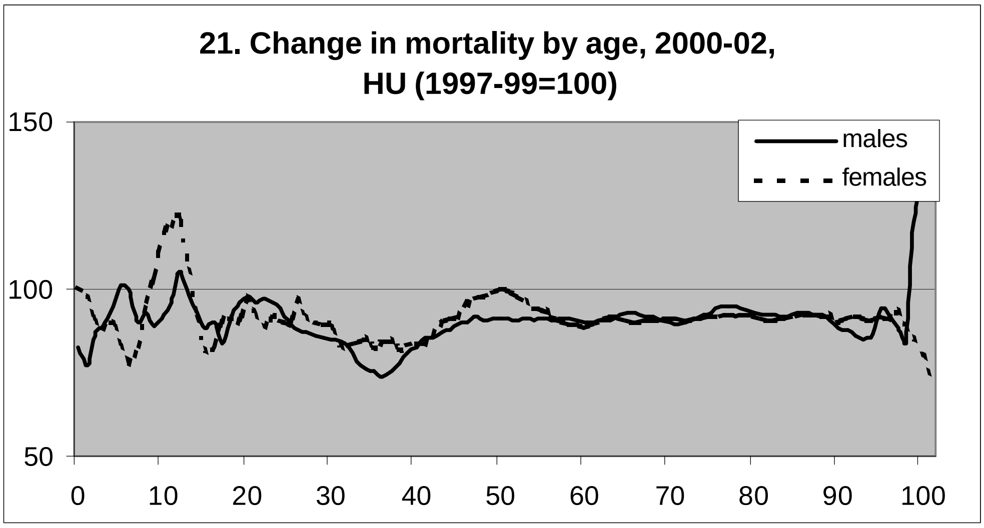
60
70
80
90
males
females


19. Change in mortality by age, 2000-02, SK (1997-99=100)
150
100
50
0
10
20
30
40
50
60
70
80
90
100
males
females

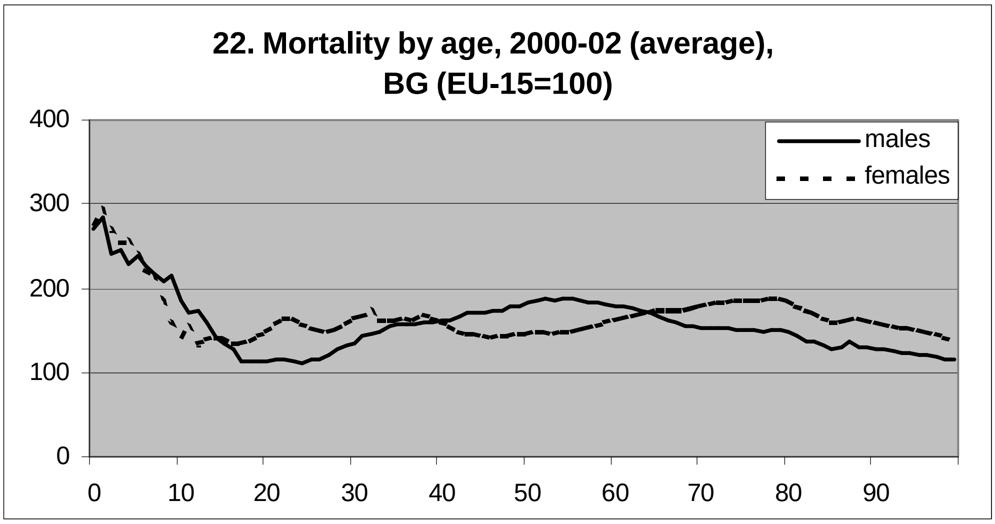
Cluster 4: Hungary, Bulgaria, Romania, Estonia, Latvia, Lithuania – far from EU -15 (difference in total life expectancy 2002: between 6 and 8 years)

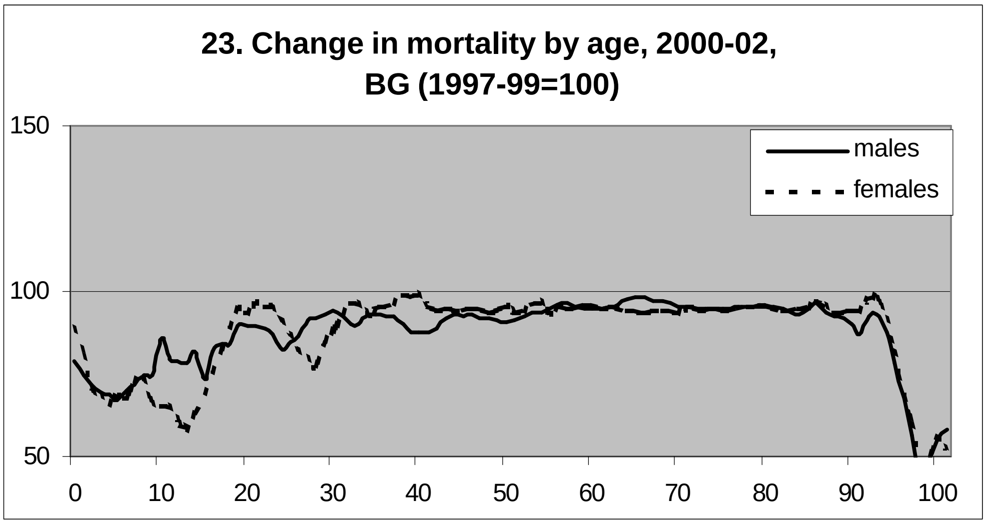
This cluster of six basically Eastern European countries is experiencing age specific mortality rates nowadays that were common in the EU -15 some decades ago. However, each country possesses a few age groups of people that are fairly close to the EU -15. In Hungary young adults and the group "oldest old" are the good exceptions (see *Graph 20*). The group of men aged 40 -60, on the contrary is facing death rates well over two times higher than the EU-15 averages. During the last 6 years, especially around the age of 35 mortality rates have substantially improved (see *Graph 21*).



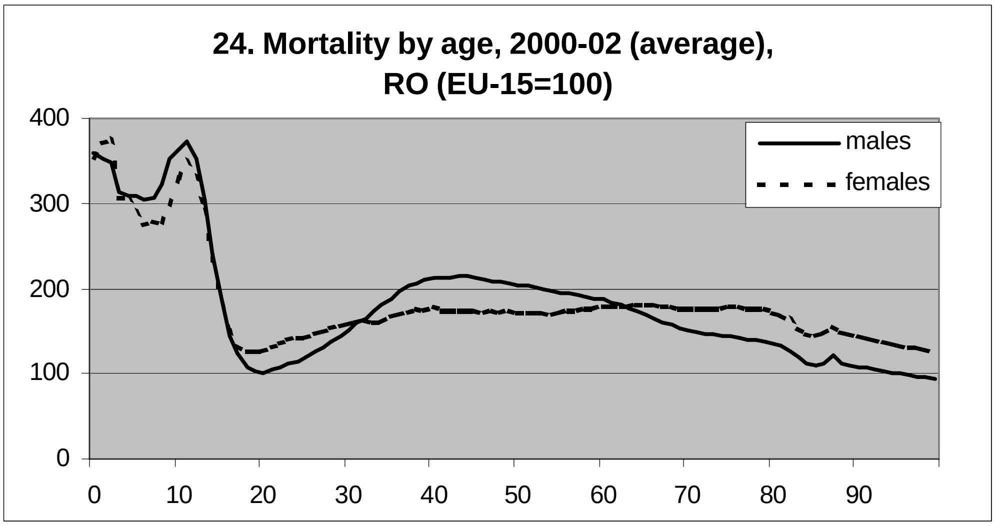


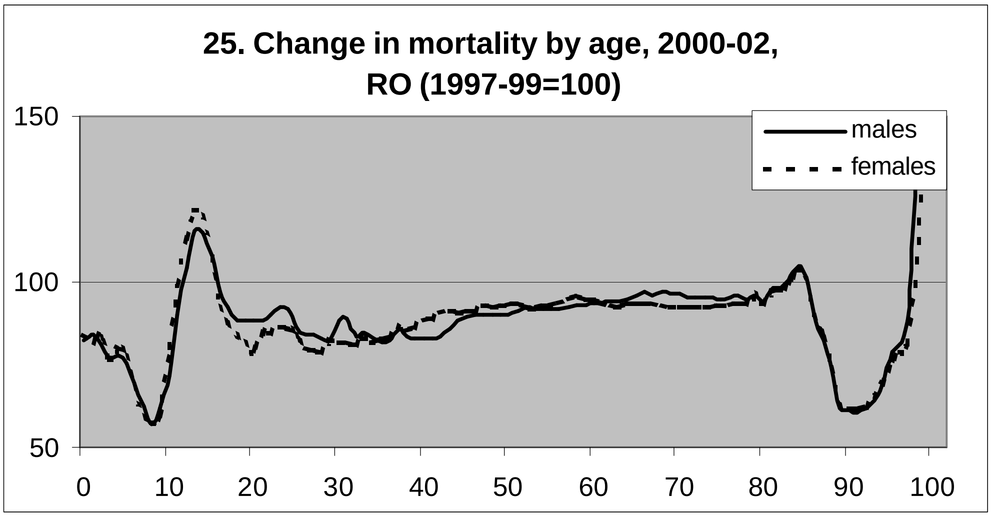
Also in Bulgaria the mortality rates among the young adults and the group of people aged 90 and over are currently the closest to the EU-15 levels (see *Graph 22*). Infant mortality and also death rates among the young children appear to be extremely high, and also men in their fifties and women in their seventies possess aged 50-60 and women aged 70-80 are at a much higher risk of dying than their cohort companions in the "old EU". Over the last 6 years relatively large reductions in mortality were reported for the (young) children, but also young adults did fairly well (see *Graph 23*). For the group oldest old somewhat extreme and therefore odd patterns of change are found, most probably due to (post census) measurement problems.



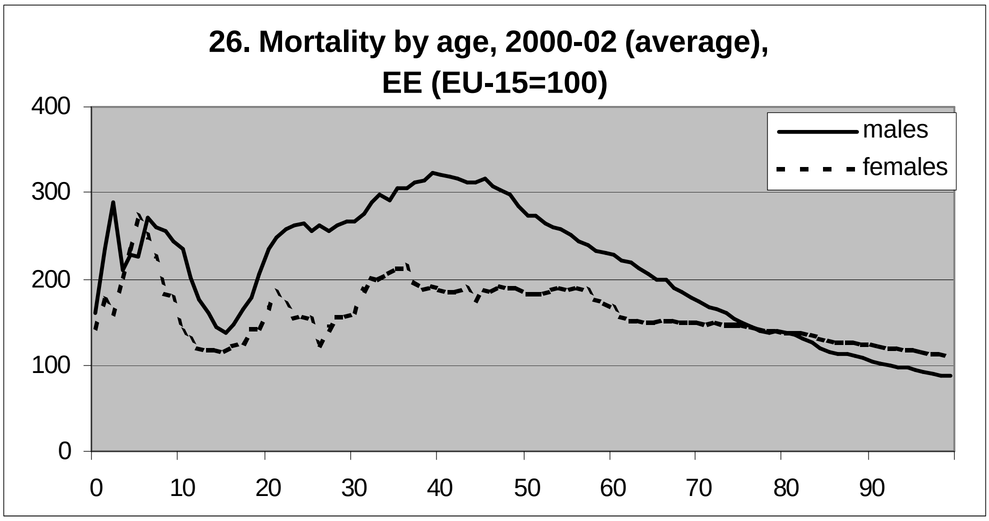


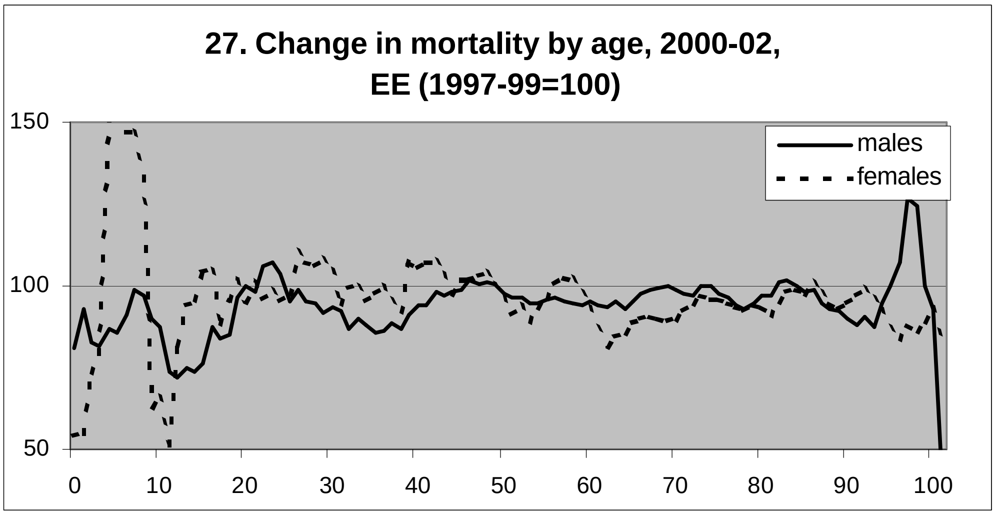
Compared with Bulgaria and Hungary, Romania shows much more pronounced differences in mortality by age: the excess mortality among young children is very high, and also the death rates of the men aged 40-60 is relatively high, however, the young adults and the oldest old men are remarkable close to EU-15 levels (see *Graph 24*). The recent observed reduction patterns are again informing us that survival rates among young children are fastly improving. Also the people aged 20-40 are experiencing a positive trend, but those around age 15 are surprisingly confronted with a downward development of life chances (see *Graph 25*). For the group oldest old somewhat extreme and therefore odd patterns of change are found, most probably due to (post census) measurement problems.

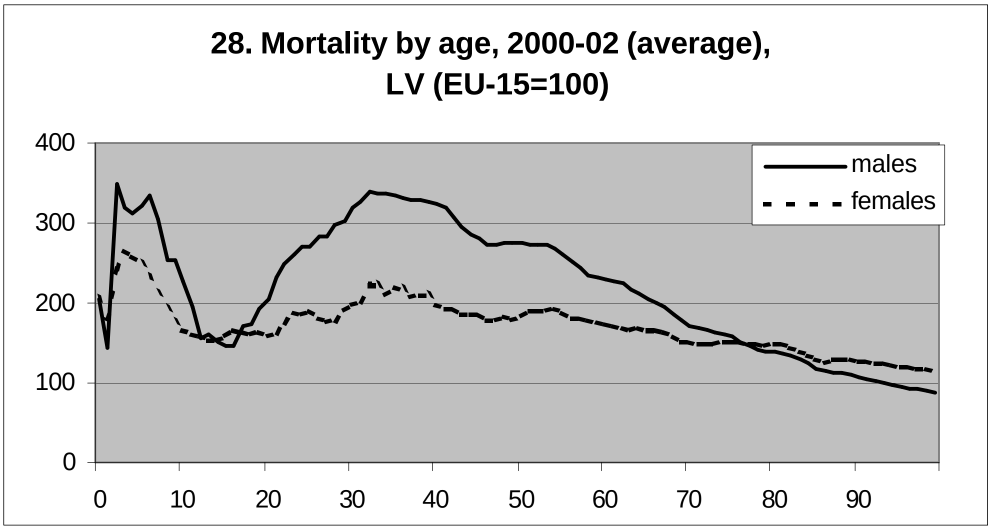


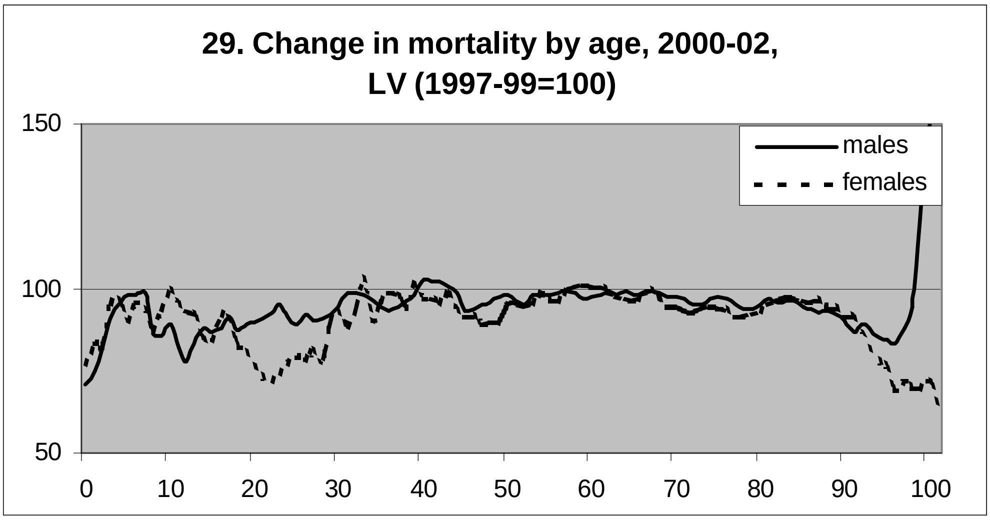


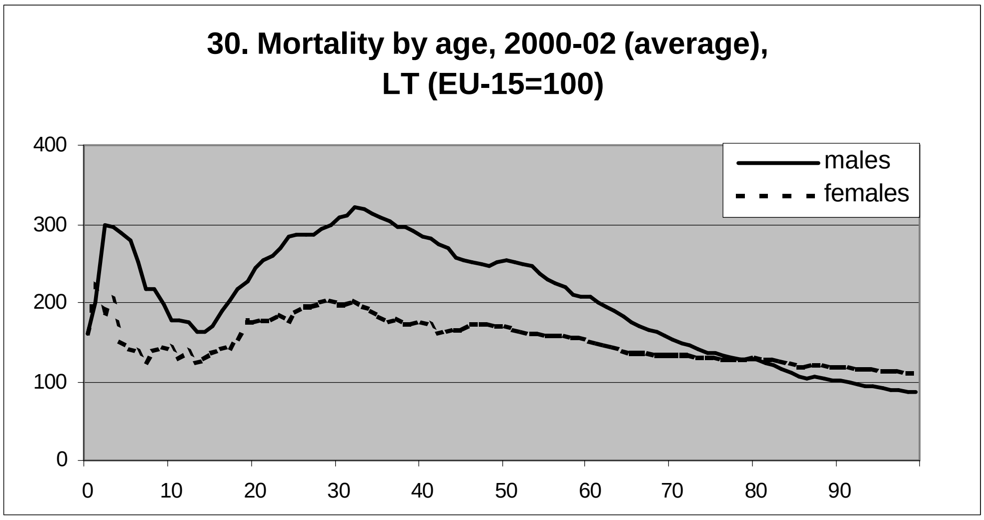
Finally, the Baltic States show mortality differences that can be summarised as "extremely high death risks for young children and men in their working age, and only close to EU -15 levels for those aged 90 and over" (see *Graphs 26, 28 and 30)*. In addition, the differences between men and women are much more pronounced than in any other new Member State. However, most surprising is that over the last 6 years there was hardly any change in the male excess mortality of men aged 30-60 (see *Graphs 27, 29 and 31*). Only in Estonia some first signs of improvement among men aged 35 are visible. Other positive news is the relatively strong decrease of infant mortality rates in Estonia and Latvia, the sharply declining death rates among young girls in Lithuania, teenage boys in Estonia, and young adult women in Latvia.

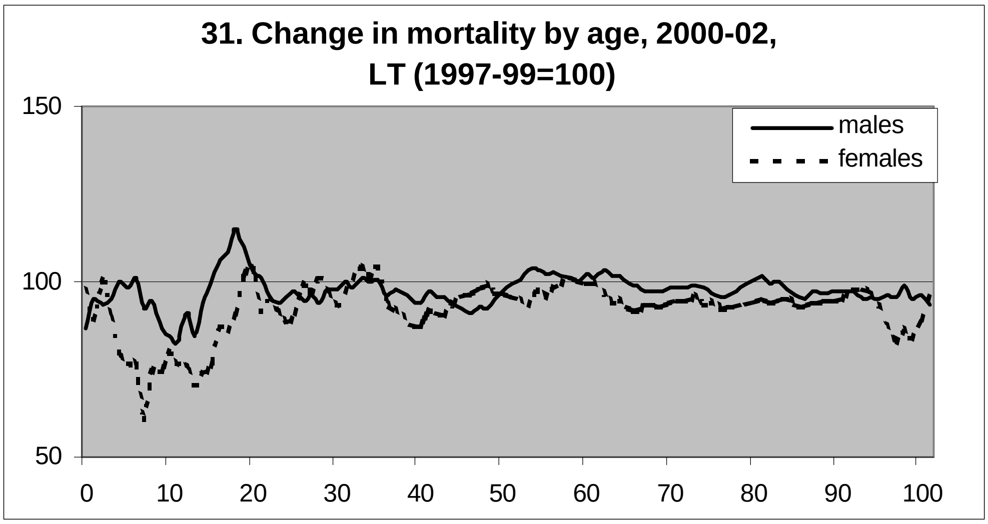





28. Mortality by age, 2000-02 (average),
LV (EU-15=100)
400
300
200
100
0
0
10
20
30
40
50
60
70
80
90
males
females


29. Change in mortality by age, 2000-02,
LV (1997-99=100)
150
100
50
0
10
20
30
40
50
60
70
80
90
100
males
females

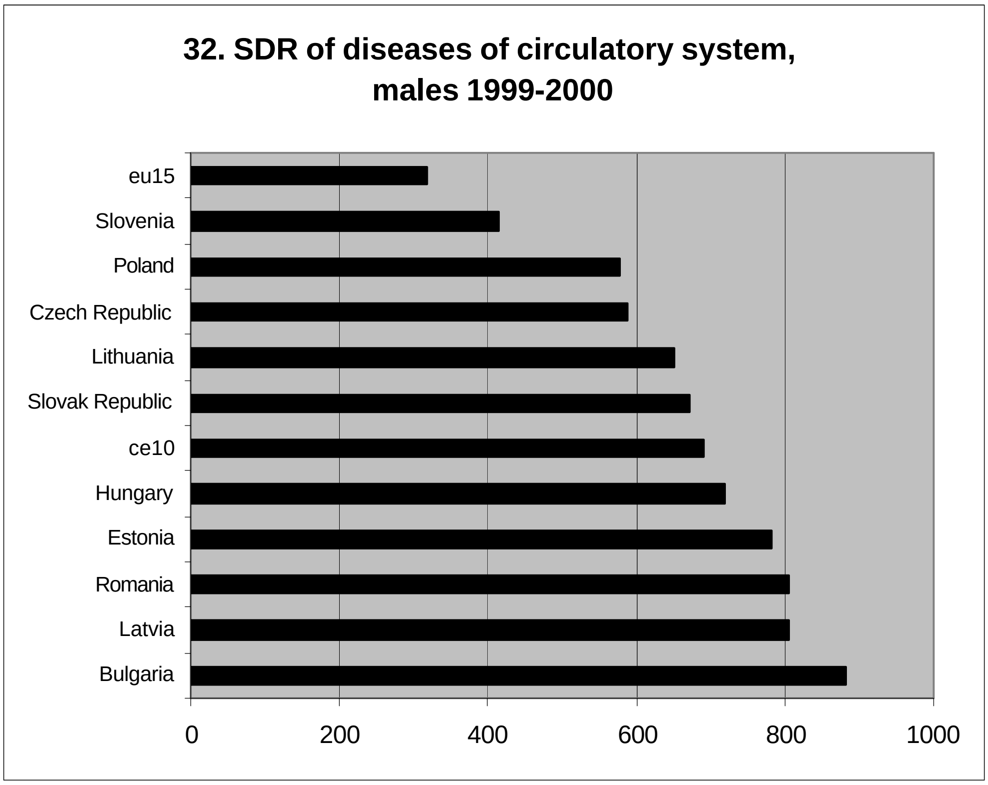

30. Mortality by age, 2000-02 (average),
LT (EU-15=100)
males
females
400
300
200
100
0
0
10
20
30
40
50
60
70
80
90

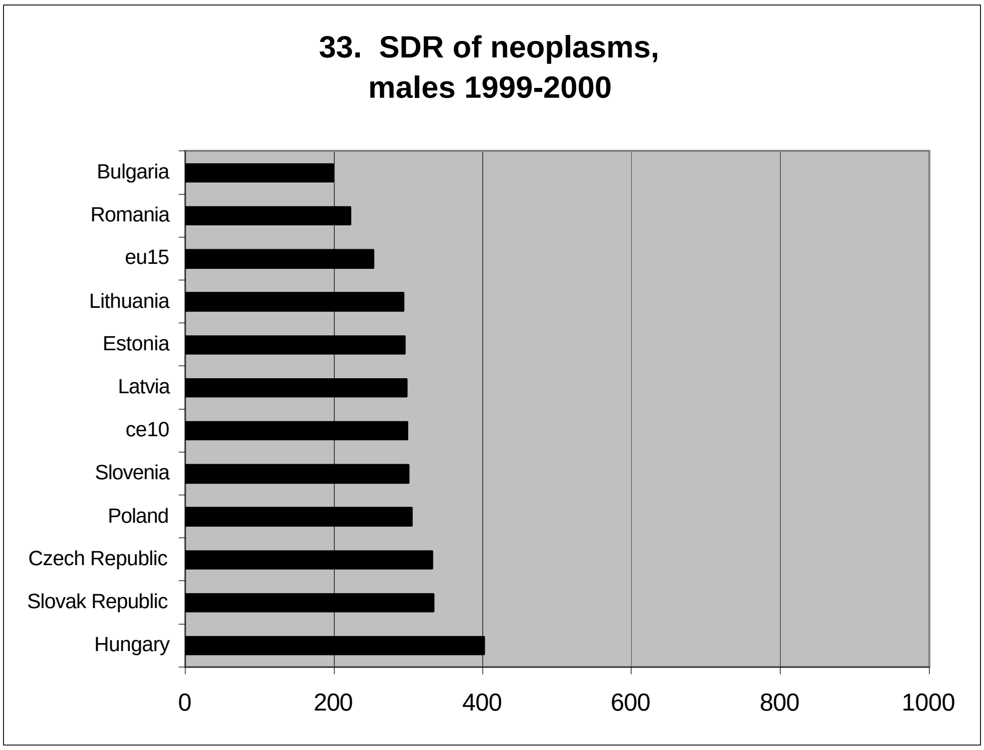

31. Change in mortality by age, 2000-02,
LT (1997-99=100)
males
females
150
100
50
0
10
20
30
40
50
60
70
80
90
100

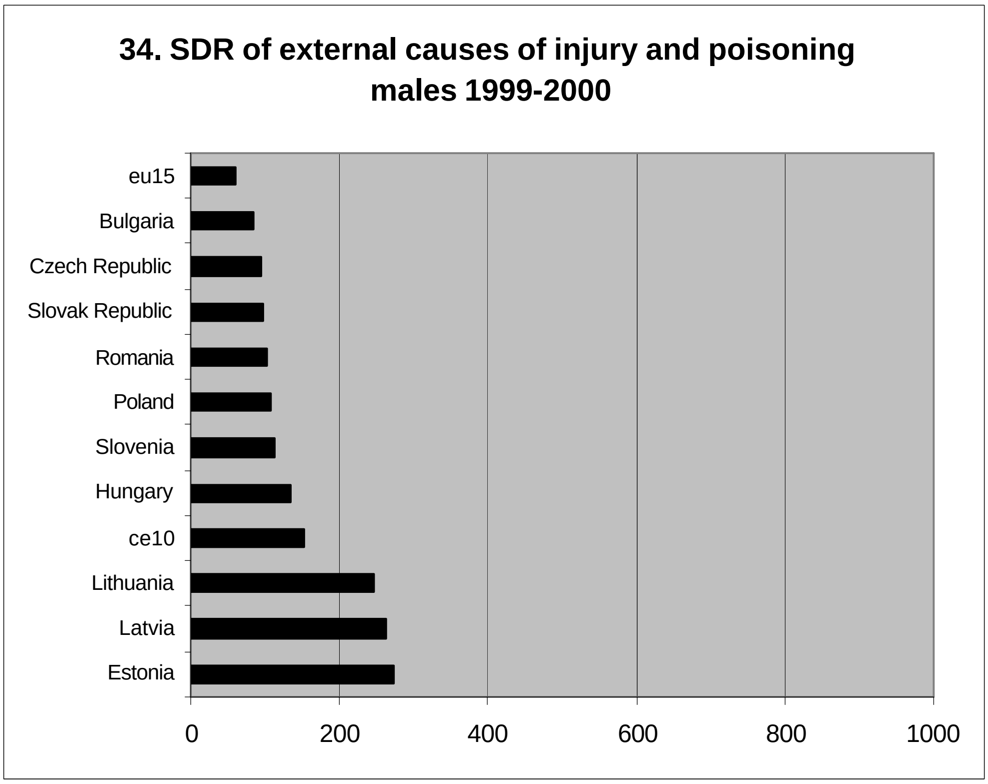
4. Contemporary differences in mortality by main causes of death

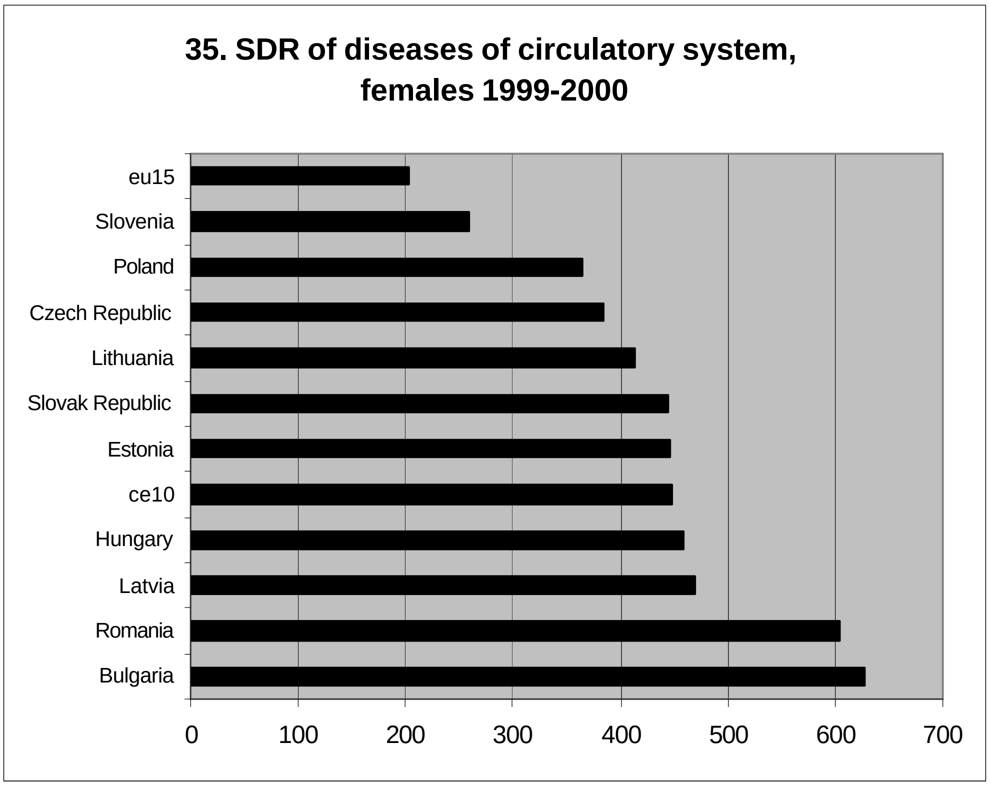
Graphs 32-34 clearly demonstrate that a large part of the excess mortality of (middle aged) men living in one of the countries of cluster 4 (Hungary, Bulgaria, Romania, Estonia, Latvia and Lithuania) can be attributed to relatively high levels of death due to diseases of the circulatory system. In all countries of this cluster the standardised death rate (SDR) of this principal cause of death is at least two times higher than the rate estimated for the EU15. Bulgaria has reported even a more than three times higher rate.
In Hungary also death to neoplasms explains a substantial part of the male mortality differences with the EU15, whereas the Baltic States report an extremely high death rate due to external causes of injury and poisoning (around 3 times higher than the EU15 level).

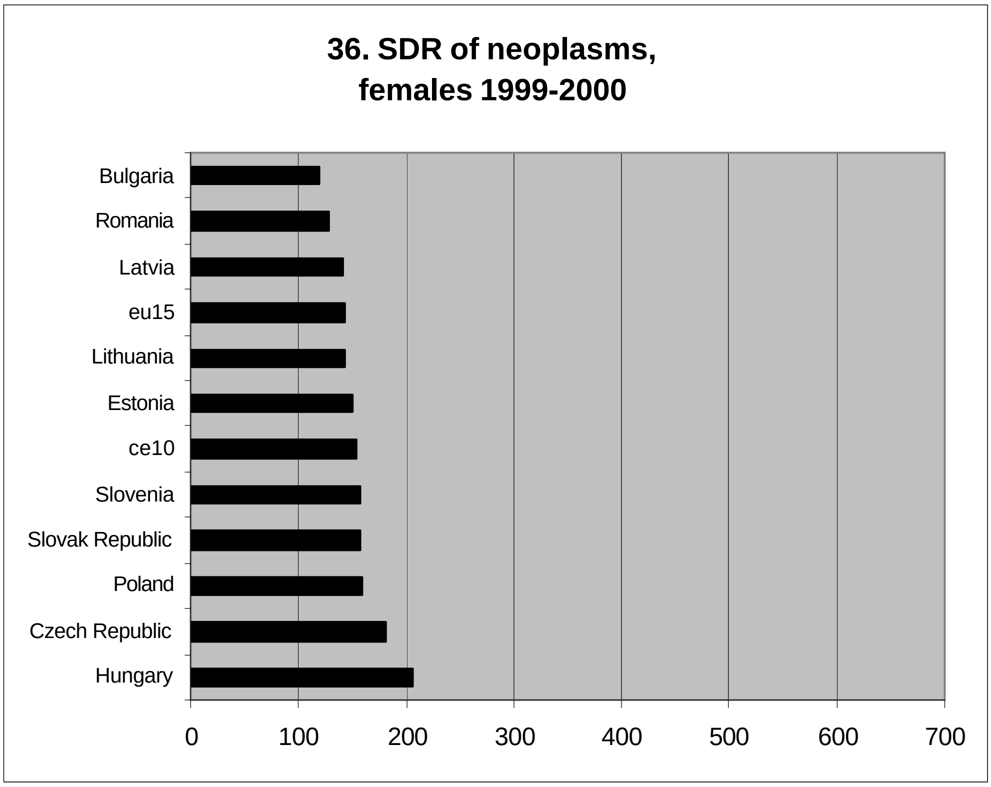
For females similar conclusions can be drawn, although the latter group of external causes of death plays a more modest role (see *Graphs 35-37*).

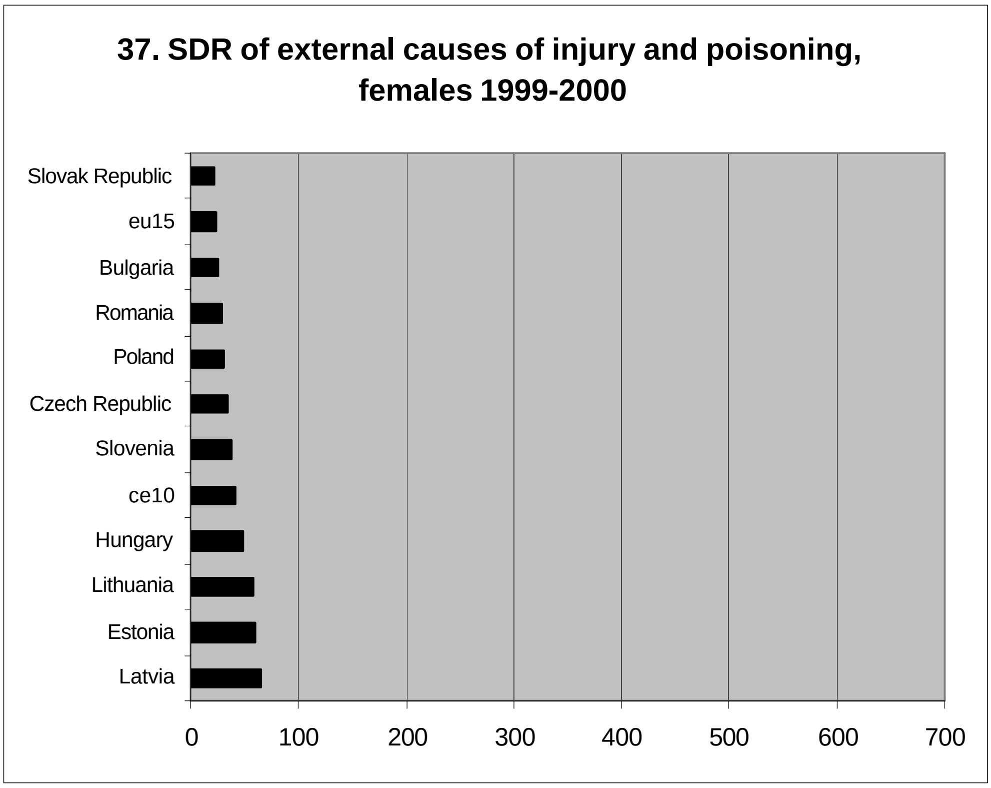



33. SDR of neoplasms,
males 1999-2000
Bulgaria
Romania
eu15
Lithuania
Estonia
Latvia
ce10
Slovenia
Poland
Czech Republic
Slovak Republic
Hungary
0
200
400
600
800
1000


34. SDR of external causes of injury and poisoning
males 1999-2000
eu15
Bulgaria
Czech Republic
Slovak Republic
Romania
Poland
Slovenia
Hungary
ce10
Lithuania
Latvia
Estonia
0
200
400
600
800
1000


35. SDR of diseases of circulatory system,
females 1999-2000
eu15
Slovenia
Poland
Czech Republic
Lithuania
Slovak Republic
Estonia
ce10
Hungary
Latvia
Romania
Bulgaria
0
100
200
300
400
500
600
700


36. SDR of neoplasms,
females 1999-2000
Bulgaria
Romania
Latvia
eu15
Lithuania
Estonia
ce10
Slovenia
Slovak Republic
Poland
Czech Republic
Hungary
0
100
200
300
400
500
600
700


37. SDR of external causes of injury and poisoning, females 1999-2000
Slovak Republic
eu15
Bulgaria
Romania
Poland
Czech Republic
Slovenia
ce10
Hungary
Lithuania
Estonia
Latvia
0
100
200
300
400
500
600
700

5. Determinants of mortality

In the qualitative part of the analysis of international differences of demographic patterns and trends executed for the compilation of the 1995-based population scenarios for the European Economic Area a fairly simple scheme of determinants of mortality has been used (de Beer and Van Hoorn, 1997). Mortality (by cause of death), successively proceeded by disease and risk factors, was supposed to be influenced by:

- individual factors such as heredity and gender;
- socio-economic status and educational level;
- physical environment, housing and working conditions, living arrangement and life style;
- health care system, health policies, progresses in medical technology and medicines.

In order to explain mortality differences between the 18 European countries considered, a multivariate analysis was carried out, using data observed in 1988. The following variables were applied:

- dependent variables: standardised mortality rate (SMR) and life expectancy at birth;
- independent variables: gross domestic product (GDP), the unemployment rate, health expenditure per capita and expressed as percentage of the GDP, the use of tobacco, and the average daily consumption of meat, fat, dairy products, wine, vegetables, fruits, etc.

It turned out that the most important explanatory variables were per capita expenditure on health care and consumption of vegetables and fruits: differences in SMR's could be explained by 50% using these two items. Combined with GDP the explained variance increased to 60%. Adding more variables did not significantly increase the explanatory power of the model applied, and therefore the ultimate tentative conclusion was that societies with a relatively high expenditure on health care and with relatively many people on a healthy, varied diet would posses lower or reduced mortality levels.

Apart from the question whether such an analysis would be actually feasible for the 10 New EU Member States and 2 Accession Countries (probably the answer is no due to the lack of sufficiently comparable data series), would it yield similar results? And more importantly for projection makers, if one would find statistically significant and sound outcomes for a single calendar year, how to extrapolate the respective explanatory variables for the next six decades?

In a recently published volume on forecasting mortality in developed countries no clear answer was given whether the line of causal modelling of past and future patterns and trends in mortality would be the most promising one (Tabeau et. al., 2001). For some important causes of death such as death due to lung cancer fairly successful and robust epidemiological projection models have been developed and applied, but in spite of all research efforts a large number of causes of death are still lacking modelling experience. In addition, the inherent problem of interdependency between causes of death has not yet been solved (and will probably never be solved).

Therefore, in full accordance with the term of reference of this project, no attempt has been made to quantitatively explain the mortality patterns and trends described in sections 2-4, and consequently develop, test and apply a new multivariate projection model. Instead we carefully examined the outcomes of recently published (or forthcoming) scientific articles and dissertations.

The general picture that emerges from this inventory that until now a limited number of demographers living and working in the CE region are actively and/or full-time involved in scientific mortality research. Most studies dealt with the “mortality crisis” in Russia. Obviously many countries or institutes are too small to capture all demographically interesting topics, and apart from the Max Planck Institute in Rostock there seems to be no (international) agency interested in organising or co-ordinating a joint research programme on contemporary health and mortality differences in this part of Europe. Instead there were a few “regional” expert meetings organised, especially after the unprecedented and therefore unexpected downturns in life expectancies in many former socialist/communist countries during the period 1985-1995. Furthermore, most scientific literature that we have collected was purely descriptive and therefore was left out. In addition, most explanatory analyses found were either qualitative or merely univariate. Partly this is caused by the general lack of internationally comparable data series, partly it reflects the specific and sometimes rather selective knowledge and experience of the researchers.
Finally, almost all literature selected tried to explain adverse or unfavourable patterns and trends such as the increasing excess mortality of adult men and the widening mortality differentials between and within countries. Very few studies were found which examine the background or causes of improving or better practices.

In order to make a systematic review of recently published (or forthcoming) results of scientific research we first enhanced the above-mentioned simplified scheme of determinants of mortality. We propose to use a more comprehensive and more concrete checklist of (potentially) important variables that may decrease or increase longevity. The list depart from all actually known and measurable health and death related endogenous items working at the individual level and ends with all relevant factors created or existing at the very macro level.

Our provisional longlist comprises the following determinants/factors/variables (apart from the basic demographic variables gender, and age/cohort):

- heredity
- length/weight/body mass
- blood pressure/cholesterol
- disability (physical/mental)
- marital status/household position/living arrangement
- region
- ethnicity/country of birth
- religion
- language
- educational attainment
- employment status
- occupation
- income
- social protection
- health insurance
- smoking habits
- drinking habits
- eating habits
- norms&values
- leisure

- mobility
- housing conditions and policies
- working conditions and policies
- transportation system and policies
- macro-economic conditions and policies
- health care system and policies
- technology (including medicines)
- law and order (criminality/corruption)
- political system
- ecological environment
- climate.

We did not find any study that covered all these items. The most comprehensive one we have spotted has tried to assess the importance of 10 determinants on temporal and spatial mortality trends by gender, age and main causes of death in Europe (Spijker, 2004):

1. marital status/household position/ living arrangement (measured by divorce rate per 100 marriages)
2. region (level of urbanisation)
3. educational attainment (measured by numbers of years of education)
4. income (distribution of income)
5. smoking habits (consumption of tobacco)
6. drinking habits (consumption of alcohol)
7. eating habits (consumption of fruits and vegetables, and cereals)
8. macro-economic conditions and policies (GDP, primary and secondary sector employment, unemployment)
9. health care systems and policies (budget expenditure on health)
10. ecological environment (pollution of sulphur oxides).

The multivariate analyses applied for both total mortality and main causes of death by gender for the period 1968-1999 was executed in two steps, one with all variables ("complete" model) and one with a restricted set of exclusively statistically significant variables ("best model"). Because of historical differences in the economic development within Europe, it was decided to conduct two groups of analyses, one with "Western" and one with "Eastern European" countries (Bulgaria, Belarus, Czech Republic, Czechoslovakia, East Germany, Estonia, Hungary, Latvia, Russia, Slovak Republic Ukraine). For the latter group of countries, the explanatory variables 5, 7, 9 and 10 had to be left out due to the lack of sufficiently long and reliable data series.
From the vast amount of results of this study the author concludes that (pp.127):

- "absolute prosperity is by no means the most important factor in causing mortality differences over time and across space";
- "all variables that were tested showed independent effects, particularly alcohol consumption in Eastern Europe";
- "recent economic and social transitions (in Eastern Europe) have had an immediate impact on the health of the population".

The first conclusion was drawn by many other demographers.
The second conclusion is less common but can also be found in a recent report presenting the principal results of one of the first micro-data studies in the region, an epidemiological case-control analysis of premature deaths among men aged 20-55 in Udmurt Republic in Russia

(Shkolnikov, 2002). The outcomes of this study reveal significant independent and combined mortality impacts of marital status, education, unemployment, smoking, and alcohol consumption on mortality from cardiovascular and external causes.
The third conclusion confirms what has been found in many other, most country-case studies. For example, Krumins (2003) convincingly explains that Latvia's population life chances during the first half of the 1990s were negatively affected by the economic crisis, that first caused a decline of income and higher unemployment, and subsequently an increase of psychosocial stress and alcohol consumption. Also the psychological attitude of the population towards a lifestyle aiming for a better or improved health became less prominent: a growing proportion of people was inclined to put the highest value on money and career. And finally, he mentions that it became more and more difficult for socially vulnerable groups to pay for health services.
Gaumé et al. (2003) arrive at similar conclusions for all three Baltic States, but they also critically discuss the explanatory power of some other possible factors. Largely based upon earlier, empirical research executed by Chen et al. (1996) and Shkolnikov et al. (1998), first the following rather simple hypotheses are refuted:

1. the "mortality crisis" was caused by environmental factors (reasons: industrial air pollution declined, particularly adult male mortality went up);
2. the "mortality crisis" was due to a collapse of the health care system (reasons: children's mortality continued to decrease, impact of curative medicine on cardiovascular and violent mortality is limited).

Thereafter, they try to assess the negative impact on adult male mortality of the following factors:

- alcohol abuse: no clear conclusion due the absence of annual figures on alcohol consumption;
- changing eating habits: less meat and diary products and more cereals, but also less fruit and vegetables, therefore no clear evidence;
- economic impoverishment: GDP's decreased by around 40% between 1990 and 1995, but mortality among the most economically dependent groups (children and elderly) was hardly or much less affected;
- increasing income inequalities: indeed leading to more psychosocial stress;
- a weakening of law and order: caused more criminality and corruption, and therefore more violent mortality;
- decrease of health facilities: e.g. the number of hospital beds fell by 20 to 30% between 1992 and 1998, but unclear what impact was.

The small number of demographers that have tried to search deeper speak either about the lagged or combined effects of all kinds of shortcomings of the former socialist/communist systems (e.g. Daroczi, 2003), cumulated frustrations that had long-term negative implications for health (Watson, 1995) or attempt to prove that for example the contribution of (new and advanced) medicines to the increase in life expectancy in Western European countries was significant, whereas during the 1980 and 1990s in the East hardly any improvement occurred due to this part of the health care system (Nolte, 2002).
Finally, as was already mentioned very few analytical studies were found on the most recent, generally more positive mortality trends in the CE10 region. Rychtarikova (2002) studied the recent mortality improvements in the Czech Republic, and her principal conclusion is that medical care improvements have most likely played a major role in the positive change. Gaumé et al. (2003) note that between 1994 and 1999, the proportions of men and women having consumed alcohol less than seven days before the survey decreased in the three Baltic States, but they don't (want) to speak about an adverse trend in drinking habits yet.

6. Three scenarios

This section describes the basic assumptions and the methodology used for setting the national mortality scenarios. The methodology has been implemented in Excel files, one for each country.

A full mortality scenario consists of a complete set of age-specific death or mortality rates ASDR(x,s,t), for each age x=0..101+, each sex s=M,F, and for each projection year 2003..2070. The key components used in specifying a mortality scenario are:

- the latest observed mortality rates ASDRs, up to 2002;
- the latest observed mortality rate *reduction factors*, up to 2002. A mortality reduction factor is the ratio of ASDRs in two consecutive years: R(x,s,t) = ASDR(x,s,t) / ASDR(x,s,t-1). It describes the pattern of improvement in survival which, in principle, can be different for different sexes, ages, and time periods;
- the latest observed mortality reduction factors for the EU-15.

Each of these components will be described in more detail below. However, first we discuss in general terms the idea behind this way of scenario setting.

Key assumptions, Baseline

The Baseline (mortality) scenario is based upon a set of general considerations, similar to those used for the compilation of the 1995-based long-term population scenarios for the EEA. This implies that the following key assumptions are applied:

- the future will be a continuation of the (recent) past;
- the New EU Member States will start or continue a process of convergence in many societal and individual aspects of life: political, economical, social, cultural, health care systems, life styles etc..

Therefore, the mortality pattern of the most recently observed year, 2002, is the point of departure for specifying the ASDRs for 2003 and later years. Because of small numbers and random fluctuations, for projection purposes this initial mortality schedule has been subjected to averaging and smoothing.
The driving force behind changes in mortality over time are the recently observed mortality reduction factors. The philosophy behind this fundamental choice is, that the mortality differences between the old and most of the new EU member states are currently so large, both in terms of levels and of recent experiences, that for the medium and long run the best we can expect is a convergence of mortality improvements, and not of absolute mortality levels. Furthermore, one of the principal outcomes from the time series analysis is that over the last 6-8 years the trend of divergence with the EU15 averages has stopped and reversed into a weak trend of convergence. The same applies for the differences between the countries and between the sexes. Therefore, we expect that countries with a currently low life expectancy will in the long run have more scope for survival improvements, especially if their recent mortality improvements have been significantly better than the EU15 reduction patterns.

The mortality scenario is thus specified in terms of the mortality reduction factors R. The ASDRs themselves, which are the input parameters for the projection model, come out as a 'side effect': the assumptions are formulated in terms of the R which, when combined with the ASDRs for the initial projection year, generate the ASDRs for all subsequent projection years. Of course, in setting the reduction factors, the implications for the future ASDRs and derived indicators like life expectancy have been taken into account in an indirect way, but technically the mortality scenario manipulates the Rs, not the ASDRs.

Basic schedule for 2003, Baseline

Starting point for the ASDR(x,s,2003) values are the observed rates for the years 1990-2002. To remove random irregularities, this schedule is smoothed by taking moving averages over three consecutive ages, and in addition by taking the average over the most recent three-year period 2000-2002.

The ASDRs for 2003, which is the first projection year, are obtained from this basic mortality schedule by applying to it a set of mortality reduction factors, to be discussed below.

Basic reduction factors for 2003, Baseline

Starting point for the R(x,s,2003) values are the observed mortality reduction factors for the years 1991-2002. To remove random irregularities, this pattern is smoothed by taking moving averages over seven consecutive ages, and in addition by taking the average over the most recent five-year period 1998-2002. In addition, only mortality *improvements* are taken into account; if for some combination of age and sex the ASDR has actually increased over 1998-2002, the corresponding R value has been set equal to one.

The Rs for 2003, which is the first projection year, are obtained from this basic mortality reduction schedule by applying a initial scaling factor which ranges approximately between 0.5 and 1.5. This factor indicates the extent to which the 2003 improvements are in line with the basic improvements: 1 indicates equality, 1.5 indicates 50% larger, 0.5 indicates 50% smaller, etc. The scaling factor is set in such a way that the gradual convergence of the R pattern towards the EU average in the medium term occurs in a plausible manner.

Medium term reduction factors for 2023, Baseline

By assumption, the mortality experiences of the EU countries gradually converge towards a common pattern *in terms of mortality improvements*. This has been operationalized as follows: after 20 projection years, all 12 new member states will have the same mortality reduction factors as the EU-15 had in 2003.

The R(x,s,t) for t between 2003 and 2023 are obtained via linear interpolation.

It should be stressed that equality of the R(x,s,2023) values for all countries by no means implies that mortality will be equal by 2023. Differences in terms of the ASDRs between countries may well persist, for two reasons: the initial ASDRs generally differ; and the R values for the initial projection years generally also differ.

Survival improvements in the long run, Baseline

After 2023 mortality rates will continue to decline, i.e. improve. The extent to which this will be the case is controlled by two additional scenario parameters: a *target year* for mortality (after the target year, no further improvements will take place); and a *relative reduction scaling factor* for the target year. Similar to the scaling factor for the initial projection year 2003, this target year scaling factor indicates the extent to which the mortality reduction in the target year will be below the reduction specified for 2023 (which is EU-15 in 2003): 1 indicates equality (i.e. reduction in the future will be the same as 2023), 0.5 indicates 50% smaller, 0 indicates no further improvement after the target year, etc. The scaling factor is set in such a way that the 2070 ASDRs and life expectancy values are plausible continuations of current experiences and in line with the general scenario assumption of starting or ongoing processes of convergence (economically, politically, socially, life styles, etc).

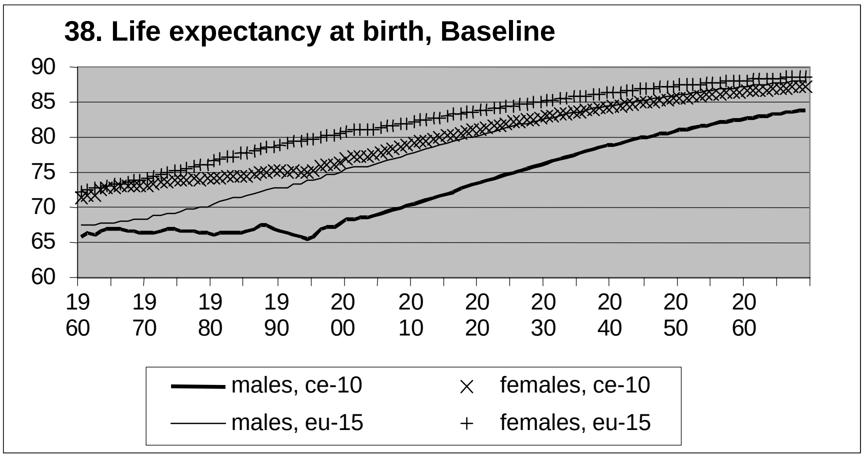
The R(x,s,t) for t between 2023 and the target year are obtained via linear interpolation. The R(x,s,t) for t after the target year are zero by definition.

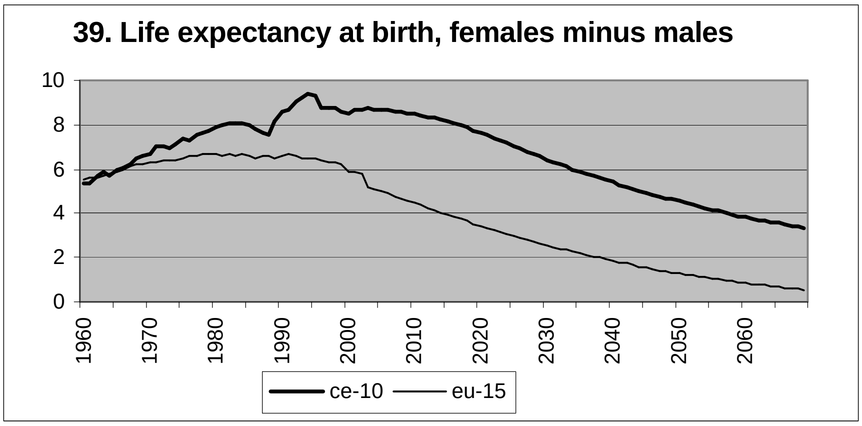
The projected life expectancies at birth for a selected number of future calendar years are presented in *table 1. Graphs 38-40* illustrate that for the period 2003-2070 we expect that most likely:

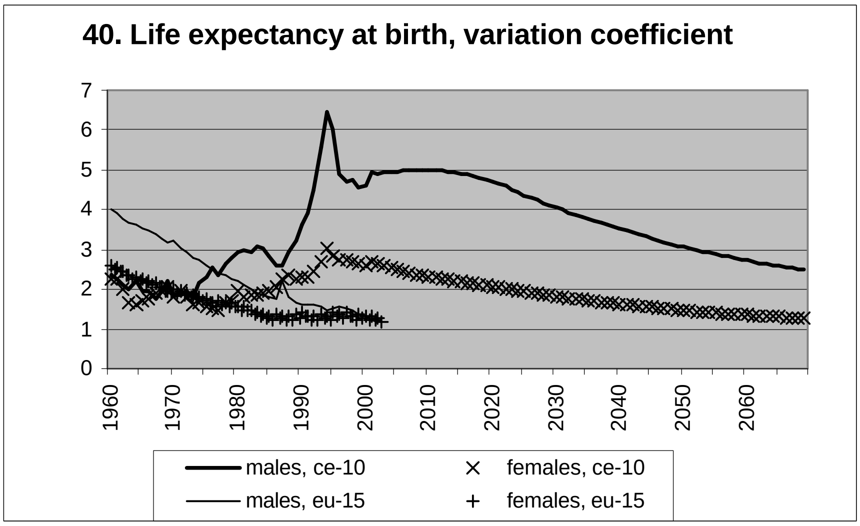
- male and female expectancies within the CE10 region will continue to increase and will simultaneously move towards EU15 levels;
- the differences in life expectancy at birth between females and males will gradually diminish;
- the differences in life chances between countries will decrease.

TABLE 1: LIFE EXPECTANCY AT BIRTH, BASELINE

		2003	2010	2020	2030	2040	2050	2060	2069	EU15-national 2003	EU15-national 2069
Males	**Bulgaria**	68,6	71,4	74,7	77,5	79,8	81,8	83,4	84,5	7,3	3,6
	Czech Republic	72,4	74,6	77,2	79,6	81,6	83,3	84,6	85,6	3,4	2,6
	Estonia	65,3	66,9	69,7	72,9	75,7	78,0	79,9	81,2	10,5	6,9
	Hungary	68,3	70,6	73,8	76,8	79,3	81,4	83,0	84,2	7,6	3,9
	Latvia	64,7	66,3	69,2	72,7	75,7	78,2	80,3	81,7	11,1	6,4
	Lithuania	66,4	67,6	70,3	73,6	76,4	78,7	80,5	81,9	9,5	6,2
	Poland	70,2	72,7	75,8	78,5	80,8	82,7	84,1	85,2	5,6	2,9
	Romania	67,3	70,4	74,0	77,2	79,9	82,1	83,9	85,1	8,6	3,0
	Slovakia	69,6	71,2	73,7	76,5	78,8	80,8	82,4	83,5	6,3	4,6
	Slovenia	72,6	74,5	77,1	79,7	81,8	83,6	85,0	86,0	3,3	2,1
	Cyprus	76,2	77,7	79,9	82,1	83,9	85,4	86,6	87,5	-0,4	0,7
	Malta	75,9	77,0	79,0	81,2	83,1	84,6	85,8	86,7	0,0	1,4
	CE-10	68,6	70,6	73,5	76,5	79,0	81,1	82,7	83,9	7,3	4,2
	NEW EU-12	69,8	71,7	74,5	77,4	79,7	81,7	83,3	84,4	6,1	3,7
	OLD+B4 EU-15	75,9	77,8	80,4	82,7	84,6	86,1	87,3	88,1		
Females	**Bulgaria**	75,4	77,9	80,2	81,9	83,3	84,5	85,5	86,2	5,6	2,5
	Czech Republic	79,0	80,6	82,4	83,9	85,1	86,1	87,0	87,6	2,0	1,1
	Estonia	76,8	77,9	79,7	81,6	83,1	84,4	85,4	86,2	4,2	2,5
	Hungary	76,7	78,4	80,6	82,4	83,9	85,1	86,1	86,9	4,4	1,8
	Latvia	76,0	77,4	79,5	81,5	83,2	84,6	85,7	86,5	5,1	2,2
	Lithuania	77,7	79,1	81,0	82,8	84,3	85,6	86,6	87,3	3,4	1,4
	Poland	78,5	80,8	83,0	84,6	85,8	86,9	87,7	88,3	2,5	0,4
	Romania	74,6	77,3	80,1	82,2	83,9	85,3	86,5	87,3	6,5	1,4
	Slovakia	77,7	79,2	81,1	82,7	84,0	85,1	86,0	86,7	3,3	2,0
	Slovenia	80,5	82,3	84,3	85,9	87,2	88,2	89,1	89,7	0,6	-1,0
	Cyprus	80,7	81,6	83,0	84,5	85,8	86,8	87,6	88,2	0,4	0,5
	Malta	80,5	81,4	82,8	84,3	85,6	86,6	87,5	88,1	0,6	0,6
	CE-10	77,3	79,1	81,2	82,9	84,4	85,6	86,6	87,2	3,8	1,4
	NEW EU-12	77,9	79,5	81,5	83,2	84,6	85,8	86,7	87,4	3,2	1,3
	OLD+B16 EU-15	81,1	82,2	83,8	85,2	86,4	87,4	88,1	88,7		


38. Life expectancy at birth, Baseline
90
85
80
75
70
65
60
19 60
19 70
19 80
19 90
20 00
20 10
20 20
20 30
20 40
20 50
20 60
males, ce-10
females, ce-10
males, eu-15
females, eu-15


39. Life expectancy at birth, females minus males
10
8
6
4
2
0
1960
1970
1980
1990
2000
2010
2020
2030
2040
2050
2060
ce-10
eu-15


40. Life expectancy at birth, variation coefficient
7
6
5
4
3
2
1
0
1960
1970
1980
1990
2000
2010
2020
2030
2040
2050
2060
males, ce-10
females, ce-10
males, eu-15
females, eu-15

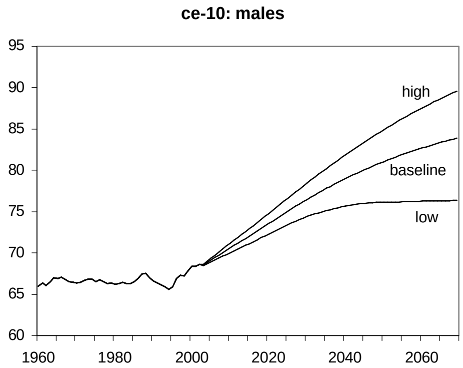
Low and high scenarios

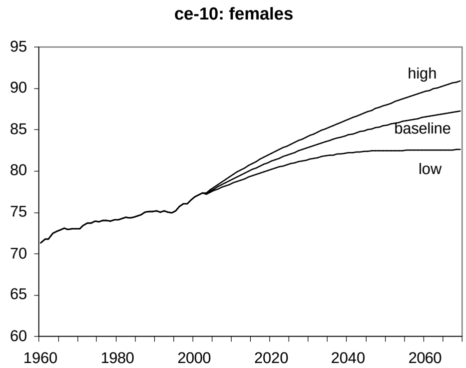
The low and high mortality scenarios have been constructed along essentially the same lines as the baseline scenario. The only differences between low/high and baseline are:

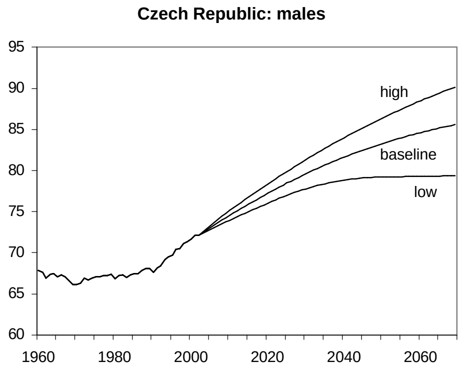
- The 2003 scaling factors for the initial Rs. For the low scenario, the scaling factor is *smaller* than for the baseline: less reduction in 2003, therefore less reduction throughout 2003-2023, and higher mortality throughout. For the high scenario, on the other hand, the 2003 scaling factor is *larger*.

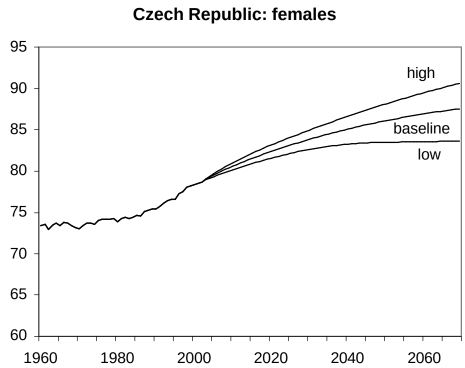
The target year scaling factors for the final Rs (relative to the 2023 Rs, which equal the 2003 EU-15 Rs). For the low scenario, the scaling factor is *smaller* than for the baseline: less reduction after 2023, therefore higher mortality throughout (and in addition, mortality in 2023 is already higher in low than in baseline). For the high scenario, on the other hand, the target year scaling factor is *larger*.

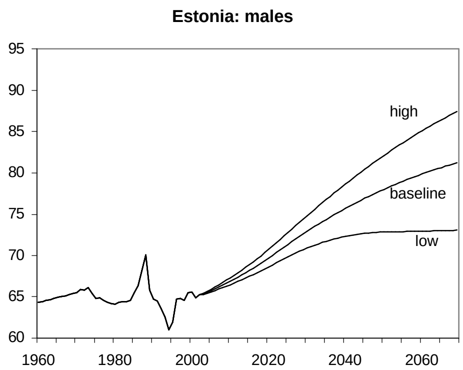
Future life expectancies at birth per country

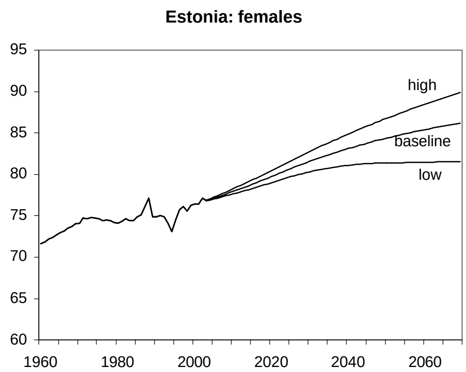




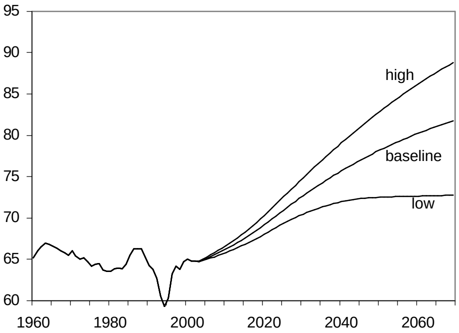








Latvia: males



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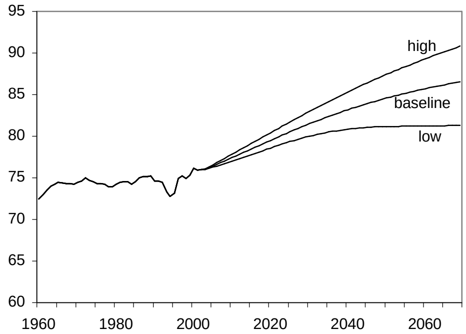

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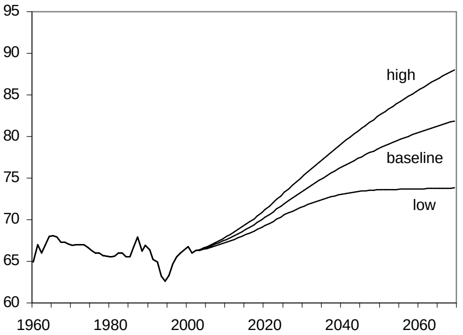

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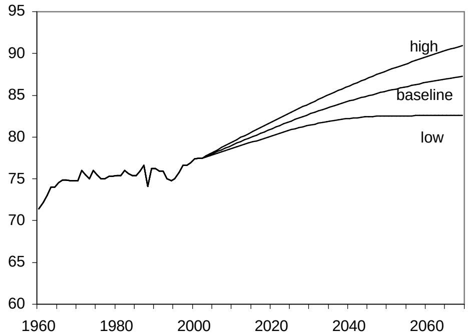

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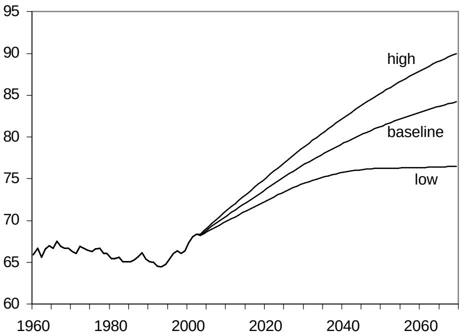

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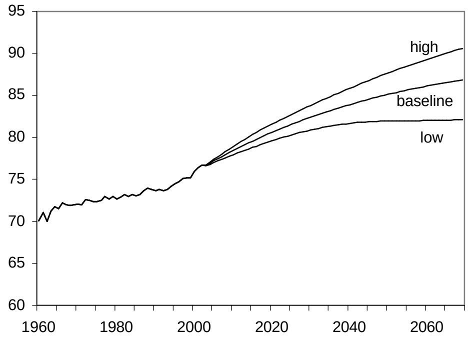

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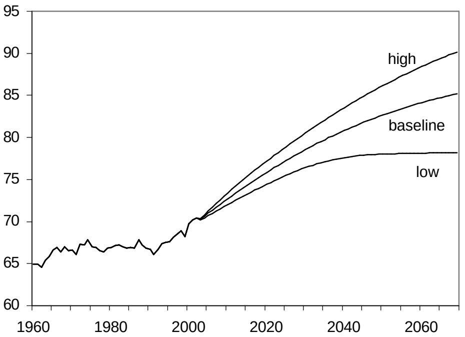

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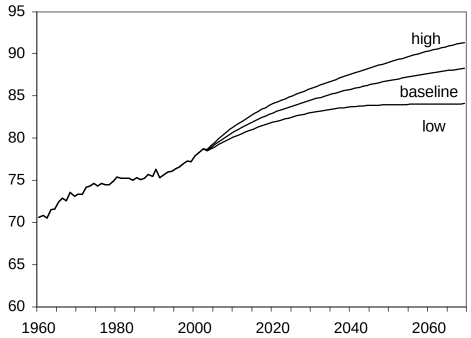

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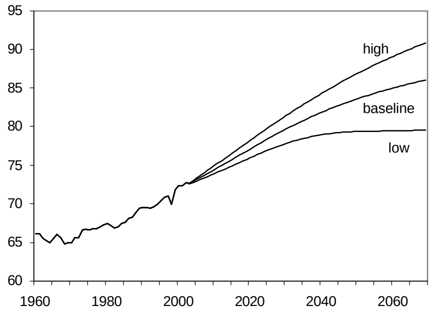

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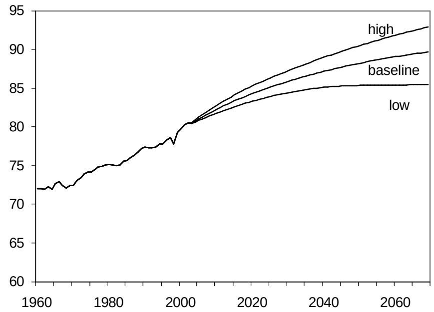

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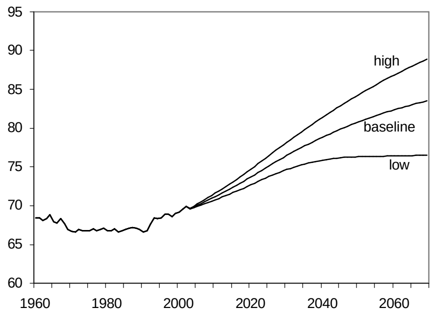

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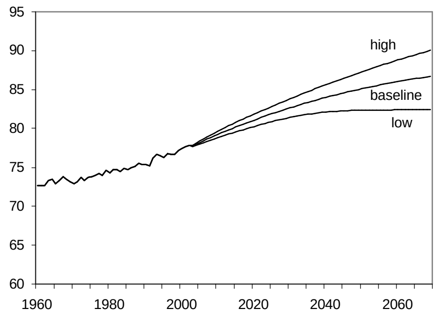

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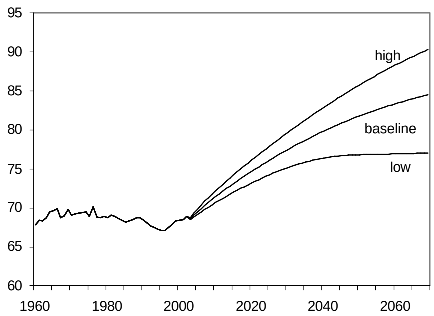

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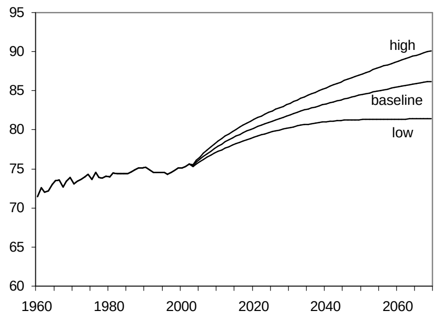

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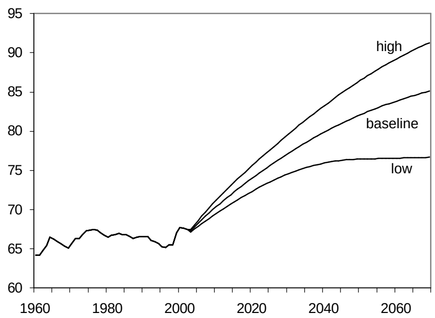

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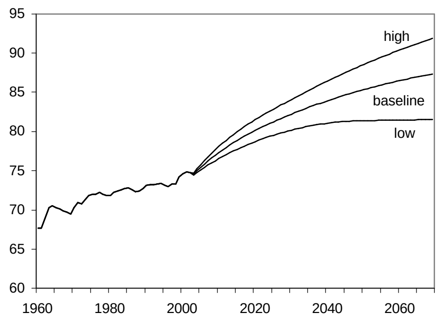

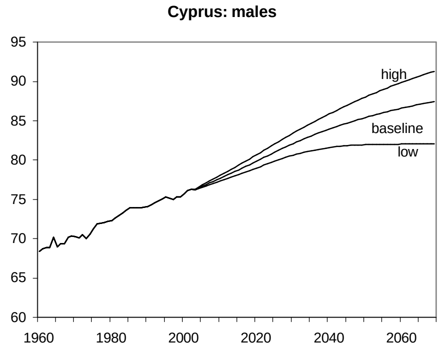
Cyprus: males
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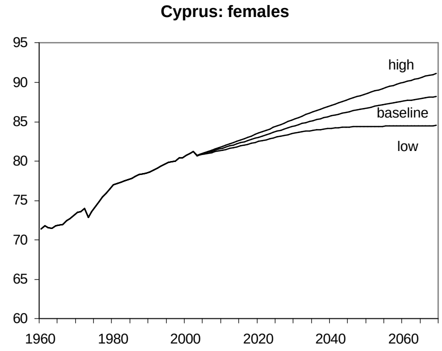
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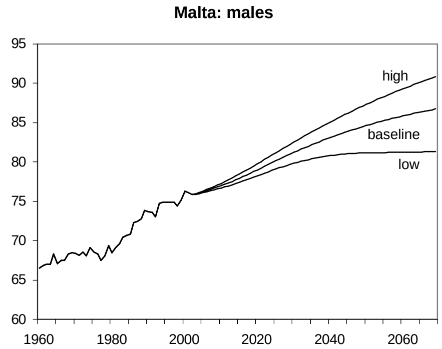
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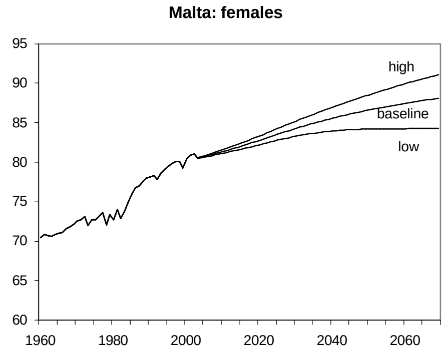
Malta: females
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