Chapter 2
The New Demography

Those with a concern for an environmentally sustainable future may see a gradual decline in population as a blessing rather than a threat, but the prospect of population decline implied by current fertility rates is anything but gradual, threatening to halve or even quarter the populations of some Western nations over the course of the next century.

(Castles 2004: 141)

2.1 Continuing Changes

Falling birth rates are the main reason why populations grow older because they reduce the proportion of children in a population and thereby raise the proportion of older people. Amid falling birth rates, it was often assumed that societies retained an inherent tendency to at least perpetuate themselves. However, birth rates in many countries have not stabilized at a level sufficient to maintain population numbers. Completely unforeseen was the emergence since the 1970s of below replacement fertility sustained for decades, rather than being merely a transitory phenomenon. At the same time, the formerly assumed limit of life expectancy – at a peak of around 75 years for females and 71 for males – has continued to be exceeded by widening margins in Europe, North America, Australasia and most of East Asia. Passing the supposed limit of life expectancy has also overturned the notion, from demographic transition theory, that mortality decline has only a minor role in raising the percentage of older people. In the developed countries' past, improvements in survival occurred mostly among the young. This led to overall population growth and, decades later, to greater numbers reaching older ages. The effect on the percentage aged 65 and over was minor, however. Present circumstances contrast sharply. Currently, progress in mortality control has reached a stage in developed countries where death is uncommon at young ages and many of the gains are occurring in middle and later life. This new phase in the decline of the death rate has the immediate effect of

Table 2.1 The old and the new demography of aging

Old demography	New demography
% 65 years and over peaks at less than 20	% 65 years and over rises to 25–35 or more
Fertility lowest at replacement	Below replacement fertility widespread
Life expectancy peaks around 75 years	Life expectancy rises to 85 years and beyond
Mortality decline: minor role in population aging	Mortality decline: major role in population aging
Slow tempo of population aging	Tempo of population aging increasing
Aging unimportant in developing countries	Numbers of the aged a major concern in developing countries

augmenting not only the numbers surviving at older ages but also the percentages. In conjunction with the extended decline of the birth rate, the extended decline of the death rate is leading to unforeseen levels of population aging.

Linked with now disproven ideas about limits of fertility and mortality rates was the expectation, discussed in Chap. 1, that the proportion in the older ages would peak as low as 16% at the end of the demographic transition. This contributed to the view that population aging denotes a victory for goal setting and policy making. Authors have also hailed it as "a great triumph of civilization" (Notestein 1954), "one of the truest measures of progress" (Cowgill 1970: 35), and "the greatest triumph that our species has achieved" (Kirkwood 2001). The "triumph" arose from humankind's ability to control disease and unsustainable high birth rates. Population aging was a sign of these achievements because it cannot occur in societies with the negative characteristics of rapid population growth or high death rates at young ages. Thus population aging was a positive development, not only because it heralded the end of the transition from high to low birth and death rates, but also because it appeared that aging would remain at a manageable level. Even as late as 1989, it was thought that "national populations in post-industrial societies … are extremely unlikely to exhibit elderly proportions much more than … 18–22% for those aged 65 and over" (Rogers 1989: 17).

Interpreting population aging as a measure of progress further assumes that the transition ceases at a theoretical end point where age structures are rectangular and population numbers are nearly stationary. Yet birth and death rates are not so closely connected that their decline terminates at equilibrium (Barclay 1966: 133). Furthermore, envisaging that population aging and progress go together presupposes that the social and economic changes responsible for falling birth and death rates permit the accumulation of sufficient resources to provide for larger numbers of older people. Instead, the provision of adequate support for the aged is an ongoing concern in all countries whatever their birth rates and income levels: generous public provision for the aged is economically unsustainable everywhere.

Replacing the former assured and even optimistic perspective on population aging, there is now mounting awareness of the extent of the continuing revolution in demographic processes. Compared with the old demography, based on the classical demographic transition, the new demography, founded on contemporary theories and observations, poses greater challenges because it entails more extreme developments to which successful adaptations are all the more important. Table 2.1

summarizes the transformation in the outlook for aging societies due to the waning relevance of the old demography of aging and the rise of the new. This chapter focuses on the implications of major characteristics of the new demography of aging, apart from its relevance to developing countries, which is discussed in Chap. 14. Ensuing sections illustrate: (i) the shift from the old to the new demography, (ii) the implications for aging of various levels of fertility, mortality and migration, and (iii) the trend towards an acceleration of demographic aging.

2.2 Overview of Trends

Figure 2.1 provides an overview of trends in aging, including the cross-over from the old demography to the new. In the diagram, the trend in population momentum through time depicts the course of population aging during and after the demographic transition. Population aging is a consequence of factors that cause changes in momentum (Myers 1990; Rowland 1996; Kim and Schoen 1997). Population momentum measures the extent to which past trends in fertility, mortality and migration have created potential for expansion or contraction to occur in the size of age groups as a result of cohort flow – the progression of birth cohorts from one age group to the next. Population momentum expands middle and older age groups in particular and aging is a direct consequence of momentum. Thus momentum indicates the potential for growth and aging inherent in a population's age structure.

Positive momentum, or 'growth potential', is prospective growth due to larger birth cohorts, or generations, growing older (Keyfitz 1971). Conversely, negative momentum is prospective decline due to smaller cohorts growing older. Negative momentum in an age structure is usually due to below replacement fertility. Positive momentum is depicted on the left of Fig. 2.1, negative momentum on the right. If the birth rate
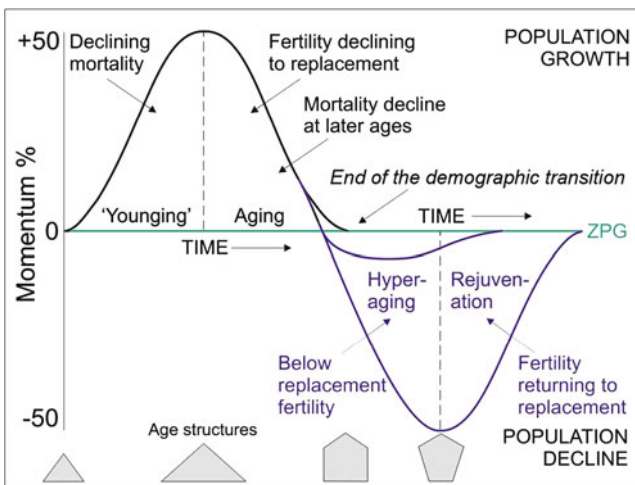

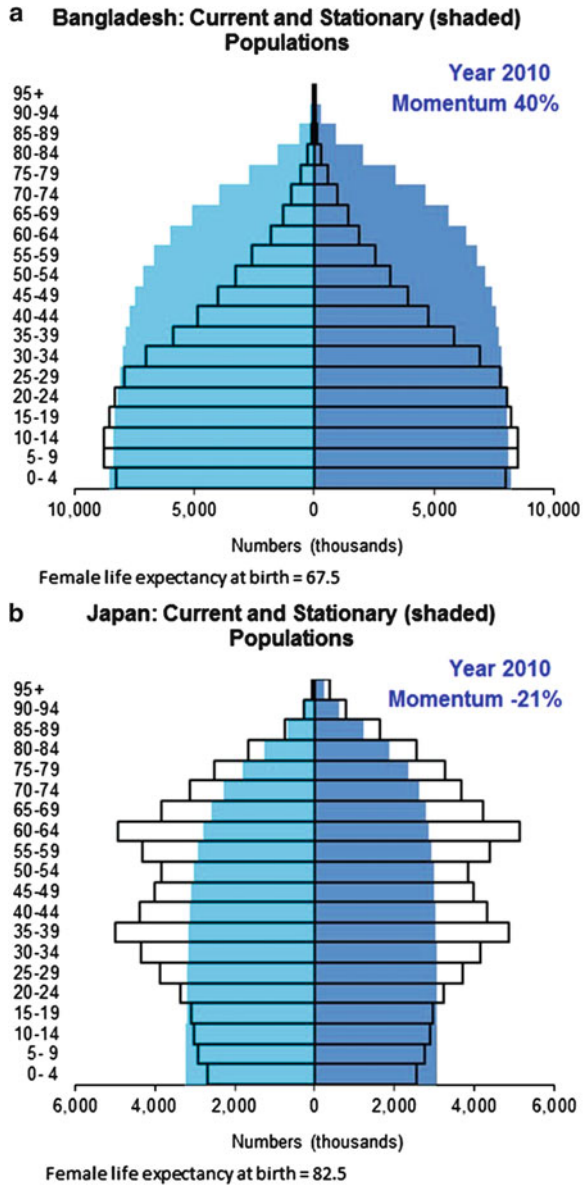**Fig. 2.1** Trends in population aging

in a growing population suddenly fell to replacement level, and the current life expectancy was maintained, the population would continue to grow for 70 years or more before levelling off (Potter et al. 1977: 555). Positive population momentum is this tendency for continued increase as younger cohorts, longer-lived than those born decades earlier, move up the age pyramid. Although no country can achieve replacement fertility instantaneously, the assumption of an immediate shift to replacement, in conjunction with the assumption of constant mortality, is useful because it permits the measurement of the current potential for change from cohort flow alone. In doing so, momentum provides an indication of how near a population is to zero population growth (ZPG) and the end of aging.

For example, in 1970, population momentum in the United States was 32%. In other words, the population had an inbuilt potential to grow by 32% in future decades through the movement of larger cohorts into older ages. This high figure reflected the considerable future growth that would arise from the progression of the country's large baby boom generation into middle and later ages (Rowland 2003: 327). Calculation of the figure of 32% assumed replacement fertility from 1970 onwards, as well as constant mortality at the 1970 level and zero migration. These assumptions eliminated sources of growth other than that built into the age structure. By 2010, the country's momentum had fallen to 7%, because the baby boom generation was 40 years older and there were fewer age groups yet to experience its impact. The fall in momentum showed that the United States was closer to ZPG. Nevertheless, a 7% increase in the size of the population, concentrated in the older ages, still constituted a substantial future change which would make zero momentum and zero growth unlikely for several decades.

Developing countries have the highest levels of momentum. For example Bangladesh, which in 2025 will have one of the world's largest aged populations, had population momentum of 40% in 2010 (Fig. 2.2). The shaded area in Fig. 2.2 denotes the size that Bangladesh's population would reach with constant replacement level fertility. The difference between the size of this population and the 2010 population (outlined) is the amount of future growth arising from momentum alone. Expansion in the middle and older ages due to momentum would be equivalent to 40% of the size of the 2010 population. In contrast, a high degree of negative momentum is present in the age structure of low fertility societies, as illustrated by Japan in 2010. Japan's population would decline by 21% if the country had replacement fertility from 2010 onwards. Heavy losses would occur at most ages over 30. Data on momentum, however, differ from other long-range projections in that they focus only on the effects of cohort flow with replacement-level fertility. Japan's actual demographic rates place its population on a trajectory to decline by 50% or more by the end of the century (Kaneko 2008).

As illustrated in Fig. 2.1, momentum is zero in the pre-transition stage because high fertility and high mortality tend to balance each other and the numbers in every age group remain much the same. This state of affairs is thought to have characterised much of human history, resulting in regions with stationary, triangular-shaped age structures with few older people, as depicted at the bottom of Fig. 2.1. The supposed equilibrium in the pre-transition stage, however, disregards

Fig. 2.2 Population
momentum in Bangladesh
and Japan, 2010. (**a**) **Positive
momentum**: Stationary
population larger than the
current population.
(**b**) **Negative momentum**:
current population larger
than the stationary
population (Source:
Calculated from data in
United Nations 2009b)

a **Bangladesh: Current and Stationary (shaded) Populations**

Year 2010
Momentum 40%

Numbers (thousands)

Female life expectancy at birth = 67.5

b **Japan: Current and Stationary (shaded) Populations**

Year 2010
Momentum -21%

Numbers (thousands)

Female life expectancy at birth = 82.5

episodes of population growth due to technological innovations and migration, as
well as population decline due to the ravages of wars, natural disasters and other
calamities. These would have caused multitudes of demographic upheavals and
crises through time and from place to place, with a net outcome in the long run of
slow population growth at best.

At the beginning of the transition stage, momentum rises above zero because death rates fall, with the greatest gains occurring among the young. Typically, birth rates remain high for a time while mortality declines. As a result, the numbers reaching successive ages expand and momentum continues to increase. During the transition stage populations may develop the potential to grow by 50% or more because of larger numbers moving up the population pyramid. The existence of momentum explains why world population growth and aging are currently unstoppable: ever greater numbers will advance from one age group to the next (see Fig. 1.1).

There is no word in the English language that means 'to make even younger something that is already young', although 'younging' and 'juvenation' are possibilities. 'Younging' occurs early in the demographic transition because improvements in the survival of children make populations younger. This broadens the base of the triangular age structure as the percentage of children increases (Fig. 2.1). Momentum keeps rising until, later in the transition, fertility starts to fall. In this phase the size of younger and older cohorts gradually evens up and momentum declines. Later in the transition, falling death rates at middle and later ages also contribute to aging because they immediately augment the number of adults surviving to older ages: this is part of the new demography. The classical demographic transition anticipated a final, post-transition, stage with zero momentum and zero population growth. The resulting stationary population has a more rectangular age structure. This hypothetical population is referred to in some later chapters because it is a useful model for comparison with national and regional age structures.

So far no population with low birth and death rates has achieved zero growth. Instead, birth rates have continued to decline below replacement level, resulting in a cross-over from the old demography of aging to the new. The right-hand side of the diagram shows the development of negative momentum and hyper-aging which, if unchecked, would ultimately lead to extinction. Momentum becomes negative when successive cohorts are smaller. Population decline ensues and the percentage aged 65 and over passes 30%. Age structures therefore become undermined and taper towards the base. Nevertheless, some Western populations could approximate zero growth around mid-century, through near-replacement fertility supplemented by immigration. This is represented by the shallower curve on the right depicting a lower level of negative momentum and an early return to ZPG. Current data on momentum in national age structures suggest this is a possibility (Fig. 2.3). A number of countries have low positive or low negative momentum – and hence are reasonably close to ZPG. This includes Australia and New Zealand, Canada and the United States, and countries in Northern and Western Europe. Developing countries mostly have high momentum, while Eastern and Southern European countries have pronounced negative momentum. Japan and Bulgaria have the lowest momentum in the data set. The deeper curve in Fig. 2.1 denotes the development of greater negative momentum. Any future recovery from this through replacement fertility would result in a much diminished population size. This is because of the severe depopulating effects of a prolonged period of negative momentum. If fertility remains well below replacement, population decline becomes self-reinforcing.
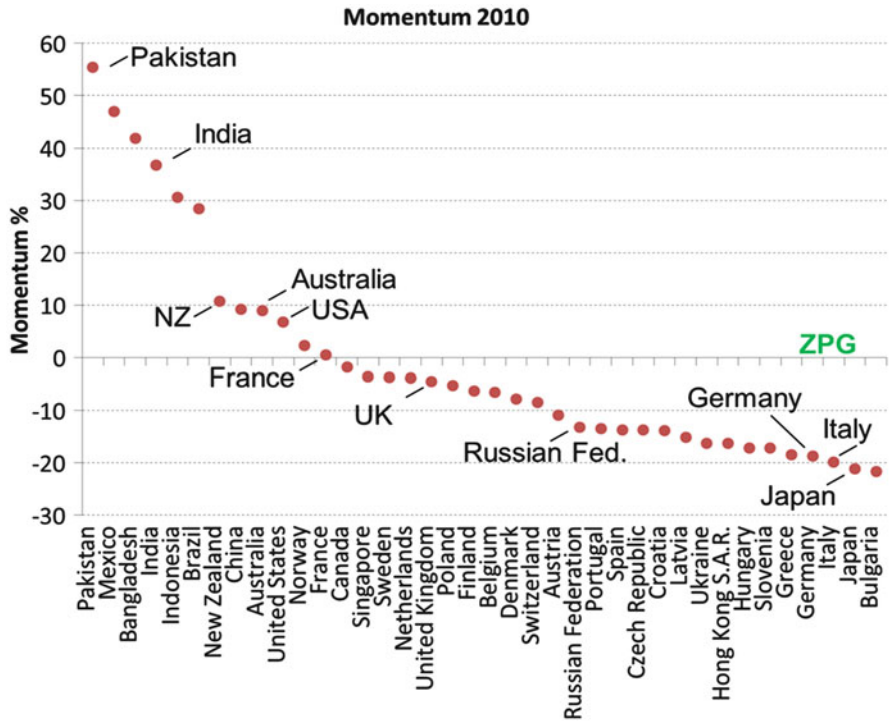
Fig. 2.3 Momentum in national populations, 2010 (Note: The statistics refer to females only) (Source: Author's calculations from population estimates (United Nations 2009b) and West model life tables (Coale and Demeny 1983; Rowland 2003))

2.3   Growth and Aging

Such an eventuality was once inconceivable, so much were concerns focused on growth and its containment. One of the achievements of twentieth century policy making, in conjunction with social and economic modernization, was progress towards reducing world population growth through enabling more women to achieve their desired number of children, rather than having little control over their own fertility. Recent examples of national fertility decline are India, Indonesia and Iran where their respective total fertility rates in 2010 were 2.6, 2.4 and 1.8 children per woman (Population Reference Bureau 2010). Unfortunately, the emergence of lower birth rates in many developing countries has helped to foster the view that further progress will follow as a matter of course. This assumes that past successes in reducing high birth rates will continue, but much will depend on the maintenance and extension of international support for reproductive health programs and social development, particularly in countries where there has been little such progress so far (Caldwell 2003: 81–82).

Achieving birth rates near replacement level are desirable goals for stabilizing global population numbers by mid-century and containing population aging. Delays in achieving lower fertility will result in much higher peaks in some national population totals and in the numbers of the aged. Nevertheless, a great increase in the population of less developed countries is inevitable because of the inherent potential for growth from population momentum as larger generations grow older. Although the persistence of medium to high birth rates in some countries is a significant factor in global population growth, population momentum is now a more important force. Illustrative projections of world population increase for the whole of the twenty-first century show momentum to be the predominant source of growth, followed by mortality decline then above replacement fertility in developing countries (Bongaarts and Bulatao 2000: 522). If the world's population had instantly achieved replacement level fertility in the year 2000, it would still have had the potential to increase by about 30% because of the inherent momentum in its age structure. The aging of the large, longer-lived generations born in the 'population explosion' together the baby boom generation in developed countries, is making huge global increases imminent and unavoidable. Global population increases of more than 50% are possible by 2050, with even greater increases in developing countries due to further mortality decline and the persistence of above replacement fertility.

Continuing population growth therefore coexists as a global issue in conjunction with population aging. In relation to the aged population, growth in their numbers is generally the immediate concern in both developed and developing countries. In the former there are expectations that policies and programs will respond quickly to changing numbers nationally and locally, and only in the longer term to structural changes due to shifts in the overall representation of older age groups. Changes in the number of people moving through the age structure also drive the nature of the market for goods and services and the demand for housing and community infrastructure. While great increases in total populations and the numbers of the aged lie ahead for many countries, overall population decline, together with labour force decline, will be difficult to avoid where fertility is very low. The mechanisms underlying the shift from high to low fertility are now reasonably well understood but still uncertain are the means of halting or reversing it when it goes too far, as is likely for example in Japan and parts of Europe. Moreover, delays in taking policy initiatives to prevent excessive population decline can postpone the time when significant benefits are possible. This is because there is a lead time in developed countries of around 30 years before most people in new generations are established in productive employment and family formation.

2.4 Contemporary Developments

While the future is necessarily speculative, many consider that below replacement fertility will persist in societies that have already reached this situation. For example, in its 2008 revision of *World Population Prospects*, the medium fertility assumption

Table 2.2 Total fertility rates in United Nations regions, 1950–2050

Region	1950–1955	1975–1980	2000–2005	2025–2030	2045–2050
World	4.92	3.83	2.67	2.21	2.02
More developed regions	2.82	1.94	1.58	1.70	1.80
Less developed regions	6.00	4.53	2.89	2.28	2.05
Africa	6.63	6.61	4.91	3.23	2.40
Asia	5.73	4.03	2.50	2.01	1.90
Eastern Asia	5.42	2.68	1.71	1.81	1.83
Europe	2.65	2.00	1.43	1.65	1.80
Eastern Europe	2.82	2.08	1.26	1.59	1.79
Northern Europe	2.38	1.85	1.69	1.84	1.85
Southern Europe	2.62	2.26	1.35	1.62	1.80
Western Europe	2.41	1.67	1.58	1.68	1.79
Latin America & the Caribbean	5.85	4.46	2.50	1.85	1.80
Northern America	3.33	1.82	1.99	1.84	1.85
Oceania	3.83	2.74	2.42	2.18	1.98

Source: United Nations (2009b), medium variant projections for 2025–2050

of the United Nations Population Division was that total fertility in all countries would eventually converge at 1.85 children per woman, although not all would reach this level before 2050 (United Nations 2009a). It is also widely expected that societies with long life expectancy will continue to experience greater longevity in coming decades. Again, United Nations projections for national populations and global regions are consistent with this. Uncertainty about population prospects increases the further into the future that projections extend. Nevertheless, there is consistency between the United Nation's recent revisions of its projections to 2050. Although the United Nations expressed the assumptions for its 2000 and 2008 medium projections somewhat differently, common to both was the expectation that below replacement fertility will persist in developed countries generally, but their total fertility in 2045–2050 will be closer to replacement than at the start of this century. After 2050, however, the 2000 series of United Nations projections assumed an eventual convergence to replacement in all regions, whereas the 2008 series assumed convergence to a figure just below replacement.

During the second half of the twentieth century, the world's estimated total fertility rate (TFR) fell by more than 40% – from 4.9 births per woman to 2.7 births (Table 2.2). This reflected the progress of the demographic transition in less developed regions together with the emergence of below replacement fertility in more developed regions. The world's oldest populations all had TFRs above replacement level in 1950–1955, including Italy (2.4) and Japan (3.0), but by the second half of the 1970s most already had below replacement fertility. Thereafter, further declines were widespread, even to TFRs of between 1.0 and 1.3. Some upturns have ensued from the lowest points. Variations between women in the timing of their first birth, the spacing of subsequent births and the total number of births create much potential for fluctuations in annual birth rates, as do external influences such as economic

booms and recessions and the introduction or withdrawal of financial support for parents. Variations in birth rates occur when many women in a large cohort delay childbearing in one interval and 'catch up' in another.

For these reasons TFRs from annual data are only partial indicators of long-run average completed family size. Among the oldest populations, the United Kingdom, France and the Scandinavian countries have proved exceptions to birth rate decline to very low levels. Their TFRs were between 1.8 and 2.0 in 2010 (Population Reference Bureau 2010). These exceptions contribute to heterogeneity in the experience of low fertility societies over recent decades and render difficult the tasks of forecasting trends. There are also many causes of national fertility differences since national rates are an amalgam of variations in fertility between regions and social groups (Bongaarts and Bulatao 2000: 87). Regions of Africa and parts of Asia and Latin America, which have continuing high fertility, will experience rapid growth in their numbers of older people in conjunction with major increases in population size overall.

Whereas discussions of future population trends commonly refer to United Nations' medium variant projections, low and high variant projections help to define the range of uncertainty within which birth rates may fall. For the 'more developed regions' the 2008 low variant projection envisages a TFR of 1.17 in the second half of the 2020s, compared with the high variant's figure of 2.17. Although the range is only one child per woman, variations within this range are critical in determining whether fertility is above, below, or far below replacement – where its depopulating effects become extreme. The medium variant projections in Table 2.2 for 2025 and 2050 mostly envisage higher fertility than was observed in 2000, but achievement of this will be particularly difficult in countries in Eastern Asia, Eastern Europe and Southern Europe.

The effects of low fertility would be more manageable if they were not accompanied by rising life expectancies. Major gains in life expectancy occurred in conjunction with fertility decline in the second half of the twentieth century as many developing countries experienced accelerated progress through the demographic transition and most developed countries exceeded its expected limits. By the early twenty-first century developing countries had added 22 and 24 years to their 1950 male and female life expectancies, while the already long-lived populations of developed countries had added 9 years for males and 11 years for females (United Nations 2009b). The trend in developing countries gave rise to the global population explosion, and now underlies the growth momentum in many national age structures.

In contrast to the United Nations fertility projections, those for life expectancy, in both 2000 and 2008, consist of a single series and do not attempt to define a range within which future changes could occur. This is a disadvantage in view of the impacts on population aging that future changes in survival will have. Projections from national statistical agencies and demographic research organizations have been giving increasing attention to these potential variations and the next section illustrates their long-term consequences. The United Nations projections, nonetheless, provide an initial view of future prospects. By 2010, most of the world's oldest

populations had life expectancies of 76–80 for males and 82–84 for females (Population Reference Bureau 2010). For the first half of the twenty-first century, the UN's projected average gain in life expectancy at birth for the 15 oldest populations is about 5 years for both males and females. Japan, however, stands out as attaining exceptionally high female life expectancy by 2050 – 91 years, compared with 84 for Japanese males (United Nations 2009b).

2.5 Implications for Aging and Population Size
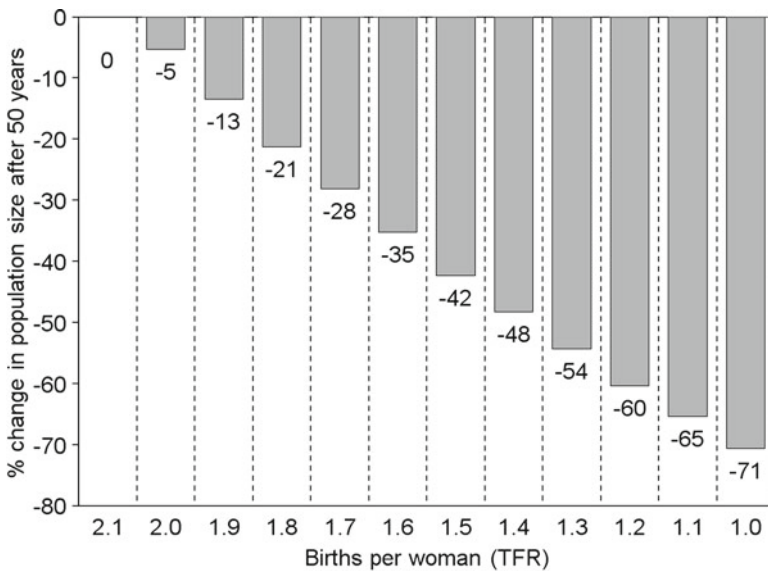
2.5.1 Effects of Fertility and Mortality

Preceding sections have shown that the extended declines in fertility and mortality have modified the conventional interpretation of the roles of fertility and mortality in population aging. The contemporary range in low fertility rates is leading to various levels of aging, all surpassing previous expectations. Extension of life at middle and older ages is reinforcing this. Demographic models reveal the full potential aging effect of long-run trends in fertility and mortality (Fig. 2.4). The models use life expectancy at birth as the measure of mortality and total fertility rates as the measure of fertility; they refer to total populations with female life expectancies between 70 and 90 years and corresponding lower male life expectancies. The lower a population's life expectancy, the higher the level of fertility needed for replacement because more die young. The total fertility rates are set at 3.0, 2.1 and 1.0, roughly corresponding to replacement levels of 150%, 100% and 50% respectively. In 2010, eight countries in Europe had total fertility rates of 1.2 or 1.3, which is little more than half the replacement level. At that time, Hong Kong, Macao and Taiwan had the world's lowest TFRs of 1.0 (Population Reference Bureau 2010).

The models show that, with replacement-level fertility, the percentage of the total population aged 65 and over reaches 18% when female life expectancy is 80 and 25% when it is 90 (Fig. 2.4). The rise, due solely to higher life expectancy, is equivalent to the effect of a substantial fall in fertility. When high life expectancy is combined with below replacement fertility, the outcome is very high levels of aging. Thus, with an average of one child per woman, the representation of persons 65 years and over reaches 38% when female life expectancy is 80, and 50% when it is 90. Clearly, extended longevity is a major force in population aging. Variously termed 'excessive aging', 'super aging', or 'hyper-aging', very high proportions in older ages represent a potential future for a number of long-lived low fertility societies, unless there are effective policy initiatives or as yet unanticipated social changes. The more sustainable scenarios in Fig. 2.4 are those where there is replacement level fertility, although even replacement fertility, in conjunction with a life expectancy of 90, results in 25% aged 65 and over.

Another concern is that TFRs well below replacement have powerful depopulating effects. This is illustrated in Fig. 2.5 where, for various low fertility rates, are
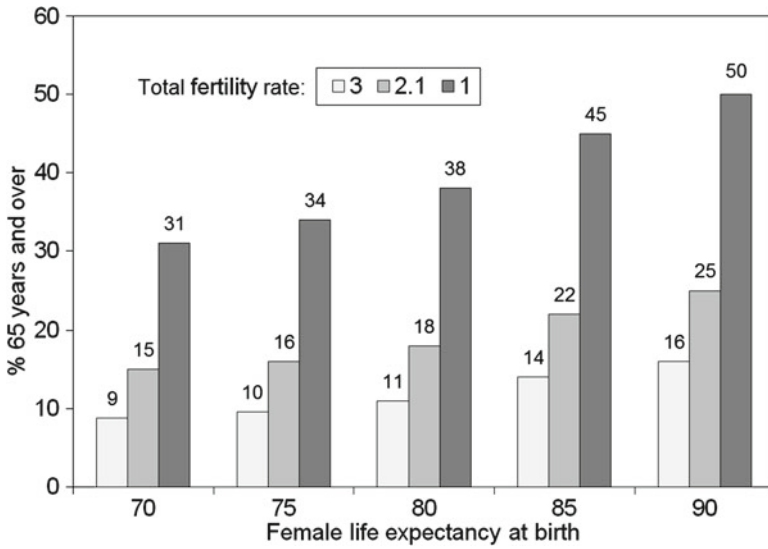
Fig. 2.4 Effects of low fertility and mortality on population aging (Sources: West model life tables, a relational model life table for a female life expectancy of 90 and stable population models: Coale and Demeny 1983; Rowland 2003: 316–321)


Fig. 2.5 Effects of low fertility and mortality on population size after 50 years (Note: The initial population for each projection is a stable population with the total fertility rate (*TFR*) indicated for each column. The models assume life expectancies at birth of 80 for females and 77 for males) (Sources: West model life tables: Coale and Demeny 1983; Rowland 2003: 316–319)

shown the resulting falls in population size after 50 years. The calculations for each column of the graph assume that the population is stable, that is, it has constant fertility and mortality rates through time as well as a constant age structure. The measure of fertility is again the total fertility rate, as plotted on the horizontal axis. The death rates for all the columns are based on life expectancies at birth of 80 for females and 77 for males – which approximated the average figures for Western Europe in 2009. The graph indicates that when the TFR is 2.1, no change occurs in population size though time. In contrast, TFRs of 1.6 or less bring rapid changes in population size, with numbers falling in 50 years by more than a third. The consequences for population size of even lower fertility are extreme. For example, maintenance of TFRs of 1.3, which occurred in parts of Eastern and Southern Europe in 2010, would cause a 54% fall in population size within 50 years.

Although the model populations in Fig. 2.5 are artificial constructs, they are relevant to national situations not only to forewarn of unfavourable circumstances, but also as indicators of trajectories that some countries are already embarked upon. An ameliorating factor for contemporary populations is that their current age structures are younger than those of most of the model populations. This will restrain population decline for some time, although substantial changes remain possible. For example, if Italy and Japan maintained their low mortality rates and TFRs of 1.3 their total populations would fall by 30% between 2000 and 2050. Bongaarts' and Bulatao's (2000: 6) projection for Italy also envisaged a 30% decline. Taking a TFR of 1.6 as "the benchmark for potential crisis", Castles (2004: 165) concluded that "roughly half the countries of the OECD are in deep trouble". He added that: "The evidence is not yet available to demonstrate the existence of a general crisis; only that some countries face huge problems if things stay the way they are." (ibid: 166).

2.5.2   Effects of Migration

Low birth rates have inevitably stimulated thinking about the ability of immigration to counter demographic decline and population aging, especially since the United Nations Population Division published its report on *Replacement Migration* (United Nations 2000). Although immigration is now recognized as no panacea for huge emerging demographic deficits, it remains one of a number of strategies with potential benefits for aging populations (Castles and Miller 2003: 82). Countries, such as the United States and Australia, which have long histories of utilizing immigration to boost labour force growth and address deficits in the young working ages, are favourably placed to do so in the future for several reasons. First, they have mostly encouraged permanent settlement, which heightens interest in these countries as destinations for family-oriented migrants. Permanent settlement also fosters the building of new generations, which supplements the numerical gains ensuing from migration. Second, they have become accustomed to integrating immigrants, granting citizenship and supporting, or at least accommodating, cultural diversity.
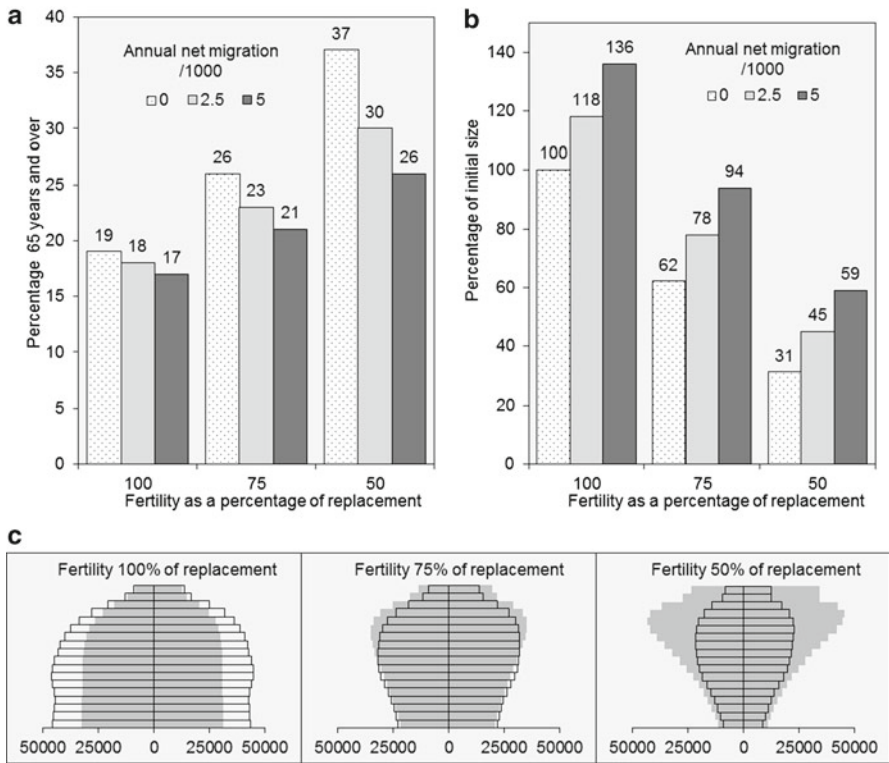
Fig. 2.6 Effects of migration on aging and population size. (**a**) Percentages aged 65 and over after 50 years of net migration. (**b**) Population size after 50 years of net migration. (**c**) Population before (shaded) and after (outlined) 50 years of net migration at 5/1,000 (Sources: Projections based on West model life tables and stable populations, see Fig. 2.5)

In contrast, temporary 'guest workers' are more likely to experience marginalization and lack of acceptance in the host society. Third, they have had long experience in recruiting immigrants in a world where the pool of tertiary-educated and occupationally-skilled potential immigrants is limited. Varying levels of interest in using migration as a policy instrument, together with competition for skilled migrants, will continue to result in an uneven distribution of migrants between potential destinations. About half of the world's international migrants go to the United States, where they account for 40% or more of its annual population growth. In the late 1990s foreign-born workers made up half of the net growth of the United States' labour force (Kent and Haub 2005: 10 and 17).

The effects of migration on population aging inevitably vary according to the shape of each country's age structure, but demographic models again illustrate the range of possibilities. Figure 2.6 shows the projected effects of migration, after 50 years, on three contrasting model populations spanning the current range in total

fertility rates in developed countries from 2.1 (100% replacement) to 1.6 (75%) and 1.0 (50%). As in Fig. 2.5, the three model populations assume a constant life expectancy of 80 years for females and 77 years for males.

Rates of migration depend on its social and political acceptability, the availability of adequate numbers of suitable migrants and the ability of the country to accommodate and employ them. The net migration rate of 5 per 1,000 in Fig. 2.6 approximates peak figures for migration to the United States in the early twenty-first century. However, it is unlikely that many countries could sustain for long a net migration rate of 5 per 1,000. Figure 2.6 therefore includes the effect of an intermediate annual net migration rate of 2.5 per 1,000, as well as zero net migration. The age structure of net migration is held constant at that employed in 'middle-range' projections for the United States, and migrant fertility is constant at the level for the destination, because migrant fertility commonly converges to that of the receiving country. Higher migrant fertility would boost growth arising from migration, potentially provoking concerns about migrant communities expanding their overall representation in the population.

The volume of net migration in each model remains constant through time because it is based on the initial population. This is useful for illustrative purposes as it omits complications arising from interactions between population size and the number of migrants. Alternatively, the migration rate could have been applied to the population at each 5 year step in the projection, resulting in an increasing volume of migration through time in growing populations and a decreasing volume in declining populations. The assumption of a constant volume of migration is more neutral because it neither assumes increasing demand for immigrants and expanding capacity to absorb them in growing populations, nor the opposite in declining populations – where migrants may be most needed.

For the three levels of fertility and the three levels of migration, Fig. 2.6a shows projections, after 50 years, of the percentages aged 65 and over. The main finding from Fig. 2.6a is that when fertility is below replacement, migration can have an appreciable rejuvenating effect on the age structure: higher rates of migration lead to lower percentages in the older ages. Also, the lower the fertility rate, the greater migration's rejuvenating effect. For example, in a population with fertility at half the replacement level, the percentages aged 65 and over would rise to 37% in the absence of migration, but to only 26% after 50 years of high migration, were it feasible. The rejuvenation would be more pronounced if migrant fertility was above that of the country of settlement.

However, the further the fertility falls below replacement, the less effective even high migration is in averting population decline. This is illustrated in Fig. 2.6b, which shows the size of the total population after 50 years, relative to the initial population. Thus in the population with fertility at 75% of replacement, numbers are 94% of the initial population size after 50 years of high migration, compared with 59% for the population with fertility at 50% of the replacement level.

In Fig. 2.6c the age-sex structures, for ages 0–4 to 85 and over, summarize the effects of high migration on the three model populations. Figure 2.6c depicts the initial and final (50 years later) age structures of populations with each level of

fertility, assuming a high migration rate and an initial population of one million. Migration at a rate of 5 per 1,000 augments the size of the population with 100% replacement fertility, but does not change the shape of its age profile greatly, apart from increasing the representation of young adults – the main migrant group. In the population with 75% replacement, high migration maintains much of the original shape as well as the size of the population. This confirms that, other things being equal, high migration can be an effective process of demographic replacement in populations with long-run total fertility rates at or above 1.6 children per woman. Raising the migration rate to just over 6 per 1,000 would keep the model's total population numbers constant at around one million. In contrast, the age structure with high migration and very low fertility (50% of replacement) confirms that migration cannot avert a major decline in numbers in countries with very low fertility, although it does restore a degree of balance to a top-heavy age structure.

In light of these findings, a continuation of very low fertility in some European and Asian countries will place them beyond assistance from migration in circumventing substantial population decline. However, they could benefit from its effects in reducing peak percentages in the older ages. While the models are indicative both of circumstances to avoid and of beneficial policy strategies, they can do no more than illustrate the long run effects of holding demographic rates constant. In real populations processes of change are seldom constant for long and countries do not have initial age structures exactly matching the models. Nevertheless, national population projections along the lines of those in Fig. 2.6 are important aids to decision-making through revealing consequences of particular trends.

2.6   The Tempo of Aging

Statistics on the time taken for the percentage aged 65 and over to double from 7 to 14 – reveal the protracted nature of population aging in the past. The interval for France was 115 years (1865–1980), for Sweden 85 years (1890–1975), the United States 69 years (1944–2013) and the United Kingdom 45 years (1930–1975) (Kinsella and Phillips 2005: 13). A striking development, foreshadowed in the United Nations medium variant projections, is the increasing tempo of aging. The pace of change is likely to quicken, partly because the large generations, born in baby booms and the population explosion, are growing older, and partly because of the extent of fertility decline in some countries. Associated with the latter is the undermining of age structures and the strengthening of negative momentum. Their continuation in coming decades would produce, around mid-century in some societies, exceptionally rapid population aging and unprecedented strains on welfare systems.

This is shown by further statistics on the tempo of aging, measuring the time taken to add five to the percentage in the older ages. The figures were calculated from United Nations (2001) estimates and projections from 1950 to 2050. Typically, the shift from 10% to 15% is protracted – the figure is 45 years for the United States,

and 33 years for more developed regions overall. The next step, from 15% to 20% is expected to be generally more rapid – 18 years for developed regions – although Germany, the United Kingdom and several other countries may have intervals roughly double this figure. The shift from 20% to 25% may take only between 10 and 16 years in the world's oldest countries. An exception is Japan, which has the shortest intervals of 8–12 years through the initial levels of aging because of its early experience of low fertility. Japan, therefore, had the most rapid rate of aging from about the early 1980s to the early 2010s. After this, the projections indicate a higher tempo of aging in Italy and Spain: in intervals of 10 years or less they might complete the steps from 25% to 30% and from 30% to 35%. The speed of aging here highlights the prospect of sudden and extreme consequences awaiting countries with persistent very low fertility. The highest figures are the most speculative, however, as they refer to developments in the 2040s. Other projections imply a somewhat lower tempo around mid century, that is if fertility in developed countries is a little above that projected in 2000. A key point is that if hyper-aging is allowed to develop, shifts to higher levels of aging are likely occur at progressively shorter intervals. The challenges of adjusting to such circumstances would far exceed current experience.

2.7 Conclusion

Unbalanced age structures, with inherent potential for excessive aging and rapid population decline, are products of the new demography. There is now greater uncertainty about the future than seemed likely when the classical demographic transition was the dominant model, because the potential range of variation is wider and the need for varied policy interventions is greater as well. What may seem minor features today can expand into major concerns. Long range projections raise issues that are not simply matters for future generations to address, but are essential input to present-day planning. Some dismiss long range projections as science fiction, especially if they include the unborn children of unborn parents. This overlooks the experimental applications of projections in clarifying the long-range implications of different population trajectories. They assist in identifying the advantages and disadvantages of current trends in light of possible developments at a number of points into the future. Also overlooked is the fact that certain changes, such as growth in the numbers of middle aged and older people, are built into a population's age structure and will be relevant to policy making for many decades ahead. Thus projections are widely recognized and carefully scrutinized aids to anticipating developments that flow from the present situation and which, without change or redirection, may have the potential to become socially disruptive. Looking to the long-term future is all the more relevant because it seems unlikely that countries with the lowest fertility will return to levels near replacement by 2025. Rising life expectancy, a widely desired goal, is similarly fostering the emergence of societies in which, for the first time in history, older people will outnumber children.

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