Recent foresight exercises on Europe and the World in 2025: Demographic issues

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What foresight exercise are available and which to choose?

The most obvious foresight exercise to choose if looking for frequently revised population projections prepared for all world regions and individual countries, is the one listening to the name *World Population Prospects*, prepared every two years (since 1980) by the *Population Division* of the *Department of Economic and Social Affairs* at the Headquarters of the *United Nations* in New York. This foresight exercise has been produced since the 1950s and includes various population change variants for all countries with a minimum of 100,000 inhabitants[1] and produces output on changing population size, due to fertility, mortality and migration as well as on the population age-sex-structure and the urban-rural divide. Methodologically spoken the projections are prepared via a cohort-survival model, with the inclusion of (sets of) country specific assumptions. The advantage thus is that similar information is available for all countries and for the same time horizon (currently 1950-2050), that historical time series are continuously evaluated and updated, that every two years new projections become available starting from a recent base date, that countries sum up to the world level, that the impact of the several revisions can be evaluated for all countries, etc. About once every ten years also a coherent long-term projection becomes available (most recent one up to 2300). Disadvantage is that UN classifications[2] are used, that assumptions may differ from local experts' expectations, that specifically the information on migration continues to be weak, that changing geographical delineations may lead to interruptions in time series, that no information is available on living arrangements / households, nor on regions within countries. However most of these disadvantages are also weak point in competing foresights.

Next to the UN exercise the U.S. Census Bureau provides a similar product "for all countries and areas recognized by the U.S. Department of State and which have populations of 5,000 or more"[3]. Outcomes differ slightly from those produced by the UN, due to differences in methodology and assumptions. Also the World Bank[4] and the (U.S.) Population Reference Bureau[5] are agencies involved in world population foresights including country specific results, but the World Bank is providing less details.

[1] The UN considers 228 countries: detailed demographic profiles for 192 countries, less-detailed information for all other 36 countries with population sizes smaller than 100,000 inhabitants. Source at http://esa.un.org/unpp/
[2] In which Europe includes the complete Russian Federation; in which Cyprus and Turkey are included in Asia; and in which "EU-27" is lacking but can be calculated.
[3] The Census Bureau's International Data Base (IDB) is located at http://www.census.gov/ipc/www/idb/.
[4] See for the World Bank data: Permanent URL for this page: http://go.worldbank.org/KZHE1CQFA0
[5] Carl Haub (2008), World population data sheets. PRB: http://www.prb.org/pdf08/08WPDS_Eng.pdf

It is relevant to notice for our study here that the various agencies do not provide large deviations in their results: for example the 2050 number of world inhabitants is estimated at 9149 million by the UN (medium variant), at 9202 million by the U.S. Census Bureau (medium variant?), at 9013 million by the World Bank (medium variant?), and at 9352 million by the Population Reference Bureau (medium variant?). The various data files also differ only little for the current world population size: for example 6909 million at mid-2010 according to the UN as against 6830 million according to the U.S. Census Bureau, 6831 million according to the World Bank, and XXXX million according to PRB. This variation has primarily to do with the 'age' of the most recent projections, i.e. the time since they were prepared (which leads to variation in availability of recent data and also in the base starting year of the projections).

The agencies just mentioned do not always have enough time nor resources to conduct new research or fully evaluate current scientific work. Therefore the National Research Council's Committee on Population (NRC, 2000) convened a panel of experts to look at and evaluate projections at greater depth. Most agencies took notice of the panel's results and build suggested improvements into their modelling work.

The agencies just mentioned are basically involved in population projections, i.e. "calculations which show the future development of a population when certain assumptions are made about the future course of population change, usually with respect to fertility, mortality, and migration. They are in general purely formal calculations, developing the implications of the assumptions that are made" (IUSSP, 1982). Projections deviate from forecasts as these are defined as "projections in which the assumptions are considered to yield a realistic picture of the probable future development of a population." In this presentation I will, on world population projections, not refer extensively to other agencies than the above mentioned. It also means that I will only rarely touch on scenario studies. However you do not hear me say to completely abstain from considering effects of technological achievements, public health services, family planning methods, educational expansion, women's labour market participation, and of socioeconomic and political developments on population growth. Such developments are implicit within the assumptions on fertility, mortality and migration which serve as a basis in modelling projections.

As the UN world population prospects are stemming from what may be considered to be the most objective authority, and are much more widely used, specifically in the international arena, I suggest we follow these in our project work. I will abstain from comparing these any further with the alternative exercises from the mentioned agencies as the results vary so little. However I will consider the different variants the UN prepared in their latest prospects.

The proposal to follow the UN prospects also stems from the little debate in policy circles on their substance. Going for the UN foresight is therefore a most obvious choice, indicating that we accept these as a very likely future and that we do not see reasons to prefer available alternatives or to prepare our own alternative projections.

Not halting here any further on some other world projections that possibly could have been considered here, also has to do with the fact that such projections have been released only incidentally, were often stemming from one-time experimental projects, or were missing regional and country specificity.[6] In general we can say that "demographers have become increasingly concerned about the accuracy of their forecasts, in part because the rapid fall in fertility in Western countries in the 1970s came as a surprise. (…) The rapid reduction in

[6] See for example the probabilistic world population forecasts by Wolfgang Lutz *et al*., or by Herwig Birg *et al*. Keilman has prepared several evaluations, specifically of population forecasting accuracy and uncertainty.

mortality after the Second World war was also not foreseen" (Keilman, 2001). As a consequence predicted birth rates were too high and life expectancy was too low. To be able to inform the user about prediction intervals for variables probabilistic population forecasting was developed, and that requires a different methodology than using a cohort-survival model. Lutz *et al*. (2001) for example are able to predict that there is an estimated 85% chance that the world's population will stop growing before 2100.

When establishing how accurate population projections were, we find that the absolute error in projected country populations averaged 4.8 per cent in 5-year projections but 17 per cent in 30-year projections. Obviously projection error increases systematically as the projection interval lengthens (NRC, 2000). Errors are also larger for developing countries than for developed countries, and larger the smaller the country (specifically those with under 1 million inhabitants).

What to choose for Europe?

Also for Europe there is an obvious choice: the EUROSTAT population projections (EUROPOP 2008 convergence scenario). These are prepared every three years and pertain to population indicators up to 2060 for all 27 MSs plus Norway and Switzerland. Likely at the next round (2011) also (potential) candidate countries may be included. Experts from various countries are consulted when preparing the projections. Other comparable exercises for MSs are not available, or it must be the national studies that most MSs produce themselves.

Advantage of using EUROPOP 2008 is that the methodology and output is similar and comparable for all MSs. However, disadvantage is that no output is available for non-EU countries (with the exception of Norway and Switzerland), and that the results for any MS may (somewhat of more substantially) deviate from the UN and/or national prospects (see for example Portugal in Table 1). Although several variants were foreseen up until now only the EUROPOP 2008 convergence scenario has been released, including a regional breakdown at the NUTS-2 level.

As recent comparable other exercises are missing I recommend to use EUROPOP 2008 whenever our study only looks at future within-EU trends. Whenever we look at EU-trends within a larger world region we use the UN prospects.

Let us have a look now at some of the main trends.

World population size

World population size currently stands at almost 6.9 billion, will continue to grow but is expected to stabilize at about 10 billion in the next century (UN 2006 Medium variant). Medium variants in earlier projections almost always indicated ongoing increases to higher levels into the far future (due to above replacement fertility), but more recent expectations make stabilization appear at the horizon, as a result of the expected fall in fertility towards the replacement level. Around 1950 a woman had on average 5.1 children, currently the average stands at half that number (2.5) expressing an enormous achievement. The UN expects a further fall towards the replacement level (2.1) by about 2040. However much uncertainty continues around these figures: a higher rate by mid-century is more likely than a lower. A recent report shows evidence on stagnation in the fall of fertility in Africa, the major region where fertility is still relatively high. If that were the case then world population size would increase further and could eventually stabilize at a higher level (Bongaarts, 2008).

Around 1900 the world had 1.6 billion inhabitants, by 1950 2.5 billion. Between 1950 and 2000 world population size more than doubled. The population growth rate is now diminishing, on world scale already from the 1970s onwards.

Since the 1980s the UN population prospects have not changed very much (Table 2): according to the 1980 made prospects world population size would change from 4.43 billion in 1980 to 6.98 billion in 2010 (which is amazingly accurate!) and to 7.81 billion by 2025; according to the 2008 made prospects from 6.91 billion in 2010 to 8.01 billion by 2025 and further to 9.15 by 2050. Also some (slight) backward revisions took place, as by 2010 the UN estimated the 1950 world population at 2.53 billion, against 2.52 billion in the 1980 revision.

Starting from today's population the UN also prepared three other variants: the high fertility variant reaches to 8.3 billion by 2025 and to 10.5 billion by 2050; the constant fertility variant, assuming that fertility will not change from its current level, comes slightly higher: at 8.3 billion in 2025 and 11.0 in 2050; it means that the high fertility variant is characterized by declining fertility but not as much as in the medium variant. The low fertility variant reached to under replacement level fertility on the world scale and peaks as a result around 2040 with a population size at 8.0 billion, i.e. only 1 billion more than currently. However most likely, an over 2 billion larger population size is expected before world population size is coming to a maximum. The reason behind is that the age structure is still relatively young: even if mothers would not have more than two children on average, even then there are so many young women in the reproductive age range that they would together give birth to many, many new world citizens.

Fertility is the main driver of population sizes. If nothing had happened in the world fertility level since 1950 (while the mortality level had improved as it did) then world population size would have been over 10 billion today, and would exponentially continue to increase towards 18 billion by 2025 (towards 35 billion by 2050; and to (astonishing!) over 250 billion by 2150). No change in both the fertility and mortality levels from 1950 onwards would lead to 10 billion inhabitants by 2025 and 15 billion by 2050 (with also a continuing exponential growth rate afterwards).

The countries that we currently call the *more developed world* are inhabited by about 20% of the world population. Around 2025 this will have diminished to around 15%. It means that population increase will be mainly a matter of the *less developed world*. Europe's[7] share will diminish from currently 12% to around 9% by 2025. In 1950 Europe's share was 22%. Other continents follow a more moderate course. Conclusion in terms of population size: Europe is the 'big loser', while Africa is the 'big winner', but Asia is 'the big star' in absolute numbers.

If EU-27 is seen as one country then it currently has, with 498 million inhabitants, the third position in the row of most populated countries, after China (1354 million in 2010), India (1214) and before the USA (317). Other countries included in the current top-10 include Indonesia (233), Brazil (195), Pakistan (185), Bangladesh (164), Nigeria (158) and the Russian Federation (140). Each of these countries is much larger than the single most populated EU Member State, which is Germany (82). By 2025 the world top-10 has not changed very much but by 2050 India is at first position (1613), China second (1417) and the EU-27 still third. Both China and the EU-27 have population decline by then (Table 3). No single European country is located in the top-10 at that time. Specifically the enormous population increase in Nigeria, Bangladesh and Pakistan is noteworthy, to a lesser extent also the increase in India and Brazil.

[7] Europe according to the UN definitions, i.e. including the complete Russian Federation.

The population of China will level off by 2040, mainly due to the one-child policy that was introduced in 1978. If no change had occurred in the Chinese fertility rates from 1978 onwards then China would currently have had some 500 million more inhabitants, i.e. about 1.8 billion.

World population behaviour may be more important than the sheer numbers. If family sizes and life expectancies drop more or less than anticipated in the assumptions prospects may turn out to be inaccurate. That is more often the case in the developing than the developed world.

One trend that offers 'good news' is that significant future improvements in human capital and, as a consequence, likely improvements in global health and material well-being are expected from the great progress in education in the past decades (Lutz, 2010): more years of schooling bring higher incomes, educational attainment is the key driver of economic growth. However that mainly works via countries having large enough layers of people with secondary and tertiary education. And, more highly educated people have better health and live longer. As educational expansion will continue, world population growth will slow down, also because higher educated people have smaller families and start family building later than the lower educated.

Number of children

World fertility declined from an average of 5.1 children per woman around 1950 towards 2.5 currently. Of course the introduction of modern contraceptives like the hormonal pill made this enormous achievement possible, but why do people nowadays want to have small families? There probably is no single explanatory variable. However, education likely belongs to the set of most important reasons. Education, together with welfare and development turns out to be a very good contraceptive recipe: unwanted childbearing diminishes, children are born later in life, spacing becomes easier, and smaller family sizes give more opportunities towards having an economic career.

More so than men's education, women's education is a driver for the number of children. The higher educated use to have smaller families than the lower educated. Also in Africa fertility among the higher educated is lower, but among the lower educated fertility rates are still high there. Elsewhere fertility rates dropped also among the lower educated. In western societies, variation has decreased considerable since families are so small now. If one looks to the number of children per *mother* the variation in number of children is almost absent: currently the higher educated are more often childless, but on the other end if they have children they have slightly larger families.

In the more developed world the number of children dropped from about 2.8 around 1950 towards 1.6 currently, i.e. below the so called replacement level; in the less developed world the decrease went from 6.2 to 2.9 in the same period. Of all continents the European fertility rate is currently the lowest, and in the 'old' EU (EU-15) it is higher than in the new Member States. Low fertility is spreading quickly, also outside Europe. According to the *second demographic transition (SDT)* theory (Lesthaeghe and Van de Kaa, 1986) it is associated with societal developments that stress the importance of ideational changes in bringing about certain (macro) demographic behaviours as single living, pre- and post-marital cohabitation, delayed fertility, high prevalence of non-marital fertility and high rates of union disruption. This developmental view is subject to debate, in particular with regard to the possible persistence within Europe of the differences between the patterns of family and fertility behaviour in north-western Europe – the cradle of 'new' family patterns – and southern European societies on the one side and central and eastern European countries on the other

side: will family and fertility behaviour converge to a common 'standard' as set by societies that are considered to be most advanced, i.e. Scandinavian countries, or will variation persist?

On the other side, on the micro level the diffusion of the SDT concept has focussed attention on the importance of subjective evaluations (especially, of values) in shaping differential family and fertility behaviours within societies. This is of course connected to the macro-level developmental idea of SDT (a higher share of the population sharing 'new' values in certain countries may imply a higher share of the population exhibiting 'new' behaviours), although it has a more general applicability. Persistence of old behavioural patterns or resistance to new behaviours can be connected to the reproduction of certain values. In addition, the connection between values and behaviour may be not direct and may vary across contexts.[8]

Connected with the spread of modern contraceptives and the increased educational levels is the fact that young western adults can experiment more extensively with union formation before settling down and start a family. As a result patterns of union formation (and dissolution) have changed substantially: unmarried cohabitation has increased, marriage takes place later and divorce occurs more often. Childbearing has become a result of deliberate reflexions (i.e. unwanted pregnancies are getting scarce) and occurs much later in people's lives; more specifically adults first spent a good time without having the responsibility for a family and only after having build up basic security on several fronts (partner, labour market and income, house) they may feel ready for having a baby. Where in western societies the first child used to come when the mother was 21-24 years old, this has shifted to 25-28 years, in some countries even 29 years (Italy, Spain, the Netherlands). Where women are 30 or over when trying to have a first child, for example because they first wanted to fulfil other aspirations (educational degree, economic career, being independent for a while) or had not found a partner yet, involuntary childlessness increases due to fecundity problems. Like natural pregnancies also getting pregnant via an IVF procedure depends on chances. About half of the IVF patients will ultimately not have the child they so badly wish.

Most people do want to have children. Unwanted childbearing has almost disappeared; pregnancies are postponed as long as not all preconditions for a happy life are secured. So, creating a 'safe and secure garden' for young adults is essential for making them decide to become parents. If the 'garden' is too nice one may easily have a number of children above the replacement level, i.e. non-sustainable. But, men and women often have different ideas on the importance of these preconditions and the optimal timing of children.

It is paradoxical to observe that the hormonal pill, developed to help people optimally decide on the number and timing of children, also led to more difficulties for youngsters to find the partner to share parenthood with. As unwanted pregnancies are easy to prevent, the search for a partner has for many developed into a troublesome and sometimes long-lasting route. After having experimented with some sequential cohabitational unions people easily separate but do not easily start a new relationship again, as they have become increasingly more critical.

Immigrants normally take with them the fertility patterns they were familiar with in their country of origin. However those who have immigrated with their parents at very young ages, or were born in the immigrant country (second generation) have already adapted substantially to the local behavioural pattern. In the third generation normally hardly any variation in the fertility pattern is observed anymore. Note that also in most of the non-western countries of origin where immigrants to Europe stem from, the fertility rates have dropped considerably over the past decades.

[8] This text on SDT is taken from http://www.eaps.nl/activities/wgcurr/2ndtransition.html

Fertility quantum and tempo

Fertility is demographically a very complicated process. From year to year births are registered together with several characteristics of child and parents. However decisions to have a baby are related to the individual's wish to have children and the possibilities to start a pregnancy. Postponement of having children is one of the major determinants of the current low fertility levels. However the current levels tell only part of the story about the number of children born per woman in her life time, as postponement may be made up later on.

The best way to understand fertility behaviour is via *birth cohort* (birth year) analysis, not via *period* (calendar year) analysis (see Figure 1). If women postpone childbearing (Phase 1), i.e. they have their first child later in their life than women born in previous cohorts, one will observe a rise in the age at first birth and, as a consequence, a drop in the number of children born per calendar year (period Total Fertility Rate – TFR). This 'tempo effect' may sometimes lead to 'dramatically low' TFR levels (like currently in several Central and Eastern European countries). When the first group of postponers starts to catch up having children but those from subsequent birth cohorts are postponing Phase 2 follows, characterized by a more or less stable low period TFR. When the increase in the age at first birth starts to diminish (Phase 3) or stalls completely (Phase 4) people are catching up having children that were postponed before, and the period TFR increases substantially again. However period TFRs will not reach the initial higher (cohort) levels, since a later start normally leads to a lower ultimate number of children (quantum decline). Making a forecast with keeping lowest low TFRs constant in a period of a rising age at first birth may lead to very inaccurate pictures of the future.

Effect of policies to influence fertility

The decline of fertility to vey low levels in countries of Southern Europe in the 1980s and in Central and Eastern Europe in the 1990s has raised concerns, as the continuation of such patterns leads to population decline, and intensifies the challenges posed by population ageing. Most governments from these countries regard their fertility levels as too low and are looking for measures that could counterbalance the trends.

History indicates that it is possible to influence the fertility level by making specific policy measures. In some authoritarian run countries evidence shows that effects may be severe (the 1978 Chinese one-child-policy to prevent a too large population; the 1966 Romanian abortion ban to stimulate a larger population, which failed already after one year as the population found other ways to prevent getting too large families – however it created a one-year excessive baby boom, for many years an awkward aberration moving upwards through the population age structure).

In democracies policy measures are rarely made with specific pronatalist population goals, but more often with an aim to facilitate people to fulfil their wishes with respect to work and family. Most evidence on the possible fertility level effect of policy measures suggests[9] that such effects are normally small, 0.1 child per woman at the maximum (Gauthier, 2007). However, several measures taken together in a coherent way may make a difference, although the costs of such interventions will most likely be enormous.

[9] It is extremely difficult to assess the fertility effect of separate policy measures, certainly when these are not quantifiable. One cannot experiment with manipulating populations under various conditions in a laboratory. Moreover cultural settings between countries may be so diverse that a specific measure might be effective in one country but not necessarily also in another.

Surveys indicate that childless people expect positive effects on their future family size from a larger availability of facilities (like child care, flexible working hours, leave). However people with already one or more children expect positive effects only from more extended financial support (like child allowance) as they do not believe anymore that facilities will be extended adequately and in time to meet their preferences.

But there is a complication. Childless people have ideas about their future family size. Initially, they have a specific, slightly utopian idea about that family size (normally above the replacement level). However, as soon as the first child is born they lower their family size wishes to a level often below the replacement level. Ultimately they are even unable to finish at that level, due to circumstances that may come on their road, like for example union break up, declining fecundity, labour market priorities. It would be very difficult then to convince people to have an extra child. Children are born as a result of couple's wishes, not for a nation's sake! Most likely low fertility will continue for at least a while in Europe.

It seems to be easier to influence the timing than the number of children, via specifically directed policy measures. If policy measures appeal to people they may be stimulated to have a child rather soon, but not necessarily have more children in their life time. If all of a sudden children are born earlier, one will observe a baby boom, together with stagnation in the increase of the mother's age at first birth, followed rather rapidly by a baby bust (see Sweden 1990-1995). So, do not interpret baby booms as a great pronatal success until being assured that the likely baby bust did not follow.

It is counterproductive to try to raise the number of children in order to facilitate expected rising costs of population ageing (CPB, 2006): adding extra children via specific pronatal or child supporting (family) policies will be so expensive that total expenditure will on the short run increase enormously. Extra financial support to couples to help them have more children than they most likely would have had otherwise is an extravagant investment as the newly born will only add to treasury after entering the labour market as a young adult, i.e. as population ageing in Europe is close to its top. Population ageing is an autonomous and inevitable process that gradually fades away in the course of this century, leaving behind a population with a much older age structure: a challenge for societies to anticipate.

Life expectancy

World wide life expectancy (at birth) has risen from 46 years around 1950 to currently 66 years. In the more developed world it went from 66 to 76, in the less developed world from 41 to 63 years. In Europe the rise was slightly less than in the more developed world, from 66 to 73, mainly due to stagnation in Central and Eastern Europe shortly after the fall of the Berlin Wall. The rise in life expectancy has been spectacular in many western countries in the first half of the previous century, as a result of the enormous efforts our ancestors made in improving sanitation and hygiene, as well as, but to a lesser extent, of the improvements in medical diagnoses and treatments. The outcome was a successful fight against infectious diseases; today most western citizens die at high age of endogenous diseases. Also very recently a noticeable rise in life expectancy is observed in many western countries: in some MSs men will cross the border of 80 years one of these days, women have passed the border of 84 years. However, lows of 66 and 76 respectively are also still to be observed.

All efforts are still directed towards making life span even longer. However, scarce, increasingly available but still conflicting data on the 'healthy life expectancy' seem to suggest that men and women have about an equal absolute number of healthy years. As women live longer, they have a larger share of unhealthy years. Do men catch fatal diseases at

lower ages than women or do they die from such diseases more speedy than women? Healthy life expectancy is rising but not so quickly as total life expectancy. Possibly new unhealthy life styles (obesity) contribute to this trend. It leads to an 'expenses' paradox: the most recent investments in health care systems and treatments add to the prolongation of 'unhealthiness'.

Epidemics normally only have minor effects on populations. HIV for example has only a small effect on total populations, their age structures etc., even though already some 2 million people have died from this epidemic and 33 million individuals are currently infected world wide. Since HIV is more prominent in sub-Saharan Africa, effects there are somewhat larger, but no country is expected to suffer from any substantial population decline only due to the HIV epidemic. HIV has passed its top but the numbers of new infections will remain high for the time being (UNAIDS, 2008). It means that still many efforts are needed to help those who suffer from the virus. It also means that the epidemic most likely will have disappeared by 2050 (at least from Europe; maybe not yet world wide).

The future of life expectancy is under debate. Some scientists believe that the rise in life expectancy will continue as it did over the past decades, others believe that it is much more difficult to keep up that pace since health improvements now have to be made mainly at higher ages while at the same time people at lower ages increasingly show unhealthy life styles. Moreover scarcity in food and drinking water may form a threat as well as climate change if that would lead to disasters including mass migration. And we should be on the alert, every day and every place, for a possible start of a pandemic, which may spread quickly (via air traffic contacts) and kill millions if we are too inattentive.

Migration and migrant populations

International migration plays a much more important role in demographic trends than before. International comparable statistics are scarce, also because the definition of what is a migrant varies. Migrants are mainly driven by economic reasons or political instability (refugees / asylum seeking), in the future likely more often also by natural disasters of which some may be the result of climate change. Migrants orient towards countries where they have historical or cultural bonds with (including language bonds), or where already larger groups from the same country of origin have settled and have send positive information. Over the past decades the European economic prosperity has attracted many immigrants from a variety of countries. Some of these migrants also made large contributions to that prosperity. Migrants may stay only for a short period (for study or work reasons), or were young at arrival and stayed much longer than initially planned. They may, at a certain moment, have build social networks, and brought their family in stead of returning home (chain migration: first economic reasons, subsequently family reunion and family formation reasons). Once established migrant flows between countries continue until incentives to migrate diminish, specifically international wage gaps. Some of the migrants, whether for economic or family reasons, arrived illegally.

UN estimates suggest that about 3% of the world population lives in another country than where being born. One third of all international migrants in the world live in Europe (i.e. persons born in another country). These 64 million persons make up 9% of the total European population. North America (44 million) and Oceania (5 million) have lower absolute numbers but higher shares of their population being born in another country than where they live, respectively 13 and 25%. Usually the number of migrants diminishes with increasing migration distance.

The various 'non-western' minority groups have substantially enlarged within Europe due to ongoing immigration, and due to higher fertility. However the longer ago immigration took

place the more first en second generation immigrants have adapted to local circumstances (in their family and fertility behaviour, but also from a human capital perspective). In general one can say that third generation immigrants can hardly be distinguished on the base of their specific behaviour. When first generation immigrant streams are lowering and the second and third generations are gaining importance (looked upon as the total minority population including offspring) one can observe various elements of integration behaviour, among which family and fertility behaviour.

In response to the long history of inadequate, incomparable and missing migration data several efforts were launched to better documents migration flows (Raymer & Willekens, 2008). Outcomes indicate that the overall migration balance for the EU-27 amounted, in 2005, to +1.0 million (3.6 million immigrants and 2.6 million emigrants) (Table 4). Almost two out of every three immigrants in EU-27 arrived from outside the Union. Per 1000 population, Luxembourg, Cyprus, Ireland and Spain had the largest immigration flows. Migration flows are heavily influenced by the levels of economic development and migration policy of each individual country.

Often politicians and others suppose that population ageing can be stopped via replacement migration, i.e. that international migration may be a help to take away some of the severe (financial) sides of population ageing. In theory that is true, but practice is different. If the number of children born per woman lies below the replacement level of 2.1 children per woman, let us say at 1.7, then the required number of extra migrants needed to stop population ageing completely, would be 0.4 ‘migrants per woman’ (and more notably these migrants would need to be 0 years old). Such practice would normally involve giant numbers of immigrants. At specific localities this may be feasible but not on large scales, as less population ageing in region A due to immigration from region B will lead to more population ageing in region B just because all world regions are ageing. However some regions (Africa) are still in an early ageing stage and could potentially send quite a few migrants as long as these regions suffer from wide spread unemployment and poverty.

It is normally extremely difficult to predict international migration. However recent efforts will soon materialise in new output on demographic trends and migration flows for European regions and cities (DEMIFER), and as a consequence the implications for regional competitiveness and European cohesion. Population growth and decline, population ageing, labour market shortages, and internal and international migration flows can be taken at a glance across European regions (NUTS-2 level). A (demographic) typology of regions will be developed. Data will be put into the ESPON database.

Population ageing

The age profile of populations mirrors the demographic history of the past 100 years (Figure 4). The number of survivors normally follows very precisely the fluctuations in fertility that took place in that period. Only excessive fluctuations in mortality and migration may be reflected as well. In many western countries even the baby boom after the First World War is still visible, even though the majority of persons born around 1919 have deceased by now. But much more impressive and ‘rather exceptional’ has been the baby boom born after the Second World War. In many countries this boom ended only around the late 1960s or during the 1970s. As these birth cohorts can also expect to profit from substantial increases in life expectancy just this boom, ending rather abruptly, forms the major reason for population ageing in Europe in the coming decades. It will last up until the last baby boomer has died. If fertility continues to be below replacement and migration will not make up natural decline, population sizes will decrease. Even in such declining populations the ageing process may

come to a halt. The models for Europe show that population ageing will reach a top around mid century (with in EU-27 a share of the 65+ population at around 30%) and that some rejuvenation will occur. However the 65+-share will only drop a few percentage points and most likely become more or less stable later this century. Anyhow it will be much higher than the current level.

The current process of population ageing that started already more than 100 years ago, is "unprecedented, pervasive, profound, and enduring" (UN, 2007). World wide the percentage of persons of 60 years or over[10] was 8 in 1950, 11 in 2007 and it is expected to rise to 22 by 2050. Almost no country escapes from this trend. Europe is frontrunner but also the first to see some relief by mid-century. Variation within Europe is large (see Figure 4), specifically Eastern Europe was hit by the world wars (low fertility, high mortality/migration), which is still visible (also because of its recurrent effects in the next generations).

As ageing basically results from falling numbers of children, the process normally shows that first the youngest age groups get smaller, but with time the following age groups are 'affected'. Gradually the labour market population will start ageing as well, first due to lower entrance streams, many years later due to larger exit streams into retirement (expected at short notice when birth cohort 1946 turns 65 years), later on followed by a boom in the number of very old people. Consequence is of course that dependency ratios are changing fundamentally as well: the number of dependent people per independent person will rise substantially. Currently the 'window of opportunities' or 'demographic bonus'[11] is in many countries relatively large: the number of 0-19 years together with the number of 65+ years compared to the number of 20-64 years (the potential labour market population) is around the lowest point, i.e. those who are economically active have only to care for a relatively small number of dependents (who used to be young children, but are now increasingly older).

Ageing will challenge intergenerational solidarity due to changes in family patterns (more unmarried cohabitation, later marriage, more divorce, more repartnering, smaller family sizes, later childbearing). This will trigger social protection systems in finding social cohesion to support people to interact as much as possible within and between generations, both in countries with cultural traditions of stronger or weaker family ties. Due to rising life expectancies and the fact that life expectancies of males and females grow closer we may expect that couples can stay together longer and that widowhood will shorten: as a consequence more married people may in the future rely on informal care provided by their partner (or children). As a consequence the future rise of informal care will be much lower than the rise of the elderly population (Gaymu *et al*., 2008). Measures in support of child and elderly care as well as measures that make work-family balances more compatible can further strengthen intergenerational solidarity.

Small and large populations

The smaller the population size the larger the effect of for example (temporary) disturbances or migration may be. To show some of such effects: Figure 5 gives the population age structure for four university cities in the Netherlands. University students (among them several from abroad) arrive in such cities around the time they turn 18-20 years, and most leave again after finishing their studies. From the graphs we can learn that the total Amsterdam population is so large that hardly any 'student peculiarity' can be distinguished even though Amsterdam has two large universities. In the other municipalities these graphs

[10] The EU normally gives percentages of the population 65+, the UN of 60+.
[11] Referring to the period with a relative high share of the working-age population.

reveal some characteristics of the university: Utrecht turns out to attract much more women than men to study there; Groningen has almost equal numbers of men and women of which many obviously leave the city again before they turn 30 years (which seems to be much less the case in Utrecht), while Delft (Technical University) obviously attracts more men.

One can display several other sub-populations, for example by ethnicity. Figure 6 gives populations by country of origin (including the second generation off-spring) for the Netherlands. As many of these immigrants arrived only in the past decades, mainly when relatively young, population ageing among these groups is currently not yet very advanced: the percentage older persons is fairly low, also because people may return to their country of origin when retiring. Moroccans have relatively large numbers of children, older Turks and Moroccans staying in the Netherlands are often males.

Population seen as a super tanker

The larger a population the less sensitive it is for disturbances. Fluctuations in fertility, mortality and/or migration should be substantial before becoming visible. Therefore it is almost for sure that world population size will further increase and not stabilise before the end of the century. The European population will decline rather soon, and population ageing is advanced and inevitable.

Populations can be compared with super tankers that just continue their path straight on unless manoeuvring far in advance before entering the harbour. This manoeuvring is very delicate since the autonomous power of super tankers makes it very difficult to get it deviating from its planned route. Starting to manoeuvre a mile too early or too late ultimately has far reaching effects like missing the harbour. Adding new elements (fertility; immigration) or losing elements (mortality, emigration) may not have many effects. Currently the EU-27 population counts almost 500 million persons. Per year almost 5 million children are born (about 10 per 1,000), 4½ million die (9 per 1,000) while net migration (immigration minus emigration) comes to 1.5 million (3 per 1,000). So, net migration is currently larger than natural increase. However the number of immigrants is smaller than the number of babies. These figures also indicate that around 98% of the population does not make any demographic transition per year. They only get older, and some of them change their household composition or location but that does not change the sheer numbers of persons present. It means that real demographic changes take place very gradually, and that effects of ‘major impacts’ are usually small, and so are usually also mortality effects of wars, natural disasters, or epidemics.

Final remarks

‘Demology’ (the full explanation and understanding of demographic changes) does hardly exist as a separate discipline. Demographers come closer with small bits, but almost always from various angles (research in union formation, fertility, mortality, migration streams, households, ageing issues, minority groups, etc). It often remains unclear as to how and under which conditions population sizes and structures are affected. Demographers are eager to develop more theories in order to explain variation but often only detailed descriptions are available, while a better understanding sometimes comes only years later.

When developing projections demographers are often confronted with ‘their arrogance’: how the hell can you say something serious about 50 years from now? Well, demographers do not pretend to know the future, but since a large share of the population that will live by 2050 is already born now, and since those who are still to come will be born according to certain

(parental life course) patterns which change only gradually, they build demographic variants (scenarios) about the most likely future given today's and yesterday's realities plus broadly discussed and supported expectations. Such expectations normally lack a more thorough underpinning of for example educational and labour market expectations as well as international economic outlooks. However population projections were less but have become more accurate (also due to more advanced modelling techniques), much more so than for example weather forecasts or economic outlooks. The demographic projections always start from the supposition that major catastrophes are not to be foreseen. Specifically in projecting populations of small areas with fluctuating migration streams prospects may turn out (very) inadequate quickly.

Population decline and population ageing are the two major issues that will determine the European demographic landscape. However it does not mean that the European population will become extinct soon. Both decline and ageing should preferably be seen as *challenges*, not as *problems*. We know fairly well what demographic processes are operating. Even though the share of the older population may still double within the coming decades, this process develops gradually over several years to come. In many countries the percentage also doubled in the past 50 years. Has that created serious problems? I think 'not': it came over us and each year we adapted. Given our current evidence-based demographic knowledge we can plan the 'political process' (national budgeting and restructuring society) much better, also learning from lessons in countries more advanced in ageing and decline.

Ageing and decline will certainly bring Europe to develop societal adaptations, most likely with within European variation. It will also give Europe a position to set political agenda's world wide. The world needs to make progress towards 'sustainability'. It will be an enormous challenge to get population sizes more sustainable, and, more important, their life style more healthy and wealthy. We do not know what is the maximum or the optimal world population size, and have probably only ideas about the optimal world wide life style. Both the optimal population size and life style depend on food and energy supply, on peaceful international cooperation, as well as on where these persons prefer to live (urban - rural?). According to the FAO it is likely that 20 billion people can be fed but not if the necessary and available food supplies to do so damp off in harbour sheds.

Note: This document hardly touched several other possible topics directly linked to demography, that could have been included, like for example nuptiality behaviour (cohabitation, marriage and divorce), household formation and living arrangements ("desperate housewives"), one- versus dual-income families, (reproductive) health, technological change among which proception/contraception and abortion, gender issues/selection, foreign citizenship and nationalization, population diversification and ethnic pluralism, internal migration and urbanization, social inequality, religion. Moreover human behaviour should preferably be analysed in life courses and not in (sometimes only short-term) period shifts.

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2008 EUROSTAT population projections

The recently released 2008 EUROSTAT population projections show new insights, although only slightly different than previously. However, the main trends of ultimately population decline and significant population ageing are reaffirmed.

The new Member States are expected to face a period with slightly more serious population ageing than earlier expected, due to a higher life expectancy and a remaining low period TFR (EU-27: from 1.54 in 2008 to 1.67 by 2060; EU-15 (the old): from 1.59 to 1.70; EU-12 (the new): from 1.31 to 1.51). Up till 2060 life expectancies keep rising, 8 years for men, 7 years for women, slightly more in EU-12 than in EU-15. So both for fertility and mortality the within-EU variation is expected to shrink. Migration will diminish, specifically in Member States with currently the highest migration rates. Consequence is that population size will continue to slowly increase in EU-27 up till a maximum around 2035 (from currently 496 million to 520 million in 2035). But that population increase only occurs in EU-15, as EU-12 will see its population decline (from currently 103 million to 85 million by 2060). Another consequence is that population ageing continues, but its speed will diminish after 2040 and around 2060 several Member States have already passed the ageing top: they will observe some rejuvenation. By 2050-2060 EU-12 is expected to be significantly older than EU-15: in EU-12 the median age will be just over 50 years as against 45 in EU-15. Currently the median age stands at 40 years (EU-27).

See: Eurostat (2008), Ageing characterises the demographic perspectives of the European societies. *Statistics in focus*, 72/2008.

Figure 1. Relationship between fertility quantum and fertility timing (based on Sobotka, 2004)

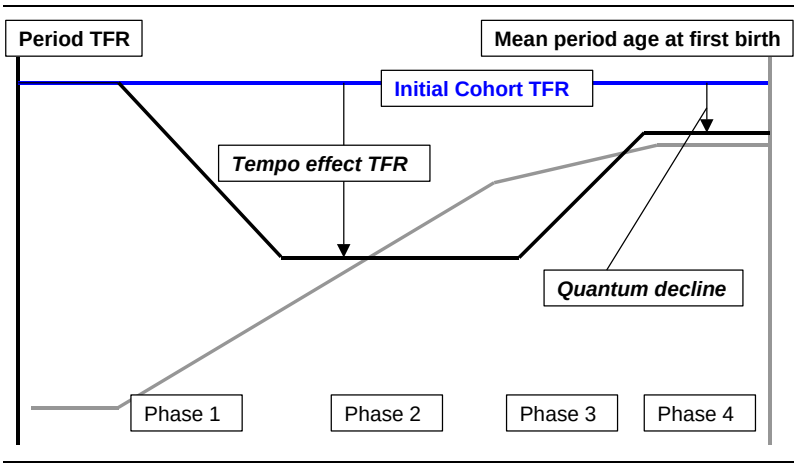


Figure 2. Population by age in 2006 and number of children born 1911-2005 in the Netherlands

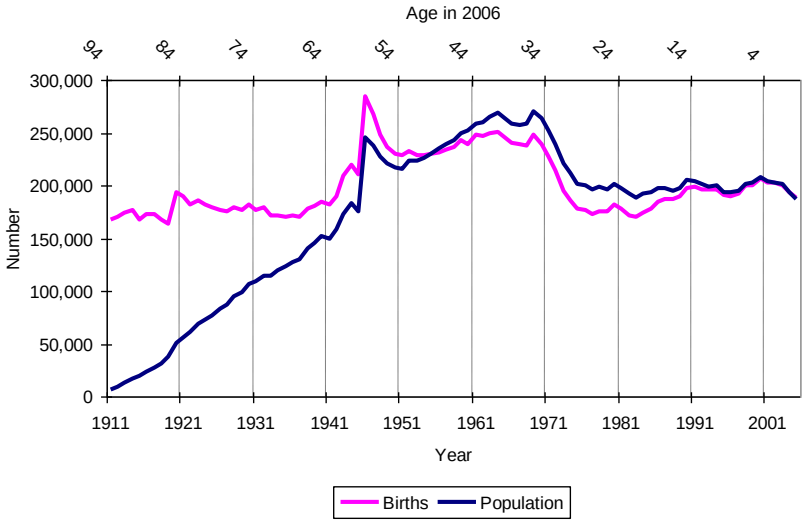
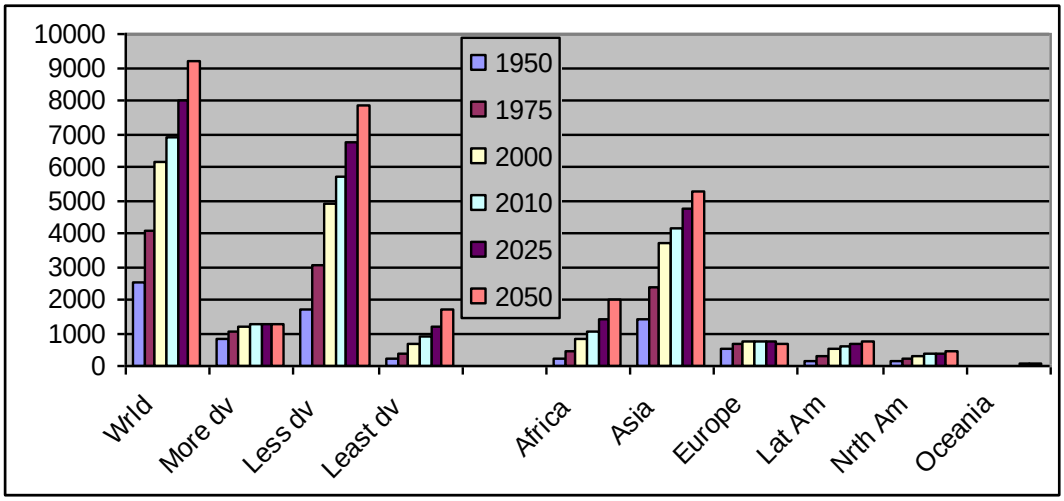
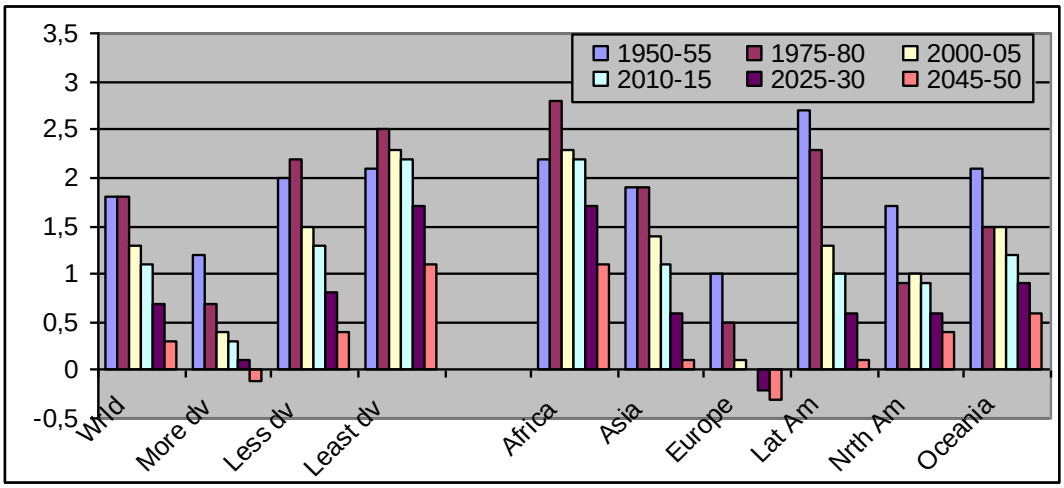


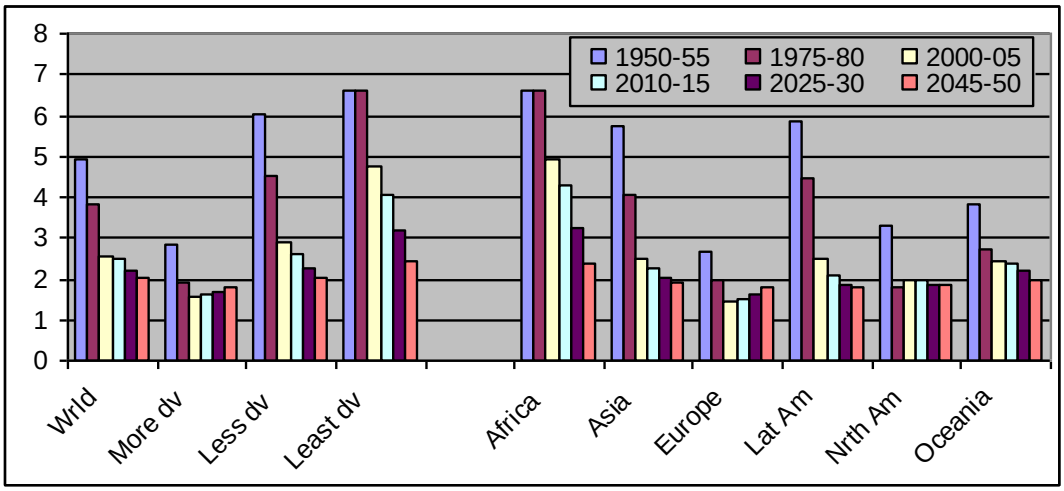
Figure 3. Demographic indicators for world regions, 1950-2050 (2008 UN prospects)
Population size



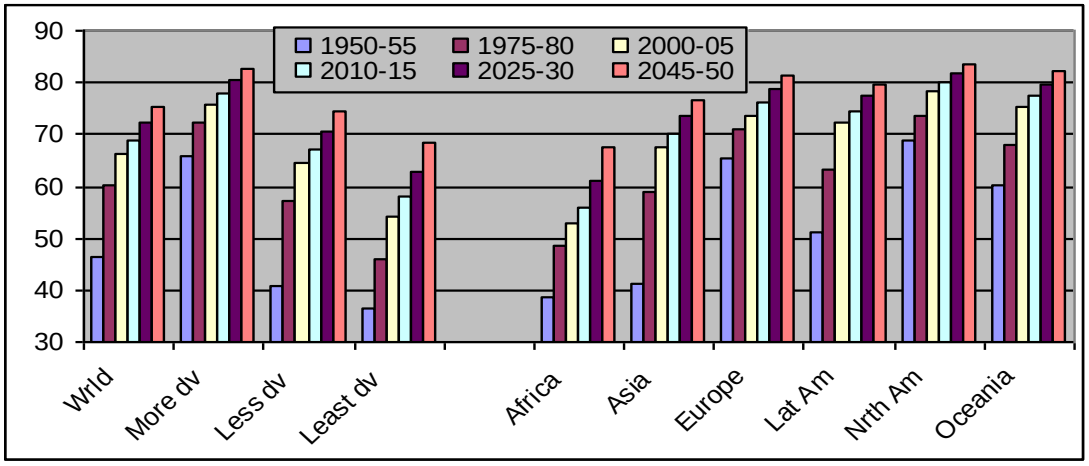
Population growth



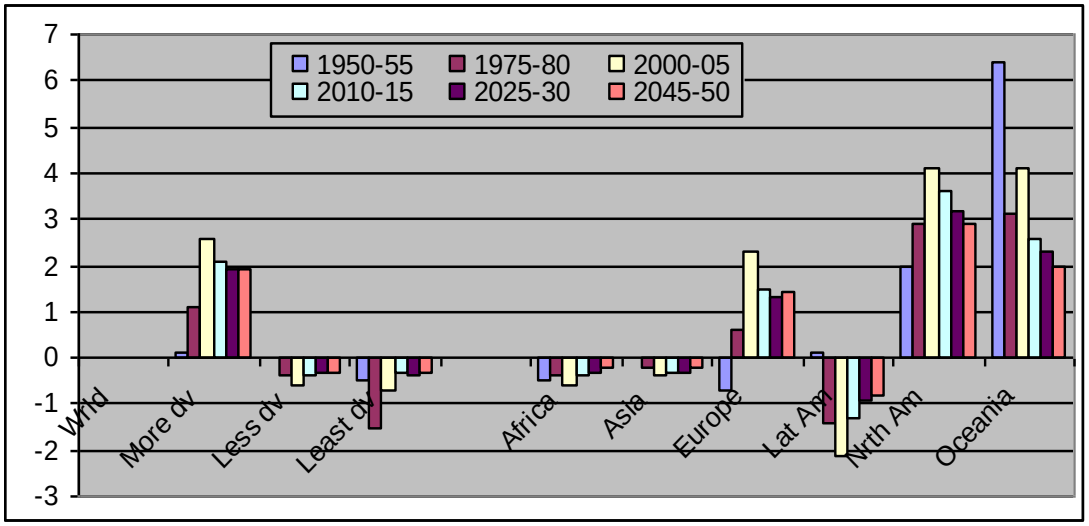
Number of children



Life expectancy



Yearly net migration (per 1000 inhabitants)



Percentage 65+

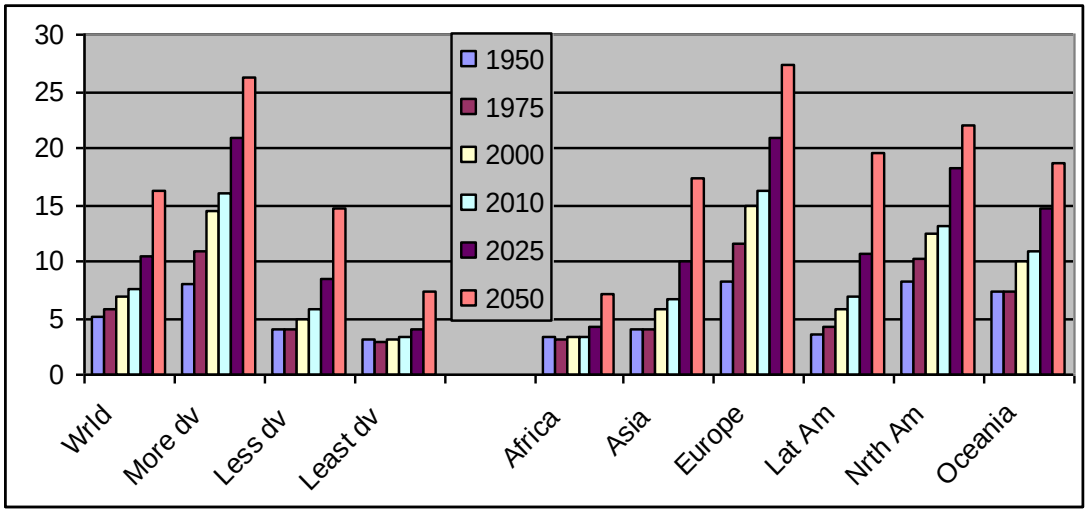
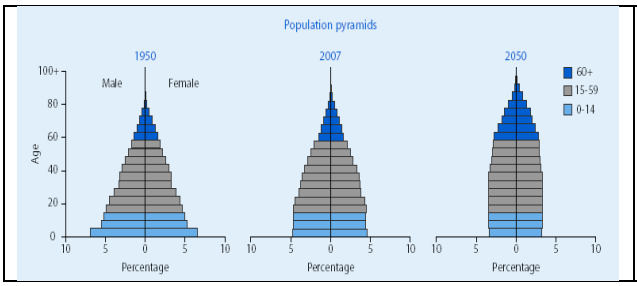
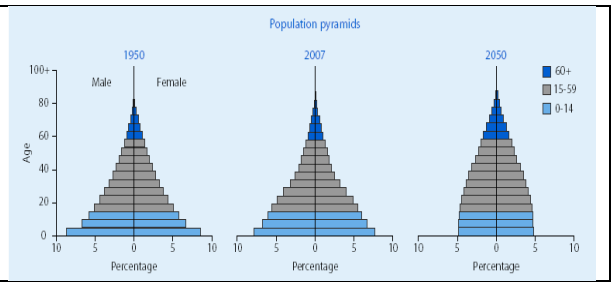


Figure 4. Population ageing 1950-2050 (source United Nations, 2007)

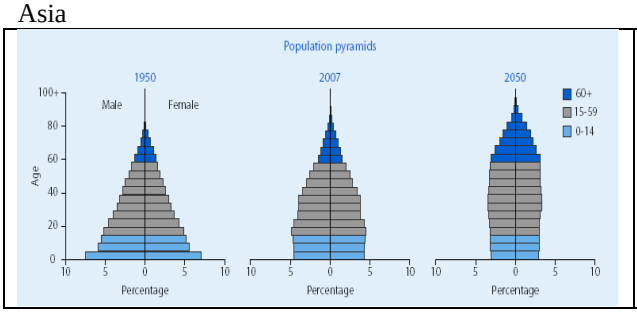
World



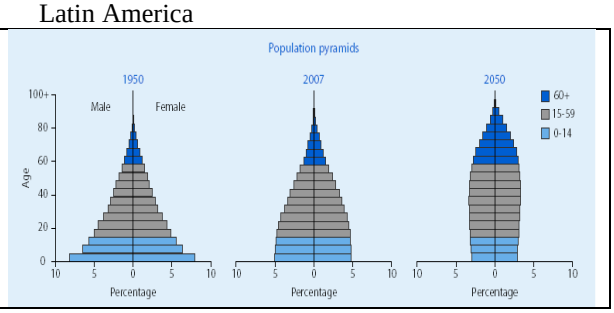
Africa



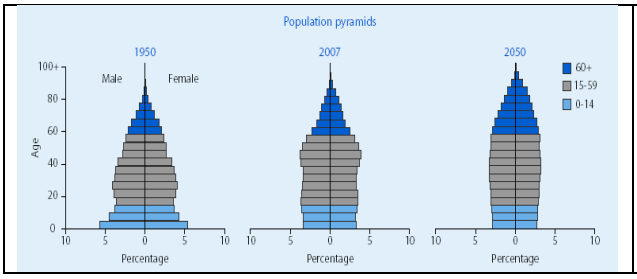
Asia



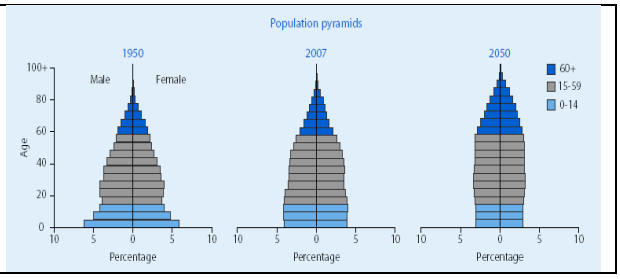
Latin America



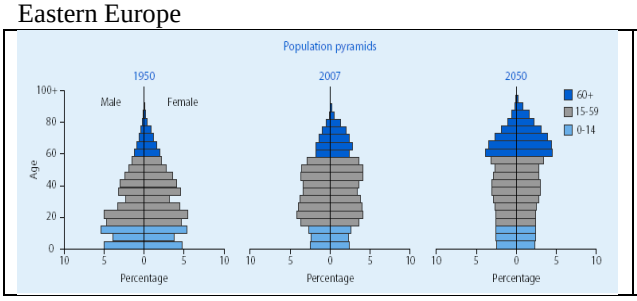
Northern America



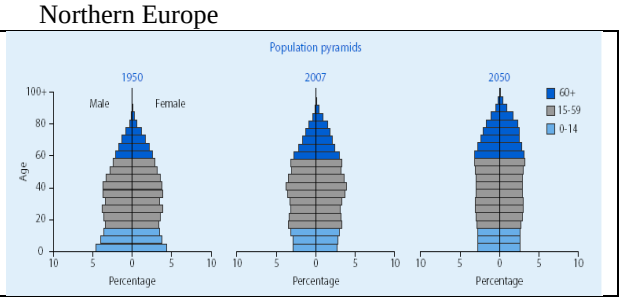
Oceania



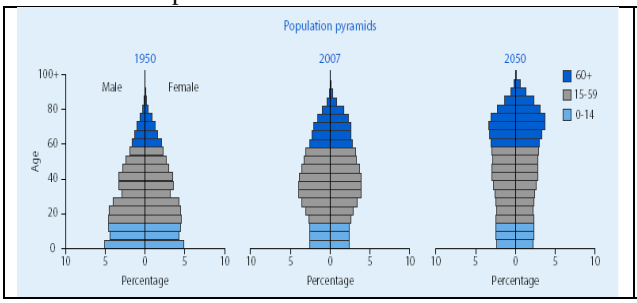
Eastern Europe



Northern Europe



Southern Europe



Western Europe

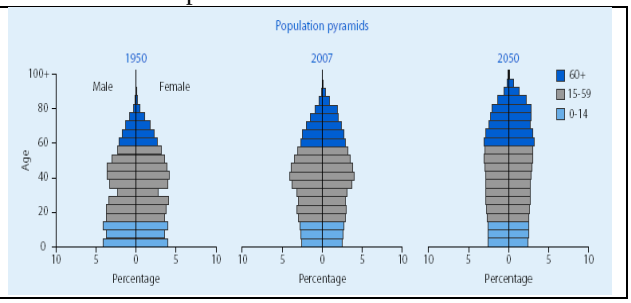
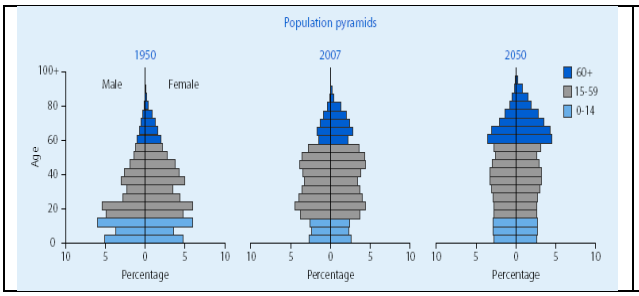
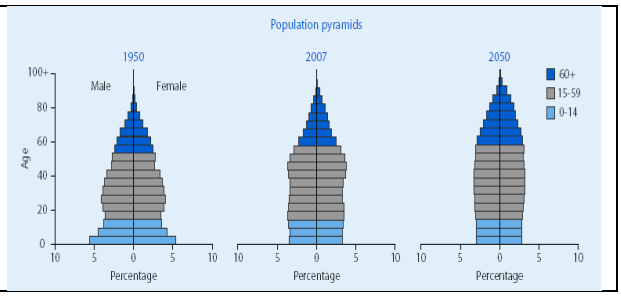


Figure 4. Population ageing 1950-2050 (continued) (source United Nations, 2007)

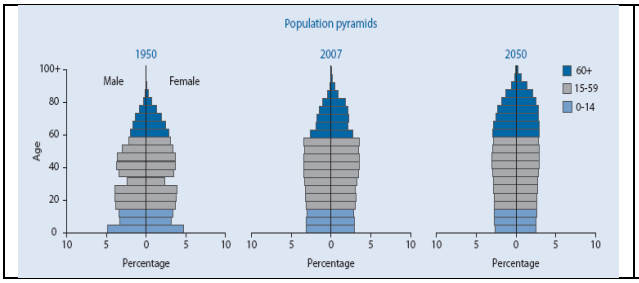
Russian Federation



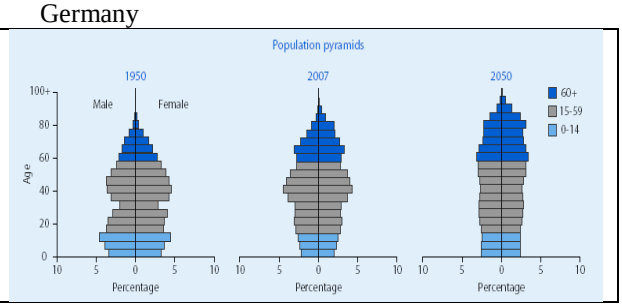
USA



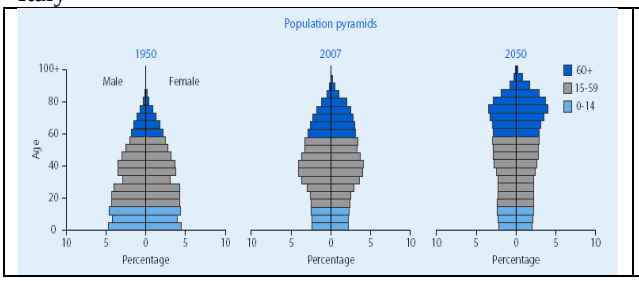
France



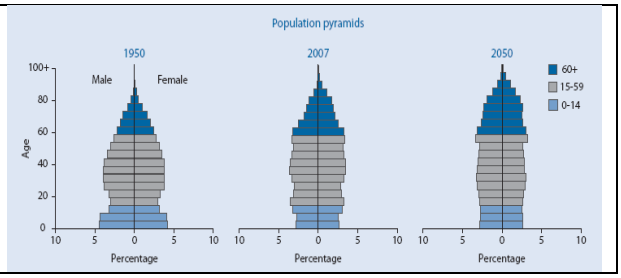
Germany



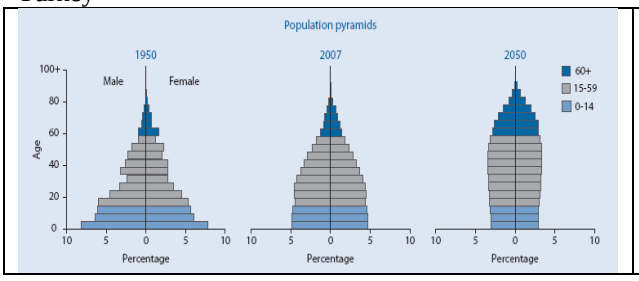
Italy



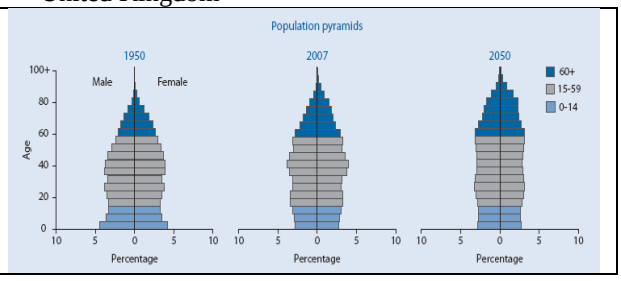
Sweden



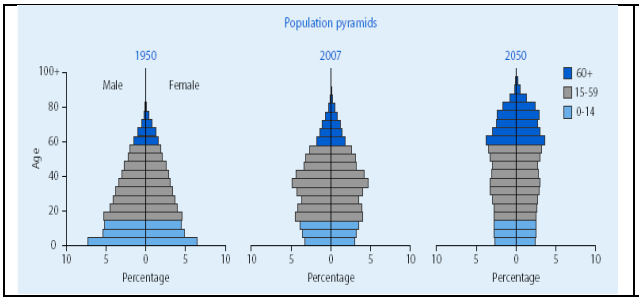
Turkey



United Kingdom



China



Japan

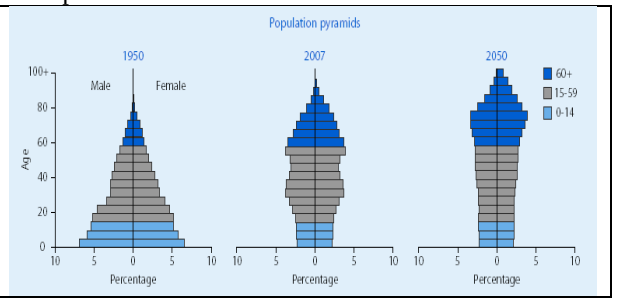
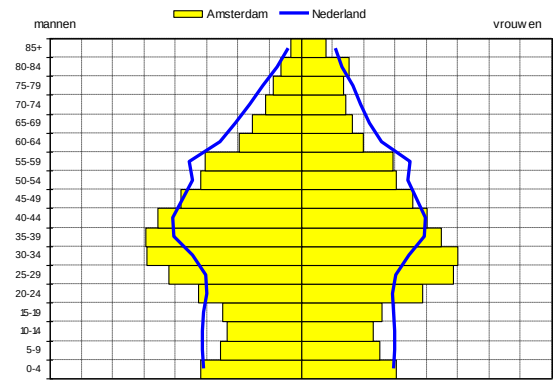
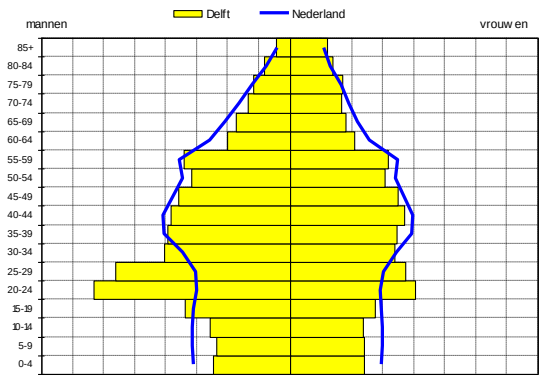


Figure 5. Population age structure, 4 University cities (yellow bars) compared to the Netherlands (blue line), 2006 (source Statistics Netherlands)

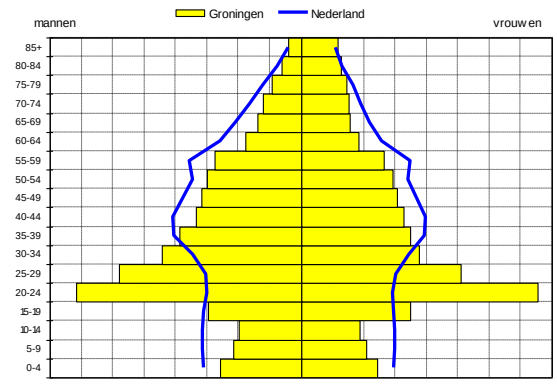
Amsterdam



Delft



Groningen



Utrecht

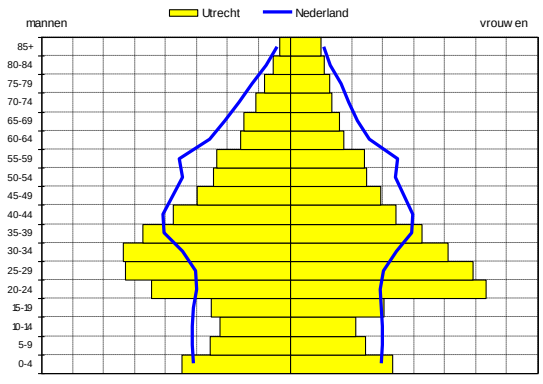
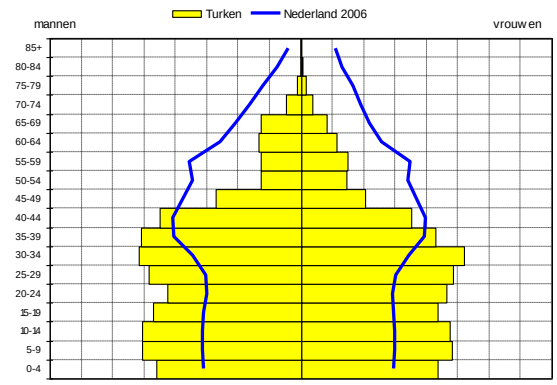
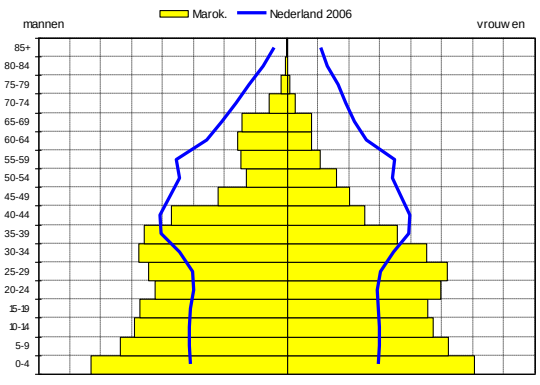


Figure 6. Population age structure, 4 'ethnic groups' living within the Netherlands (yellow bars) compared to the Netherlands (blue line), 2006 (source Statistics Netherlands)

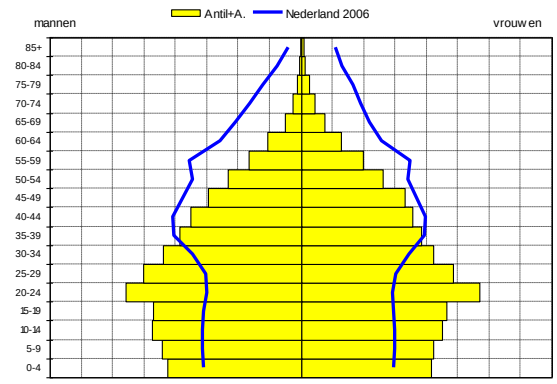
Turks



Moroccans



Netherlands Antilleans



Surinamese

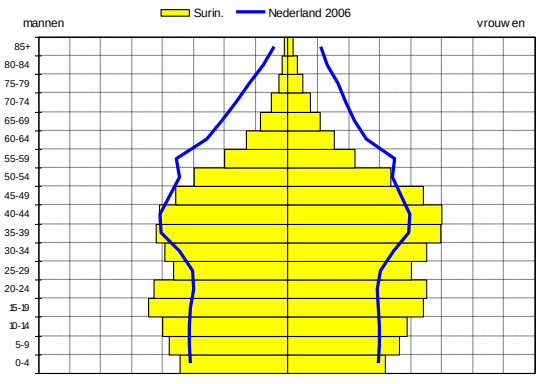
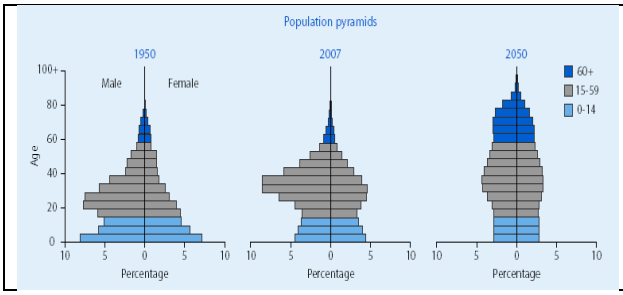
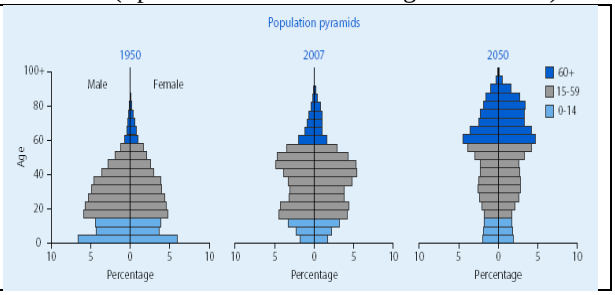


Figure 7. Population ageing, some 'exceptional' examples, 1950-2050 (source United Nations, 2007)

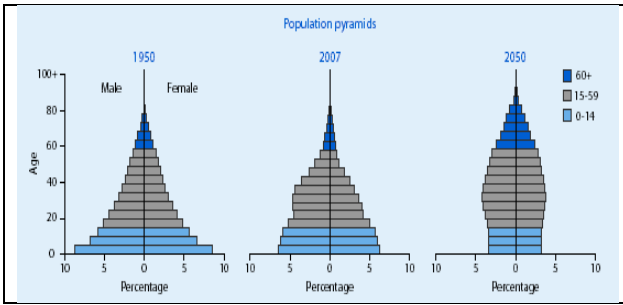
Kuwait



Macao (Special Administrative Region of China)



Saudi Arabia



Singapore

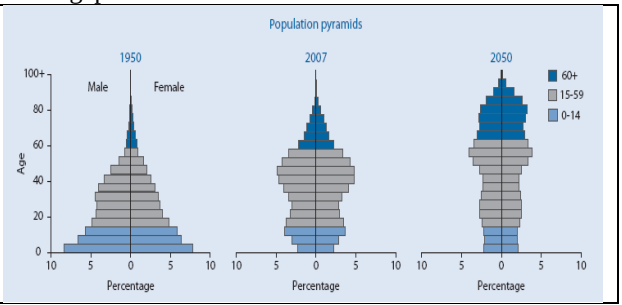


Table 1. Population size (x 1000) per EU Member State (EUROPOP 2008 versus UN 2008 prospects)

	2010		2025		2050		
	EUROPOP	UN	EUROPOP	UN	EUROPOP	UN	% difference
EU-27	499,389	497,532	517,811	506,227	515,304	493,856	1.04
Belgium	10,784	10,698	11,547	11,191	12,194	11,493	**1.06**
Bulgaria	7,564	7,497	6,974	6,752	5,923	5,392	**1.10**
Czech Republic	10,394	10,411	10,516	10,573	9,892	10,294	0.96
Denmark	5,512	5,481	5,736	5,590	5,895	5,551	**1.06**
Germany	82,145	82,057	80,907	79,258	74,491	70,504	**1.06**
Estonia	1,333	1,339	1,292	1,321	1,181	1,233	0.96
Ireland	4,614	4,589	5,673	5,370	6,531	6,295	1.04
Greece	11,307	11,183	11,575	11,274	11,445	10,939	**1.05**
Spain	46,673	45,317	52,101	49,265	53,229	51,260	1.04
France	62,583	62,637	66,846	65,769	71,044	67,668	**1.05**
Italy	60,017	60,098	61,683	60,018	61,240	57,066	**1.07**
Cyprus	821	880	1,017	1,014	1,251	1,175	**1.07**
Latvia	2,247	2,240	2,095	2,101	1,804	1,854	0.97
Lithuania	3,337	3,255	3,158	2,985	2,737	2,579	**1.06**
Luxembourg	494	492	579	582	697	733	**0.95**
Hungary	10,023	9,973	9,790	9,647	9,061	8,934	1.01
Malta	414	410	431	426	415	413	1.00
Netherlands	16,503	16,653	17,069	17,348	16,910	17,399	0.97
Austria	8,405	8,387	8,866	8,600	9,127	8,515	**1.07**
Poland	38,092	38,038	37,612	36,964	33,275	32,013	1.04
Portugal	10,723	10,732	11,224	10,706	11,449	10,015	**1.14**
Romania	21,334	21,190	20,484	19,961	18,149	17,279	**1.05**
Slovenia	2,034	2,025	2,047	2,050	1,878	1,954	0.96
Slovakia	5,407	5,412	5,402	5,413	4,859	4,917	0.99
Finland	5,337	5,346	5,549	5,533	5,448	5,445	1.00
Sweden	9,306	9,293	10,094	9,915	10,672	10,571	1.01
United Kingdom	61,984	61,899	67,543	66,601	74,506	72,365	1.03

Table 2. Population sizes (x 1000). UN 1980 prospects versus UN 2008 prospects

	Medium variant			
	UN 1980 prospects:		UN 2008 prospects:	
	World	Europe	World	Europe
1950	2,524,622	391,955	2,529,346	547,460
1960	3,037,215	425,129	3,023,358	604,464
1970	3,695,584	459,425	3,685,777	656,197
1980	4,432,147	474,171	4,437,609	693,113
1990	5,241,911	499,250	5,290,452	720,989
2000	6,115,514	512,017	6,115,367	726,568
2010	6,984,816	518,332	6,908,688	732,759
2020	7,809,952	521,439	7,674,833	732,952
2025	8,192,137	522,199	8,011,533	729,264
Prospects for 2025 population size made in:				
1980	8,192,137	522,199		
1984	8,205,765			
1988	8,466,516			
1992	8,472,446			
1996	8,039,130			
2000	7,936,741			
2004	XXXX			
2008	8,011,533	729,264		

NB. The UN geographical definition of what is called 'Europe' changed between 1980 and 2008

Table 3. The 10 most populous countries (UN 2008 prospects)

10 most populous countries (millions) by					
2010		2025		2050	
China	1,354	China	1,453	India	1,613
India	1,214	India	1,431	China	1,417
'EU-27'	498	'EU-27'	517	'EU-27'	515
USA	317	USA	359	USA	404
Indonesia	233	Indonesia	263	Pakistan	335
Brazil	195	Pakistan	246	Nigeria	289
Pakistan	185	Brazil	213	Indonesia	288
Bangladesh	164	Nigeria	210	Bangladesh	222
Nigeria	158	Bangladesh	195	Brazil	219
Russian Federation	140	Russian Federation	132	Congo (Zaire)	148

Table 4. Estimated EU migration flows, 2005 (millions) (Raymer & Able, 2008)

To:	EU-27	EU-15	EU-12	Elsewhere	Total
From:					
EU-27	1.4	1.1	0.3	1.1	2.6
EU-15 (old)	0.8	0.6	0.2	1.0	1.8
EU-12 (new)	0.6	0.5	0.1	0.2	0.8
Elsewhere	2.2	2.0	0.2		
Total	3.6	3.1	0.5		

Table 5. World and European population size. per variant (UN 2008 prospects)

World
Population (thousands)
All Variants
1950-2050

Year	Medium variant	High variant	Low variant	Constant-fertility variant
1950	2 529 346	2 529 346	2 529 346	2 529 346
1955	2 763 453	2 763 453	2 763 453	2 763 453
1960	3 023 358	3 023 358	3 023 358	3 023 358
1965	3 331 670	3 331 670	3 331 670	3 331 670
1970	3 685 777	3 685 777	3 685 777	3 685 777
1975	4 061 317	4 061 317	4 061 317	4 061 317
1980	4 437 609	4 437 609	4 437 609	4 437 609
1985	4 846 247	4 846 247	4 846 247	4 846 247
1990	5 290 452	5 290 452	5 290 452	5 290 452
1995	5 713 073	5 713 073	5 713 073	5 713 073
2000	6 115 367	6 115 367	6 115 367	6 115 367
2005	6 512 276	6 512 276	6 512 276	6 512 276
2010	6 908 688	6 908 689	6 908 687	6 908 688
2015	7 302 186	7 369 003	7 235 360	7 342 730
2020	7 674 833	7 850 649	7 498 821	7 798 900
2025	8 011 533	8 324 226	7 698 240	8 264 771
2030	8 308 895	8 762 174	7 855 775	8 741 186
2035	8 570 570	9 181 935	7 966 536	9 241 316
2040	8 801 196	9 606 206	8 024 592	9 782 041
2045	8 996 344	10 037 286	8 022 171	10 374 956
2050	9 149 984	10 461 086	7 958 779	11 030 273

Europe
Population (thousands)
All Variants
1950-2050

Year	Medium variant	High variant	Low variant	Constant-fertility variant
1950	547 460	547 460	547 460	547 460
1955	575 466	575 466	575 466	575 466
1960	604 464	604 464	604 464	604 464
1965	634 191	634 191	634 191	634 191
1970	656 197	656 197	656 197	656 197
1975	676 207	676 207	676 207	676 207
1980	693 113	693 113	693 113	693 113
1985	706 988	706 988	706 988	706 988
1990	720 989	720 989	720 989	720 989
1995	727 361	727 361	727 361	727 361
2000	726 568	726 568	726 568	726 568
2005	729 421	729 421	729 421	729 421
2010	732 759	732 759	732 757	732 759
2015	734 000	740 117	727 843	732 557
2020	732 952	747 982	717 696	728 727
2025	729 264	754 400	703 598	721 628
2030	723 373	758 137	687 943	712 212
2035	716 190	761 295	670 866	701 050
2040	708 489	766 018	652 361	688 186
2045	700 191	773 094	631 751	673 395
2050	691 048	781 789	608 813	656 808