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Demographic transitions in Europe and the world

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Abstract

The demographic transition is a universal phenomenon. All regions of the world experience a change from high levels of mortality and fertility to low levels. The onset and pace of the demographic transition vary between regions and countries because of differences in timing of events and conditions that trigger the transition. As a consequence, we observe diverging trends in population growth and ageing around the world. The paper shows that transitions in mortality, fertility and migration have several features in common. Demographic transitions are intertwined with science and technology, the economy, cultural change and social and political processes. The interaction between these processes take place at the level of the individual, not at the population level. The human desire for a long and fulfilling life is the main driver of demographic change. Science and technology provide instruments to control demographic processes but the use of these instruments is conditioned by economic and cultural change. Individuals are more likely to act if they are aware that they can influence the outcome of their action, the outcome is beneficial and they have the instruments to exercise control. The pace of a transition depends on (a) diffusion processes that govern the transmission of values, preferences, norms and practices and (b) inertia in a population due to its composition.

Keywords: Demographic transition, path dependence, diffusion, agency, demographic dividends

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1. Introduction

The world population continues to grow but the rate is declining. The population reached one billion at the beginning of the 19th century, 3 billion in 1960, 6 billion in 1999 and 7 billion in October 2011. The United Nations expects that the world population will reach 10 billion around the turn of the century. For centuries, the population growth rate was low, less than one tenth of a percentage per year. The situation changed in the 19th century (in France in the 18th century). The population growth rate started to increase because children were more likely to survive and women continued to have many children. The rate of growth reached a maximum of over 2 percent in the early 1960s and has been declining since. Today it is 1.2 percent and the United Nations expects the rate to reach 0 percent around 2100. At that time world population growth comes to an end.

This overall picture masks large differences. In Europe the growth rate has been low since 1950 and fell to zero at the end of the 20th century. It increased afterwards because of migration. In Asia and Latin America the rate declined rapidly from 2.5 percent in 1960 to about 1 percent today. The rate remains high in Africa, well over 2 percent, but is expected to decline too. These diverging trends have created a demographic divide between countries with rapidly growing populations and those with stagnant or declining populations. The regional figures mask large differences between countries and between socio-economic groups. More educated people have fewer children. The Demographic and Health Survey for Ethiopia revealed that women without any formal education have on average 6 children, whereas those with at least secondary education have two children.¹ More educated women generally marry later and less, use contraception more effectively, have more knowledge about and access to contraception, have greater autonomy in reproductive decision making and are more motivated to implement demand because the opportunity costs of unintended childbearing are higher (Bongaarts, 2010). They also have higher aspirations for their children. Better-educated persons also live longer and are healthier. Their children are less likely to die in infancy or childhood. A baby born to a Bolivian mother with no education has 10% chance of dying, while one born to a woman with at least secondary education has less than 1 percent (0.4%) chance (World Health Organization, 2008, p. 29).

About 3 percent of the world population of 7 billion (214 million people) lives in a country different from the country of birth (IOM World Migration Report 2010). The proportion remained remarkably stable over the recent years, increasing only slightly from 2.9 percent in the 1990s. Because of population growth, the size of the foreign-born population increased. In Europe and Northern America the proportion of the foreign-born population increased substantially from 6.9 percent in 1990 to 9.5 percent in 2010 in Europe² and from 9.8 percent to 14.2 percent in Northern America. In Africa it declined from 2.5 percent to 1.9 percent. In Asia and Oceania it remained stable around 1.5 percent and 16 percent, respectively.

¹ <http://ethiopia.unfpa.org/drive/Fertility.pdf>. Accessed 18 April 2012.

² Europe is the region defined by the United Nations. It includes the EU27, Switzerland, Norway, Russia, Belarus, Moldova, Ukraine and a number of smaller countries.

How can we explain these changes and differentials? Population change is the outcome of mortality, fertility and migration. The human desire for a long and fulfilling life is the main driver of demographic processes. Throughout history, the majority of humans tried to postpone death, to prevent the children they could not afford and to find a good place to raise their children. Science and technology provided the instruments to control demographic processes but the use of these instruments was conditioned by economic and social change. In several cases governments and civil society, such as religious groups, have facilitated or inhibited the human desire for a long and fulfilling life and the dissemination of the means to accomplish that goal.

The structure of the paper is as follows. In Section 2, I describe the features the three demographic processes have in common. The mortality transition is covered in Section 3, the fertility transition in Section 4 and the migration transition in Section 5. In Section 6, I discuss consequences and some policy implications of the mortality and fertility changes in Europe.

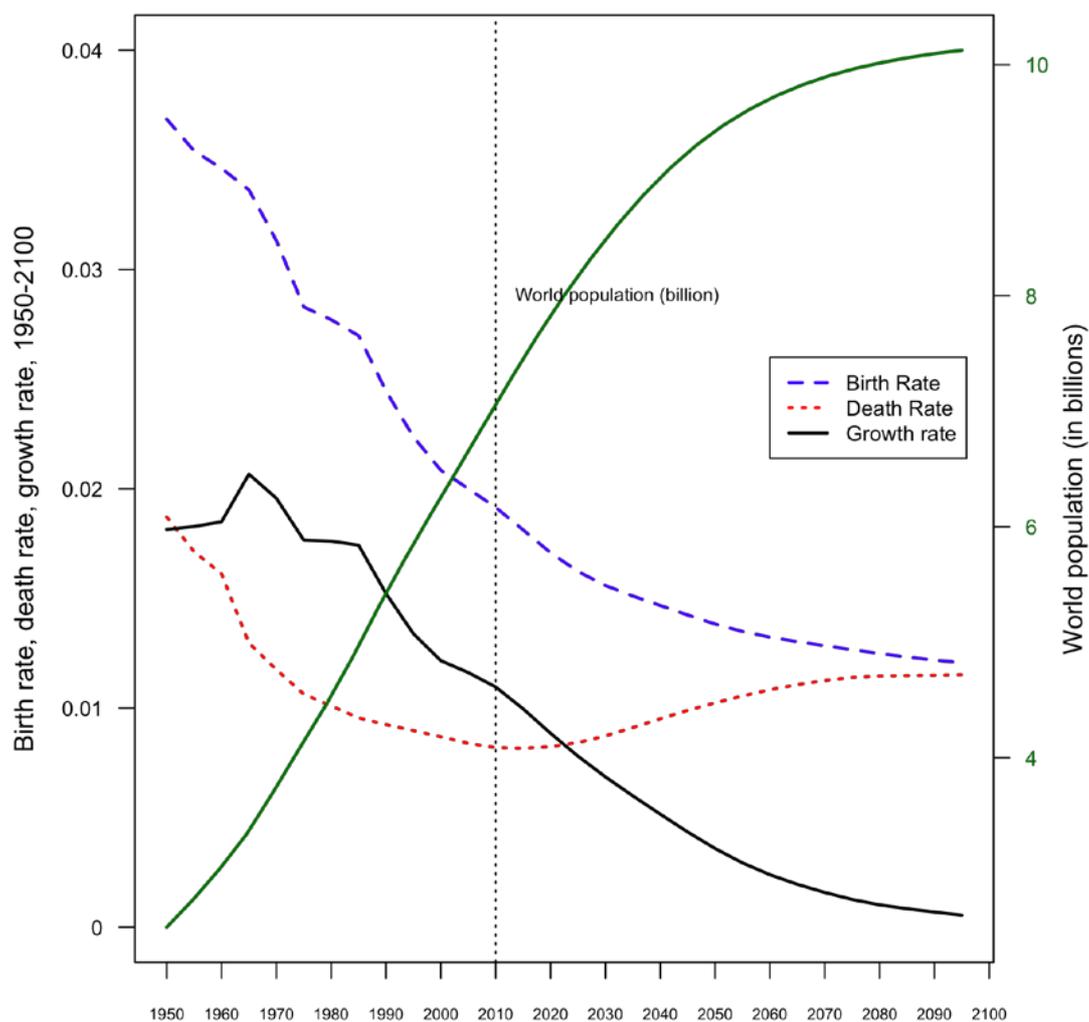
2. Demographic transitions: common features

Figure 1 shows global observed and expected demographic change between 1950 and 2100. In the early period, both the birth rate and the death rate decline. The birth rate is considerably higher than the death rate because, by 1950, large families was still a norm in many parts of the world, whereas infectious disease was not the killer it used to be in the 19th century and the first part of the 20th century. Today low fertility is a fact in many countries of the world. Most couples prefer small families and a considerable proportion remains childless. The United Nations does not believe that in large parts of the world, fertility below replacement level is a long-term trend. Replacement fertility is considered more realistic. For a long period, the declining infant and child mortality determined the trend in the death rate. The recent increase in the death rate and the future increase are associated with an ageing population. An old population has a larger death rate than a young population.

The fertility transition and the mortality transition start much earlier in some parts of the world than in other parts and the paces of the transitions differ significantly. As a consequence, population growth varies greatly between regions of the world (Figure 2).

The processes that underlie demographic transitions are intertwined with science and technology, the economy, cultural change and social and political processes. Some events, such as scientific discoveries, social revolutions, epidemics and natural or man-made disaster, trigger processes that have potentially large impacts on fertility, mortality or migration. “*Potentially*”, because of intermediate factors. Innovations in science and technology have no effect on demographic processes unless humans are ready and willing to adopt the products of that innovation. Three preconditions need to be met for people to change their behaviour. First, people should be aware that they can influence the processes that affect them. They should have sufficient self-efficacy, i.e. the belief that they can succeed when they make an effort. If they believe that success is up to God or another authority, they are less likely to do things differently than their predecessors and their contemporaries. Second, intervention must be perceived to be advantageous. People should benefit from taking control over

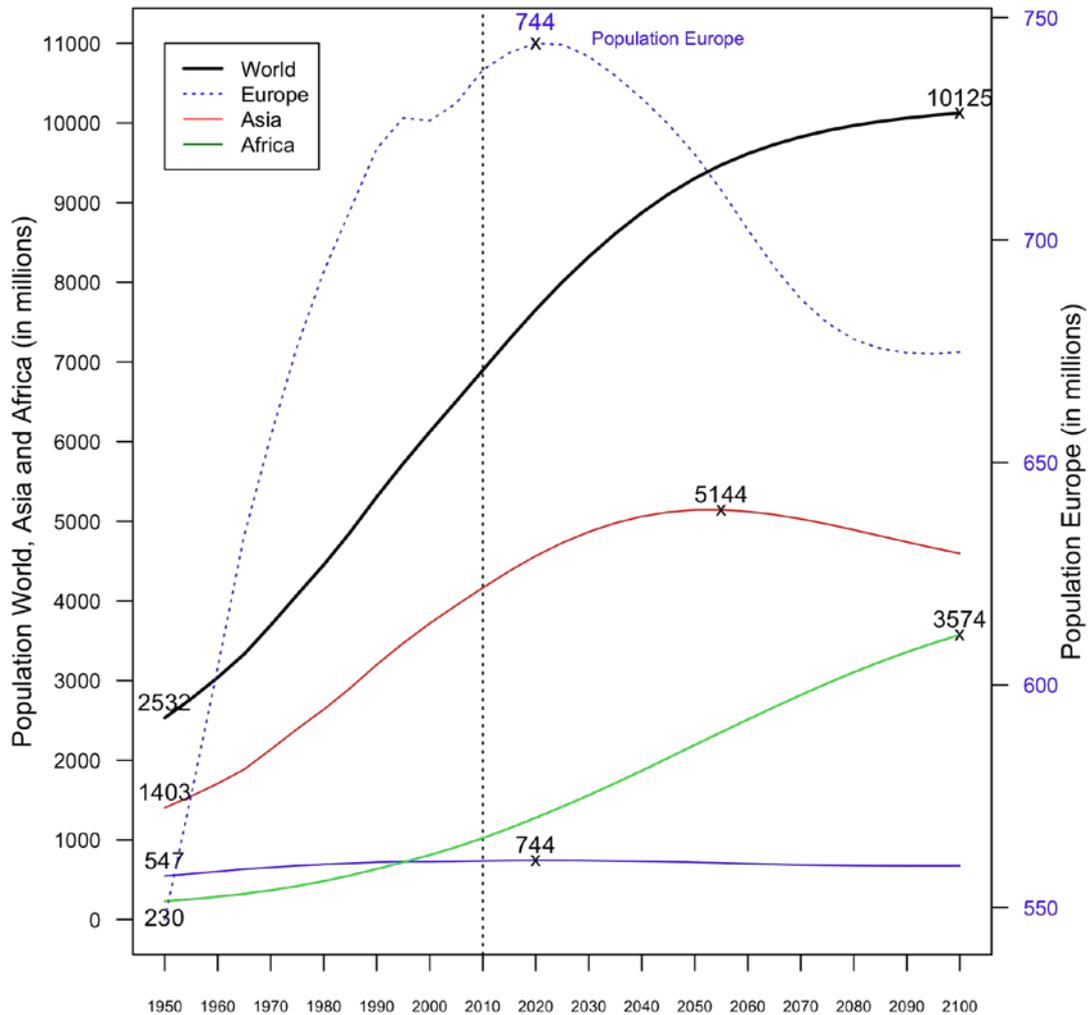
Figure 1. World birth rate, death rate and population growth rate (left y-axis), and world population (right y-axis)



Source: United Nations (2011)

processes. Third, they should have the instruments to exercise control. In the 1970s Ansley Coale formulated these preconditions, which he labeled *ready, willing and able (RWA)*. The context was marital fertility decline, but the preconditions are applicable in other areas as well. People increase their control over fertility, mortality and migration if they are ready, willing and able to do so.

Figure 2. Population of the world and selected regions (in millions), 1950-2100



Source: United Nations (2011)

The effects of science and technology and the other factors depend not only on *how* persons respond to opportunities for change, but also on *how many* people respond. If only a few people are ready, willing and able to change their behaviour, the population remains unaffected. If many change, the entire population changes. Demographic change is a diffusion process. The select few that initially are ready, willing and able to take control over birth, death and where they want to live, do not trigger a population change unless they have sufficient followers. When the followers exceed a given proportion of the population, spreading is irreversible, although it may take time. Coale, in a study with Watkins, found that if 20 percent of the population uses modern contraceptives to control their fertility, the diffusion of contraceptive use becomes irreversible (Coale and Watkins, 1986). Demographers used that finding to model the fertility transition (e.g. Hilderink, 2000).

Population growth and decline, and ageing are outcomes of mortality, fertility and migration processes. Population growth is a consequence of declining mortality and high fertility. Ageing is a consequence of declining mortality and declining fertility. Migration has some effect, but not much. It may affect how fast a population ages, but not that it ages.

Transitions in mortality, fertility and migration have several common features:

- a. *Micro-foundation*. Populations change because individual persons give birth, migrate and die. Individuals are the actors. In order to fully comprehend population change, we should understand why some people die prematurely while other people reach old age; why some women get pregnant and give birth at a young age, why other women postpone or have no children at all; and why some people travel long distances to start a new life while other people never leave their place of birth.
- b. *Embeddedness*. The demographic processes are embedded in a context or environment; they are situated in time and space. The significance of the historical, cultural and political contexts for the demographic transition illustrates the significance of embeddedness. Processes interact with the context, i.e. influence the context and are influenced by it. The context of demographic processes consists of multiple levels. The first is the individual life course. Childbearing, migration and death are life events that may be triggered by other events in the life course or may be enhanced or inhibited by personal and situational factors. Some triggering events are situated early in life. Life-course factors include genetic predispositions, early-life experiences, occupational status and occupational career, level of education, place of residence and migration career, marital status and marital career, employment status and employment career, etc. For instance the low fertility in Europe cannot be understood without insight in partnerships and strategies to balance work and family life. Changes in mortality from chronic diseases cannot be understood unless lifestyle (e.g. smoking) is considered. Migration is an instrumental behaviour, which can be understood only in relation to other life events. Marriage migration is different from family reunion and employment migration.

The second level is the household. Household members exert strong social influence on each other. Some decisions, e.g. migration, are usually made at the household level. Other decisions are influenced by household characteristics. For instance, in societies with a strong son preference, the likelihood of another child depends on the sex of children in the household. If a second or third child is seriously discouraged, such as in China, and ultrasound is available and affordable, the sex of the fetus can be determined and sex-selective abortion may be practiced.

The third level is the community or area. Community variables include access to family planning services and health centres, sanitation, educational facilities, etc. Area characteristics include physical characteristics (e.g. to explain environmental migration), social, economic, cultural and political characteristics. The fourth level is the country. Legislation, administrative regulations, welfare regimes and policies affect demographic processes. They enable, enhance, prevent or inhibit processes. For instance, the high fertility in Sweden relative to that in other countries of Europe is attributed to policy measures supporting gender equality. In France it is the availability and affordability of child care.

The fifth level is the supra-national level, consisting of groups of countries (e.g. European Union) or organizations at the global level (e.g. United Nations, World Bank, Population Council, Bill and Melinda Gates Foundation, the International Organization for Migration).

The embeddedness is illustrated in the many studies that view demographic transitions as part of larger transformations in society pointing at the influence of industrialization, urbanization and secularization in the early stages of the fertility transition in Europe and individualization in the later stages of the transition.

- c. *Path dependence.* The outcome of a process depends not only on current conditions, but also on the history and the dynamics of the process. A number of mechanisms exist that produce path dependence. (i) Events during early stages of the process may have long-term consequences. For instance, the dominant method of birth control in early stages of the fertility transition may remain the dominant method for a long time. Examples include abortion in Russia, sterilization in India and condoms in Japan. Adoption of these dominant methods in these countries is related to particular conditions, actors or policies during the very first stages of the transition and positive feedback mechanisms that reinforce practices adopted during early stages (Arthur's, 1989). (ii) During the evolution of a process, institutions (including rules and organizations) may emerge or be established to facilitate, inhibit or monitor the process. Reproductive health programmes and border control policies are examples of such institutions. Institutions are usually context-specific. Feedback between individual behaviour and the evolving institutions induces path-dependent transitions. (iii) The transition processes depend on social interaction. Styles of communication in social networks and media vary greatly in time and space. The dynamics that result from the interaction influences the outcome of the process (For a discussion, see Kohler, 1997).
- d. *Transition is a diffusion process.* The demographic transition from high to low fertility and mortality and low to high migration involves the transmission of innovative attitudes (about the family, the need to live a healthy life, emigration) and behaviour (e.g., birth control method use, personal hygiene, physical exercise) from some individuals to others. The diffusion of innovation has much in common with the spread of infections and epidemics. Travel and migration are important factors in the spatial (geographic) diffusion. For instance, trade played an important role in the spread of the Black Death in the 14th century and migration played an important role in the spread of HIV/AIDS in sub-Saharan Africa. In demography the study of diffusion mechanisms is of a more recent date (see e.g. Committee on Population, 1999). Ideas, opinions, attitudes and information on health and family planning practices are transmitted through communication channels. These include mass media and interpersonal communication channels. Communication is more likely to take place between individuals who frequently interact or who are similar (e.g. peers, colleagues, neighbours, etc.).

The role of diffusion processes for the demographic transitions has two consequences. The first is a divergence followed by a convergence. Since some groups respond before other groups do, the divergence in a population increases. When more people respond, convergence sets in. The second is the increased response rate among newcomers. A population that starts a transition late, i.e. when other populations (e.g. other countries) are already in an advanced stage,

has a higher response rate. In developing countries mortality and fertility declined more rapidly than in Europe, where the start was earlier. The reason is that newcomers have access to knowledge and instruments; they do not need to develop methods of disease control and fertility control but can rely on existing methods.

- e. *Primacy of the individual.* The demographic transitions are part of larger transformations in society. In the later stages of mortality, fertility and migration transitions, a significant feature is the primacy of the individual. Individuals get more personal autonomy in choosing the lifestyle and life course they want but at the same time they are expected to behave responsibly while interpersonal relationships, solidarity (e.g. partnership), social institutions (e.g. marriage) and social support mechanisms (e.g. intergenerational transfers; social security) are reinterpreted. Over the years, the individual capacity to act independently and to make choices (*agency*) has increased while the role of institutions and social constructs (*structure*) declined (in relative terms). People respond to opportunity structures in their immediate and more distant environment (family, community, country, world). People also respond to what other people do. If some groups in society change ideas about family and children, about birth control, about living a healthy life or about the need to emigrate to improve living conditions, others are likely to follow and that ideational change may trickle down to all groups in society. That social interaction and the resulting diffusion of ideas represent the mechanism of social change. Since young people are more likely to adopt new ideas than old people (e.g. because of their personal opinion and peer pressure), the replacement of old cohort by new cohorts enhances social change (Ryder, 1965). A population is composed of individuals, stratified by cohort or generation. Individuals born during a same period encounter major new opportunities and constraints in technology, economics or politics during the same stages of life and, as a consequence, their lives are shaped in similar ways.

3. The mortality transition

Mortality decline is one of the major achievements of civilization. One hundred fifty years ago, 25 to 30 percent of the children died of infections and other causes before the age of 5; today it is less than one percent. Life expectancy was around 40. Those who survived to age 5 had a life expectancy of 50 years. Today, in Europe (EU27), less than one percent of the newborns die before age 5 and the life expectancy is 79 years, 76 for males and 82 for females (2009 figures). In Europe the mortality decline started around 1800 in France and at the end of the 19th century in other countries. Everywhere, the decline follows particular patterns. Initially, infant and child mortality declines and, as a consequence, adult mortality increases. Cardiovascular disease becomes the main cause of death. Smoking and food habits are important risk factors of cardiovascular diseases. If, as a result of cardiovascular risk management, the incidence of cardiovascular disease declines or treatment is successful, people get older and cancer becomes a major cause of death. In Europe, lung cancer is the dominant cancer death among men and may soon replace breast cancer as the leading cancer death among women (Malvezzi et al., 2012). When cancer is conquered and death is pushed back to very old ages, mental diseases (e.g. depression, dementia) are expected to become dominant (Meslé and Vallin, 2011). The increase in life expectancy is remarkably stable. Since 1840, the ‘best practice’ life expectancy, i.e. the highest value recorded in a single country in a given year, rose by about 2.5 years

every decade for women and 2.2 years for men (Oeppen and Vaupel, 2002). The leader of the league table changes almost every year, however, and leaders may enter extended periods of stagnation, as we will see.

The mortality transition describes the shift of high mortality to low mortality. That shift is characterized by the disappearance of diseases and the emergence of other diseases. In the first stage, mortality is high and erratic (fluctuates around 3 per thousand). Acute infectious diseases, famine, natural hazards and conflict (war) are the main causes of death. Children have a high probability of dying. Preventive measures such as safe drinking water, hygiene and vaccinations do not exist because the causes of the diseases are not known. Different cholera pandemics in the first half of the 18th century killed millions of people around the world. The killing stopped when in 1854 John Snow in England discovered that the infection was caused by contaminated water. That led to the preventive measures of piped drinking water, sewage treatment systems and sanitation. In the middle of the 18th century, mortality started to decline (Omran, 2005). Several causes of infection, e.g. influenza, were discovered in the 19th century and preventive measures taken. As a result mortality declined further.

Today, mortality is low in the developed world, but remains high in poor countries. Many people in the world have no access to preventive measures and continue to face high mortality. Today 11 percent of the world population has no access to drinking water and more than one third (2.5 billion people) lack access to basic sanitation. In the developing world, it is half (United Nations, 2012). One in seven (13 percent) does not have enough food and is hungry (FAO, 2011). Because of these conditions mortality remains high and mortality disparity increases. In Congo (RDC) 18 percent of the children die before the age of 5, about the same proportion as in Afghanistan. These countries are lagging behind in the demographic transition. High infant and child mortality keep life expectancy low, between 30 and 35 years. Every year, 1.5 million children under five die because of Diarrhoea (3000 every day), 80 percent in Africa and South Asia (UNICEF/WHO, 2009). It is the second leading cause of death among children under five globally. The main cause is lack of safe drinking water, sanitation and hygiene. Some years ago, Millennium Development Goals have been formulated to reduce preventable deaths.

In Europe, the decline in infectious diseases was the main reason for mortality decline until the first half of the 20th century. Around the mid-1960s chronic diseases replaced infectious diseases as the main causes of death (Meslé and Vallin, 2011). Life expectancy was around 70 years. Cardiovascular diseases and cancer became prominent causes of death. It is interesting to note that at that time the United Nations expected the life expectancy to converge to a maximum value of 75 years. That was before the cardiovascular revolution of the 1970s. But in the 1970s cardiovascular diseases declined as a result of life-saving treatment and prevention based in new insights in risk factors. For instance, in 1980 in the United States, 40 percent of the people with an infarction died within a year; it declined to about 5 percent (Weisfeldt and Zieman, 2007). Epidemiologic studies, such as the Framingham Heart Study, a longitudinal study that started in 1948 and continues today, established the major risk factors of high blood cholesterol levels, high blood pressure, and smoking and obesity. Coronary heart disease and stroke, the two major causes of CVD-related mortality, are not influenced to the same degree by the recognized risk factors. For

example, elevated blood cholesterol is a major risk factor for coronary heart disease, and hypertension is the major risk factor for stroke. Physical activity, smoking cessation, and a healthy diet, which can lower the risk for heart disease, also can help lower the risk for stroke. The effect of obesity on mortality has been a subject of extensive debate, in part as a result of an assertion by Olshansky et al., (2005) that the rise in life expectancy could come to an end and turn into a decline because of the obesity epidemic. The debate continues. Childhood obesity causes premature death (Reilly and Kelly, 2011) but obesity at higher ages (e.g. age 50) seems to increase disability but not mortality (Reuser et al., 2009).

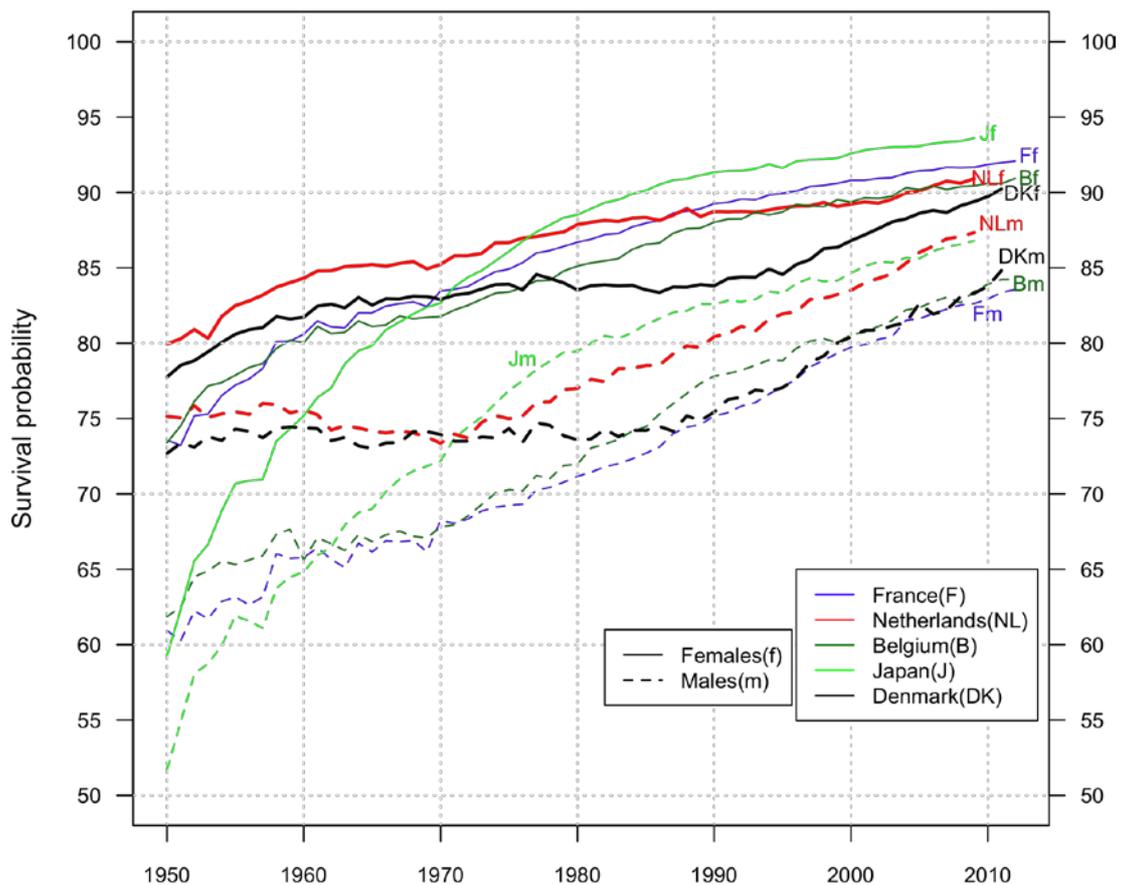
In 1970, the life expectancy in Europe (EU27) was around 70 for males and 75 for females. In 2009 it was 76 for males and 83 for females. Some countries deviate significantly from the average pattern. Progress was highest in Portugal. In 1970, it had the lowest life expectancy of Western Europe (65 for males and 70 for females). By 2009, it had reached 76 and 82 years, respectively. The reason is that in 1970 Portugal had not yet completed the second stage of the mortality transition. It still had a high infant mortality (50 per thousand, the level of India). Infant mortality declined as expected and in 2009 it reached a low 4 per thousand. Russia is another extreme. In 1970, life expectancy at birth was 63 for males and 73 for females. The female life expectancy did not change much. It increased a little (2 years) until the collapse of the Soviet Union in 1991 and then it declined until 2002 and increased afterwards. In 2009, it surpassed the level of 1991. The male life expectancy declined and reached a low of 58.5 years in 2003. Today (2010), the life expectancy did not yet recover to its 1970 level. Lifestyle, in particular heavy alcohol consumption, is a major factor in the decline. The cases of Portugal and Russia illustrate a major trend of mortality decline, which started in the mid-1960s: Western Europe and other western countries (and Japan) continued to make progress, while countries of East Europe and the former USSR experienced a long period of stagnation and even deterioration. For East Europe the stagnation ended in the 1990s, when cardiovascular diseases started to decline. Meslé and Vallin (2011) explain the differences in the rate of mortality decline by the differences in the rate of adoption of new medical technologies to treat cardiovascular diseases and new means of prevention.

Between 1970 and the end of the 1980s, life expectancy at birth in the former communist countries of CEE (Czech Republic, Hungary, Poland and Slovakia), Russia and the Baltic states (Estonia, Latvia and Lithuania) stagnated or declined. This led to an increasing gap between them and Western European countries. Within a few years of the collapse of the Iron Curtain and the Berlin wall in 1989, life expectancy started to steadily increase, first in the Czech Republic (1990) followed by Poland, Slovakia and Hungary and much later by Romania and Bulgaria (Meslé and Vallin, 2011). The rate of increase was not enough to close the divide between Western and Eastern Europe, although the Czech Republic is catching up. The reason for the lack of convergence is not clear. Leon (2011) suggests that the parallel change is the product of the diffusion of knowledge and ideas that improve public health and medical treatment. Some countries more quickly adopt new technologies and are more aggressively pursuing prevention and lifestyle change (e.g. anti-smoking campaigns, healthy nutrition).

Mortality decline in Western Europe is not uniform either. Two countries, the Netherlands and Denmark, have a deviating pattern. Around 1980, mortality in

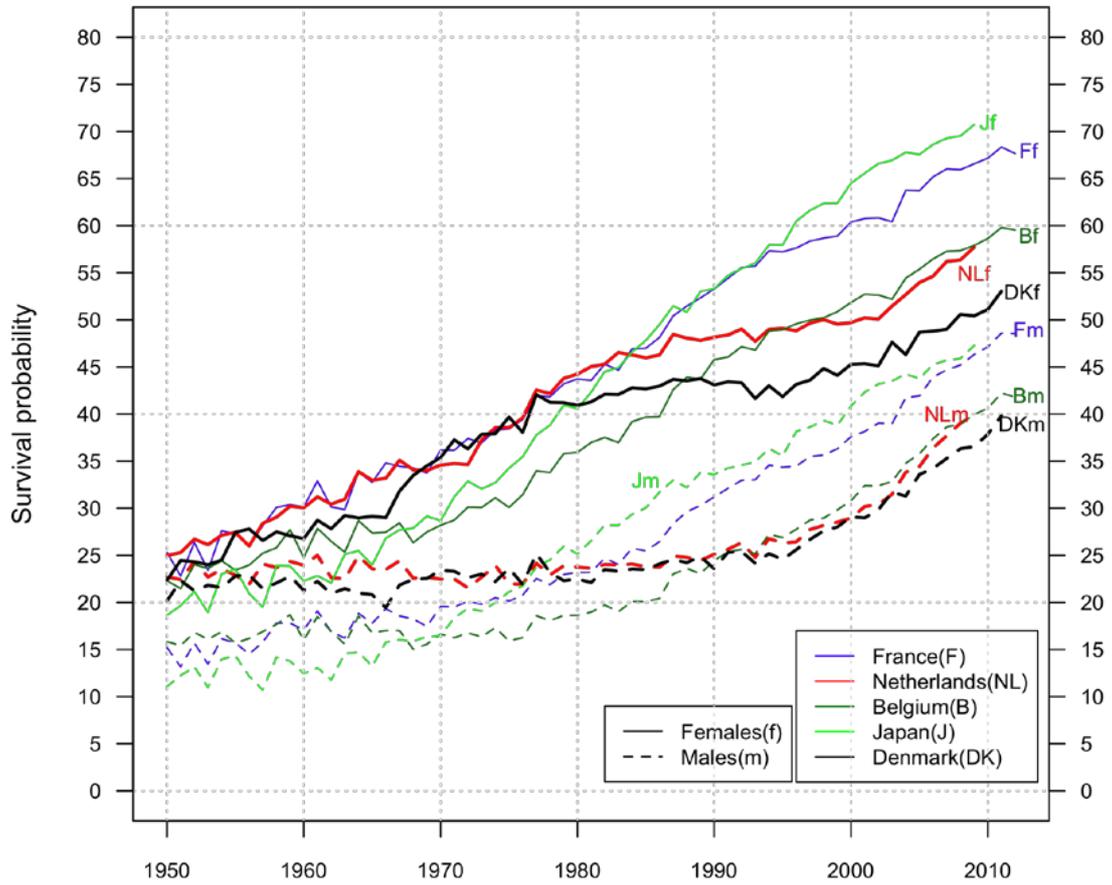
Western Europe started to diverge. Since mortality decline occurs predominantly at higher ages, life expectancy at age 65 is considered. Figure 3 shows the probability of surviving from to age 65 for a selection of European countries and Japan. In Japan, the survival probability increased rapidly in the 1950s and continued to increase until it leveled off in the late 1970s. In the Netherlands and Denmark, the probability of surviving to age 65 was already relatively high in 1950 but it did not increase much further, enabling other countries to catch up and surpass. In the Netherlands and Denmark, males experienced a decline in the probability of reaching 65. Figure 4 shows the probability that an individual of age 65 survives to age 85. Japanese women and men experienced a remarkable increase. If the 1950 mortality rates would apply, a Japanese woman of age 65 would have 20 percent chance to survive to 85. That percentage increased, in particular since the 1970, and in 2009 it reached 70 percent. The changes in France are similar to those in Japan, but they are less rapid. Mortality improvements in Netherlands and Denmark stagnated, first for males (period 1950 – 2000) and later for females (period 1975 – 2000).

Figure 3. Probability of surviving to age 65. Selected countries, by sex, 1950-2012



Source: Human Mortality Database (www.mortality.org)

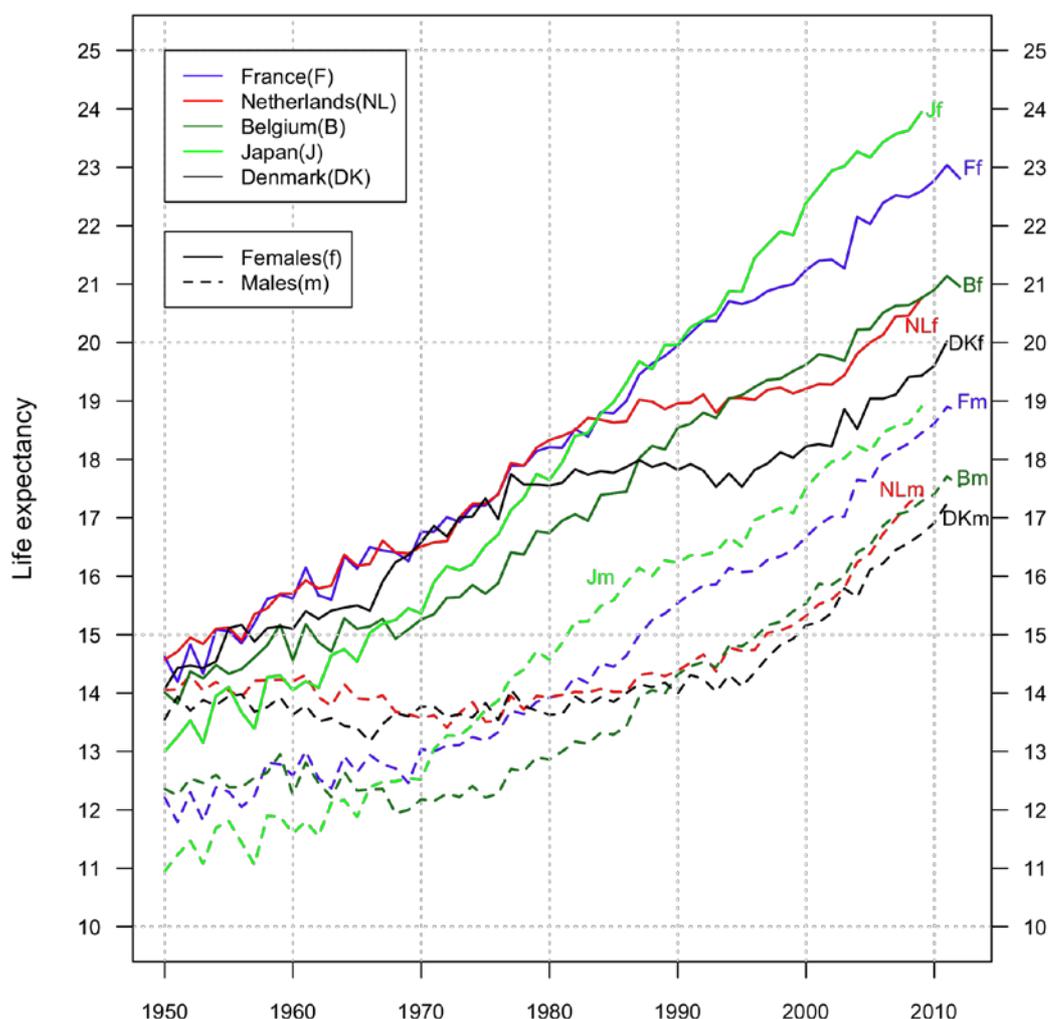
Figure 4. Probability of surviving from age 65 to age 85. Selected countries, by sex, 1950-2012



Source: Human Mortality Database (www.mortality.org)

Figure 5 shows the life expectancy at 65 for a selection of countries. The trend is similar to that of the probability persons of age 65 survive to age 85.

Figure 5 Life expectancy at age 65. Selected countries, by sex, 1950-2012



Source: Human Mortality Database (www.mortality.org)

Most countries of Western Europe experienced a steady increase in life expectancy. All countries benefited from the cardiovascular revolution of the 1970s. In the Netherlands and Denmark life expectancy stagnated around 1980.³ In the 1950s, Denmark, the Netherlands and Sweden were world leaders in life expectancy. The stagnation puzzled scientists. The stagnation in Denmark is mainly attributed to smoking and alcohol use, although a lower investment in health care than in Sweden may also have contributed (Christensen et al., 2010). In the mid-1990s the life expectancy started to improve again. The reason for the improvement is a decreasing cardiovascular mortality. Christensen et al. attribute the shift to a decrease in smoking and alcohol use and the introduction of the “Heart Plan”, which allocated substantial national funding to improve cardiovascular disease treatment. In the Netherlands, smoking has also been a major reason of the stagnation (Mackenbach and Garssen,

³ The life expectancy also stagnated in the United States.

2010). The stagnation ended in 2002. Mackenbach and Garssen attribute the end or the stagnation to a more active approach toward the treatment of seriously ill patients, associated with increased hospital admissions and life-saving and life-prolonging treatments. The improved treatment was facilitated by a sudden rise in government spending for health care, which started in 2001 after a massive public protest against the waiting lists and other problems of access to the health care system.

What may we expect next? The United Nations expects that the global life expectancy will increase from 68 years today to 81 year at the end of the century. In Europe, it is expected to increase from 75 to 87, in Asia from 60 to 82 and in Africa from 55 to 77 (United Nations, 2011). Eurostat projects an increase of life expectancy in the EU27 of 7.9 years for males (from 76.7 in 2008 to 84.6 in 2060) and 6.5 years for females (from 82.5 in 2008 to 89.1 in 2060), implying a convergence of life expectancy between males and females. Eurostat assumes that the life expectancy in the member countries of the EU will converge too. Therefore the organization assumes a larger increase in countries that currently lag behind (European Commission, 2012).

The final stage of the mortality transition is characterized by a delay in the age at onset of degenerative diseases, increasing the life expectancy further. A question of growing concern is whether that increase also means a healthy life. In the EU27, the expected number of years in good health is 61.7 years for men and 62.6 years for women (Eurostat, 2012; 2010 figures). At age 65, the remaining healthy life years are 8.7 years for males and 8.8 years for females. *A necessary precedent for healthy ageing is the compression of morbidity.* In 1980, Fries introduced the compression of morbidity hypothesis. It posed that the age at onset of chronic illness may be postponed more than the age at death and squeezing most of the morbidity in life into a shorter period with less lifetime disability. He assumed a maximum average life span of 85 years.⁴ Others emphasized the reduction in the fatality of chronic diseases. Advances in medical technology and public health are geared to keep people with a chronic condition alive. As a result, people would live longer in ill-health and/or with an impairment. The debate continues. For a number of reasons, it remains difficult to establish the presence or absence of compression of morbidity. First, health status is usually self-reported and reporting varies in time and space. Second, it is necessary to distinguish between ill-health and disability. A person with a chronic condition, e.g. a heart condition, may live a normal life, provided adequate medication is available and affordable. Third, disability, which is emerging as the more important concept, depends on the availability of social support and other means to overcome the disability.

Epidemiological research reveals important inequalities in health and mortality. The inequalities are masked by population figures. Risk factors (in particular smoking and obesity) and socio-economic characteristics (in particular education) are important for health and longevity. For example, in the Netherlands, females and males in households with a disposable income per person of less than 14000 euros (in 2006) (low income) have a life expectancy that is 7 years lower than those in households with a disposable income per person that exceeds 28000 euro (high income). In

⁴ Later, he clarified his earlier statement and stated that increases in life expectancy do not need to slow or to stop for compression of morbidity to occur. It is the relative rate of increase in morbidity rates and in mortality rates that is the important metric (Fries et al., 2011).

addition, they live 18 years less in good health and the difference in years without disability is 14 years (Knoops and van den Brakel, 2010). Among men in the low income category, the age at onset of disability is 62 on average. It is 76 for men in the highest income category. For women, the figures are 61 and 75. High socio-economic inequalities in mortality persist and even increased in several countries of West Europe (Mackenbach et al., 2003). Reducing socioeconomic inequalities in mortality critically depends upon speeding up mortality declines from cardiovascular diseases and other causes of death in lower socioeconomic groups. Recently, Kibele et al. (2013) found similar results for Germany. 65-year-old men with the highest pension incomes could expect to live another 20 years, while 65-year-olds with the smallest pensions could expect to enjoy less than 15 years of additional life. The average life expectancy is increasing among men of all social classes, but is rising much more slowly among men with very small pensions than among their better situated counterparts. It means that the demographic divide between the rich and the poor is increasing.

In developed countries, cardiovascular diseases are being conquered and cancers become the dominant causes of death. When medical progress pushes back the prevalence of cancer and people live to very old ages, mental disorders such as dementia may dominate. Meslé and Vallin (2010) expect a pandemic of “mental disorders and disabilities”. Alzheimer’s Disease International (ADI) estimates the number of people with dementia worldwide in 2013 at 44 million and expects an increase to 135 million in 2050. The growth will shift to low and middle income countries. The proportion of patients in low and middle income countries is expected to increase from 62 percent in 2013 to 71 percent in 20150 (Prince et al., 2013). Meslé and Vallin report that some countries, like Japan and France, are already fighting successfully against the emerging pandemic, while other countries like the United States and the Netherlands are not as pro-active and are likely to be affected more by the pandemic. They attribute the difference in success not to a deliberate fight against specific mental disorders, but to differences in the attention to the health of the elderly. The authors admit that there is no definitive evidence for this interpretation and their conclusion is based on the fact that the United States and the Netherlands are lagging behind the mortality decline among people aged 80 and over. Although the ageing of the population will affect the prevalence of dementia, authors are cautiously optimistic that the incidence of dementia is declining, meaning that dementia is pushed to higher ages. In some countries, including the USA, significant reductions have been reported (e.g. Manton, 2005). Recent studies in the UK and Germany confirm the observation in the USA (Matthews et al., 2013; Doblhammer et al., 2014). Better cardiovascular disease management, including a greater awareness of vascular risk factors, and a better education leading to a larger cognitive reserve are factors underlying the reduction in incidence (see e.g. Reuser et al., 2011).

At the global level, non-communicable diseases (NCD), mainly cardiovascular diseases, cancers, diabetes and chronic lung diseases, are the leading causes of death, killing more people than all other causes combined (World Health Organization, 2011). Nearly 80 percent of NCD deaths occur in middle- and low-income countries. In these countries, cardiovascular disease became the leading cause of death.

The likelihood of a major new infectious disease is low but it is not zero. If it occurs, the spread will be rapid because of patterns of international travel and trade.

4. The fertility transition

The fertility transition is the shift from high to low fertility. The transition started in France in the 1790s, immediately after the French Revolution, probably as a result of the role of women in the revolution that triggered an emancipatory movement (Binion, 2001, p. 181). The social unrest that led to the revolution of 1789 was in part a consequence of inadequate food supply and a growing population (following the mortality decline in the 18th century).⁵

In the demographic literature, there has been and continues to be a debate on the causes of fertility decline. One school explains fertility changes as a response to changes in mortality or migration. No declines in fertility have been observed in the absence of mortality decline. That school considers zero population growth as the natural state of affairs, a stable equilibrium. Built-in mechanisms, ‘preventive checks’ such as delaying age at marriage, would reduce the birth rate and ‘positive checks’, such as famine, misery, plague and war, would increase mortality. Other theories relate the demographic transition to economic and social development.

These macro-level theories fail to capture the role of agency, i.e. the role of individuals and couples in the fertility transition. There are places in the world that experienced sustained fertility transition without economic development. Kerala in South India is such a place. Kerala combines a low level of economic development (measured in GDP) with a long experience of public health, child welfare and universal education, and its matrilineal system gives women a unique position in society (Nair, 2010). Micro-level theories of fertility change emphasize individuals and couples and consider the costs and benefits of children, changes in values and aspirations (quality more important than quantity; self-fulfillment and autonomy; and desire for adequate standard of living). These changes at the individual level are made possible by technological innovation and economic and cultural changes resulting in a greater individual ability to choose. The changes are also influenced by inhibiting factors such as legal restrictions and social control mechanisms. In short, people should be ready, willing and able to control their fertility. The three preconditions must be met jointly to succeed (Lesthaeghe and Neels, 2002).

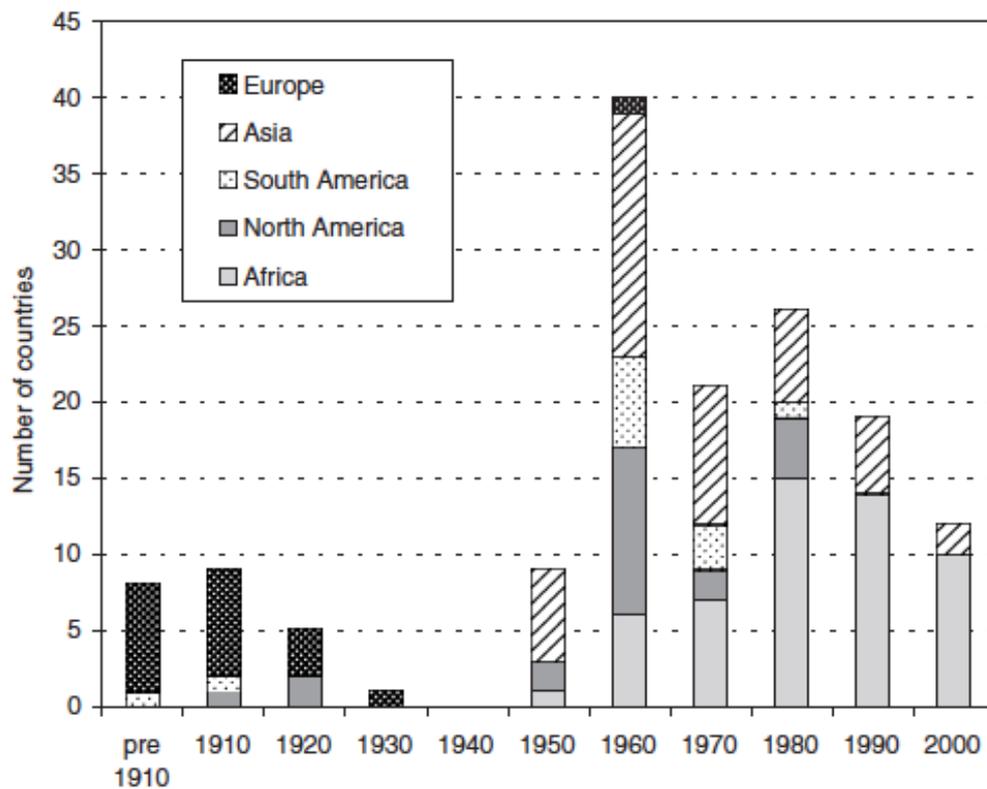
Demographers describe the mechanism through which fertility is reduced in terms of

⁵ That is the context in which Malthus wrote his *Essay on the principle of Population* (published 1798). Malthus wrote the essay in response to essays by Godwin and Condorcet, two persons who were inspired by the French revolution and the idea of enlightenment. They advocated values of the French Revolution (equality): perfecting society (*perfectibility or man*) through continued social progress and through the growth of our insight in its functioning. The condition is universal education: “Without education, the perfection of mankind becomes impossible” (Concordet, in Eichengreen, 2011). Malthus opposed the emancipatory movement and warned against the utopians of the French Revolution because social progress would inevitably lead to unchecked population growth and poverty because “population, when unchecked, increased in a geometrical ratio; and subsistence for man in an arithmetical ratio.” (Malthus, 1798, II.1). For the same reason he criticized the English Poor Laws, the predecessors of the modern welfare state, because they would encourage early marriage. Malthus opposed the emancipatory movement in France and used the prospect of a population explosion and food scarcity to convey his argument. Sen (1999, p. 214) reminds us that Condorcet anticipated a voluntary reduction in fertility and predicted the emergence of new norms of small families, based on the *progress of reason*. For some remarks on Malthus vs Condorcet, see Van de Kaa (2010), McNicoll (1998) and Willekens (2014).

proximate determinants or intermediate factors: proportion marrying, age at marriage (exposure factor), deliberate fertility control (contraceptive prevalence, induced abortions), and natural control (duration of breastfeeding associated with the length of post partum insusceptibility, and spontaneous abortion or miscarriage). These factors affect fertility directly. Other factors, such as schooling and religion, affect fertility through the intermediate factors. Onset of fertility transition is commonly defined as a 10 percent drop or more in marital fertility without fertility rebounding thereafter.

Fertility decline started in Europe at the end of the 19th century and spread to the rest of the world. In Asia, the fertility transition started in the 1950 and 1960s and in Africa in the 1970s and 1980s (Figure 6) (Reher, 2004). In most developing countries fertility decline is associated with a rise in contraceptive use to deliberately limit family size. Since 2004 the majority of the world population lives in areas with below-replacement fertility (Myrskylä et al., 2011).

Figure 6. Date of onset of fertility transition in selected regions of the world.



Source: Reher, 2004 (reprinted with permission, Wiley, 2014)

Marriage and deliberate fertility control remain important drivers of fertility change. In recent times and in developed countries, control over fertility became almost perfect and the emphasis on individual autonomy and self-fulfilment continued and became more pervasive. Young adults who value individual autonomy are likely to delay decisions that restrict that autonomy. They are likely to postpone having children. According to Van de Kaa (2008), prevention of conception is the rule and the interruption of the prevention becomes a deliberate act. The growing emphasis on human capital accumulation (education) and the social expectation to be economically

active and independent has a delaying effect. Education has a direct effect on postponement of childbearing (incompatibility between school enrolment and becoming a mother) and an indirect effect (opportunity cost of children increases with increases human capital) (Philipov et al., 2006). As a result of the emphasis on individual autonomy and self-fulfilment, growing numbers of people reject traditional institutions such as marriage. The traditionally strong link between marriage, sexuality and reproduction has been relaxed. These factors create a condition for a sustained low fertility. In some countries fertility declined to extreme low levels with period Total Fertility Rates below 1.3. Part of the shift was due to postponement of childbearing towards higher ages. Because the changes, which were made possible by the availability of safe and reliable contraceptives, are sufficiently different from the earlier demographic changes, Lesthaeghe and Van de Kaa mark them as *The Second Demographic Transition* (Lesthaeghe and Van de Kaa, 1986; Van de Kaa, 2008). Many European countries started to worry about falling fertility.

But then, quite unexpectedly, fertility in Europe started to increase. Was that turnaround the effect of catching up after a period of postponement or was it related to the further decline of the marriage institution? The erosion of the marriage institution had advanced enough to weaken the link between marriage and childbearing. Cohabitation is on the rise and an increasing proportion of children are born out of wedlock. Myrskylä et al. (2011) explored the positive link between high development and increased fertility and showed the driver is fertility increase at older ages but only in the presence of gender equality. Gender equality is crucial for fertility increase. In the Green Paper on demographic change, the European Commission (2005, p. 5) sees the low fertility rate as “the result of obstacles to private choices: late access to employment, job instability, expensive housing and lack of incentives (family benefits, parental leave, child care, equal pay).”

What may we expect next? The United Nations (medium variant) expects that in Europe the number of children a woman has during her lifetime will increase from 1.5 to 2.0 (United Nations, 2011). In other parts of the world it will continue to decline. The global Total Fertility Rate will decline from 2.5 in 2005-2010 to 2.03 at the end of the century. In Africa it will drop from 4.6 to 2.1, in Asia from 2.3 to 1.9. The United Nations believes that an equilibrium at zero population growth is a natural state of affairs. Eurostat expects the Total Fertility Rate of EU27 to increase too, from 1.59 in 2010 to 1.64 in 2030 and 1.71 in 2060. Fertility will remain below the replacement level. The largest increases in fertility rates are projected to take place in countries that have the lowest fertility rates today (Latvia, Hungary and Portugal). Eurostat assumes that in the long run fertility levels in the countries of Europe will converge to a same level. In 2060 that same level will not be reached yet. Fertility is expected to be highest in Ireland (TFR of 1.99) and lowest in Latvia, Hungary and Portugal (TFR of 1.51). Scientists differ in their views on the future of fertility in Europe but they agree that fertility will remain below replacement for a long time.

5. The migration transition

Massey (2003) divides the history of international migration in four periods. The first period is the mercantile period (1500-1800). The dominant flow was people leaving Europe to settle in the Americas, Africa and Asia and the dominant reason was agriculture. During that period, 10 million African slaves were forcibly exported to the New World. The second period was related to the spread of industrialization. During the second period, from 1800 to 1929, 48 million people left Europe, with five main destinations: the United States, Canada, Argentina, Australia and New Zealand. The first World War and the economic recession of the 1930s brought migration to a halt. The years 1930-1960 was a period of limited international migration, except for the refugee migration in Europe. Around 1960 international migration became a global phenomenon. Employers in Europe and elsewhere started to recruit immigrant workers (*guest workers*) because of a shortage of native labour supply. Labour migration was mainly from South Europe to North and West Europe. Recruitment of migrants in East Europe was not possible because of the Iron Curtain. Only Yugoslavia allowed their citizens to migrate to West Europe. During the same period, colonies became independent. That event triggered considerable (return) migration flows. Massey estimates that, before 1930, 85 percent of all international migrants originated in Europe. Since 1960, 85 percent come from Latin America, the Caribbean, Asia and Africa.

In the European Union, three phases of immigration can be identified in the last half century (European Commission, 2011). The first is the guest-worker phase. That phase ended abruptly in 1974 when the oil crises produced a recession. Many guest-workers did not return to their country of origin, contrary to the initial expectation. As a consequence, in the 1970s family reunification increased. Refugee migration (asylum seekers) increased in the 1980s and 1990s, and was related to shocks, such as the fall of the iron curtain, wars and ethnic conflicts. The 1951 Convention relating to the Status of Refugees had an important impact on migration. The Convention was designed to protect people from persecution.⁶ In the 1990s immigration dropped, partly due to tighter controls. At the end of the 1990s it increased again and after 2000 an annual net immigration of around 2 million was recorded before dropping to a net migration of about a million in 2009.

Today, globally 214 million persons are living outside of their country of birth, 3 percent of the world population. In Europe, the foreign-born population is 9.5 percent of the population (70 million). It is 50 million in Northern America (14.2 percent of the population), 61 million in Asia (1.1 percent) and 19 million in Africa (1.9 percent) (United Nations, 2009). In the 1990s countries in South Europe shifted from emigration countries to immigration countries.

A recent Gallup report (Esipova et al., 2011) offers a look at the experiences of people around the world who desire to migrate. The report is based on interviews with more than 750,000 adults worldwide since 2005 and provides information on the decision

⁶ The 1948 Universal Declaration of Human Rights recognizes that, "Everyone has the right to seek and to enjoy in other countries asylum from persecution" (Article 14, Paragraph 1). The 1951 Convention is an implementation of that basic right and focuses on how States should treat refugees. At the end of 2010, 15.4 million people throughout the world were seeking refuge from conflict and persecution (UNHCR, 2011, p. 5). It has become a significant part of irregular migration.

process and the effects others have on the outcome. The Gallup World Poll found that 14 percent of the world's adults (15+) population (630 million) say they would like to emigrate if they could. Only 8 percent of them are planning to do so within 12 months and less than half (39 percent) of those planning to move say they have already started making preparations. Most individuals stay in what the report calls the *dream stage* and do not continue to the planning stage and preparation stage.

Zelinsky (1971), who proposed the concept of mobility transition, linked migration to the demographic transition and to industrialization and economic transformation (see also de Haas, 2010). Skeldon (1990, 1997) extended the mobility hypothesis by introducing the role of nation state formation including the colonization and decolonization. Colonization shaped migration along particular corridors and that path dependence contributed to the emergence of world migrations systems (see later). The link between migration and the demographic transition is manifest. High fertility countries have a relatively large population of young adults, many of whom may be unemployed and eager to emigrate, unless economic growth in origin countries is sufficient to accommodate the *demographic dividend*. Low-fertility countries experience a shrinking labour force as the baby-boom generation retires. The World Economic Forum (2011) estimates that “*To sustain economic growth, by 2030 the United States will need to add more than 25 million workers, and Western Europe will need to add more than 45 million employees.*” Some see the global competition for workers, in particular skilled workers, a mega-trend of the 21st century. These drivers of international migration are largely situated at the population (macro) level and emphasize structural factors such as labour supply and demand. Development is defined as economic development. The drivers are formulated in terms of equilibrium-seeking tendencies (homeostatis) (migration as a labour-market adjustment mechanism). Proponents of this perspective consider an equilibrium between the demand and supply of labour as the natural state of affairs.

Communication and transportation technologies changed the landscape for international travel and migration. National borders and long distance no longer are the barriers they used to be. The UN World Tourism Organization (UNWTO) estimates that in 2010 close a billion people entered a foreign country as a tourist (940 million), 4.4 percent growth compared to 2009. International tourism generated close to a trillion dollars in export earnings. In 2012 the UN expects more than a billion international tourist arrivals. The UNWTO defines tourism as involving a stay away from one's usual place of residence of not more than a year. If the stay is more than a year, it is considered a permanent migration. Different types of migration involves stays of less than one year (e.g. temporary migration, circular migration). The distinction between tourism and migration is becoming increasingly blurred. Resident tourist and lifestyle migrants are concepts used to describe the growing international mobility in search for a better lifestyle or way of life. Torkington (2012) reviews the academic literature on the subject and discusses lifestyle migration between Northern Europe and the Algarve in Portugal, where people from Northern Europe are not considered immigrants but *resident tourists*, even when they settled permanently in the country. The label ‘immigrant’ is reserved for those of African, Asian and Brazilian origin as well as Eastern European labour migrants. A distinguishing feature of resident tourists, according to Torkington, is that they do not speak the local language and predominantly go to places where they meet their compatriots.

The increase in international tourism and different forms of international migration are manifestations of an increasingly mobile society. Many people are ready, willing and able to migrate in search for a better life. Technological change in communication and transportation enables a global community that is connected. Furthermore, globalization and the associated socio-economic transformations trigger new international migration flows.

Micro-level theories of migration consider individuals. Most people want a better life and many consider migration to achieve that goal. Some want to join their family, others look for a school, a job, a partner, protection or a better climate. Some like to see new places and meet new people. Migration is instrumental to achieve particular goals in life. The desire to migrate is a consequence of the geography of opportunities. To most people international migration is a life strategy. People migrate for a reason. The usual types of migration such as employment migration, marriage migration, family reunion, residential mobility and retirement migration are manifestations of the dependence of migration aspirations on events and stages in life. Migration is not only part of economic transformation processes, but also of individual developmental processes. De Haas (2010) proposes to adopt Amartya Sen's (1999) definition of development: the process of expanding the substantive freedoms that people enjoy. The *capabilities approach* to development emphasizes creating an enabling environment and opportunities for people to use their functional capabilities (e.g. ability to live to old age, participate in the economic and political activities) (see also Nussbaum, 2011). It differs from economic development (measured by GDP); it is the intellectual foundation of the Human Development Index (HDI), which emphasizes health and education. Development means increasing human capabilities.⁷ It calls for increasing self-efficacy⁸ by giving priority to health and education, and by taking down barriers to free choices. In Sen's development concept, agency plays a pivotal role but agency in itself is not sufficient. The execution of agency requires capabilities. The mechanisms by which human development leads to higher levels of migration are: (1) increasing capabilities by loosening constraints on movement, (2) increasing aspirations and (3) increasing occupational specialization (De Haas, 2010).

Migration flows exhibit strong path dependence. Once an immigration stream begins, the flow tends to be reinforced through migrant networks and migration policies. As a result, at the population level migration patterns emerge with characteristic migration corridors between places evolving into a migration system. A *migration system* is a set of places (within or across state borders) linked by flows and counter-flows of people, goods, services, and information, which tend to facilitate further exchange, including migration, between the places (de Haas, 2010). The settlement of migrants in a place alters the structural conditions for migration through various feedback mechanisms. Migrants transfer money, goods, ideas and information back home. Thanks to cheap phone calls and flights emigrants are more likely to maintain frequent contact with people in their country of origin. They may cause ideational changes and produce new, *transnational* identities. Many of the estimated 40 million overseas Chinese (persons of Chinese descent living outside China), the over 30 million non-resident

⁷ The capabilities approach is remarkably similar to the approach to development advocated by Condorcet at the time of the French Revolution and vigorously opposed by Malthus.

⁸ Perceived self-efficacy is defined as people's beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives.

Indians (persons of Indian origin who resides outside India), the 1.7 million Turks in Germany and the 150 thousand Nederbelgen in Belgium are transnationals. In 2013, migrants worldwide saved enough to transfer an estimated US\$ 550 billion to their countries of origin, 75 percent or US\$ 414 billion to developing countries (Ratha et al., 2013). Remittances sent home by migrants to developing countries are close to four times the size of official development assistance and represent a lifeline for the poor. Diaspora and other migrant networks influence not only future migration but also trade and investment flows. The World Bank sees diasporas as important sources of trade, capital, technology, and knowledge for origin countries. The Bank advises low-income country governments to issue diaspora bonds for infrastructure projects and market them to emigrants in rich countries.⁹ Ketkar and Ratha (2010) provide the rationale. Diaspora bonds are essentially a form of government debt that targets members of the national community abroad, based on the presumption that their emotional ties to a country make investing in such products worthwhile. Diaspora bonds are a way to capture part of the remittances for national investment projects.

What may we expect next? In the 2010 projections, the United Nations (2011) assumes that net migration in Europe remains constant over the next decades at around 1 million per year and declines gradually after 2050. Eurostat (2011) expects a limited increase of net immigration in the EU27 from around 1 million to a maximum of 1.33 million in 2020, followed by a decline to 0.9 million in 2060. Migration is more difficult to predict than mortality or fertility. The ignorance about what to expect explains the assumption that net migration remains at its current level. The assumed decline in the long run is likely to be based on the belief in the state of equilibrium with zero net migration is the natural state of affairs. Multiple disequilibria are more likely, because of conflict, natural disasters and other events that trigger migration flows. In addition, the geography of opportunities will continue to motivate people to consider migration in search for a better life. Technological developments are likely to take down further barriers to international travel, and short-term and long-term migrations. The nature of migration will change too. The number of transnationals, people who identify with more than one country, is likely to increase.

Today, 9.5 percent of the population of Europe is foreign-born (United Nations, 2009). In the EU27, it is 9.4 percent or 47 million (Vasileva, 2011). About 31 million were born outside of the EU and 16 million were born in another member state. Immigration cannot prevent the ageing of the population. It can delay it a little. In Europe, migration management and the economic and social integration of immigrants remain major challenges.

6. Discussion

⁹ India and Kenya have issued bonds and Nigeria, Bangladesh and the Philippines are planning pilot projects (see e.g. Dilip Ratha's blog on migration, remittances and development <http://blogs.worldbank.org/peoplemove/category/tags/diaspora-bonds>; accessed 15 March 2014).

In October 2011, the world population reached 7 billion. The population of Europe was 740 million and the population of the European Union (EU27) 500 million. In 1950, 22 percent of the world population lived in Europe. Today it is 10 percent. That figure will drop to 6.6 percent in 2100 if the United Nations' projections would become reality. Today, two-thirds of the population of Europe is between 15 and 64, which is close to the world average, and 16 percent is 65 and over, which is twice the world average of 8 percent. Europe is leading the world in ageing. The other continents will follow, Asia relatively soon and Africa much later. Projections indicate that in 2100, 27 percent of the Europe's population is 65 and over. The world figure is that every fifth person will be 65 or older. The projected figure is 26 percent for Asia and 15 percent for Africa.

These population figures are results of the demographic transition. Europe is leading because the continent was the first to start the transition and is therefore further advanced along the path. Other continents follow. In 2100, the transition is expected to be completed in Asia but not yet in Africa. As a result, the greying of Asia catches up with the greying of Europe. Europe and Asia will be of advanced age when Africa collects the demographic dividend.

During the last 50 years in Europe, the life expectancy increased 2 years per decade. That is a major achievement. The challenge is to live with that achievement and adapt. Lives should be reorganized because the lifespan has become much longer. That is essentially what many people are doing. They stay in school longer and postpone transitions to adulthood. They enter the labour market later, postpone a stable relationship and postpone having children (Lee and Goldstein, 2003). Half a century ago transitions to maturity were compressed into a narrow age span. Today the transition appears to be becoming more diffuse and the transition period longer. Biological, institutional and behavioural barriers inhibit the adjustment of the life course. Women who postpone childbearing run the risk of childlessness, although assisted reproduction and adoption can be an outcome. Incentives for early retirement have grown with the generosity of pension programmes in recent decades. Traditional concepts of age continue to dominate the retirement debate, in particular the debate on retirement age. Sanderson and Scherbov (2010) advocate replacing prospective age for chronological age. Chronological age emphasizes years lived, while prospective age emphasizes remaining lifetime. If pension schemes would express entitlements and benefits in terms of prospective age, a condition would be created that enhances the rescaling of the life course with increase in lifespan. A side effect is a more sustainable pension system. Recent reforms that link pension benefits to life expectancy at (mandatory) retirement age are a first step toward prospective age.

Using prospective age rather than chronological age would also help the debate on differential retirement age. Today, few occupations (hazardous and arduous work) entitle someone to retire early (e.g. after a working life of 30 years instead of 45 years) with full benefit (for a review in OECD countries, see Zaidi and Whitehouse, 2008). The rationale is that they are exceptionally demanding. An alternative approach to equity is to enhance that everyone has the same expected number of years of retirement. People with a low life expectancy at retirement age retire at a younger chronological age than people who may expect to live longer and, therefore, benefit longer. With increasing life expectancy, several inequities are introduced in the social security system because not everyone benefits equally from mortality reduction. In

the Netherlands, females and males with low income have a life expectancy that is 7 years lower than those with high income, and they spend more years in ill-health and with disability (Knoops and Brakel, 2010). Disability starts at age 62 for men with a low income and at age 76 for men with a high income. The differences are even higher at age 65. At age 65, men in the lowest income category have a life expectancy of 15 years while men with the highest income may expect to live another 19 years. Women may expect to live 17 and 23 years, respectively. The differences are not taken into account in determining pension benefits relative to contributions. As a result people with low income subsidize the pensions of people with high income. In the daily newspaper NRC of 13 December 2006, Bovenberg, Mackenbach and Mehlkoph urged to end the *perverse solidarity* (income distribution from poor to rich). Recently, Bovenberg and van Ewijk (2011) called for more heterogeneity in pension schemes (longevity insurance). There is an urgent need for pension reforms that lead to pension schemes that are efficient, sustainable and equitable.

Equity also concerns the intergenerational transfer in pay-as-you-go (PAYG) pension schemes. In these schemes, the working population pays the pensions of the retired population. Funds, collected through taxes or premiums, are not accumulated but spent in the same year. If many contribute and few benefit, the premium is low. That is the case when a large generation (baby boom generation) is active. As the baby boom generation starts retiring, a shrinking working population (baby bust generation) is requested to finance the state pensions of an expanding retired population, implying an increase in compulsory social security contributions and a decrease in disposable income.

To illustrate the effect of ageing and the baby boom generation retiring, I offer an estimate of how much an individual member of the active population should contribute to provide each person over 65 an annual pension of €10000. To keep it simple, I assume that all members of the active population, defined as persons aged 20 to 64, contribute. For details and the mathematical model, see Willekens (2010a) and for a more elaborate discussion, see Willekens (2010b). In 1957, when the universal state pension (AOW) was introduced in the Netherlands, every member of the active population would have to contribute €1587 per year to cover the pensions of the persons over 65. During a period of 50 years the amount increases modestly to €2361 in 2007. The increase depends entirely on the changes in age structure of the population as a consequence of declining mortality and fertility in the period 1957-2007. Although fertility decline between 1957 and 2007 is substantial, the contribution increases less than expected because the baby boom generation contributes in 2007 but not yet in 1957. The true effect of fertility and mortality decline can be determined using a hypothetical population that is independent of the age structure of the population in 1957 and 2007, and depends only on the mortality and fertility levels in 1957 and 2007. The hypothetical population is the stable population. The growth rate and the age structure of the stable population are derived from age-specific mortality and fertility rates. If in 1957 the age structure of the population would be determined entirely by the mortality and fertility levels in that year, each member of the active population would have to contribute €1904 to provide a pension of €10000 to everyone aged 65 and over, an increase of 20 percent. It means that the real age structure in 1957 was younger than expected on the basis of mortality and fertility in that year. In 2007, the contribution would almost double to €4615. The difference of €2361 and €4615 can be attributed to the size of the baby-

boom generation relative to earlier generations. It is the *demographic dividend* of the baby boom generation. Because of their size and the PAYG pension system, their pension contributions increased by not more than 50 percent in 50 years. If the assumption that all members of the active population contribute is replaced by an assumption that the working population contributes but not the population without paid employment, then the contribution in 2007 would have to be 34 percent higher (€154). If more members of the active population are gainfully employed (and pay contributions) and work longer, then the contribution increases less.

The decline in fertility that started in the mid-1960s with the introduction of the contraceptive pill, will have major consequences for the pension contributions of younger birth cohorts. Until the baby-boom generation starts retiring, the contribution does not change much. When the baby-boom generation starts retiring, the retired population is larger than what is expected on the basis of current and future fertility and mortality levels. The demographic dividend turns into a *demographic debt burden* that falls on the younger generation if the PAYG system is maintained. If the system is gradually replaced by a savings scheme (capitalization scheme) the younger generation carries a double burden: providing for the elderly and saving for their own pension. A policy option that limits the intergenerational inequity built in the PAYG system is to quantify the demographic dividend received by the baby-boom generation, and transfer (part of) it to younger generations. The funding source is the inheritance tax or estate tax, which increases substantially when the baby-boom generation starts dying. In future years the tax incorporates an important demographic dividend (collected by the government).

The pension premium may also be used to demonstrate the impact of increasing fertility. In Europe, low fertility has the attention of public authorities but policies are inadequate. Fertility increase critically depends on improvement in work-life balance. Countries with relatively high fertility have implemented one of three policies. First, labour market policies, with increase in part-time jobs (Netherlands). Second, child care (France). Third, gender equality (Sweden). These are the policies that seem to work. Suppose a policy is enacted that increases fertility by 30 percent, meaning that the Total Fertility Rate (TFR) increases from 1.72 (in 2007) to 2.24. With the fertility policy, in about 20 years time, the active population starts to be larger than without a policy and in about 65 years time, the elderly population starts to be higher than without a policy. When all members of the active population pay pension contributions and the retirement age remains at 65, then the pension premium declines from €4615 in 2007 to €3972, a 14 percent reduction. The annual number of births increases from about 180000 to 200000 (the Netherlands). The number of births increases less than the TFR because of the relatively old age structure of the population. The impact of the policy measure will be felt after a period of about 25 years. First the pension contributions will decline as the additional children born are active. The contribution of €3972 applies when the distorting effect of the increased fertility on the age structure is phased out. The example illustrates that the effect of fertility policies, even aggressive policies, on pension premiums in a PAYG system with a retirement age at 65 is absent in the short run and limited in the long run. To increase intergenerational equity, barriers to family formation should be removed and persons who raise children should gain pension credits in an individual notional pension account.

Ageing will not go away and Europe is leading the world in ageing. Individuals are adapting to the increased longevity by reorganizing their lives. The young generation delays labour market entry and family formation. They are likely to delay labour market exit, provided barriers to late exit are removed and flexible schemes are introduced that view retirement as a process and not as an event. The reorganization of the life course provides an opportunity to better integrate the different stages of life in a scheme that includes all life contingencies.

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