



## World Population and Human Capital in the Twenty-First Century

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## Future Fertility in Low Fertility Countries

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### Abstract and Keywords

Chapter 3 is the first of six that present a comprehensive science-based assessment of what we know today about the drivers of future fertility, mortality, migration, and education. This chapter concerns countries with currently low fertility. It presents and justifies assumptions for future fertility trajectories based on an overview of recent fertility changes in major low-fertility regions, a discussion of theoretical arguments, a review of factors contributing to fertility change and variation during the late phases of demographic transition, a global survey of experts, and an invited meeting of experts. The survey contains 184 expert assessments with forecasts of period total fertility rates in 2030 and 2050, and substantive assessments of the validity and potential impact on fertility of 46 possible fertility-influencing factors. Invited experts participating in a meeting in Vienna in December 2011 helped transform these survey results into the scenarios that informed the projections reported in this book.

**Keywords:** low fertility, experts, forecasts, education, demographic transition, fertility change, TFR, total fertility rate

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**(p.40)** 3.1 Introduction and summary of past trends: beyond the fertility transition

### 3.1.1 Introduction

#### 3.1.1.1 The future of the low fertility world

The ongoing transition to low fertility is, alongside the long-term expansion of life expectancy, the key force reshaping populations around the world. It has sweeping economic and social repercussions as it affects labour markets, intergenerational ties, gender relations, and public policies. Many middle-income countries, including China, Brazil, Iran, and Turkey, have joined the expanding list of low fertility countries. Consequently, low fertility is no longer an exclusive feature of rich Western societies. As close to half of the global population now lives in regions with below replacement fertility, low fertility has become a truly global phenomenon.

What are the key ingredients of this ‘revolutionary’ change? Expanding education, rising income, the rise of gender equality, female labour force participation, ideational changes, consumerism, urbanization, family disintegration, economic uncertainty, globalization, modern contraception, and many other complementary or contrasting forces are often highlighted. But how will these drivers shape the long-term future of fertility? Will fertility in most countries stabilize at around the replacement level threshold, as implied by the demographic transition theory, or will it decline below this level? Is very low fertility merely a ‘passing phenomenon’, a sign of a temporary imbalance between rapid social and economic changes and opportunities on the one hand, and family, gender relations, and reproduction on the other?

#### 3.1.1.2 Outline of this chapter

This chapter aims to present both a comprehensive overview of the forces shaping contemporary reproductive behaviour in low fertility countries and an exploration of possible future scenarios based upon a new IIASA-Oxford survey of international experts introduced in Chapter 2 of this volume.<sup>2</sup> We begin with a presentation of recent trends in fertility in low fertility settings followed by a review of the particular recent histories of fertility change in North America, Europe, and the emerging low fertility settings in East Asia, Latin America, and the Middle East. We then explore the theoretical and empirical evidence that has been cited in the literature as underpinning these past trends and possible future scenarios. As well as ‘meta-theories’ such as the Second Demographic Transition (SDT), section 3.2 considers the roles played by cultural, biomedical, and economic factors, family policies, economic uncertainty, education, and the contribution of migrants’ fertility.

**(p.41)** The concise summaries of underlying drivers of recent fertility trends presented in section 3.2 pave the way for the overview of the main results of the expert survey in section 3.3. While most demographers, as well as the global projection scenarios by the United Nations (UN), expect that fertility will

continue declining in countries with currently higher fertility rates (Chapter 4), there are many uncertainties about the future of fertility in the low fertility world. Some of these uncertainties have been addressed in the IIASA–Oxford global survey of population experts, which included a module on the future of fertility in low fertility countries and the main factors likely to drive these future trends. In section 3.3, therefore, we outline the *raison d'être* for the expert survey, its design, and evaluation, and present the results of the qualitative element of the survey—namely the subjective appraisal of a series of forces shaping future trends of fertility in low fertility settings.

In section 3.4 we present the results of the quantitative component of the survey. Here, experts were invited to provide point and range estimates of period total fertility rates (TFRs) in 2030 and 2050. In addition to summarizing these figures, we compare them to the assumptions used by the UN in their global population projections. Section 3.5 takes all of the information gathered throughout the exercise, as well as the arguments of the experts participating in the Vienna meeting, and demonstrates how we then produce a series of fertility projections scenarios—medium-term until 2050, and very long-term until 2200—to be integrated into the Wittgenstein Centre (WIC) global population projections. In particular, we attempt to integrate education-specific futures into our projection scenarios.

Compared to many existing studies on low fertility, this chapter is innovative in several respects. First, in line with the evidence that low fertility has become a global phenomenon, it covers both the ‘traditional’ low fertility world (Europe, Japan, North America, Australia, and New Zealand) and the more recent and emerging low fertility regions. Thus, it also bridges the increasingly artificial distinction that is still often made between ‘developing’ and ‘developed’ countries. Second, the discussion about likely future developments is shaped by the views of experts who represented in their responses as many as 42 low fertility countries. This is an important step forward in overcoming the limitations of traditional population projections, where a few carefully selected experts formulate national and global fertility scenarios. It also allows incorporation of ‘nonconformist’ voices that might otherwise be disregarded (Lutz et al., 1999a). One way to find out that our approach does make a difference from the more traditional projection-making exercise was to compare the projected future fertility trends with those of the 2010 World Population Prospects by the UN (see section 3.4.2). Third, many contributing authors and collaborators have been involved in drafting selected sections of the chapter and also in reviewing its early drafts. Finally, the special focus on education brings to the fore a dimension that can be quantified, has been neglected in the past population analyses and projections, and, at the same time, has been suggested as ‘a key factor, if not the single most important determinant in development’ (Lutz et al., 1999b, p. 45; see also Chapter 2). Specifically, we argue that rising education level, among women, is the most important factor

contributing **(p.42)** to the observed global fertility trends in the last decades, especially the decline of fertility in higher fertility countries, and the postponement of parenthood to higher childbearing ages in affluent countries with low fertility. In addition, the inclusion of education is also adding a ‘quality’ dimension to the otherwise quantitative study of population changes (Lutz and KC, 2011).

### 3.1.2 The ongoing fertility transition in East Asia, the Middle East, and Latin America

Half a century ago, the global fertility map was polarized, reflecting the traditional division between ‘developed’ and ‘developing’ countries. The group of the ‘more developed countries’ (MDC; defined by the UN for statistical purposes as Europe, Northern America, Japan, Australia, and New Zealand) had experienced relatively low fertility by the early 1950s and saw gradual, but continuing, fertility reduction from the late 1960s through the 1990s, when the period TFR<sup>3</sup> in the region fell below 1.6 (UN, 2011; Figure 3.1a). In contrast, the group of the ‘less developed countries’ (LDC)—that is, all other regions not listed earlier—had high and stable fertility rates at about six births per woman throughout the 1950s and 1960s: more than double the level of the MDC group. However, in the early 1970s, sustained fertility declines across much of the LDC group had begun, with the whole set of countries reaching a TFR level of 2.6 by 2010 (PRB, 2012)—a level reached by European countries in the 1950s and early 1960s. The continuous and strong fertility declines in the LDC group led to the gradual reduction in fertility differences between major world regions that began in the early 1970s, with only sub-Saharan Africa and parts of Asia recording fertility rates above four births per woman in 2010 (PRB, 2012).

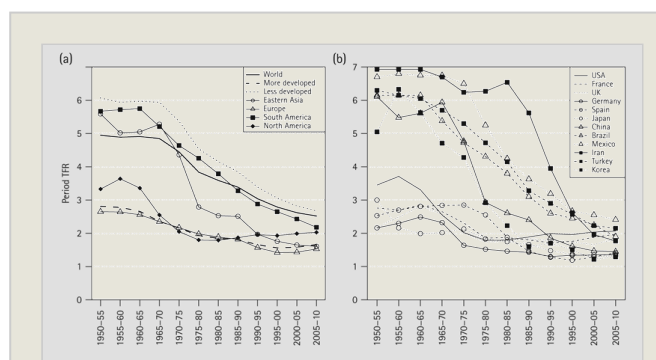
Three regions covered in this chapter—Latin America, East Asia, and parts of the Middle East—have undergone dramatic fertility transformation since the 1960s. The breathtaking pace of fertility decline in the largest countries in these regions is illustrated in Figure 3.1b. In 1960–65, fertility in these countries ranged from a TFR of 5.6 in China and South Korea to 6.8 in Mexico and 6.9 in Iran. Rapid fertility declines then ensued, with fertility rates typically falling by a half in the course of 2–3 decades. This surprising pace of fertility transitions is partly attributed to government action concerning family planning, whether through explicit restrictions in China (see section 3.1.4.10), effective campaigns in Korea and elsewhere in East Asia (Choe and Park, 2006), or the sanctioning of family planning by religious authorities in Iran (Abbasi-Shavazi et al., 2009a). However, the remarkable similarity of fertility transitions, with all of the **(p.43)** compared countries experiencing fertility rates in 2005–10 ranging from 1.45 in China to 2.4 in Mexico, indicates that while targeted government action might have facilitated or accelerated observed changes, fertility change was driven by a host of other factors related to socio-economic development, modern contraception, and new values and norms favouring small family sizes (e.g. Cai,

2010 for China). Caldwell (2001, p. 109) sees this transformation as a manifestation of a 'globalisation of fertility attitudes and behaviour'.

As the boundaries between MDC and many LDC countries are becoming increasingly blurred with regard to demographic and socio-economic characteristics, so it is with fertility behaviour. Many 'less developed' countries, including China, Cuba, and Iran, have lower fertility today than some of the countries traditionally belonging to the club of the 'most developed' countries with low fertility, such as Sweden, France, and the USA. Indeed, more than 45 per cent of the global population lives in countries with below replacement fertility levels, and when regions of India are taken into account, more than half of humanity lives in below replacement fertility settings (Wilson and Pison, 2004). Low fertility is no longer an issue confined to the most affluent societies, but has become an important topic for public discussion and a motivation for development of government policies. On the one hand, a few countries have even reversed their policies and become explicitly pro-natalist either through limiting family-planning programmes (as in Turkey and Iran) or through extensive, explicitly pro-natalistic family policy interventions (e.g. Singapore, Taiwan, South Korea) (section 3.1.4.8). On the other

(p.44) hand, the Chinese government has been slow to respond to demographers' arguments calling for the dismantling of China's fertility restrictions, which limit the authorized number of births per couple (Wang et al., 2013).

With this transformation in fertility regimes, many new questions arise. Where will fertility decline stop? Will East Asia retain the position of the lowest-fertility region globally? Will the Middle East and Latin America follow and experience decades of very low fertility? Can previous experience of post-transitional fertility trends in Europe, the USA, Japan, and other rich societies serve as a guide to what might happen elsewhere? Will many non-European countries experience protracted postponement of family formation to ever-later ages, depressing period fertility levels for many decades to come (Bongaarts, 1999)?



**FIGURE 3.1(a, b)** Period total fertility rate (TFR) in major world regions and in largest countries covered in this chapter, 1950-55 to 2005-10.

**Note:** Period TFR in China in 1990-2010 is likely to be overestimated in the official statistics and the UN data (see Box 3.1); data shown are based on Zhao and Zhang (2010, p. 490, Table 6).

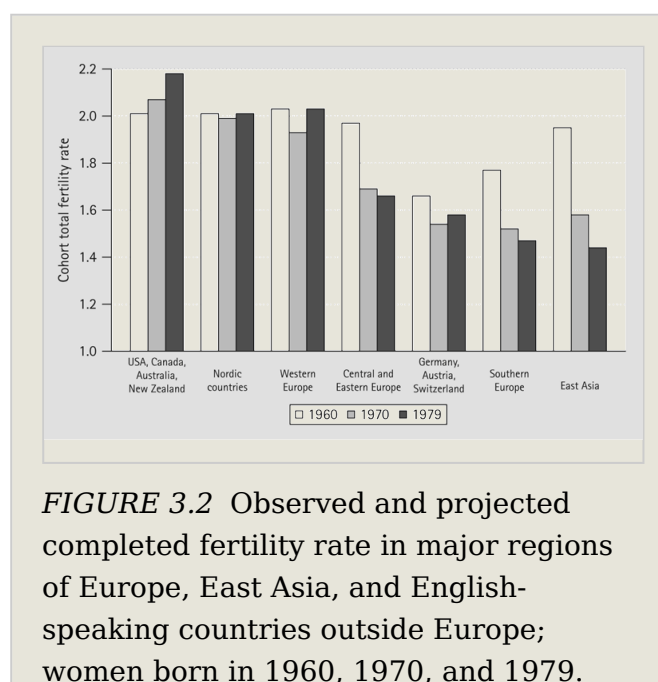
*Data source:* UN (2011, Table A.22).

### 3.1.3 Europe, the USA, Japan, and other highly developed countries

The USA, Canada, Japan, and most European countries have a long history of low fertility rates. In the 1930s, in the context of economic crises and shifts in values and attitudes towards family, many Western countries, including Austria, Germany, Sweden, and Great Britain, temporarily experienced TFRs falling below two births per woman (Kirk, 1946; Van Bavel, 2010a). In the 1970s and 1980s ever more developed countries experienced what were thought to be irreversible falls of fertility to sub-replacement levels, while, in the 1990s, a phenomenon of 'lowest-low fertility' with a TFR declining below 1.3 temporarily affected countries with more than half of Europe's population (Kohler et al., 2002; Sobotka, 2004a). Beginning in around 2000, however, declines in period fertility halted and an upturn took place across most low-fertility regions, with the notable exception of East Asia (Goldstein et al., 2009; OECD, 2011). The upturn lasted until the onset of the global economic recession in 2008 (see also Box 3.3). This fertility recuperation was largely an expected consequence of the slowing-down in the pace of fertility postponement and the associated tempo effect (Bongaarts and Sobotka, 2012; see also section 3.2.2). It marked the first concerted rise in fertility across the developed world, with many countries registering an absolute TFR increase of 0.3–0.6, or around 20–40 per cent in absolute terms (Goldstein et al., 2009). Moreover, this fertility increase demonstrated that there is nothing inevitable about extreme low fertility rates, as many former state-socialist countries that were seemingly 'stuck' at very low fertility levels suddenly experienced remarkable increases in their period TFRs.<sup>4</sup>

While period fertility rates are notoriously unstable, estimates and projections of cohort fertility suggest a broad stabilization or even a small increase among the women **(p.45)**

born in the 1970s in most European countries, as well as the USA, Australia, Canada, Japan, and New Zealand (Myrskylä et al., 2013). Figure 3.2 presents observed and projected completed cohort fertility rates (CFR) for larger regions in Europe and East Asia among women born in 1960–79, based on the computations of Myrskylä et al. (2013).<sup>5</sup> Although the data for the most recent cohort, 1979, are still subject to possible downward revisions owing to the recent recession-induced period fertility declines (section 3.2.4; see also Box 3.3), the contrasts in regional fertility





trends are sizeable and robust. Among women born in 1960, five out of seven analysed regions had fertility rates very close to two children per woman; only Southern Europe (CFR at 1.77) and the three predominantly German-speaking countries in Central Europe (Austria, Germany, and Switzerland, CFR at 1.66) showed an early spread of fertility well below replacement. Subsequently, regional cohort fertility trajectories diverge. The English-speaking countries outside Europe show a modest increase to cohort fertility slightly above replacement in the 1979 cohort (CFR at 2.18), chiefly because of the projected fertility increase in the USA (CFR at 2.23). Nordic countries have a flat fertility trend at around a CFR of 2.01. Western Europe shows a slight U-shaped trend, with a projected CFR in the **(p.46)** 1979 cohort identical to that in 1960 (2.03). In contrast, former state-socialist countries of Central and Eastern Europe (CEE) display sizeable falls in cohort fertility in the 1960s cohorts, with the projected CFR down to 1.66 in the 1979 cohort; even stronger and continuous declines are projected for East Asia (Japan, Korea, Singapore, and Taiwan), where the projected CFR falls to the lowest level of all regions analysed (1.44). Finally, cohort fertility in the two regions with earlier onset of sub-replacement fertility is expected to decline as well, moderately in the three German-speaking countries (with a slight recovery in the 1970s cohorts) and more in Southern Europe, eventually falling below the 1.5 threshold (CFR of 1.47 in the 1979 cohort).

Prior to the fertility upturns of the early twenty-first century, a notable reversal in an aggregate correlation between socio-economic and cultural indicators and fertility rates occurred (Castles, 2003).

Factors traditionally associated with low fertility rates became associated with higher fertility when most developed countries were compared with each other (see also section 3.2.1). While these findings were often not replicated at the individual level, they nevertheless signal an important change. The aggregate reversal was most

frequently discussed in the relationship between women's labour force participation and fertility (Brewster and Rindfuss, 2000; Engelhardt and Prskawetz, 2004). More recently, it has been suggested that at advanced levels of development, further increases in development no longer translate into lower fertility, but could instead lead to rising fertility rates (Myrskylä et al., 2011, 2009; OECD, 2011; section 3.2.1).

**Notes:** Completed fertility is partly projected in the cohorts born in 1970 and 1979. Regional data are weighted by population size in 2012 of all countries in a given region. The region 'Central and Eastern Europe' includes all former 'state-socialist' countries of Europe, including the former Soviet Union (except Latvia), but excluding most of the former Yugoslavia, where only Slovenia was included (data not available for other countries). 'East Asia' includes Japan, South Korea, Singapore, and Taiwan.

**Sources:** Computations based on cohort fertility data and projections presented by Myrskylä et al. (2013, Table 2).

### 3.1.4 Summary of past trends and key factors in major low fertility regions

In this section we outline recent trends in fertility by region.<sup>6</sup> We use regions that are distinct geographically, economically, culturally, and demographically. In Europe we distinguish smaller regions that mirror particular histories of low fertility and family patterns.

### **3.1.4.1 The USA, Australia, Canada, and New Zealand**

The USA, Australia, Canada, and New Zealand have shared similar fertility patterns for much of the post-World War II period, including a relatively a pronounced baby boom in the 1950s and early 1960s. Between 1960 and 1980, these countries experienced fertility declines from around 3.5 (higher in New Zealand) to sub-replacement TFRs ranging from 1.8 in Canada to 2.0 in New Zealand (Preston, 1986). In the USA, fertility decline bottomed out in 1976 when the TFR reached 1.75, the lowest level recorded to date.

**(p.47)** Since 1980, fertility has remained relatively stable. While the USA experienced gradual increases, Canada's fertility decline continued through to 2000 when it briefly dropped below 1.5. By then, the fertility contrast between Canada and the USA surpassed half a birth (TFRs of 1.49 and 2.05 respectively). Most recently, US fertility declined most following the onset of the recession, while Canada's TFR showed continued slow recovery. The period TFR in 2011 ranged from below 1.6 in Canada through 1.9 in Australia and the USA up to a 'high' value of 2.1 in New Zealand. The lower fertility in Canada is illustrated in differences in cohort fertility among women born in 1970, which declined below 1.8 in Canada, but remained above 2.0 in the other three countries, reaching 2.02 in Australia, 2.11 in the USA, and 2.17 in New Zealand (Myrskylä et al., 2013; see Table 3.2).

The USA has relatively high fertility compared with most other developed countries, which, combined with its population size of 314 million, warrants special attention. Different explanations have been proposed to explain the USA's 'exceptionalism' in fertility, including higher fertility rates among specific migrant and minority groups, especially Hispanics; a slower trend toward delayed childbearing; stronger importance of religion; and highly flexible labour markets combined with ample availability of cheap private childcare (Frejka, 2004; Hayford and Morgan, 2008; McDonald and Moyle, 2010). But, arguably, the key factor in the higher fertility in the USA is the closeness of intended and realized family size, with the level of intended fertility being only slightly higher than observed period TFRs despite considerable inconsistency in the number of children individual women intend and actually bear (Morgan and Rackin, 2010; see also section 3.2.3.1). In other words, a large number of women 'miss their target,' but approximately equal numbers miss low and high. The primary reason many women exceed intended parity is a high frequency of unplanned pregnancies—especially among teenagers and low educated and economically disadvantaged social groups (resulting in unintended and unwanted births) (Finer and Zolna, 2011; Musick et al., 2009). Almost half of all pregnancies (49



per cent in 2006) in the USA are unintended, with very high shares among never-married young women. In contrast, Canadian completed fertility is more than 0.3 births per woman lower despite evidence of a 'remarkable stability of fertility intentions reported by Canadian women' averaging 2.1 births (Edmonston et al., 2010, p. 320). While high teenage childbearing has been a general characteristic of English-speaking countries, this is less true for Canada, where the mean age of childbearing has increased to nearly 30 years, similar to Western Europe. Thus, Canadian women, as in much of Europe, have low fertility because, in the language used earlier, many more 'miss low than high'. The Canadian and US difference may also represent different effects of immigrant fertility (see also section 3.2.6). The flow of Hispanics (especially Mexicans) into the USA increases fertility (Frank and Heuveline, 2005); immigrants to Canada (primarily from Asia) often exhibit higher fertility initially (with a notable exception of Chinese immigrants who display low fertility early on), but their fertility quickly falls to the levels of natives (Woldemicael and Beaujot, 2012). Among the second generation, fertility among migrants is, in fact, lower (Adsera and Ferrer, 2010).

**(p.48)** If one compares 2010 non-Hispanic whites' TFR in the USA with overall Australian TFR, the rates are very similar (1.8 and 1.9 respectively). Australia's selective immigration policy reduces the impact of immigrant fertility. In contrast, the higher TFR seen in New Zealand—in 2010 the second highest after Iceland (2.2) among the most developed countries—partly reflects the higher fertility rates of Māori and Pacific women (New Zealand Government, 2010).

### 3.1.4.2 Latin America and the Caribbean

The most recent UN estimates show a TFR in the Latin America and Caribbean (LAC) region of 2.3 births per woman in 2005–10, with a falling trend of about 0.2 every 5 years (UN, 2011).<sup>7</sup> As such, by the time of publication it is highly likely that period TFR in this region has fallen to replacement rate.

Brazil and Mexico are key to understanding the trends in LAC given that their populations make up about 50 per cent of the region's population. Brazil has recently reached sub-replacement fertility with an estimated 2009 TFR of 1.94 (IBGE, 2010). In Mexico, meanwhile, the TFR is estimated at 2.4 births per woman in 2005–10 (UN, 2011). In both countries this represents a fall of over four births per woman since the onset of the fertility transition in the 1960s. Fertility decline in Brazil accelerated in the 2000s (Potter et al., 2010), concurrent with rapid economic growth and broadening of the middle class. Brazilian fertility is clearly heading to levels substantially lower than replacement, especially if Brazil experiences an intensive postponement of childbearing similar to that experienced in European and East Asian countries in recent decades. By contrast, fertility decline in Mexico has slowed down: its TFR estimate for 2005–10 was corrected upward by 0.2 in the light of the 2010 census results. The anticipation of the Mexican government of reaching the

replacement level by 2005 (Tuiran et al., 2002) will only be fulfilled at least a decade later.

The highest fertility in LAC occurs in the two countries with the largest indigenous ethnic groups (CELADE, 2012): Guatemala (41 per cent indigenous) and Bolivia (62 per cent) with a TFR of 4.1 and 3.5, respectively, as well as in Haiti, the poorest country in the region, which has a TFR of 3.5. The onset of the fertility transition arrived in these countries later—in the 1970s and 1980s—but their fertility decline has been faster in the first decade of the twenty-first century, by about one birth per woman compared to the LAC average of 0.4 (UN, 2011). There is no reason to believe that the fertility decline in these ‘laggard’ countries will stop before reaching the replacement level.

Cuba has the lowest TFR in LAC, estimated at 1.8 in 2011 (ONE, 2012), following an upturn from a low of 1.4 in 2006. But even in Cuba, adolescent fertility remains **(p.49)** relatively high at 57 births per thousand women aged 15–19 in 2011. This high adolescent fertility is a characteristic of the whole region, with an average rate of 73 per 1000 (Rodríguez, 2011). Closely related are the statistics revealing that women in Latin America also report very high shares of unwanted pregnancies and births, ranging from 21 per cent in Paraguay to 60 per cent in Bolivia in the early 2000s (Casterline and Mendoza, 2009, Figure 1). However, recent census and survey data suggest both teenage fertility rates and unwanted fertility rates have declined in the region, fuelling, to a large extent, the observed fertility decline (Casterline and Mendoza, 2009). The social imperative of early motherhood and motherhood in general, which has long prevailed in the region, is weakening in young cohorts (Rosero-Bixby et al., 2009). An increase in voluntary childlessness coupled with further reductions in unwanted fertility and the trend towards childbearing postponement would facilitate the occurrence of lowest-low fertility levels, similar to those in Southern Europe, in many LAC countries.

### 3.1.4.3 Western Europe

Western European countries (Belgium, France, Ireland, Luxembourg, the Netherlands, and the UK)—alongside the Nordic countries—generally exhibit higher fertility than other parts of Europe. They share family and fertility patterns typical of an advanced stage of the SDT, marked by a late timing of childbearing, high rates of extramarital childbearing, and a high labour force participation of women (see section 3.2.1). In Western Europe, the trend toward late childbearing had already begun in the early 1970s, but slowed after 2000. This led to a pronounced cycle of fertility decline after 1970s and a gradual fertility recovery in more recent years, especially between the late 1990s and 2008 when period and cohort fertility levels converged to similar values. Once changes in fertility timing are taken into account, period and cohort fertility levels in Western Europe have been remarkably stable during recent decades despite the ongoing trend to later childbearing, rapid family transformations,

rising tertiary education, female labour participation, and more competitive labour markets (section 3.1.3).

Fertility outside marriage has been increasingly accepted since the 1970s, so that by 2011 between 34 per cent (Ireland) and 55 per cent (France) of births took place outside marriage, mostly in cohabiting unions. This broad acceptance of cohabiting unions and childbearing outside marriage may arguably have a positive impact on fertility (section 3.2.1).

France and the UK have similar fertility levels, with the period TFR close to 2.0 in 2010, and cohort fertility of women born in 1970 at the same level for France and a slightly lower level of 1.9 in the UK (VID, 2012). But this similarity masks contrasts with respect to birth timing, order-specific fertility, and social status differences in fertility, which partly reflect different institutional conditions, including family policies, norms, and contraceptive use. The French fertility pattern, similarly to the Nordic countries, can be characterized as 'egalitarian', with low childlessness and relatively low differentials by social status (Ekert-Jaffé et al., 2002; Rendall et al., 2009). This can be explained, in part, by an **(p. 50)** active family policy introduced in France in the 1940s and adapted in the 1980s to accommodate women's entry into the labour force. Pro-natalist in nature, this active set of policies seems to have created especially positive attitudes towards two- or three-child families in France (Toulemon et al., 2008).

The fertility pattern in the UK can be seen as 'polarized', marked by high childlessness of around 20 per cent (especially among women with a university education), a higher share of women with four or more children, high social status differentials (Ekert-Jaffé et al., 2002), and, similar to the USA, higher rates of both teenage and unintended pregnancies. Since reaching a low point of 1.6 in 2001, period TFR in the UK has increased as a consequence of the diminishing importance of the tempo effect, higher fertility among immigrants, and, arguably, the introduction of a raft of more 'family-friendly' policies (Sigle-Rushton, 2008).

Ireland, until recently a more conservative Catholic country than others in Western Europe, has been an outlier in Western Europe in maintaining a high TFR above 3.0 until the mid-1970s and barely falling below 2.0 in the period 1994–2006. In contemporary Ireland a strong preference for larger families seems to be in evidence (Testa, 2012). In fact, Ireland now has the highest TFR level in Europe of 2.11 in 2011, followed by Iceland (2.04 in 2012) and France (2.00 in 2012).

The Benelux countries (Belgium, the Netherlands, and Luxembourg) also experienced sharp declines in fertility in the 1970s and 1980s, followed by a gradual recovery. In the Netherlands TFR briefly fell below 1.5 in the early 1980s, but a subsequent recovery brought it back to about 1.7 by the turn of the

millennium, a rate similar to Belgium and to the completed fertility in both countries. In the Netherlands, a combination of work and family life is facilitated by a wide adherence to part-time work, which is very common among women with children, and also of some significance among men (Yerkes, 2009). In Belgium, a relatively high and stable cohort fertility (just above 1.8 for the 1950s–1970s cohorts) went hand-in-hand with reversals in the educational gradient in fertility, with tertiary educated women having above average fertility levels since the 1950s cohorts (Neels and De Wachter, 2010).

#### **3.1.4.4 Central and Eastern Europe**

CEE is an economically, culturally, and demographically heterogeneous region composed of countries that belonged to a state-socialist political system that collapsed between 1989 and 1991. Fertility rates in the region fell to relatively low levels in the late 1950s following legalization of abortion and a push to dramatically expand women's labour force participation. Unlike many other parts of Europe, CEE did not experience a distinct baby boom in the 1950s and 1960s, instead recording some of the lowest fertility rates globally, with some countries, including Croatia, Hungary, Romania, Russia, and Ukraine, experiencing sub-replacement TFR levels (Sobotka, 2011). In response, governments started stimulating fertility in the form of social, housing, and family policies, as well as more restrictive measures, especially limiting access to abortion (David, 1999).

**(p.51)** By the late 1990s the CEE countries stood out as a result of their almost universal and relatively early marriage and childbearing, a strong adherence to the two-child family norm, and high abortion and divorce rates, especially in parts of the former Soviet Union (Sobotka, 2003). Political regime change in 1990 resulted in a long and painful period of economic and social transformation toward a market economy, parliamentary democracy, and, in the case of central Europe, Bulgaria, and Romania, eventual entry to the European Union (EU) (Heyns, 2005). Fertility and family have changed profoundly, with marriage and fertility trends best characterized by later, fewer, less universal, and—with respect to social status differential—more heterogeneous. A rapid shift toward later timing of births generated a sizeable tempo effect, which exacerbated the fertility decline in the 1990s, leading to extreme low levels of period fertility rates across the whole region at the end of the decade (Goldstein et al., 2009; Sobotka, 2003). The multifaceted nature of fertility changes fuelled discussion of both positive and negative aspects, including falling living standards, expanding tertiary education, new opportunities, the spread of modern contraception, and new attitudes typical of the SDT. Because these changes proceeded simultaneously, it is impossible to single out the effects of individual factors that drove fertility decline and postponement (Philipov and Dorbritz, 2003; Sobotka, 2011).

After recovering somewhat in the decade since 2000, fertility rates in CEE still remain relatively low, with a period TFR ranging between 1.3 in Latvia and Hungary and 1.5–1.67 in Estonia, Belarus, Lithuania, Russia, and Slovenia in 2010. The lowest levels of completed fertility rates among women born in 1970 were recorded in Russia (1.6) and Ukraine (1.55; VID, 2012). Fertility and family patterns grew much more differentiated, with Central European countries, especially the Czech Republic, Estonia, Hungary, former German Democratic Republic (East Germany), and Slovenia experiencing particularly rapid postponement of first births and also the shift away from marriage to cohabitation and single living, including single motherhood, especially among socially disadvantaged women (Perelli-Harris et al., 2012). The prolonged experience of very low fertility rates led to renewed concerns about low fertility and population decline, and to the resurgence of explicit top-down pro-natalism in parts of Eastern Europe, especially in Belarus and Russia, where achieving higher birth rates is seen as a matter of national interest and a key for achieving ‘demographic security’ (e.g. Heino, 2012; Ministry of Labour, 2010).

#### **3.1.4.5 Germany, Austria, and Switzerland (‘German-speaking’ countries)**

A number of distinct fertility developments in Austria, Switzerland, and Germany can be pointed out. First, fertility has been lower in these three countries than in most of Europe since the 1920s, and the fall in fertility rates after 1964 took place with greater intensity than in neighbouring regions. The Federal Republic of Germany (Western Germany) was the first European country to experience a TFR fall below 1.5 in 1975 and a brief decline below 1.3 a decade later. Second, fertility has remained at similar low levels since the mid-1970s, little affected by the shifts typical for many other parts of Europe **(p.52)** (Dorbritz, 2008; Prskawetz et al., 2008). In 2011 the period TFR ranged from 1.36 in Germany to 1.52 in Switzerland, slightly above the lows reached between 1994 and 2001; the adjusted TFR that aims to eliminate influences of the changes in the timing of births (section 3.2.2) has remained around 0.2 higher. Third, low fertility in Austria, Switzerland, and Western Germany is largely attributable to high childlessness, especially among university educated women. Finally, low fertility appears to be linked to low family size intentions and ideals, in contrast to North America (Goldstein et al., 2003; Sobotka, 2009).

In Germany, low fertility has resulted in a negative balance between births and deaths since 1972. The data for Germany hide persistent contrasts in fertility patterns and their underlying institutional conditions between the eastern and western parts of the country (Basten et al., 2011; Goldstein and Kreyenfeld, 2011; Kreyenfeld, 2010). However, differences in fertility levels diminished after the post-unification ‘demographic shocks’ in Eastern Germany (Conrad et al., 1996) when a record low TFR level of 0.77 was reached in 1993–94 (Goldstein and Kreyenfeld, 2011).

As the three countries were relatively little affected by the recent economic recession, fertility rates remained stable after 2008. Projections suggest a stabilization in completed fertility rates among Austrian women born after 1970 at a level of 1.6 and a slight rise among (West) German women, who reached the lowest cohort fertility in Europe of 1.5 in the 1968 cohort (Myrskylä et al., 2013; VID, 2012).

### 3.1.4.6 Nordic countries

The five Nordic countries (Denmark, Sweden, Norway, Finland, and Iceland) are characterized by stable and relatively high fertility, with completed cohort fertility of postwar generations consistently around two children per woman (Andersson et al., 2009). In Finland, for example, two surviving children per mother has been the dominant pattern for well over a century (Liu et al., 2012). Women born in the 1960s had their first child 2–3 years later than those born in the 1950s, and mean age at first birth is now around 29 years. There has also been a steady increase in childlessness, reaching around 15 per cent for women born in the 1960s (Andersson et al., 2009). The great majority of Nordic women wish to have two or three children, and voluntary childlessness stands at less than 5 per cent (Miettinen, 2010).

The period TFR increased modestly after the early 1980s, peaking in 2008–10, and then began declining, arguably as a result of the recent economic recession. Apart from Iceland, which retained a TFR around replacement level (reaching 2.23 in 2009, but declining thereafter), Norway has the highest completed fertility (Andersson et al., 2009), as well as lowest ages at first birth and lowest proportion of childless women (around 12 per cent for women born in the late 1960s). Denmark had the lowest fertility in the 1980s with the TFR falling briefly below 1.4, but is now close to Finland with a TFR of 1.73 in 2012. Finland exhibits higher childlessness, around 19 per cent for the youngest cohorts now completing their fertility (Miettinen, 2010). Projections by national statistical offices published in 2012–13 assume fertility rates just below replacement levels by **(p.53)** mid-century, reaching—in 2050—1.89 in Norway, 1.91 in Sweden, and 2.00 in Iceland, according to the medium variant (online databanks of Statistics Sweden, Statistics Norway, and Statistics Iceland, accessed 20 June 2013).

Higher fertility in Nordic countries is often explained by generous family policies and high levels of gender equality (Rønsen and Skrede, 2010; see also section 3.2.5). Availability of local childcare has been shown to increase fertility at all parities (Rindfuss et al., 2010), while family policy in the form of childcare allowance buffered Finnish fertility at higher parities during the severe economic recession in the early 1990s (Vikat, 2004). Gender equality also appears to promote family formation in the region, but not necessarily progression to third or later births (Duvander et al., 2010). The relationship between socio-economic status and number of children is positive among men,



and neutral or positive among mothers (Kravdal and Rindfuss, 2008; Lappegård et al., 2011).

#### **3.1.4.7 Southern Europe**

Fertility in Southern Europe has undergone major changes during recent decades. Fertility rates remained among the highest in developed countries well into the late 1970s. In 1975 the TFR ranged from 2.80 in Spain and 2.75 in Portugal to 2.32 in Greece and 2.21 in Italy. Since the mid-1980s, however, all these countries experienced a dramatic fertility decline. After 1992, Italy and Spain became the first countries in Europe to experience ‘lowest-low fertility’—a TFR below 1.3 (Kohler et al., 2002)—with Greece joining them in the late 1990s. The decrease was initially more moderate in Portugal. Tempo effects associated with the rapid expansion in educational attainment and subsequent entry of women into the labour market are estimated to have depressed TFR by about 0.3 during the late 1990s, although this influence decreased thereafter (for Spain, see VID, 2012).

Furthermore, high unemployment rates during the late 1980s and early 1990s contributed to fertility postponement (Adsera, 2011a); indeed, the mean age at first birth in Spain and Italy, about 30, is now among the highest in Europe. Childlessness has been rising rapidly but still remains at less than 20 per cent. Surveys on fertility intentions indicate only a low proportion of women desiring no children (Testa, 2012). Since the 1990s almost all Southern European countries have experienced a rapid increase in the share of out-of-wedlock children, an uncommon occurrence until recently (Delgado et al., 2008). However, this trend is very unevenly distributed—in 2011 non-marital births comprised 43 per cent of all births in Portugal, 37 per cent in Spain, and 23 per cent in Italy, but only 7 per cent in Greece.

The consequences of the dramatic decline in fertility are evident in the age composition of the population (OECD, 2012). The current imbalance between births and deaths was compensated by large immigration flows between the mid-1990s and late 2000s, particularly to Spain and Italy, reversing the migration outflows of the 1960s and 1970s. Although migrants display, on average, higher fertility than natives, this difference diminishes over time and gives only a minor boost, if any, to the TFR (Roig Vila and **(p.54)** Castro-Martín, 2008; see also section 3.2.6). The recent economic crisis has had a strong impact in Southern Europe—particularly among recent migrants. Fertility is down from 2008 levels (see also Box 3.3), accompanied by a decrease in immigration flows or even net outflows in Spain.

#### **3.1.4.8 The Middle East**

In 1950, the TFR in the Middle East stood at 7.0, higher than in other world regions, including sub-Saharan Africa. The lowest TFR was recorded in Lebanon (5.7), while the highest was in Yemen, which had fertility above eight children

per woman. The figures for such countries as Iran, Turkey, Kuwait, United Arab Emirates, and Qatar were also remarkably high at around 7.0 (Dyer, 2008; UN, 2011). High fertility rates prevailed in the region throughout the 1950s and 1960s, and were noted by Kirk (1966), who argued that Muslim countries as a group were experiencing only the early stages of demographic transition.

Fertility decline in the Middle East commenced in the mid-1960s, and by 1980 the period TFR had slightly declined to around 6.3 in the region as a whole. However, many countries experienced an accelerated decline during the 1980s, so that by 2010 the TFR in the region was below 3.0. But the regional average masks wide cross-country differences: Iran's sharp fertility decline since the mid-1980s is, for example, unique—the TFR declined from around 6.5 in 1985 to around 2.0 in 2000, and further decreased to around 1.8 in 2006 (Abbasi-Shavazi et al., 2009b, p. 209), stabilizing thereafter and estimated at 1.9 in 2012 (PRB, 2012). The recent fertility levels in several other countries in the region have also been much lower than those recorded in the 1980s. For example, during 2005–10 the TFR in Qatar (2.2) and Turkey (2.2) was slightly higher than the figure in United Arab Emirates (2.0) and Lebanon (1.6); all of these countries have reached fertility around or below replacement. In contrast, Yemen (4.9) and Iraq (4.4) still retained very high TFR levels (UN, 2013). Indeed, many of these countries are included in Chapter 4, which deals with 'higher' fertility settings.

The high Muslim fertility observed in the past led some scholars to believe that religion and fertility were more closely correlated for Muslims than for other religious groups (Jones and Karim, 2005). However, the sharp and accelerated fertility decline of recent decades does not support this hypothesis (Abbasi-Shavazi and Jones, 2005, pp. 35–6; Eberstadt and Shah, 2012).<sup>8</sup> The decline of fertility in recent decades appears to be much more clearly linked to urbanization, advancement of women's education (Abbasi-Shavazi and Torabi, 2012; Lutz et al., 2010), and rising aspirations for women who seek employment (Jones, 2012), as well as an accentuation of children's education **(p.55)** and opportunities, access to media, changing family ideals, decline of infant mortality, and the introduction of effective contraception. Finally, there are indications that universality of marriage is also being questioned (Rashad et al., 2005; Torabi et al., 2012), with divorce rising in most countries (Singerman, 2007).

Fertility trends in Israel warrant special attention—it is a society more developed and more affluent than many countries in Europe and East Asia, yet it shows a persistence of high fertility and high fertility intentions, with the period TFR stabilizing around 3.0 since the mid-1980s (CBS, 2011). This is achieved through a unique combination of pro-natalism (policies supporting large families), cultural, ethnic, and religious diversity, and competition. Some population subgroups, especially the 'ultra-religious' Jews, maintain traditional values in tandem with very high fertility (Bystrov, 2012; DellaPergola, 2007).

Such unique conditions will not be repeated elsewhere, but the same elements may contribute to higher fertility and possibly also a return of more traditional values in some post-transitional settings in the future.

The diversity of the region implies that Middle Eastern countries will retain different fertility patterns, although recent trends and the experience of other countries suggest that further declines in fertility are likely. Some countries in the region, especially Iran and Turkey have reverted to actively pro-natalist rhetoric and policies (Roudi, 2012), which—if fully implemented—could interrupt or partly reverse fertility decline.

### **3.1.4.9 East Asian countries and territories**

Fertility decline in Asia began in the late 1940s in Japan where the TFR dropped from 4.5 in 1947 to 2.0 in 1957. It continued a slow decline to 1.5 in 1994 and 1.3 in 2002 (Retherford and Ogawa, 2006). Fertility was high in Singapore, South Korea, and Taiwan in 1960 with TFRs of around 6.0, but declined rapidly in the 1970s and 1980s (Tsuya et al., 2009). In Singapore, fertility dropped to replacement level by 1975, below 1.5 in 1998, and below 1.3 in 2003 (Yap, 2009). TFR in South Korea and Taiwan reached below replacement level about a decade later than in Singapore, in 1983 and 1984 respectively. The decline then proceeded rapidly, and the TFR fertility in these four countries dipped below 1.3 in the early 2000s. Since then, the TFR in Japan climbed slightly to 1.4 in 2010, but it remained at an ultra-low level in other countries, reaching 1.2 in Singapore and South Korea, and 0.9 in Taiwan and the Special Administrative Region of Hong Kong (statistical offices: various countries and years). Indeed, national statistical offices in the region assume that fertility in the region will stay very low (Basten, 2013a). Fertility trends are considerably less certain in North Korea, where only limited data are irregularly released by the government and official institutions; Spoorenberg and Schwegendiek (2012) show the period TFR around replacement level in two census years, 1993 (2.16) and 2008 (2.00), with a possible intermediate dip during the periods marked by famine and economic collapse.

Rapid economic development, increasing level of education among women leading to increasing labour force participation, and effective national family planning programmes (**p.56**) initiated in the 1960s (excluding Japan) are considered to be major forces behind the rapid fertility decline in all of these countries (Choe, 2006; McDonald, 2009; Tsuya et al., 2009). Fertility declines in recent decades are mostly due to delayed onset of childbearing, resulting, in part, from increasing age at first marriage combined with still low levels of non-marital births (Bumpass et al., 2009; Jones, 2007). Persistent gender inequality marked by limited involvement of men in household work and childrearing have contributed to these trends (see Box 3.2).

The importance of having a son while fertility levels were falling to below replacement level, combined with modern medical technology that allowed parents to identify the sex of the fetus and easy access to induced abortions, produced an unusually high sex ratio at birth in South Korea, Taiwan, and Singapore before the preference for boys began to weaken (Chung and Das Gupta, 2007). In contrast, fertility behaviour in Japan is not associated with son preference.

In Japan, South Korea, Taiwan, and Singapore, higher education for men is associated with higher probability of marrying, but also results in a slower pace of marriage. Among women, higher education is associated with lower probability of ever marrying and slower pace of marriage. As a result, a large proportion of men with low levels of education and women with high levels of education remain unmarried into their late 30s.<sup>9</sup> Education differentials in marriage notwithstanding, fertility decline proceeded almost simultaneously in most social groups. Especially in South Korea there was a remarkable convergence in fertility by education, indicating that rising education level contributed only a little to the observed fertility decline (Yoo, 2013). At the same time, Anderson and Kohler (2012) argued that under competitive conditions typical for East Asia, the desire of parents to provide their children with a top education makes children very costly in terms of both time and money. This 'education fever' constitutes an important force behind very low fertility in the region.

#### **3.1.4.10 China**

While a notable fertility reduction had already been observed in some Chinese cities in the 1950s and 1960s (Lavelly and Freedman, 1990), nationwide fertility decline did not begin until the early 1970s under the 'Later, Longer, Fewer' family planning policy, which encouraged 'later' childbearing, 'longer' birth intervals, and 'fewer' total births. During that decade, China's TFR fell from about 6.0 to about 2.5 children per woman. In the 1980s, following the enactment of more proscriptive family planning regulations, the TFR fluctuated between 2.3 and 2.9 (Yao, 1995). These fluctuations were largely observed in period TFR, whereas cohort fertility continued to decline during this period (Zhao and Guo, 2010). China's fertility recorded another sharp reduction in the early 1990s when the TFR fell below replacement. It declined further to around 1.6 in 2000. While many studies have suggested that China's fertility has remained that low or has fallen to a lower level in (p.57) the first decade of the twenty-first century (Cai, 2008; Retherford et al., 2005; Scharping, 2005; Zhao and Zhang, 2010), there is some controversy over the 'true' fertility rates of China (Box 3.1). Morgan et al. (2009) estimate that the 1976–80 birth cohorts will reach fertility well below replacement threshold and will have about 1.7 births per woman.

China's unique history of family planning regulations has undoubtedly affected its recent demographic history. The 'Later, Longer, Fewer' family planning programme played a major part in driving down fertility in the 1970s. However, some scholars have recently argued that the macro-level effect of the restrictive 'one-child policy', introduced in 1978 and applied in 1979, has been overstated (Cai, 2010). First, the policy was not universally implemented, with many exceptions made for rural areas, ethnic minorities, or couples with a daughter. Indeed, Gu et al. (2007) show that in the late 1990s 11 per cent of couples were allowed to have two or three children, and as many as 54 per cent were allowed a second child if their only child was a girl.<sup>10</sup> Second, the fertility decline seen in China echoes that seen elsewhere in East Asia (see section 3.1.4.9). As such, economic and social development can be argued to be a major driver as much as policy (Wang et al., 2013). Despite this, there is currently a significant policy debate regarding ending or at least reforming the family planning restrictions.

In East Asia and in China in particular, growing evidence indicates a deviation from the two-child norm prevalent in Europe and North America. In China, 2001 national data show a mean desired number of children among married women aged 20–29 of 1.50 for urban areas and 1.75 for rural women (Zhang, 2004). A number of regional surveys in both urban and rural settings have reported ideal family sizes around these figures (Basten and Gu, 2013). In Taiwan and Hong Kong, surveys of young people indicate levels similar to China, of around 1.5–1.7 (Basten, 2013b). While deliberate under-reporting of fertility ideals is widespread in China, the similarities to Hong Kong and Taiwan are indicative of such low ideals being 'genuine' in China.

China's fertility is likely to stay at current low levels—or decline further—even if family planning restrictions are relaxed (Zheng et al., 2009). Like many other populations in East Asia, China is experiencing a significant change in its reproductive culture. China's traditional marriage patterns are going through a great transition, with age at marriage and proportion remaining single having increased and likely to increase further. Divorce, sex outside marriage, and same sex partnering are likely to become ever more acceptable (Wang and Zhou, 2010). These changes are likely to spread from urban to rural areas. All of these factors could lower fertility, although some of the fertility declines may be caused by the temporary effect of rising age at childbearing (Box 3.1). **(p.58)**

### Box 3.1 Finding China's Period Fertility Rate

While the low fertility rates reported in the text are supported by the preliminary results of China's 2010 census, which was of a high quality according to the National Bureau of Statistics (Ma, 2011), the rates differ markedly from those reported by China's National Population and Family Planning Commission, which suggests that China's total fertility rate (TFR)

has been 1.8 since the mid-1990s (National Strategy on Population Development Research Group, 2007). The UN's 2010 World Population Prospects (WPP) stated that China's TFRs were 1.80, 1.70, and 1.64 for 1995–2000, 2000–05, and 2005–10 respectively (UN, 2011). However, China's 2010 census recorded only 222 million children aged 0–14. If these results were, indeed, accurate, China's TFRs for 1996–2010 would be significantly lower than those suggested by both the Chinese government and the United Nations Population Division (Cai, 2011; Zhao and Chen, 2011). In line with that, the 2012 WPP released in 2013 lowered the estimate of the TFR in China in 2000–05 to 1.55 (UN, 2013).

This confusion arises partly from the fact that China's demographic data were often collected by different government departments for different purposes, which resulted in some inconsistencies. In addition, the sharp fertility reduction in the early 1990s was not expected at the time, which led government officials and researchers to believe that the reported low fertility was caused by serious under-registration (Zeng, 1996). Some demographers questioned this notion and further examined China's fertility decline in recent years (Cai, 2008; Zhao and Zhang, 2010). Similar changes in how the data are viewed have not yet been observed among policymakers. Officially endorsed fertility figures are most likely to have over-estimated China's fertility for more than a decade.

### 3.1.5 Regional trends: common issues and key factors

This overview of regional fertility developments shows that a trend toward low fertility has become a defining feature of the demographic landscape in a number of countries whose fertility levels were considered to be 'too high' only two or three decades ago. With the notable exception of sub-Saharan Africa, all major global regions appear to be firmly set on a path to low fertility. Furthermore, the epicentre of lowest fertility moved away from the 'Western World' to East Asia and some formerly communist countries in Central and Eastern Europe.

Paradoxically, some of the countries that were at the forefront of the march to sub-replacement fertility in the 1960s–70s, especially the Nordic countries and the USA, now register close-to-replacement and relatively stable (or even slightly rising) CFRs (Myrskylä et al., 2013; see also section 3.1.4). This evidence gives rise to the possibility that countries with very low fertility may eventually witness a recovery to levels close to replacement once broader societal conditions become more conducive to having children (Myrskylä et al., 2011), especially if the predominant family size ideal remains fixed at around two children. Equally possible, however, are other alternative scenarios, either of a continuing diversity in low fertility as currently seen in Europe, or a global move



to **(p.59)** very low fertility levels, with widespread childlessness and a widespread one-child family ideal (see also section 3.5.2).

Having outlined major trends in contemporary low fertility settings, section 3.2 explores some of the key factors driving these patterns as highlighted by the experts and the literature.

### 3.2 Explaining past and future fertility trends: theories and empirical evidence

#### 3.2.1 'Meta-theories' of low fertility and family changes

There are many overarching theories that have been employed to explain recent fertility patterns and differences in the countries covered in this chapter. The very basic contour of the global fertility decline has been provided by the concept of the demographic transition. This 'theory' of population, which has been applied, adjusted, and critiqued continually since it was first proposed in the mid-1940s (Notestein, 1945), envisages a shift from high mortality and high fertility to stabilization at low levels of mortality and fertility around replacement rate. However, the presence of below replacement fertility both before and after the publication of the theory suggests that it has relatively little—in its unmodified form—to say concerning currently low fertility settings.

One of the most widely used concepts is an overarching narrative of the 'Second Demographic Transition' (SDT) (Lesthaeghe, 2010, 1995; van de Kaa, 1987). This theory links dramatic changes in family behaviour—including sustained below replacement fertility, extensive postponement of marriage and childbearing, and the rapid rise of cohabitation and births outside of wedlock—with a transformation in values, emphasis on individual self-fulfilment, the massive rise in higher education, and changing gender roles. A closer investigation of the link between the progression of the SDT and fertility revealed a strong correlation with childbearing at higher reproductive ages (the 'recuperation' component; Lesthaeghe, 2010), and an unexpected positive correlation between the SDT and the level of period fertility rates in Europe (Sobotka, 2008a). The SDT was also shown to be closely associated with the approval of voluntary childlessness (Merz and Liefbroer, 2012).

The decline in marriage and the rise in partnership instability have been surprisingly little connected with fertility declines, at least in Europe. In most of the traditional low-fertility countries (with the important exception of Japan), marriage has become ever less relevant for reproduction and childbearing has increasingly shifted outside marriage, especially to cohabiting unions. In 2011, almost 40 per cent of births in the EU took place outside marriage; in the USA the corresponding share was 41 per cent in 2010. Eight European countries, including Bulgaria, France, Sweden, and Slovenia, registered more than half of all births outside marriage; in Spain, where only one out of **(p.60)** ten births took place outside wedlock in the early 1990s, 37 per cent births were

extramarital in 2011. European countries with high shares of non-marital births have, on average, higher fertility rates, suggesting that permissive attitudes to less conventional living arrangements go hand in hand with more opportunities for women and couples to form a family (Billari and Kohler, 2004; see also section 3.1.4.3, 'Western Europe'). The spread of less stable family forms together with rising divorce rates and, in some countries, a higher frequency of single motherhood, increased the exposure of children to the experience of living with one parent only, typically with the mother (Heuveline et al., 2003; Perelli-Harris et al., 2012). The evidence on the impact of union instability on fertility is mixed or slightly negative (Bélanger et al., 2010; Thomson et al., 2012), as three contrasting mechanisms can be identified. Union break-up means a disruption in family life, which negatively affects the likelihood of having another child in the subsequent period when most of the women and men live without a partner. However, the formation of a new union provides an opportunity to have another child, a decision which also signals the commitment of the new partners to each other and is often expected to 'cement' their relationship (Griffith et al., 1985). At younger ages, partnership instability may lead to the delay of family formation, as many women and men are unable or unwilling to form a lasting union, which is often seen as a precondition for parenthood. On balance, the aggregate effect of union instability depends on the age at first union formation, family stage (and age) at which divorce or dissolution takes place, the share of women who re-partner after separation, and the speed with which these new partnerships are formed (e.g. Beaujouan and Solaz, 2012; Thomson et al., 2012).

The finding on the positive correlation between SDT progression and fertility rates is also related to the debate on the possible reversal of the relationship between economic and social development and fertility, fuelled by the studies suggesting that at advanced levels of development (as measured by the gross domestic product (GDP) level or by the Human Development Index (HDI)) fertility decline stops or even reverses. These studies (see Luci and Thévenon, 2011; Myrskylä et al., 2009) have turned on its head the widely accepted notion that more development generally equals lower fertility. However, the hypothesis on the reversals between development and fertility is not universally accepted: the study by Myrskylä et al. (2009) has been criticized for the indicators used, countries omitted from the analysis, for relying on the period TFRs that are affected by tempo effect, lack of robustness, and other data issues (e.g. Furuoka, 2009; Harttgen and Vollmer, 2013). Luci and Thévenon (2011) and Luci-Greulich and Thévenon (2013) highlight the key role of institutional changes that make it possible for women to combine career and fertility in most developed settings. In a more recent study revisiting their earlier work, Myrskylä et al. (2011) indicate that the development-fertility reversal can also be traced with the completed fertility rates for women born in 1970. Furthermore, they show that the positive effect of development (HDI) on fertility is limited to childbearing at later ages (30+), suggesting that there is a positive association between development and

the recuperation of the previously postponed births. This link is conditioned **(p. 61)** by the level of gender equity in the society, with countries scoring low on gender equality registering declining fertility even at very advanced levels of development (see also section 3.2.3.3).

Another influential notion in most international projections is the concept of convergence between countries of fertility to a given level. This idea has, for many decades, informed some long-term population projections produced by the UN (which envisioned that fertility will universally rise towards the replacement level) and prevailed in long-term fertility scenarios beyond 2050 by the WIC, as described in section 3.5.2.

Related to the previous concept is an idea of ‘feedback’ effect. Demeny (2004, p. 142) observed that the UN’s medium projections ‘implicitly assume that the trend toward lower birth rates ... will elicit negative feedbacks that by the middle of the twenty-first century will bring fertility back to near-replacement levels everywhere’. This is derived from an implicit assumption of a homeostatic response by humans to ensure a continuity in (at least) replacement levels of population. However, Demeny also observed that positive feedbacks were ‘equally plausible...reinforcing a tendency for further falls in fertility’. As a consequence of population ageing, individuals needing to provide for their old age have an increased incentive to accumulate human capital and savings, and to acquire pension benefits. This could result in the institutionalization of many of the elements discussed earlier that are driving low fertility in East Asia. Indeed, such a situation has been formalized in the so-called ‘Low Fertility Trap’ hypothesis (Lutz, 2006). First, population decline fuelled by sustained low fertility leads to fewer women of reproductive age and, hence, fewer births. Second, through socialization and social learning, family size ideals are influenced by the experiences of young people who grow up in an environment with few children (e.g. few siblings, absence of larger families). Hence, children will figure less prominently in their own image of a desirable life. Finally, rapidly ageing societies drive pessimism among the young regarding their own economic opportunities. This, combined with widening consumption opportunities, can lead to an ever greater gap between aspirations and income—a gap which childbearing would only further exacerbate. Should each of these conditions be met, then reversing fertility decline would prove to be extremely difficult.

When considering heterogeneous concepts, including those outlined earlier, it is important to examine the contribution of more specific drivers in fertility change—in other words, the issues which underlie these grand theories and how they interact with choices over the life course such as timing of fertility. For example, many features of the SDT are barely nascent in much of East Asia. Therefore, we explore in greater depth some of the main issues and determinants behind the fertility changes outlined in section 3.1 and, ultimately, those further explored in

the IIASA–Oxford survey of experts. These include the effect of fertility postponement; cultural factors relating to ideals and intentions, religion, and gender equality; family policies; immigration; and biomedical aspects and education. Before we do so, however, it is crucial to consider the effect of fertility postponement upon how we measure contemporary fertility.

### **(p.62)** 3.2.2 Fertility postponement and its impact on period fertility

Across the developed world, parenthood has been shifted to ever-higher ages (Kohler et al., 2002; Sobotka, 2004b). In Western, Northern, and Southern Europe, as well as Japan, the mean age of mothers at first birth has reached 28–30 years, 4–6 years later than in the early 1970s (Schmidt et al., 2012). The frequency of childbearing has increased most rapidly at advanced reproductive ages, including women aged over 40.

This postponement transition (Kohler et al., 2002) has multiple roots. The expansion of higher education and the resulting later age of completing education and entering of the labour market (as well as the concomitant increase in the share of women entering the labour market) have been repeatedly identified as important factors (Blossfeld and Huinink, 1991; Goldin, 2006; Ní Bhrolcháin and Beaujouan, 2012). Other factors include the spread of hormonal contraception, rising economic and employment uncertainty in young adulthood, decline of marriage, the rise of more unstable forms of partnerships, and the spread of new values incompatible with parenthood (Blossfeld et al., 2005; Goldin and Katz, 2002; Goldin, 2006; Kohler et al., 2002; Mills et al., 2011; Sobotka, 2004a).

This fertility postponement temporarily affected period fertility rates, as some births that would otherwise have taken place in a given year were shifted into the future, potentially leading to more dramatic assessments of fertility change than would otherwise be the case. The resulting tempo effect (or tempo distortion), which is the difference between the observed and hypothetical fertility in the absence of birth postponement, has become widely debated in the literature (Luy, 2011) and has emerged as one of the key explanations for the very low fertility levels observed in many rich societies (Bongaarts and Sobotka, 2012; Kohler et al., 2002; Sobotka, 2004b). A number of methods have been proposed to account for the tempo effect and compute tempo-adjusted period fertility rates (e.g. Bongaarts and Feeney, 1998; Bongaarts and Sobotka, 2012; Kohler and Ortega, 2002). The Bongaarts and Feeney (1998) method became most prominent (although not universally accepted; see, e.g., Schoen, 2004). As a result of tempo effect, depressed period fertility rates are often incorrectly interpreted as implying similarly low levels of cohort fertility in the future. Sobotka and Lutz (2011) demonstrate that these interpretations may lead to dramatic assessments of fertility trends. Empirical analysis based on tempo-adjusted period fertility indicators suggests that in the absence of the shifts in fertility timing, the period TFR in the EU around 2008 would have been by

almost 0.2 higher, at 1.77, than the observed TFR of 1.59 (VID, 2012). Large cross-country differences exist, however, in the estimated size of this effect (Bongaarts and Sobotka, 2012; Goldstein et al., 2009).

Fertility trends will continue to be affected by changes in the timing of births. In Europe the pace of increase in the mean age at first birth diminished after 2000 and the 'postponement transition' was seemingly coming to an end in some countries by 2008 (Bongaarts and Sobotka, 2012). However, the recent economic recession has brought a renewed postponement of births, leading to additional downward pressure on period **(p.63)** fertility (see section 3.2.4 and also Box 3.3). In contrast, developing and middle-income countries with low fertility typically report earlier ages at childbearing with most only beginning to experience a shift towards later parenthood, which may depress their period TFRs for decades to come (Bongaarts, 1999; Rosero-Bixby et al., 2009).

Postponement of childbearing has a critical biological dimension. The higher a woman's age when she attempts to become pregnant, especially above 35 years, the longer the waiting time for a pregnancy to occur, resulting in a lower chance of achieving a pregnancy and a higher risk of miscarriage if there is a pregnancy (Menken, 1985; see also section 3.2.7.1). Furthermore, men's age has been identified as an independent risk factor for infertility (section 3.2.7.2).

Consequently, couples delaying childbearing face an increased risk of not realizing their childbearing plans through either lower completed fertility or higher involuntary childlessness (Leridon, 2008; Te Velde et al., 2012; sections 3.2.7.1 and 3.2.7.3).

Rising infertility at higher childbearing ages implies an increase in the demand for assisted reproduction technology (ART), as well as elevated multiple birth rates (section 3.2.7.3). In addition, higher maternal and paternal ages are linked to an increased risk of pregnancy complications and adverse reproductive outcomes. However, positive influences of rising age at childbearing include psychological maturity, lower income loss for the mothers, and a higher level of happiness among the parents (Miller, 2011; Myrskylä and Margolis, 2012).

### 3.2.3 Cultural and social forces in fertility ideals, intentions, and behaviour

#### 3.2.3.1 Fertility intentions

Where modern contraception makes it easy for couples to prevent unwanted pregnancies, fertility preferences are key determinants of reproductive behaviour and fertility trends (Bongaarts, 2001; Schoen et al., 1999). Yet, the number of children individuals intend to have often surpasses the number they actually achieve by the end of their reproductive career (Testa, 2012).

Constraints on meeting intentions include not having a suitable partner, experiencing partnership instability, fecundity impairments, and unexpected events that may lead to a downward revision of reproductive intentions (Iacovou and Tavares, 2011; Liefbroer, 2009). While childbearing intentions can also move

upward, especially as family size grows, these shifts are less frequent than downward adjustments.

A two-child family appears to be the dominant ideal of Europeans, which has become entrenched over time according to the Eurobarometer surveys conducted in 2001, 2006, and 2011 (Testa, 2012, 2006). The mean intended family size is also concentrated at around two children in all European countries, with the notable exception of Austria and Germany, which show, according to some surveys, below replacement ideal and **(p.64)** intended family sizes (Goldstein et al., 2003). The temporal trend is marked by a remarkable stability, with the exception of Greece and Portugal, where an abrupt and pervasive decline in family size ideals has been observed between 2006 and 2011. This decrease is most likely linked to the recent economic recession, which was particularly severe in these countries (Testa and Basten, 2012).

The Eurobarometer survey, which is only cross-sectional, shows that more than one third of European women and men stop childbearing with fewer children than initially desired (Testa, 2012). In addition, the share of people reporting a family bigger than the size actually desired amounts to 10–15 per cent. Hence, the use of lifetime fertility intentions for forecasting purposes has its limits owing to considerable challenges in measuring both intentions and (un)certainly (Morgan, 2001). Negative reproductive intentions (not wishing to have a child) are usually more reliable predictors of subsequent behaviour than the positive ones (Rovi, 1994).

Because of a lack of adequate data, most studies on fertility are based upon the female perspective. However, some evidence on gender differences in intentions exists. In Europe, women generally indicate a slightly larger family size ideal than men, and they also display smaller inconsistency between ideal and actual family size (Testa, 2012). Studies based on couple data show that men and women have equal influence over the final reproductive decision (Thomson, 1997) and therefore have equal power in negotiation if a conflict arises between them (Jansen and Liefbroer, 2006). In settings characterized by low gender equality where women have the main or the sole responsibility for childcare, such as in Italy and Austria, women also have a greater influence on childbearing decisions than men in the early stages of the family formation process (i.e. at parities zero and one) (Testa et al., 2011). This may also be the case in countries with a high acceptance of single mothers, such as the Nordic countries, where women may decide to have a child ‘on their own’. Typically, the disagreement between partners favours the one who does not want to have a child. This couple approach increases the predictive power of fertility intentions (Beckman et al., 1983).



In the USA, the aggregate correspondence between intended and actual fertility is generally higher than in Europe, largely owing to a high share of unplanned pregnancies and unintended births (section 3.1.4.1). Furthermore, there is growing evidence in East Asia that the two-child norm that is dominant in Europe may be much more fluid in that region (Basten et al., 2013). This could have profound consequences for future fertility trends (section 3.1.4.10).

### 3.2.3.2 Religion

A review of studies referring to the 1950s and early 1960s documented the higher fertility of Catholics compared with other religious groups and the non-affiliated for Western countries (Jones and Nortman, 1968). This was mainly attributed to the prohibition of artificial contraception by the Catholic Church. Marked fertility differences by religious affiliation had, by and large, disappeared by the 1970s (Derosas and van Poppel, 2006; Westoff and Jones, 1979), but a gap with the non-affiliated persists (Philipov and Berghammer, 2007). Moreover, some religious minorities diverge from average (p.65) fertility levels (Skirbekk et al., 2010). Muslims have a higher number of children than members of other religions in Europe, but there is convergence over time (Pew Research Center, 2011; Westoff and Frejka, 2007). Religious affiliation is an important correlate of family size in parts of Asia (Morgan et al., 2002), but less so in some Latin American countries (Heaton, 2011). Higher levels of fertility are observed in countries with Muslim majorities, even though they have fallen in recent decades (Pew Research Center, 2011). Abbasi-Shavazi and Jones (2005) and Abbasi-Shavazi and Torabi (2012) argue that the high fertility recorded until recently in many predominantly Muslim countries could be largely explained by their socio-economic and cultural characteristics. In some contexts, religious differences in fertility behaviour have a crucial impact on the future religious composition of a population (Hout et al., 2001).

Studies report clear fertility differences by religious intensity for Western countries, often measured by church attendance or self-assessed religiosity (Philipov and Berghammer, 2007; Zhang, 2008). In explaining why religious people have larger families, scholars refer to the influence of religious teaching, the role of church-based social networks, and the coping function of religion (Chatters and Taylor, 2005). The socio-economic traits of adherents also matter, as does the status of the religion within the social and economic order of society (McQuillan, 2004).

In some contexts, religious fertility differences have a crucial impact on the future religious composition of a population (Hout et al., 2001; Kaufmann, 2010; Skirbekk et al., 2010). The way in which the share of religious people in a country is related to fertility rates is, however, unknown. One may argue that the erosion of religion should have a negative effect on fertility, but examples of

secular countries with higher fertility rates (e.g. Sweden and France) and vice versa suggest that the link may be more complex.

### 3.2.3.3 Gender equality

At the societal or institutional level, gender equality includes whether women and men are offered similar opportunities for educational attainment, economic participation, health and survival, and political empowerment. When women are offered similar educational and employment opportunities as men but these opportunities are severely restricted by having children, women react by having fewer children and having them later in life. In a large meta-analysis of the central reasons for birth postponement in advanced societies, Mills et al. (2011) suggest that gender equality plays a key role. Although empirical evidence connecting gender equality at the societal level to fertility faces methodological challenges (Mills, 2010) and has been less rigorous, there is evidence that institutional factors affect fertility.

Gender equality can be examined at the societal (political empowerment), institutional (provision of childcare and parental leave), household (division of labour), and individual level (gender role attitudes). In the latter two cases, the term 'gender equity' is often used, referring to 'fairness and opportunity rather than strict equality of outcome' (McDonald, 2013, p. 983). A number of aggregate indices measuring the status of women and different aspects of gender equality have been proposed since the **(p.66) (p.67)** mid-1980s (Bericat, 2012). Gender systems determine the division of labour and responsibilities between the sexes, as well as the rights and responsibilities allocated to men and women, and are therefore considered crucial for understanding fertility patterns (Mason, 1997; McDonald, 2000).

### Box 3.2 Living Arrangements, Gender Roles, and their Relationship to Fertility in East Asia

Current family behaviour, including marriage, childbearing, gender roles, and living arrangements, in Japan, China, South Korea, Singapore, and Taiwan reflect both the influence of the Confucian family tradition and the rapid economic and social changes of the second half of the twentieth century.

The family system based on Confucian ideals emphasizes proper roles and relationships based on gender, generation, and age. The basic purpose and function of the family was preservation of lineage and prosperity. Under a family system based on patrilineal descent, the most important obligation of a person was to marry and produce a son. Marriage was mandatory, and early marriage was common. Co-residence with parents was the norm for both men and women until marriage, and for the eldest sons even after

marriage. A woman's position in a family changed drastically from being a daughter to being a daughter-in-law with low status upon marriage; however, a married woman attained a high status within the family by bearing and rearing a son (Choe, 2006; Tsuya et al., 1991).

Meiji restoration in Japan in the nineteenth century and the establishment of republics in other East Asian countries in the twentieth century provided the legal basis for equal rights for women. It took until the second half of the twentieth century, however, for substantial changes in family behaviour and gender roles to occur, in tandem with rising levels of education for women, rapid economic growth, urbanization, and greater geographic mobility. Now, women and men are marrying at increasingly later ages, and the proportion of people who never marry is rising (Jones, 2007). Typical family size has decreased to two or fewer children, and it has become less common for grown children to reside with their parents. Most women work outside home before marriage, and a substantial proportion continue to work after marriage and having children.

However, the persistence of traditional norms in East Asian countries has resulted in patterns of family behaviour different from those experienced in the West. The strong patrilineal and patriarchal family traditions, for example, have kept out-of-wedlock childbearing at very low levels (Bumpass and Choe, 2004; Jones, 2007), with the civil code in Japan requiring registration of a birth of a child in his/her father's family registry. In South Korea, the family law was changed in 2005, abolishing the household headship system and making birth registration a stand-alone document. However, it is not yet possible to see whether this has had a large effect on the attitude and behaviour of the general public. A child whose father is unidentified experiences serious social stigma. The divorce rate was low until the 1990s. Although women, including married women, are participating in paid employment at increasingly higher levels, men rarely take on domestic roles (Rindfuss, 2004; Tsuya et al., 2005). In addition, long-standing preferences for boys combined with very low fertility and the spread of sex-selective abortion led to an emergence of distorted sex ratios at birth in China, Korea, and Taiwan (section 3.1.4.9). Finally, participation in housework and childcare responsibilities has remained persistently low among Asian men, which some scholars have suggested plays a role in discouraging partnership formation and childbearing for (increasingly better educated) women (Ishii-Kuntz et al., 2004).

The literature on household gender equity stems largely from Becker's (1981) argument that women's increased economic independence results in higher relative opportunity costs of childbearing via foregone earnings during childbearing and care periods, thereby generally lowering fertility. Unequal

gender roles in the household and specifically the perpetuation of the male breadwinner/female homemaker model, force women to choose between a career without children or remaining in the home (Cooke, 2004; Mills et al., 2008; Oláh, 2003). The lack of sustained improvement in gender inequality in the household is considered as a core underlying determinant of very low fertility (McDonald, 2000), particularly in East Asia (Box 3.2). This discrepancy between new public opportunities and sustained domestic obligations is sometimes referred to as the ‘incomplete gender revolution’ (Esping-Andersen, 2009).

Empirical results linking egalitarian gender role attitudes to fertility are mixed, particularly in relation to men (Goldscheider et al., 2010; Westoff and Frejka, 2007). Some studies suggest that men’s more gender-egalitarian roles result in higher fertility (Kaufman, 2000; Puur et al., 2008), while others find the opposite (Westoff and Higgins, 2009), and still others identify a U-shaped effect, where men with either traditional or egalitarian views report higher ideal family sizes (Miettinen et al., 2011) (Box 3.2).

#### 3.2.4 Employment, economic uncertainty, and fertility

The fertility literature has long highlighted the relevance of both aggregate and individual economic conditions for the timing and number of births. Economic events and economic uncertainty alter current and future demand for children among couples (De Cooman et al., 1987). Sobotka et al. (2011) note that, overall, fertility has exhibited a pro-cyclical relationship with economic growth for more than a hundred years. However, the effect is small and difficult to identify as most recessions have been short-lived and fertility developments were often dominated by stronger and longer-lasting shifts, including the fall of fertility to low and very low levels in most European countries and East Asia in the 1970s–90s. This section highlights general findings on the links between economic uncertainty and fertility; more detailed examination of fertility changes during the recent economic recession is provided in Box 3.3.

As noted earlier, Becker’s (1981) microeconomic model of fertility offers a good analytical tool to explain the conflicting impacts of economic conditions on childbearing decisions. Childbearing is time-intensive relative to other activities, and its associated opportunity cost can be measured by the potential wage of the mother. Whereas increases in men’s work mainly entail an income effect that raises the demand for **(p.68)** children, higher female wages give rise to a combination of income and substitution effects as they result in an increase in the cost of a child relative to other ‘goods’. Accordingly, women (particularly those with high potential wages) may restrict their fertility and trade-off children for less time-demanding alternatives if the substitution effects are important.

In this context, a woman's temporary unemployment is a good time for childbearing, and fertility should be counter-cyclical, as in the USA during the 1960s and early 1970s when contraceptive access also improved (Butz and Ward, 1979). However, most analyses have found a negative relationship between different measures of unemployment and first births both in long time series (Rindfuss et al., 1988) and for recent periods (Adsera, 2011a; Kravdal, 2002; Myrskylä et al., 2013; Neels et al., 2013). The association between unemployment and fertility is complex and heterogeneous across age, parity, institutional frameworks (labour regulation, types of contracts, unemployment benefits), and the length and acuteness of economic shocks, as these factors mediate opportunity costs of having children. In a recession, women who are at a point in their life cycle when human capital accumulation is crucial may postpone childbearing to acquire more work experience or education. The pervasive long-term and youth unemployment characterized by the most recent recession is bound to have had a large negative impact on household permanent income. It may render childbearing unattractive not only for those directly affected by unemployment but also for those threatened by it—as documented for the Great Depression era (Becker, 1981; Murphy, 1992) and for the periods of high unemployment in Europe during the 1980s and 1990s (Adsera, 2011b). While the majority of short-lived recessions only seem to affect the tempo of fertility (Lee, 1990), severe crises have also had an impact on the quantum of fertility as women who postponed childbearing for lengthy periods of time did not have all the children they intended (Sobotka et al., 2011). In addition, with persistent unemployment, partnership formation is delayed (and with it, childbearing), particularly in Southern Europe or East Asia where fertility outside marriage was, and still is, relatively rare. Likewise, parents may invest more per child and reduce their family size to improve their future outlook (Easterlin, 1976), and young adults may prolong their educational training (Kohler et al., 2002).

The association between employment and fertility is weaker in countries where the family trade-offs are minimized by the availability of permanent public employment, and support for working mothers through flexible work schedules, generous leaves, or abundant and affordable childcare (as in Scandinavia) (D'Addio and d' Ercole, 2005; Matysiak and Vignoli, 2008). Conversely, the short-term contracts with meagre provisions and high turnover that expanded rapidly during the 1990s, particularly among the young in Southern Europe owing to previous strict regulation and dualization of the labour market, do not offer any of those guarantees and are associated with further depression of fertility (Adsera, 2011b). Both individual unemployment experience and aggregate economic shocks matter (Adsera, 2011a), and in some places the latter matter the most (for Norway, see Kravdal, 2002).

**(p.69) (p.70) (p.71)** A major challenge for this literature is to find the appropriate way to measure economic conditions, both aggregate and individual. Declines in GDP tend to be associated with corresponding declines in fertility (Goldstein et al., 2009). However, once other covariates are introduced, such as unemployment, the relationship weakens or disappears (for Latin America, see Adsera and Menendez, 2011). Arguably, this is partly caused by the effects that family and social policies have in offsetting some of the adverse effects of the recession. While measures of consumer sentiment or perception of the crises fit better, unemployment appears to be the most enduring relationship (Sobotka et al., 2011). Recent papers have employed new methods to deal with the problem of endogeneity of unemployment measures. Del Bono et al. (2012) use unexpected plant closings in Austria as a statistical instrument to study fertility changes after job displacement, and find fertility decline in the short and medium term, mostly due to the impact of career interruption rather than income changes.

### Box 3.3 The Impact of the Recent Economic Recession

The economic recession that started in 2008 has marked an end to the first concerted increase in period total fertility across the developed world since the Baby Boom era of the 1950s–60s, which occurred between the late 1990s and 2008 (Bongaarts and Sobotka, 2012; Goldstein et al., 2009). The early evidence for the years 2008–11 suggests that in many countries total fertility rates (TFRs) stopped rising in 2009–10 and subsequently declined in 2011 (Lanzieri, 2013; Myrskylä et al., 2013; VID, 2012). This is in line with a pro-cyclical association between economic trends and fertility rates that characterized developed countries in recent decades (Adsera, 2011a; Neels et al., 2013; Sobotka et al., 2011). However, there was considerable variation in fertility changes by country, age, and birth order, which suggests that different segments of the population responded differently to the early stage of the recession (Lanzieri, 2013; Myrskylä et al., 2013).

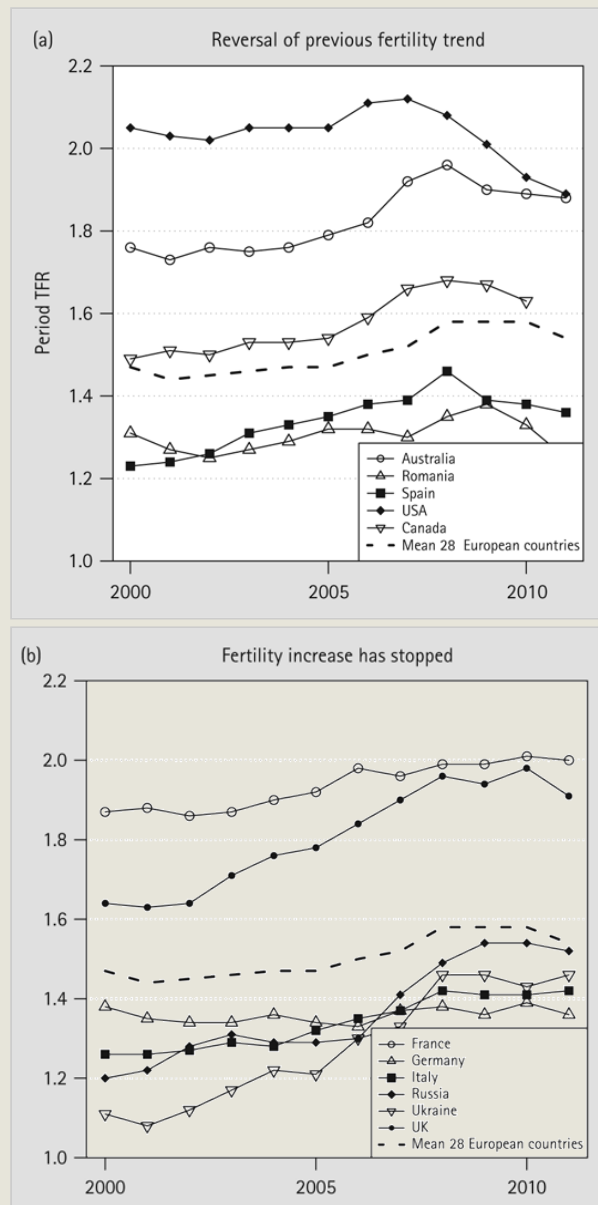
This trend reversal in fertility has thus far been limited to Europe, the USA, Australia, and Canada—regions affected by the economic downturn. Moreover, large cross-country differences can be observed in recent fertility trends. The USA shows a clear pattern of reversal, with a period TFR peaking at 2.1 in 2007—the highest level since 1971—before falling to 1.90 in 2011 (Livingston and Cohn, 2012), while in Europe the evidence is mixed. An average TFR for the 37 European countries shows period TFR stabilizing at 1.58–1.59 in 2008–10 and subsequently declining to 1.55 in 2011 (Figure 3.3a,b, left panel). Of these 37 countries, as many as 26 experienced a decline by 0.02 or stronger, four had stagnating fertility rates (between  $-0.01$  and  $+0.01$ ) and only seven recorded some fertility increase ( $+0.02$  or



more). If countries with problematic data are removed (i.e. countries where post-2011 census revisions of population data made time series incomparable between 2010 and 2011; see note below Figure 3.3a,b), only three European countries (Belarus, Malta, and Ukraine) experienced rising fertility in 2011. This decline strongly contrasts with the situation before the onset of the recession: in 2008, 35 countries experienced rising fertility and only two saw a stable trend.

The trend towards fertility decline has been more pronounced in countries and regions that experienced stronger economic downturns and faster increases in unemployment (Livingston, 2011 for the states of the USA; Sobotka et al., 2011). Figure 3.3a,b plots the TFR trends in 2000–11 in the most populous European countries (with population over 20 million), as well as Australia, Canada, and the USA. It illustrates clearly the heterogeneity in fertility ‘responses’ during the initial stage of the economic recession. Among these large countries, only the USA, Romania, Spain, and, to a smaller extent, Australia and Canada have seen a reversal in the previous trend of increasing fertility. A more common pattern, with the pre-recession fertility increase subsequently coming to a halt, was typical of many large European countries, including France, Italy, and the UK. Finally, Germany stands out for its stable period TFR and Russia for its continuous fertility increase, partly fuelled by pro-natalist policies established since 2007. This heterogeneity makes it difficult to incorporate explicitly the possible future effects of the recession into fertility scenarios for the next five years (see section 3.5.1 and Appendix 3.1).

In the past, economic recessions typically induced postponement of childbearing rather than a permanent decline of fertility that would also affect cohort fertility rates (Neels et al., 2013). The current evidence suggests the same pattern for the recent recession. Fertility decline has been largely concentrated among women younger than 25 and, in most countries, confined especially to first birth rates (Lanzieri, 2013; Myrskylä et al., 2013). Also, the rise in the mean age at first birth, slowing before 2008, accelerated thereafter, suggesting that tempo effect was largely responsible for the observed declines in period TFRs.



**FIGURE 3.3(a, b)** Period total fertility rate (TFR) in selected European countries, Australia, Canada, and the USA, 2000–11.

**Notes:** Average values for 28 European countries constitute a simple average that is not weighted by population size; data include countries with available data on TFR in 2011 and population size > 1 million. In addition, countries with a series break in 2011 due to post-census adjustments were excluded (Bulgaria, Latvia, Lithuania, Slovakia, the UK). The 2011 fertility decline in the line

representing UK data might be artificial as a new post-census round of population estimates was used in the computation of 2011 data, making them incomparable to the data series up to 2010.

**Sources:** Eurostat statistical database (2012) and national statistical offices (data reported until February 2013).

### 3.2.5 Family policies

Family-related policies cover a spectrum of interventions that range from explicitly pro-natalist measures through ‘softer’ regulations that help people to balance work and family life and have the number of children they desire. Policies that help parents balance work and family are central to mobilizing female labour supply, promoting gender equity, increasing the labour income of couples, and ensuring the financial sustainability of the welfare states (OECD, 2011; Saraceno et al., 2012). Furthermore, family policy interventions can play a role in combating child poverty and ensuring equal opportunities for children from different backgrounds (Bradshaw and Mayhew, 2006).

A key differentiating characteristic of policies across countries is whether they emphasize financial assistance, entitlements to leave work after a birth, or the provision of childcare services (OECD, 2011). There is no convincing evidence of cross-national convergence in family policies (Gauthier, 2002). Different mixes of these three policy instruments are rooted in welfare state histories, as well as prevailing attitudes towards families, the government’s role, and current family patterns. Thévenon (2011) provides an in-depth description of cross-country differences and similarities in the policy mix created to support families in OECD countries. The Nordic countries (Denmark, Finland, Iceland, Norway, and Sweden) provide comprehensive support for working parents with very young children (under the age of three) through a combination of generous leave arrangements after the birth of a child and widely available childcare services (Björklund, 2006). While English-speaking countries (Ireland, the UK, Australia, New Zealand, and, to some extent, Canada and the USA) provide much less support in time and in-kind for working parents with very young children, financial support is more generous—if primarily targeted to low-income families and preschool children (McDonald and Moyle, 2010). Not all of these countries offer the same level of support, with Canada and the USA lagging behind the others. Western and Eastern European countries form a more heterogeneous group occupying an intermediate position. **(p.72)** Among these countries, France and Hungary stand out by offering rather generous support for working parents compared with the other countries in their respective groups. In East

Asia, policy provision ranges from the laissez-faire approach of Hong Kong up to the more comprehensive measures enacted in Japan and Taiwan (Chin et al., 2012; Frejka et al., 2010). However, across the region, the relatively low tax rates and, in some cases, high public budget deficits mean that investment in family policy is often limited.

Not all policies succeed in promoting the conditions necessary for individuals to start or enlarge their families. The evidence on the effect of family policies on fertility is inconclusive (Gauthier, 2007). Interestingly, the increase in fertility rates prior to the onset of the recent economic recession has been steeper in countries where female labour market participation has also risen markedly and where women have more opportunities to combine work and childbearing. Hence, fertility rates are now higher in countries with high rates of female employment, while the opposite situation prevailed 30 years ago (Billari and Kohler, 2004; Engelhardt and Prskawetz, 2004; OECD, 2011). Recent research has emphasized the contribution of family policies to this reversal (D'Addio and d' Ercole, 2005; Hilgeman and Butts, 2009; Luci-Greulich and Thévenon, 2013). In particular, policies that help parents balance work and family life (leave entitlements, but especially the availability of childcare services for children below the age of 3, and part-time work) are found to encourage fertility (for a literature review see Thévenon and Gauthier, 2011).

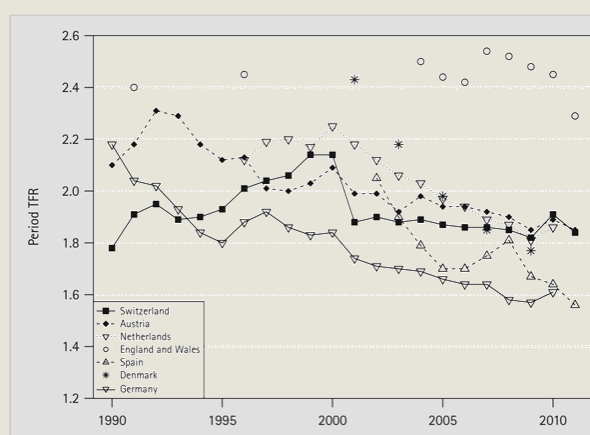
### 3.2.6 Migrants' fertility

With generally rising mobility, migration has contributed to population increase in many low-fertility countries that would otherwise be experiencing declining population (Coleman, 2009). Around 2005, births to immigrant women accounted for 15–25 per cent of all births in the USA and many Western European countries, including the Netherlands, France, the UK, and Sweden (Sobotka, 2008b).

In most low fertility countries migrants have higher fertility than the native-born women (Sobotka, 2008b).<sup>11</sup> This difference can be quite substantial, reaching as high as one child per woman, when measured with the conventional period TFR. Migrant women in France had a high TFR level, estimated at 2.89 in 2008 compared with 1.89 for women born in France (Pla and Beaumel, 2012). Similarly, migrants in the USA, especially Hispanics, have had higher fertility rates for many decades—although recently the notion of high Hispanic fertility has been contested (Parrado, 2010). There are also massive differences between groups of migrants. For instance, in Sweden, where detailed statistics are available for the main groups of migrants, the TFR among immigrants in **(p.73)** 2009 ranged from below 1.8 among women born in Bosnia-Herzegovina, Finland, or Thailand up to 4.0 for women born in Somalia (SCB, 2010, Table 2.2.14).

Despite having, on average, higher fertility rates, migrant women in many low fertility countries have achieved sub-replacement fertility. According to the data for 2007–11, all migrant or foreign women combined had a period TFR below 2.0 in Austria, Germany, the Netherlands, Spain, and Denmark (national statistical offices; see also Figure 3.4). In contrast, migrant fertility remained at about, or slightly above, the replacement level (2.0–2.3) in Italy, Greece (data for 2005; Tsimbos, 2008), Norway, Sweden, and the UK (national statistical offices and Tromans et al., 2009), whereas it stayed above 2.6 in the USA in 2010 (estimate based on Livingston and Cohn, 2012) and approached the high level of three births per woman in France in 2008 (Pla and Beaumel, 2012). Indeed, in most low fertility countries the fertility of migrants has declined considerably since the early 1980s (Figure 3.4), contributing to a gradual fertility convergence between migrant and ‘native’ women. Moreover, the recent economic recession has negatively affected the fertility rates of migrants more than those of ‘native women’ and in several countries, including Denmark, Spain, the UK, and the USA migrant fertility fell sharply between 2008 and 2011 (Livingston and Cohn, 2012, Figure 4).

**(p.74)** In many low fertility countries there is a common misconception that birth rates among immigrants have a significant influence on fertility rates (e.g. Héran, 2004). Also, the increase in fertility in Europe in the early 2000s has been often falsely interpreted as an outcome of high immigration. These views are not supported by the evidence as fertility rates in that period increased the most among native-born women, while they often stagnated or even declined among immigrants (Figure 3.4). In most European countries with sizeable immigration, the fertility of migrants had a small positive effect on country TFR in 2007–08, ranging from 0.03 in Germany to 0.13 in England and Wales in absolute terms. In smaller regions with high



**FIGURE 3.4** Period total fertility rate (TFR) among immigrant (or foreign) women in selected European countries, 1990–2011.

**Notes:** Data pertain to immigrant women in Denmark, England and Wales, the Netherlands, and Austria since 2002. Other data pertain to women with foreign citizenship. Data for Denmark are for five-year-periods centred in a given year and exclude migrants of Danish origin.

**Sources:** national statistical offices, Sobotka (2008b).

immigration, this effect was often much stronger: in Vienna, in 2009, fertility of immigrant women lifted the overall TFR for all women by 0.28 in absolute terms (Zeman et al., 2011). In contrast, in the Netherlands, the fertility of migrants and women born in the country (including the second generation) has broadly converged, and in at least one country—Denmark—migrants' fertility has fallen below that of the native-born women as of 2008. Finally, the daughters of immigrants, representing the second generation of immigrants, typically have fertility rates similar to fertility among the women without migrant origin. This rapid convergence to the fertility patterns of the host country has been illustrated even for higher-fertility populations of Turkish and Moroccan origin in the Netherlands (Garssen and Nicolaas, 2008). One important exception is the elevated fertility among the second- and third-generation of Mexican-origin migrants in the USA (Frank and Heuveline, 2005).

Little is known about the fertility effect of emigration. Short-term migration is likely to have a negative effect on fertility as many couples face temporary separation or have to relocate. Long-term emigration probably does not have a significant effect on fertility rates among the women staying in a country, but it could distort official statistics on birth and fertility, especially in countries with sizeable emigration that is poorly registered (Sobotka, 2013, section B).

### 3.2.7 Biomedical factors

Huge individual variability in fecundability (Dunson et al., 2002) presents women and men of reproductive ages with two contrasting challenges: how to prevent undesired pregnancies from occurring, and how to achieve pregnancy if and when one is ready to have a child. Current low fertility rates in rich countries have been reached thanks to the widespread use of modern contraception throughout much of women's reproductive lives (Skouby, 2004) and, in many countries, owing to the relatively widespread use of abortion (Sedgh et al., 2012). Still, given that 47 per cent of pregnancies and 22 per cent of births in the more developed countries are estimated as unintended, it is clear that not all sexually active women and men consistently use reliable contraception when not planning to bear children (Singh et al., 2010).

This section reviews three key issues where biomedical factors and assisted reproduction (AR) influence fertility rates: (i) infertility and its age pattern, (ii) the notion of **(p.75)** deteriorating male reproductive capacity, and (iii) AR and its potential role in fertility trends at higher childbearing ages.

#### 3.2.7.1 Infertility and sterility

Analysing trends and variation in infertility and sterility is difficult as different concepts and definitions are used and modified over time; also, medical, epidemiological, and demographical definitions of infertility vary (Habbema et al., 2004; Leridon, 2007; Mascarenhas et al., 2012a). It is now common in the medical field to define as 'infertile' a couple that has been unable to conceive

after a defined exposure to unprotected intercourse. This period may vary from 12 months to 5 years. It would be more appropriate to report explicitly 'one-year infertility rates' or 'five-year infertility rates', but this is rarely the case. In this section we will use the word 'infertility' in this broad sense.

Data on infertility have mostly been collected for higher-fertility, less-developed countries. Boivin et al. (2007), using a wider definition of infertility that includes women reporting current 'difficulties in carrying a child' ('subfecundity'), showed that in selected rich countries current prevalence of infertility ranged from 3.5 per cent in Australia (1988) to 16.7 per cent in Russia (1998). Lifetime infertility prevalence in these countries varied even more, from 6.5 per cent in Norway (1985–95) to 26.4 per cent in the UK (1993). These estimates vary so widely in part because infertility definitions differ, and because infertility is affected by different age patterns of childbearing across countries. Mascarenhas et al. (2012b) produced global and regional standardized estimates of primary (absence of a first live birth) and secondary infertility (absence of a live birth among women with at least one child) cumulated for couples over a five-year period of unprotected intercourse. Using these definitions, primary infertility was very low and amounted in 2010 to 1.5 per cent globally (1.9 per cent among child-seeking women), with little variation by country and region. Secondary infertility varied considerably more: the global average was 2.9 per cent for all women and 10.2 per cent for child-seeking women (Mascarenhas et al., 2012b). These data also show that very few women experience infertility from an early age on. While infertility prevalence is often computed for women, male-factor infertility strongly contributes to observed infertility of couples (CDC, 2011; Thonneau et al., 1991).

Relatively few studies have examined infertility trends over time. Mascarenhas et al. (2012b) showed there were no strong shifts globally and in high-income countries between 1990 and 2010, especially when age-standardized data were used. Rich evidence exists on infertility trends in the USA. Mosher and Pratt (1985) reported a decline in infertility between 1965 and 1982, whereas more recent analysis by Stephen and Chandra (2006) covering the period 1982–2002 found a gradual infertility decline up until 1995, which was particularly pronounced among older childless couples. These and other studies do not lend support to the notion of a general increase in infertility over time.

The key factor in infertility is age. Among men, fertility is usually maintained until high age, but it is negatively affected by age-related degenerative changes to sperm and testes, as well as erectile dysfunction (e.g. Kühnert and Nieschlag, 2004; Sartorius and Nieschlag, 2010). As a result, male age has an independent effect on couple's fecundity, **(p.76)** and higher male age (>40) has detrimental effects, especially in combination with advanced reproductive age of the woman (de la Rochebrochard and Thonneau, 2003). For women, age imposes much stricter limits to their ability to reproduce as the number and the quality of their

oocytes (eggs) decline rapidly (Broekmans et al., 2007). Infertility, sterility, the frequency of miscarriages, and pregnancy complications increase gradually among women aged 30–39 and then surge after age 40. By age 40 almost 17 per cent of women are permanently sterile, while as many as 35 per cent of women will remain childless if starting their first pregnancy effort at that age, mainly because the rate of foetal wastage increases rapidly after age 35 (Leridon, 2008).

### **3.2.7.2 Male reproductive health**

Carlsen et al. (1992, p. 609) stated in a meta-analysis of studies published between 1938 and 1990 that ‘there has been a genuine decline in semen quality over the past 50 years’, a finding partly confirmed in a more sophisticated analysis by Swan et al. (2000). Regional studies from Europe and Asia have demonstrated heterogeneity in the results (Iwamoto et al., 2007; Jørgensen et al., 2002). The European Science Foundation’s Science Policy Briefing (ESF, 2010, p. 7), prepared by some of the leading scientists in the field, voiced concern about ‘significant adverse trends in reproductive health problems in young men’. The research suggesting decline in sperm quality has, however, been challenged by some studies that question the methods and data, particularly of the meta-reviews (Fisch, 2008; Lerchl, 1995). The few studies based on the measurement of the time to conception, notably in the UK (Joffe, 2000) and Sweden (Scheike et al., 2008), have not found evidence of a declining trend in fecundity. Overall, there are many conflicting findings and no consensus on this issue (Bonde et al., 2011; Fisch and Braun, 2013; Merzenich et al., 2010).

The reported risk factors for declining semen quality (measured by sperm counts, motility, and morphology) include the effect of chemicals such as xeno-oestrogens and lifestyle effects of tobacco, obesity, and stress (He and Ju, 2008; Jensen et al., 2004; Sharpe and Skakkebaek, 1993). Declining sperm quality could play an important role in shaping levels of reproductive success within certain subgroups of society and, eventually, affect aggregate fertility rates (ESF, 2010). Furthermore, increasing age of fatherhood is a significant determinant of declining semen quality and reproductive success (Frattarelli et al., 2008). In the context of increasing age of first birth and a generally greater social acceptance of older fathers, this factor could play a prominent role in the future.

### **3.2.7.3 Fertility postponement and assisted reproduction**

Data on AR, although incomplete for many countries, indicate continuing increase in its use, including by women at higher reproductive ages (Ferraretti et al., 2012). According to AR registries in European countries, between 0.5 per cent (Turkey) and 4.6 per cent (Denmark) of children born in 2008 were conceived via AR (Ferraretti et al., 2012); the average for European countries with available data was 1.6 per cent, comparable to the USA (1.5 per cent in 2009). AR has a very minor positive effect on aggregate **(p.77)** fertility rates in rich countries (Habbema et al., 2009; Sobotka et al., 2008) although its ‘net



impact' is difficult to estimate as some of its users would otherwise achieve a spontaneous conception (Pinborg et al., 2009).

To what extent can AR compensate for infertility linked to postponing childbearing to higher reproductive ages? The contribution of AR using women's own oocytes is relatively small. A simulation by Leridon (2004) showed that an ability of AR to overcome age-related infertility falls dramatically with age. Fewer than 30 per cent of the births 'lost' by postponing conception attempt from age 35 to age 40 could eventually be 'compensated' by *in vitro* fertilization. In the USA in 2009, only 18.1 per cent of AR cycles using non-donor oocytes at age 42 resulted in pregnancy, with 8.6 per cent resulting in a live birth. Leridon and Slama (2008) simulated population-level impact on fertility of additional postponement of childbearing and 'compensatory' use of ART. In the contemporary French population, an additional shift in age at pregnancy attempts by 2.5 years was estimated to lead to a 5 per cent decline in fertility rate (from 2.00 to 1.90), of which only one fifth (0.02) would later be made up through AR use. Despite this evidence, many women erroneously believe that AR can help them to overcome infertility at high reproductive ages (Maheshwari et al., 2008).

Much higher success rates have been achieved with AR using donor oocytes from healthy young women. However, relying on donors implies women will have offspring who carry someone else's genetic endowment. Recently, oocyte cryopreservation (OC), or 'egg freezing', has emerged as a major breakthrough (Setti et al., 2012) that may give women more autonomy in reproductive decisions and erode the age boundaries of reproductive ages (Wyndham et al., 2012). Ideally, women using OC would have their oocytes harvested at prime reproductive ages, and cryopreservation would then preserve them for possible later use with the help of AR. AR using oocytes vitrified at younger ages, especially until a woman's early 30s, achieves similar success rate as AR with donor oocytes (Cobo et al., 2011). Although the number of births after OC has increased (Noyes et al., 2009), there is still a lack of long-term data about success rates and possible drawbacks of using AR with OC after many years of cryopreservation.

### 3.2.8 Education

Conventional demographic wisdom holds that fertility levels among women have a negative relationship to educational attainment (e.g. Castro Martin, 1995; Skirbekk, 2008). The causal direction of the relationship seemed clear because education was typically completed prior to the time when women started having children. Now, in low fertility countries, where massive expansion of high education has taken place and the education process has extended well into the fecund years, the causality question has become murkier and the education-

fertility association has become more varied (Andersson et al., 2009; Kravdal and Rindfuss, 2008; Neels and De Wachter, 2010).

The expansion of higher education in developed countries, particularly among women, has been a major factor behind the postponement of parenthood and the **(p.78)** emergence of very low period TFRs in the final decades of the twentieth century (Billari and Kohler, 2004; Ní Bhrolcháin and Beaujouan, 2012). First, there is a normative expectation that women still in school are not ready for motherhood. In this context, the ever expanding time spent in education further delays first births (Blossfeld and Huinink, 1991). As a result, women with higher levels of education have a later mean age at childbearing (Andersson et al., 2009; Mills et al., 2011) and, during the transition from lower to higher levels of education, the associated fertility postponement leads to lower levels of period fertility. Second, a higher level of education entails enhanced human capital and a higher earnings potential, which women may want to capitalize on in the labour market. This implies that higher educated women have more to lose by staying at home to provide childcare—a situation aggravated by the persistence of traditional gender role division, particularly in East Asia (see Box 3.2). These higher opportunity costs of childbearing may contribute both to the delay and decline of fertility (Kravdal, 2004; Lappegård and Rønsen, 2005). But education effects are likely not confined to financial issues. Higher levels of education prepare one for jobs and careers that are more interesting, creative, and intrinsically rewarding. An increased orientation toward careers in the labour market may motivate educated women to further postpone motherhood until they have gained work experience, established their position in the labour market, and accumulated sufficient material resources to afford starting a family (Kravdal and Rindfuss, 2008; Mills et al., 2011). Third, field of study can also be important for fertility timing. One reason is that different subject areas imply differential earning potentials in the labour market after graduation (e.g. fine art compared to engineering). The choice of study discipline also tends to both reflect and mould a person's attitudes, including those related to family formation (Hoem et al., 2006; Martín-García and Baizán, 2006; Van Bavel, 2010b). Postponement has been more limited among graduates from disciplines in which stereotypical attitudes about gendered family roles prevail and in which a large share of the graduates are female (Van Bavel, 2010b).

Whereas the effects of education on the timing of entry into parenthood are well documented and reasonably consistent, the effect on fertility quantum is much less clear (Kravdal and Rindfuss, 2008). The aforementioned postponement effect, higher opportunity costs of childrearing, and stronger career orientation should lead to lower levels of completed fertility, and there has been empirical support for this effect (e.g. Kohler et al., 2002). However, women with higher levels of education are more likely to be able to afford the costs associated with

raising children, even more so if they are partnered with a highly educated male (which is usually the case).

The empirical record on the relationship between educational attainment and completed fertility is little studied. In the Nordic countries, the fertility gradient by level of education has almost disappeared for women, and parity progression ratios to a second and third child are positively associated with women's education level (Andersson et al., 2009; Kravdal and Rindfuss, 2008). In Belgium, Neels and De Wachter (2010) reported crossovers in fertility and education association, with above average completed fertility found among women with tertiary education born in the 1950s. There are also difference by parity, with Adsera (2011a) observing a U-shaped relationship between **(p.79)** educational attainment and third births across the EU. However, when parity-specific patterns are disregarded, research, in most countries, shows a continuation of the negative education-fertility differentials for women (Davie and Mazuy, 2010; Musick et al., 2009; Sobotka, 2012; van Agtmaal-Wobma and van Huis, 2008). We review the empirical evidence on trends and cross-country variation in education-fertility differentials in low-fertility countries in sections 3.5.3.1–3.5.3.5.

Our expectation is that countries that have the least developed institutional support for a combination of motherhood and employment will have both the steepest negative education-fertility gradient and the lowest levels of completed fertility. The evidence suggests that the relation between education and the number of children strongly depends on the social context. A key factor here is the practical availability and cultural acceptability of non-family childcare, which differs dramatically across countries for children below the age of three (Liefbroer and Merz, 2010; OECD, 2011). Childcare facilities may greatly mitigate the opportunity costs of childbearing, which are known to be highest for highly educated women (Kravdal and Rindfuss, 2008). It has been found that formal childcare availability has a positive effect on second birth rates in Europe, but only for highly educated women (Van Bavel and Róžańska-Putek, 2010). The development of organized childcare and other institutions promoting gender equity in family life has probably contributed to the diminishing gradient between women's level of education and their fertility (Kravdal and Rindfuss, 2008).

### 3.2.9 Limitations and moving to the future

In sections 3.1 and 3.2 we have outlined the prior quantitative trends, as well as a set of socio-economic and cultural determinants of fertility, in a varied set of countries characterized by low fertility. We have also highlighted what we believe to be some of the key underlying themes and issues that have shaped these trends over the last few generations.

Although we have attempted to give a comprehensive overview of all the major factors shaping fertility, our review has limitations. We have paid relatively scant attention to the slowly accumulating literature on male fertility determinants, levels, and patterns. Some potentially relevant factors were not discussed because the literature is relatively undeveloped, the evidence on their relevance is limited, or simply because the lack of space precludes discussing every possible driver of fertility. Examples of such ‘neglected’ factors include type of settlement and the potential role of urban–rural differentials, population density, and environmental and climate-related factors. Similarly, this chapter has not covered widely enough the ongoing transformation in family and living arrangements, and its multiple links to childbearing behaviour. Also, we have not discussed potentially important psychological factors operating at both societal and individual levels, such as how the degree of trust, insecurity, sense of control, and, more generally, ideologies, fads, and fashions related to childlessness or having children, influence fertility decisions. With the exception of economic uncertainty and the more **(p.80)** specific case of anomie during the post-communist transition in CEE (Philipov et al., 2006), the literature is very limited and usually dated. Of potential relevance as a fertility-limiting factor in the future may be the ideology of intensive mothering prevalent in many affluent countries. In the long-run, the increased ‘price of parental time’ may clash with the widespread notion that parenthood, especially motherhood, should be child-centred, emotionally involving, and time-consuming (Arendell, 2000).

We have also provided only a limited discussion of the links between different determinants of fertility, in particular, of how micro-, meso-, and macro-level factors interact to generate broader fertility trends (for a useful discussion, see Balbo et al., 2013).<sup>12</sup>

We would like to highlight two broader issues that deserve more attention in future research. First, more attention should be paid to analysing and discussing family size norms and ideals in different settings and population subgroups. Coleman (1998) suggests that besides normative factors there are no pertinent theoretical arguments suggesting that fertility and fertility preferences should be higher than zero. Other contributions that take for granted that parenthood and nurturing care about offspring provide a unique experience that is desirable for most individuals suggest that the preference for having one child might be the most rational outcome, also considering the emphasis on the ‘quality’ of children (Foster, 2000). Yet the overwhelming evidence for the majority of countries indicates a surprisingly strong and stable persistence of two-child family norms and ideals. Given that the actual fertility in rich countries with widespread use of modern contraception is usually lower than fertility ideals and intentions, it is important to study the experience of urban China and other settings with an emerging dominant preference for one-child families, which might herald an era of ‘ultra-low’ fertility in these places (Basten and Gu, 2013).

Second, more attention should be given to the unfolding ‘postponement transitions’ (Kohler et al., 2002) in middle-income countries that have seen fertility rates falling close to the replacement level. There, the empirical experience of the countries with a long history of low fertility shows that such fertility tempo transitions can negatively affect period fertility rates for decades, often contributing to the temporary spells of very low fertility (Bongaarts, 2002; Goldstein et al., 2009; Sobotka, 2004a). Thus, the key question is whether couples in countries such as Brazil, China, India, Iran, Mexico, and South Africa will embark on a similar trend of having children at ever later ages. If they do, perhaps in part as a consequence of an expansion of tertiary education there, these countries may see decades of very low fertility, significantly below the current levels. But differently from the case of the normative shifts towards low ideal family size, some recovery of fertility can be expected once the postponement transition comes to an end and the age patterns of childbearing eventually stabilize.

**(p.81)** When we look to the future, however, how can we discern the likely track of fertility rates? Furthermore, which of the forces and issues discussed in section 3.2 will have the most impact on such future trends? In this context, we employed a ‘low fertility’ module within the IIASA-Oxford survey discussed in Chapter 2 to elicit both quantitative information regarding likely future trends and qualitative information regarding the validity and potential effect of possible drivers of these trends. In section 3.3 we discuss the design of the survey module and outline the findings.

### 3.3 Expert survey and results of expert meeting: summary of findings

#### 3.3.1 Introduction

The low fertility module (LFM) of the IIASA-Oxford survey sought to gather information regarding numeric estimates of future fertility, as well as its underlying determinants, in countries defined as having low fertility. For a full discussion of the selection procedure, as well as the list of countries involved, see Appendix 3.2. First, respondents were presented the baseline TFR estimate for 2010 as published by the Population Reference Bureau (PRB) (PRB, 2012) and asked to provide point projection and 80 per cent uncertainty interval (CI) range for the TFR in 2030 and 2050. These estimates are at the heart of fertility scenarios prepared for the low-fertility countries as described in section 3.4. Second, respondents were asked to assess the impact and validity of a series of qualitative statements regarding future drivers of fertility. Finally, respondents were asked whether they wished to reassess their initial TFR forecasts after performing the qualitative exercise. Experts could add additional countries or regions for which their assessment was valid; they could also comment on the survey or on individual arguments.

In this section we outline the design and construction of the LFM, followed by a description of the characteristics of respondents. We then introduce the qualitative statements regarding likely drivers of future trends of fertility and analyse the responses in total by region and in some cases by individual country. Given the emphasis on education and human capital in this project, we analyse responses pertaining to education-related arguments separately in section 3.3.4.

### 3.3.2 The IIASA–Oxford survey

#### 3.3.2.1 Survey design and evaluation

The broad tenets and workings of the survey are outlined in Chapter 2. Here, we briefly outline the main concepts and how they have been adapted for use in the LFM.

**(p.82)** Each module of the expert survey comprised numerous arguments. These arguments took the form of a statement on future trends that might affect population dynamics. The statements were formulated in a neutral way, without explicitly referring to their likely consequence on fertility, mortality, or migration. It was deemed important not to give respondents preconceived judgements about the way diverse social, cultural, biomedical, health, policy, and economic developments may affect population. For instance, one argument in the LFM of the survey reads: ‘Men and women will increasingly share the burden of housework and childcare’.<sup>13</sup> Each argument is grouped into a series of forces. These are the broad themes that encompass most of the main determinants of low fertility and broadly reflect the discussion in section 3.2.<sup>14</sup> These forces (and respective number of arguments) in the LFM were:

- cultural and social forces in fertility ideals, norms, and desires (9)
- partnerships, living arrangements, and gender differences (9)
- role of policies (9)
- employment and economy (9)
- biomedical and timing of parenthood (7)
- education (3).

For each argument, respondents were asked to gauge its expected future likelihood or validity and its impact pertaining to the year 2050. These are defined and interpreted as follows.

1. Validity, ranging from 0.0 to 1.0, gives an indication whether a given argument is likely to be true, based on five predefined response options and the validity score attached to them. The complete phrasing and response options are illustrated in the following example:

**Module:** low fertility countries

**Force:** role of policies

**Argument:** government will take an increasingly pro-natalist stance (e.g. through communication campaigns and family policies)

---

Based on your knowledge of the empirical evidence and the validity of the reasoning involved, and with reference to the selected country and the period up to 2050, do you think the above argument is:

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Very likely to be wrong (0.0)	More wrong than right (0.25)	Ambivalent (0.5)	More right than wrong (0.75)	Very likely to be right (1.0)
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2. Impact, also called conditional impact, represents an assessment of the hypothetical influence of a given trend on fertility (mortality, migration). The predefined range **(p.83)** was from -1 (strongly negative) to +1 (strongly positive). Specifically, the respondents were asked:



**Regardless of your answer above, if the above argument were completely true**, what effect would this have on future levels of cohort fertility in country?

Strongly decreasing (-1.0)	Moderately decreasing (-0.5)	None (0.0)	Moderately increasing (0.5)	Strongly increasing (1.0)
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3. Finally, validity and conditional impact are assessed in combination to define a net impact. This was computed in two steps. First, the validity score and conditional impact score were multiplied resulting in a net impact which is, by definition, smaller or equal to the conditional impact, and can range from -1.0 (strongly negative) to +1.0 (strongly positive), with the results presented on-screen.<sup>15</sup> Subsequently, the experts were allowed to adjust the net impact so that it better reflected their expectations. Thus, we have frequently obtained two alternative measures of the net impact for each argument, one computed in a standardized fashion and the other adjusted by the respondent. We use the latter measure in our analyses and further computations as it better reflects respondents' views.

Mean likelihood, mean conditional impact, and mean net impact on fertility were calculated for each argument for the set of all analysed countries for regions and for selected countries. These were calculated as simple averages over all respondents for a given country or region. Alternative approaches, such as weighting responses of experts by the population size of their countries of expertise, were rejected, as this could give disproportionately strong influence to experts from large countries with a very small expert base.

In the analysis of responses in the LFM, a complementary indicator—an index of disagreement—was computed for each of the three main indicators. It gauges the level of consensus among the experts over the validity and impact of different arguments. When all responses point in one direction, the index of disagreement falls towards 0.0; when the experts are split into two opposing groups of the same size, the index reaches a maximum value of 1.0. The cut-off point for delineating two diverging groups was set at 0.5 for the validity measure (recall that responses ranking below 0.5 signal disagreement with the argument's validity and vice versa), and 0.0 for impact and net impact. The index of disagreement is computed by relating the number of respondents holding a minority view (either positive or negative) to the number of respondents supporting a majority view.

Finally, we calculated indicators pertaining to the broad forces. First, force weights express the relative importance of a given force or cluster of arguments, as assessed by **(p.84)** the respondents. This sums up to 100 per cent (or 1.0) for all clusters combined. Again, we compute mean cluster weights overall and by regions and countries as a simple average across all experts in a given country or region. Aggregate net impact represents a sum of net impacts computed for each expert across all 46 arguments. The more negative the score, the more arguments were suggested to have a negative impact on future fertility, and vice versa. Combined net impact, in contrast, summarizes net impact across different arguments by country, region, or for all analysed countries. It is computed either for individual forces or for all arguments

combined. We computed it as a simple sum of the net impact for all the arguments considered. It can therefore reach values outside of the range of the net impact for individual responses (-1.0 to +1.0).

We then analysed experts' estimates pertaining to the future level of period TFRs in 2030 and 2050. These mean values are computed for countries and regions, as well as globally. They differ from the indicators above in that they are weighted by population size of the countries in each region in order to better reflect expected regional and global fertility levels. Finally, voluntary data regarding respondent's age, gender, country of origin, and place/nature of work were collected, as well as comments concerning either missing arguments or the structure of the survey. The survey as a whole was extensively tested with an estimated completion time of about 20–30 minutes.

### **3.3.2.2 Feedback and testing for bias**

A number of respondents left valuable feedback that helped us evaluate the exercise. In terms of the survey itself, some respondents found it too long, and there were concerns that some arguments were missing<sup>16</sup> or of limited relevance to particular countries and regions. However, the latter concern could easily be addressed by rating these arguments as unlikely to be correct or as having no potential impact on fertility. Conceptually, some respondents expressed concern about making period TFR estimates for the future and about the time scale involved. Generally, however, most feedback was positive.

One method by which we could evaluate the broader consistency and integrity of responses by individual respondents was to compare the aggregate argument score (see section 3.3.2.1) for each expert with their estimate of the expected change in the period TFR between 2010 and 2050. It can be expected that the experts who thought that many of the factors presented will negatively affect future fertility should also, on average, forecast that fertility levels will decline. This 'internal logic' is, indeed, in evidence in Figure 3.5, which depicts a good correspondence between the direction and the strength of the aggregate argument score on the one side and expected fertility change on the other side (correlation coefficient is 0.38).

**(p.85)**

We were also concerned that the implied trajectory, or direction, of the arguments should be as balanced as possible, that is, that a similar number of arguments pointed towards higher and lower fertility. One method of testing for any systematic bias was to analyse the extent to which respondents altered their initial estimates of TFR in 2050 as a consequence of performing the qualitative exercise. If experts disproportionately lowered their estimates, for example, then it would suggest that our arguments may have been geared towards a negative impact on fertility, potentially biasing projection scenarios that were largely based on expert's expectations (see

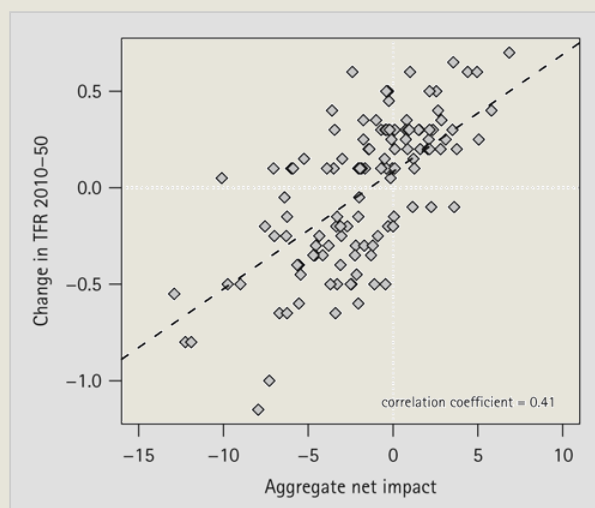
section 3.4). If the arguments were disproportionately leading in one direction, this could fundamentally alter the total projection exercise and create either a downward or upward bias.

A changed estimate of TFR in 2050 was found in 32 of the 184 questionnaires. However, as Figure 3.6 demonstrates, the directionality is far from uniform. Indeed, the number of respondents who revised their estimates up or down is almost identical. This suggests that our arguments were generally not biased towards indicating either lower or higher fertility futures.

A final check was performed by examining the net impact of the 46 arguments. Overall, 26 were deemed to have a negative effect, while 20 were suggested to have a positive impact.

### 3.3.2.3 Respondents

Altogether, 184 questionnaires on the LFM of the survey were completed by more than 170 experts (some experts chose to make two or more assessments; 110 experts revealed their full names). Appendix 3.3 gives a full breakdown of the respondents' profiles. The vast majority come from an academic background. Altogether, for 14 countries, 5 or (p.86)



**FIGURE 3.5** Aggregate net impact and estimated total fertility rate (TFR) change in 2010–50 (individual experts, all low fertility countries combined).

more experts have provided assessments, with the USA by far the most popular country (22 assessments), followed by China (14 assessments), Italy (12), and Germany (9). A number of experts have assessed countries outside the traditional low fertility regions of Europe, Northern America, Japan, Australia, and New Zealand. Clearly, despite uneven coverage of some countries—with no expertise provided for France with a population of 64 million and 7 assessments for Sweden with a population of 9 million—the assessments mirror quite well the wide geographical spread of low fertility today, with particularly good coverage of China, Brazil, Japan, Mexico, Turkey, and Iran.

### 3.3.3 Results

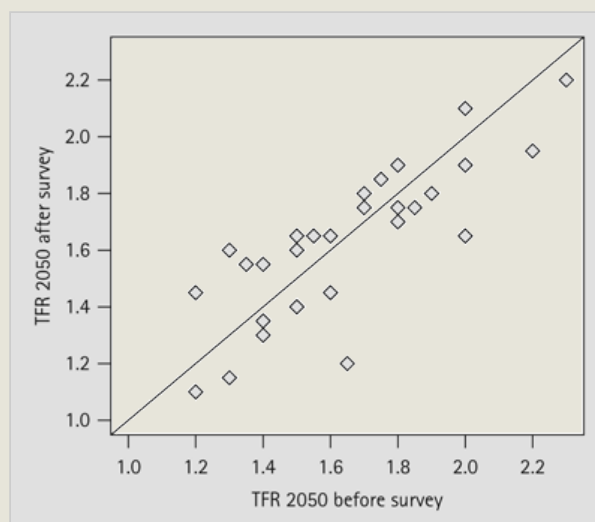
#### 3.3.3.1 An overview using CIRCOS plots

In Figure 3.7 we summarize the general results of the survey using a Circos plot (Krzywinski et al., 2009). Around the plot are abbreviated versions of the arguments and their associated code (for the complete list of all arguments, see Appendix 3.4). The arguments are clustered into their associated forces, which are labelled in the centre (e.g. 'Education' and 'Culture').

#### 3.3.3.2 The relative importance of different forces (width of sections)

When considering the 'overall' forces alone, respondents felt that forces 1 and 4, namely, 'Cultural and social forces in fertility ideals, norms, and desires' and 'Employment and economy' were the most pertinent for shaping future fertility trends. These forces were weighted as 0.230 and 0.221 respectively. Forces 2, 3, and 6 concerning 'Partnerships, (p.87) living arrangements, and gender differences', 'Role of policies', and 'Education', respectively, are gathered together in a second-tier cluster (weights 0.162, 0.156, and 0.156 respectively), while force 5, which concerns issues relating to biomedicine (including infertility and AR) and the timing of parenthood, was ranked last (0.077).

In Figure 3.7, these weights are translated into the width of the segments devoted to each force irrespective of the number of constituent arguments. Note, for example, the different sizes of the 'Culture' and 'Biomedical' forces. In terms of directionality, of the six groups only 'Policies', broadly defined, were deemed to have a positive net impact on fertility, while 'Partnerships, living arrangements, and gender differences' were expected to have the most depressing effect. However, without further exploring the impact of individual



**FIGURE 3.6** Respondents who altered their total fertility rate (TFR) estimates for 2050 *ex post*.

arguments, which often run in the opposite direction within each broad force, this general finding is difficult to interpret. Finally, there are sizeable regional differences in terms of the net impact of both the entire forces and individual arguments by region. We address the regional differences in arguments later in Figure 3.8 and in Table 3.2.

### 3.3.3.3 Mean net impact (outer circle)

As discussed earlier, the mean net impact of an argument is derived from a combination of the stated validity of a given argument with its conditional impact (i.e. the impact it would have if it were completely true). In Figure 3.7 those arguments that were deemed to have a positive net impact are shaded in lighter grey, while those perceived to have a negative impact are shaded darker.

Across the entire survey, the arguments perceived to have the strongest net positive impact on fertility related to immigration from higher fertility countries, increasing flexibility in work practices, the provision of universal childcare and other family policies, and increased gender equity in the performance of housework. Regarding the strongest net negative impact, uncertainty in individual life course planning and the related arguments concerning job instability among the young and an inability to find the right partner were key. Two related arguments of spending more years in education and the postponement of childbearing were also expected to place a downward pressure on fertility, suggesting that most respondents expected continuation of the trend towards later timing of childbearing in the coming decades.<sup>17</sup> Finally, the argument that ‘Women will follow lifestyles incompatible with motherhood’ also had strong negative mean net impact on fertility. This suggests that different facets of increased gender equality may have contrasting impacts on fertility that largely offset one another: while, on balance, a stronger engagement of men in household tasks is expected to give some boost to **(p.88)**

**(p.89)** fertility, women's more independent lifestyles are likely to put a downward pressure on fertility rates.

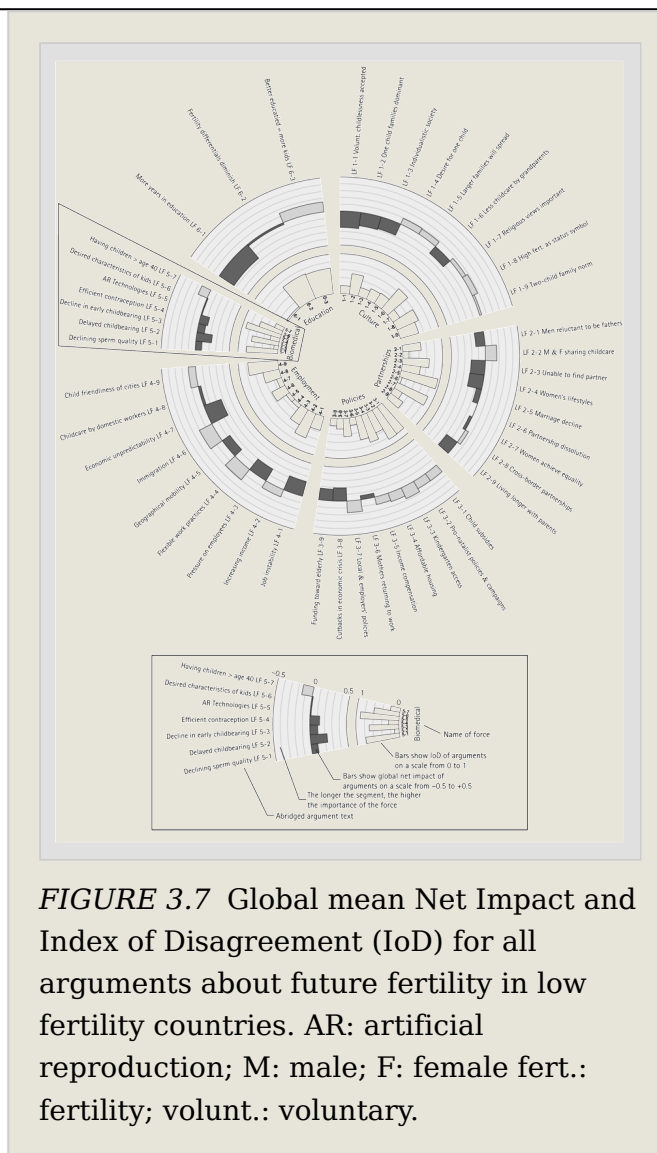
### 3.3.3.4 Validity of arguments and the index of disagreement (inner circle)

The validity of an argument is key to determining its net impact, as well as giving useful evidence of the confidence that respondents have in the continuation of key social, cultural, and economic processes affecting fertility.

The continuation of two related trends towards ever longer time spent in education and delayed childbearing were deemed to be the most valid arguments, followed by partnership dissolution and re-partnering, increased flexibility in work practices, geographical mobility, and the growing acceptability of voluntary childlessness. In contrast, respondents thought that the role of religion in shaping family attitudes and the share of large families (defined relatively) were the least valid arguments, followed by the statement that 'men are increasingly reluctant to become fathers'.<sup>18</sup>

To demonstrate the importance of measuring both validity and impact, it is worth considering a particular argument in Table 3.1. Argument 2.6 'Partnership dissolution and re-partnering will become more common' was deemed very valid, but its mean net impact was precisely 0.0.<sup>19</sup>

More interesting, however, is the extent to which respondents disagreed over the validity of a given argument. This is measured by the index of disagreement in the inner circle of Figure 3.7. The index ranges from 0.0, which would imply that all of the experts shared a similar view (either joint agreement or joint disagreement with the statement), up to 1.0, which implies half of the respondents agreed and half disagreed (section 3.3.2.1). As Figure 3.7 shows, the arguments with the highest indices of disagreement of 0.84 or above were



related to the further decline of marriage (argument 2.5, index of disagreement 0.94), continued barriers to AR (5.5), the elimination of gender inequalities in the public sphere (2.7), and the role of governments through taking an explicitly pro-natalist stance (3.2) and increasing spending on child subsidies and tax benefits (3.1).

Clearly, there was significant disagreement among respondents concerning the institution of marriage, the accessibility of AR, and the likelihood that women achieve equality with men. Respondents were also divided on the likelihood of governmental intervention. In each of these cases, the mean net impact is minimal.

(p.90)

**Table 3.1 Arguments Deemed Most and Least Valid**

<b>Argument (abbreviated, see full version in Appendix 3.4)</b>			
<b>Most likely to be right</b>	<b>Group</b>	<b>Validity score</b>	<b>Mean net impact</b>
6.1 'More young adult years enrolled in education and training'	6 (Education)	0.78	-0.26
5.2 'Delayed childbearing yet more common'	5 (Biomedical)	0.75	-0.23
2.6 'Partnership dissolution and re-partnering more common'	2 (Partnership)	0.73	0.00
4.4 'Work practices will become more flexible'	4 (Economy)	0.71	0.19
4.5 'Geographical mobility will increase'	4 (Economy)	0.70	-0.14
1.1 'Voluntary childlessness increasingly accepted'	1 (Culture)	0.70	-0.24
<b>Most likely to be wrong</b>			
1.7 'Religious views on family will gain importance'	1 (Culture)	0.33	0.06
1.5 'The share of groups with larger families will increase'	1 (Culture)	0.36	0.09
2.1 'Men increasingly reluctant to become fathers'	2 (Partnership)	0.41	-0.14



These disagreements can also reflect regional differences in the responses on important factors shaping contemporary fertility. In the next section we examine differences by region in terms of both forces and arguments.

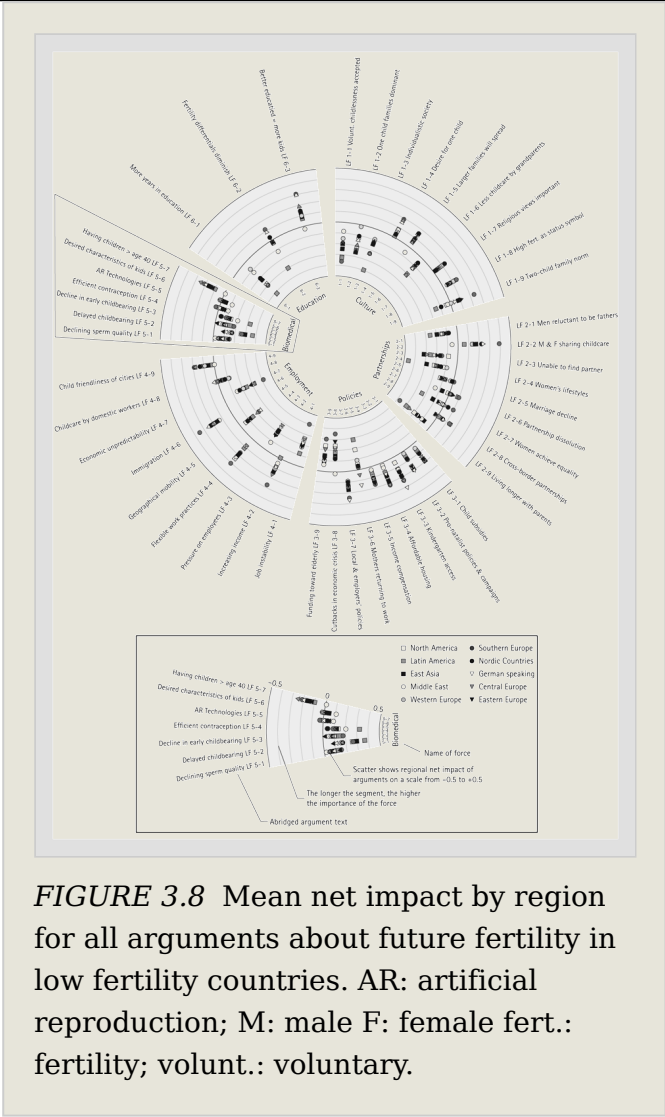
### **3.3.3.5 Regional differences in net impact of arguments**

Figure 3.8 represents the responses to each argument differentiated by the relevant region. This should be read in conjunction with Table 3.2, which shows the two arguments that respondents deemed to have the strongest positive and negative impact on future fertility trends for each individual region (see Appendix 3.3 for listing of all the countries with at least one respondent within each region). Table 3.2 also shows the net impact of all forces combined for each region, that is, the overall general direction in which the responses suggest fertility will go.

Regional variation concerning ‘Cultural and social forces in fertility ideals, norms, and desires’, and ‘Partnerships, living arrangements, and gender differences’ was broadly similar, with respondents for Latin America reporting a strong association between these forces and future rates of fertility compared with Europeans (excluding CEE), who felt these forces would contribute to either only a small decrease or, in the case of Western Europe, a very small increase. Interestingly, respondents for Japan stated that ‘Partnerships, living arrangements, and gender differences’ was the force that would have the most depressing effect on future fertility—a feature that concurs with our discussion on gender roles in section 3.2, especially Box 3.2.

**(p.91)**

(p.92)



**Table 3.2 Top Two Arguments Deemed by Respondents to Have the Strongest Mean Net Impact on Future Trends of Fertility, Either Positive or Negative**

Region and net impact of all forces combined	Code	Abbreviated argument*	Mean net impact
North America (-2.20)	4.4	Work practices become more flexible	+0.24
	4.6	Immigration from high fertility countries will increase	+0.20
	1.1	Voluntary childlessness is increasingly socially accepted	-0.32

Region and net impact of all forces combined	Code	Abbreviated argument*	Mean net impact
	4.7	Economic unpredictability means uncertain life course planning	-0.32
Latin America (-4.55)	4.6	Immigration from high fertility countries will increase	+0.15
	3.7	Increased family-related policies by local governments and employers	+0.14
	6.1	Ever more years of life enrolled in education	-0.41
	2.4	Women will pursue lifestyles not compatible with motherhood	-0.46
East Asia (-1.47)	4.4	Work practices become more flexible	+0.20
	3.3	Government will provide universal nursery/kindergarten access	+0.19
	5.2	Delayed childbearing will become yet more common	-0.30
	2.3	Harder to find the right partner to form a family	-0.31
Western Asia/Middle East (Iran and Turkey) (-1.86)	3.2	Government will take an increasingly pro-natalist stance	+0.17
	4.6	Immigration from high fertility countries will increase	+0.13
	4.1	Unemployment and job instability among under-30s will increase	-0.19
	5.4	Broad availability and use of efficient contraception	-0.20
Western Europe (-0.31)	4.6	Immigration from high fertility countries will increase	+0.19
	5.7	Assisted reproduction will allow routine childbearing at ages 40+	+0.17

Region and net impact of all forces combined	Code	Abbreviated argument*	Mean net impact
	4.3	Employers will put more pressure on their employees	-0.18
	4.7	Economic unpredictability means uncertain life course planning	-0.21
Nordic countries (-0.37)	4.6	Immigration from high fertility countries will increase	+0.23
	2.2	Men and women will increasingly share housework and childcare	+0.22
	6.1	Ever more years of life enrolled in education	-0.20
	4.3	Employers will put more pressure on their employees	-0.20
Southern Europe (-0.32)	2.2	Men and women will increasingly share housework and childcare	+0.39
	4.6	Immigration from high fertility countries will increase	+0.35
	4.1	Unemployment and job instability among under-30s will increase	-0.40
	4.7	Economic unpredictability means uncertain life course planning	-0.41
Austria, Germany, Switzerland ('German-speaking') (+0.26)	3.3	Government will provide universal nursery/kindergarten access	+0.32
	6.3	Better educated women will want more children and pursue a career	+0.30
	4.3	Employers will put more pressure on their employees	-0.25
	4.7	Economic unpredictability mean uncertain life course planning	-0.32

Region and net impact of all forces combined	Code	Abbreviated argument*	Mean net impact
Central Europe (-1.07)	5.7	Assisted reproduction will allow routine childbearing aged 40+	+0.25
	3.3	Government will provide universal nursery/kindergarten access	+0.24
	2.3	Harder to find the right partner to form a family	-0.29
	4.7	Economic unpredictability means uncertain life course planning	-0.31
Eastern Europe (-0.89)	4.4	Work practices become more flexible	+0.19
	3.4	Increased provision of affordable housing for families/young adults	+0.18
	3.8	Retrenchment of family support when economic conditions worsen	-0.28
	4.7	Economic unpredictability means uncertain life course planning	-0.28

(\*) See Appendix 3.4 for full text of all arguments.

**(p.93)** The role of policies was felt to have a potentially depressing effect upon fertility among respondents for North America, perhaps mirroring widespread scepticism about the possibility of launching a more comprehensive set of family-related policies there, but a generally positive effect among respondents for Europe and Asia. We explore the causes of this contrast later in this section. The net impact of employment and economy was generally small across the regions (with the exception of Mexico and Iran), with the opposing impacts of individual arguments largely cancelling out. Biomedicine and the timing of parenthood were held to have a universally depressing effect on fertility across the regions, with Latin America (-0.90) and Western Europe (-0.18) as high- and low-impact extremes.

In terms of positive impacts, immigration from higher fertility countries was among the top two arguments in six regions, including the Middle East, but not German-speaking countries. Increasing flexibility in work practices was among the top two factors in North America, East Asia, and Eastern Europe. Policy is clearly deemed as important, with three related arguments concerning childcare provision, social housing, and the role of local government and employers

reported as a leading argument in five regions. Indeed, within German-speaking countries, there is logical consistency between the top two arguments of 'Government will provide universal nursery/kindergarten access' and 'Better educated women will want more children and pursue a career'. Respondents in Iran and Turkey emphasized the expected role of government pro-natalism, mirroring the new emphasis given to supporting higher birth rates there (section 3.1.4.8). Curiously, respondents for Nordic countries and Southern Europe—traditionally at different ends of the domestic gendered division-of-labour—both agreed that an increase in male contribution to childcare and housework is likely to positively influence fertility in the future. Finally, for Western and Central Europe, the role of ART was deemed as important.

**(p.94)** Aside from the economy, the more generic argument concerning delayed childbearing was prominent in East Asia and the Middle East, while in Latin America and Central Europe the related issue of ever more years spent in education was also cited. Other unique, region-specific arguments include the growing acceptability of voluntary childlessness in the USA; work-related geographical mobility in German-speaking **(p.95)** countries; the pursuit of lifestyles by women that are incompatible with childbearing in Latin America; and the increasing inability to find the right partner in East Asia. Each of these top-ranking arguments 'makes sense', especially when linked back to our thematic and region-specific reviews in sections 3.1 and 3.2.

### Box 3.4 Expert Views on Current Economic Uncertainty by Country

In terms of expected negative effects on fertility, the role of economic uncertainty and job security in general, and the current economic recession explicitly, are clearly highlighted by the respondents. At least one of the related arguments of 'Economic unpredictability means uncertain life course planning' and 'Unemployment and job instability among the under-30s will increase', ranked among the top two arguments in all regions except for East Asia, Latin America, and Nordic countries. It is no coincidence that these are the regions that have escaped from the recent recession relatively unscathed. Likewise, it is no surprise that these two arguments resonated particularly well in Southern Europe, where economic uncertainty is expected to have the strongest negative impact on fertility.

We can disaggregate further by examining the responses for particular countries. Table 3.3 shows responses to the two arguments mentioned for countries with four or more respondents. Clearly, the experts for Italy and Spain were the most pessimistic, while those for Brazil, China, and Iran appear generally less concerned. Japan is an interesting example in that the emphasis was especially placed upon job security for the under-30s rather than the more general economic uncertainty and life planning. It is curious

that Austria and Germany should score so high, especially given that both countries have weathered the recent economic recession relatively well.

**Table 3.3 Impact of Economic Uncertainty Upon Future of Fertility, Mean Net Impact**

4.1 'Unemployment and job instability among the under-30s will increase'		4.7 'Economic unpredictability mean uncertain life course planning'	
Italy (N12)	-0.52	Italy (N12)	-0.53
Japan (N6)	-0.28	Spain (N7)	-0.36
USA (N22)	-0.26	Austria (N7)	-0.35
Austria (N7)	-0.26	Germany (N10)	-0.35
Turkey (N5)	-0.26	Mexico (N6)	-0.34
Sweden (N9)	-0.25	USA (N22)	-0.31
Spain (N7)	-0.22	Australia (N5)	-0.26
Germany (N10)	-0.20	Czech Republic (N6)	-0.23
Czech Republic (N6)	-0.19	China (N14)	-0.20
Mexico (N6)	-0.18	Turkey (N5)	-0.18
Iran (N9)	-0.14	Brazil (N7)	-0.15
China (N14)	-0.10	Iran (N9)	-0.14
Brazil (N7)	-0.10	Japan (N6)	-0.10
Australia (N5)	-0.08	Sweden (N9)	-0.08

In conclusion, there are large differences between regions in terms of the validity and impact of different arguments, of which we highlight only the most prominent features. Several key themes can be detected across the regions, especially regarding immigration, family policy, and economic uncertainty, which is further explored in Box 3.4. However, there are also unique factors that are particularly salient for a given region.

### 3.3.4 A focus on education

As discussed in Chapter 2, a key element of this exercise is to examine the role of education in shaping population futures. This will be seen in both section 3.5 and Chapter 9, which present population projections by age, sex, and educational level. In this section, we explore the arguments concerning education in greater depth and consider their significance.

**(p.96)** Taken together as an overall force consisting of three arguments, education appears to have a relatively marginal negative impact at the global level, returning a net impact on fertility of  $-0.14$  (recall that this number does not pertain to any specific indicator). There are, however, important regional differences. For example, in Latin America the net impact of the education force is  $-0.64$ , indicating an expected massive fertility-depressing effect of rising educational level in the region (compared to  $-0.06$  for the group of arguments pertaining to policies and  $-0.40$  for employment and the economy). Meanwhile, in German-speaking Europe education had a positive effect of  $+0.19$ —second only to the policy cluster, in fact indicating an expectation that high levels of education will increasingly be compatible with motherhood.

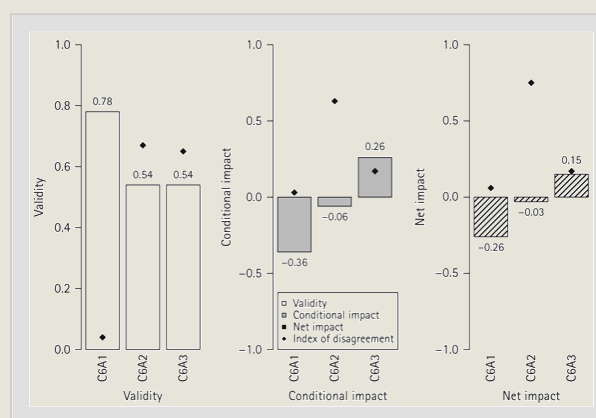
### 3.3.4.1 Education arguments

The education component of the survey contained three arguments:

- 6.1 ‘People will spend ever more years of their young adult life enrolled in education and professional training on the job’
- 6.2 ‘Fertility differentials by level of female education will diminish’
- 6.3 ‘There will be a new trend for better educated women to have more children and simultaneously pursue a professional career’.

The validity of these arguments and their conditional, as well as net, impacts are depicted for all low fertility countries in Figure 3.9, while the net impact is also shown by region in Figure 3.8. Regional variation in expert expectations regarding the impact of education on future fertility is further analysed in section 3.5.3.5.

The intimation in argument 6.1 is that as more and more people spend increasing periods of their adult life enrolled in education (usually tertiary education), which is frequently perceived as being incongruous to raising children, a depressing effect on fertility could ensue. Generally, there was very strong agreement that the amount of time spent by young people in education would increase. Indeed, on a global level this was the most likely scenario across all the arguments. Not surprisingly, most respondents predicted this would have a negative effect on fertility. The global mean net impact was  $-0.26$ . After ‘Individual life-course planning becoming ever more uncertain’, this argument had the strongest individual net impact among the 46 arguments in the exercise



**FIGURE 3.9** Validity, impact, and net impact (with indices of disagreement as black dots) for all countries in low fertility data set.



and was negative in all regions. With regard to regional variation, this argument was found to have smaller impact in Western Europe (-0.08) and the Middle East (-0.12). The strongest negative impact was envisioned for Latin America (-0.41) and South Europe (-0.30).<sup>20</sup>

The second and third educational arguments (6.2–6.3) approach the widely discussed topic of the possible convergence of fertility among women with different levels of education (argument 6.2, discussed in sections 3.2.7 and 3.5.3.1–3.5.3.5). This could take place either because higher educated women will be able to have more children (argument 6.3), or, presumably, owing to further reductions in fertility among women with low levels of education. Unlike argument 6.1, 6.2 saw significant levels of disagreement among the **(p.97)** respondents in terms of both validity and impact, suggesting considerable ambiguity among them on whether achieved level of education will remain an important differentiating factor in fertility. For argument 6.3, meanwhile, most respondents agreed on the conditional impact of the argument if true, but there was significant disagreement on the likelihood that highly educated women will achieve higher fertility in the future.

As Figure 3.8 shows, the regional variation within responses to argument 6.2 is relatively slight, with a congregation around no overall impact, with the exception of Latin America and the Middle East. Argument 6.3, meanwhile, revealed some interesting regional variations. Respondents in Southern Europe and German-speaking Europe reported the highest net impact of better educated women having more children combined with a career (both about 0.3). When we compare this to East Asia, Latin America, and the Middle East, where the net impact was perceived to be virtually non-existent, we might conclude that the expected positive impact of education on fertility is strongest in the two European regions envisioned to progress through Esping-Andersen's (2009) 'incomplete gender revolution,' with the East Asian countries trailing well behind.

### 3.4 Quantitative forecasts of future fertility levels: experts' views

#### 3.4.1 Introduction

The development of assumptions for the projection exercise was a multi-stage process. In step one, respondents to the survey were asked to provide point (main) and range (covering 80 per cent CI) estimates for period TFR in 2030 and 2050. In step two, these estimates were analysed and interpreted by an invited group of experts in low fertility at a meeting in Vienna in December 2011.<sup>21</sup> These experts focused on discussing the likely **(p.98)** long-term fertility trends through 2050 in major low fertility countries such as China, the USA, Brazil, Japan, Russia, Germany, and Iran, as well as in countries representing broader regions (e.g. Sweden for the Nordic countries). They also discussed possible factors and mechanisms influencing fertility in the very long-term horizon through 2200. Finally, in step three, numerous adjustments to the projections

have been made jointly by the WIC teams working on low fertility countries, high fertility countries, databases (including data on education–fertility differentials), and defining and implementing projection scenarios (see section 3.5 and Chapter 9). During this process, future fertility rates have been forecasted for every country in the ‘low fertility’ group (see Appendix 3.2), including the countries with no expert evaluation or expert discussion, by means of implementing regional averages. To assure consistency in projections within broad geographical regions, future fertility in Latin America, South East Asia, and most of West Asia and the Middle East (except Iran, Israel, and Turkey) was projected using a forecasting model applied by the researchers analysing ‘high fertility countries’ (Chapter 4). In addition, the scenarios of fertility by level of education have been specified (section 3.5.3.5). In this section we concentrate on presenting the opinions of the respondents in the survey.

One of the key elements of the exercise was to obtain predictions of period TFRs by the respondents for 2030 and 2050. These not only form the basis for the projection scenarios, especially the main variant, but are also a means of providing a local expert-based ‘bottom-up’ comparison to the model-derived assumptions from the UN World Population Prospects (UN, 2011).<sup>22</sup> In this section we outline some of the key findings, presented as global results across all analysed countries, for world regions, and selected countries. Regional means were created as population-weighted averages for all countries within each region with available responses by at least two experts. We use final point projections of the TFR that the experts had a chance to revise after assessing all the arguments pertaining to the future fertility trends.

3.4.2 Overall trends

3.4.2.1 Global trends

The overwhelming global message from the survey is that respondents expect that fertility will stay below the replacement level to 2050, even should the current negative tempo effect eventually lose relevance. As Table 3.4 shows, among the experts who changed at least some of the predefined future TFR values (point, low, or high estimate;  $N = 174$  out of the total of 184), the overwhelming majority thought fertility would remain below replacement to 2050, with about one-sixth expecting it to reach a very low level of 1.3 or below. Even in the high variant—or the expert-defined upper level of the (p.99)

**Table 3.4 Experts’ Projection of the Period Total Fertility Rate (TFR) in 2050 (Final Main Estimate of All Low Fertility Countries in Survey; Selected Results)**

	N (experts)	% (N = 174)
Point estimate of the TFR in 2050		

	N (experts)	% (N = 174)
<sup>3</sup> 2.0	26	15.2
... of which > 2.1	13	7.6
≤ 1.5	53	30.5
... of which < 1.3	24	13.8
TFR in 2050 will be...		
Lower than in 2010	61	35.1
... of which by ≤ 0.5	19	10.9
Higher than in 2010	75	43.1
... of which by <sup>3</sup> 0.5	11	6.3
Same as in 2010	38	21.8

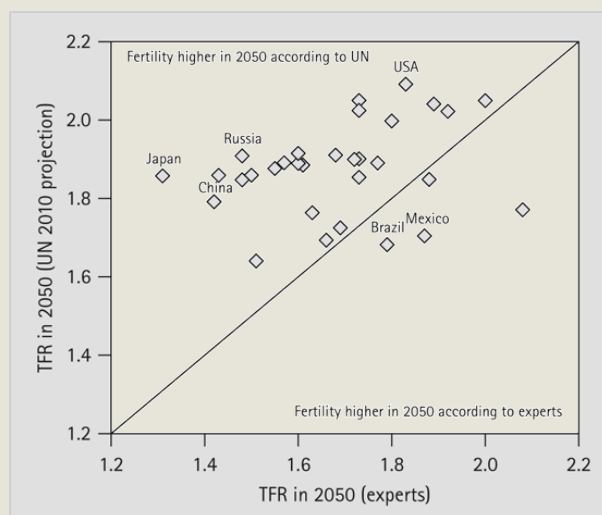
80 per cent CI—over one-third of experts anticipated that fertility would remain below two children per woman. Because recent fertility rates were very low in many countries, more experts expected a TFR increase between 2010 and 2050 ( $N = 75$ ) than expected a decline ( $N = 61$ ). Only few expected that these increases or declines would be of a large magnitude of 0.5 or higher.

These expectations differ considerably from the higher TFR values projected by the 2010 round of the UN population projections (UN, 2011). Figure 3.10 shows the mean point projections of the TFR in 2050 for each country with at least two participating experts, as contrasted with the UN medium projection. In 27 out of 31 countries the experts expected lower fertility in the future than the UN projection; the four exceptions are Argentina, Brazil, Mexico, and Georgia. In as many as 12 countries the experts expect the TFR to be at least 0.3 lower than the median UN projection in 2050; this discrepancy surpasses 0.5 for Japan and 0.4 for Russia and Romania. The experts expect sizeable fertility declines (by 0.2 or more) and/or stagnation at a low level (1.6 or lower) for the majority of the most populous low-fertility countries, including China, Iran, Russia, Turkey, Italy, and Japan (see also Table 3.5). These expectations paint a picture of a rich- and medium-income world where many smaller countries may retain fertility rates relatively close to the replacement levels, but some of the major countries experience persistent low fertility. Overall, the UN model predicts TFRs for the total group of analysed countries of 1.70 in 2030 and 1.84 in 2050; the respondents' mean projection is 1.58 and 1.57 respectively.<sup>23</sup> Overall, the number of countries with a TFR below 1.5 is expected to diminish, and most countries are expected eventually to fall in a broad range between 1.50 and 1.99 (p.100)

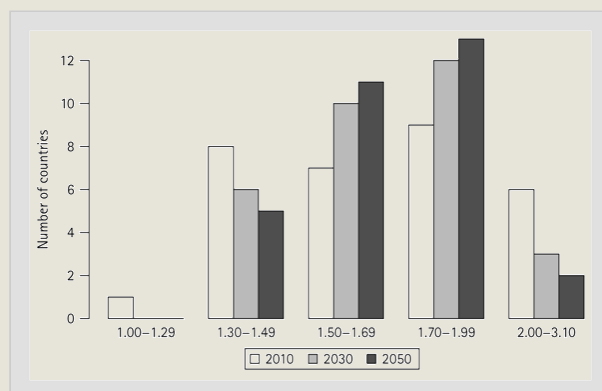
**(p.101)** (Figure 3.11), with 11 out of 31 countries belonging to the low fertility group (1.50–1.69) and another 13 to moderately low fertility group (1.70–1.99) as of 2050. The diminishing number of countries expected to retain very low (TFR below 1.5) or around replacement fertility (TFR at 2.0 or higher) indicates that the experts envision a gradual trend towards convergence to moderate sub-replacement fertility for most countries. This is illustrated in Figure 3.12, which depicts a close correlation between the observed TFR level in 2010 and the expected TFR change between 2010 and 2050. Almost all countries with a TFR at 1.7 or lower are expected to experience an increase in fertility, while almost all countries with the currently higher TFR level are expected to see future fertility declines.

Figure 3.13 presents a further comparison to the UN's 2010 assumptions, showing both the medium assumption and the 80 per cent CIs for all low fertility countries with at least two experts in 2030 and 2050. The UN probabilistic projection is remarkably similar to the WIC projection in its upper boundary of the 80 per cent CIs, but it shows progressively higher values of the main TFR estimates, as well as of the lower boundary of the 80 per cent CIs, especially after 2025.

Turning to a country level confirms the expectation of a low fertility future. Among the large countries, two East Asian giants, China and Japan, are ranked at the bottom of the expected future TFR levels, with the point estimates of their TFR in 2050 of 1.31 and 1.42 respectively (see section 3.4.2.2). These



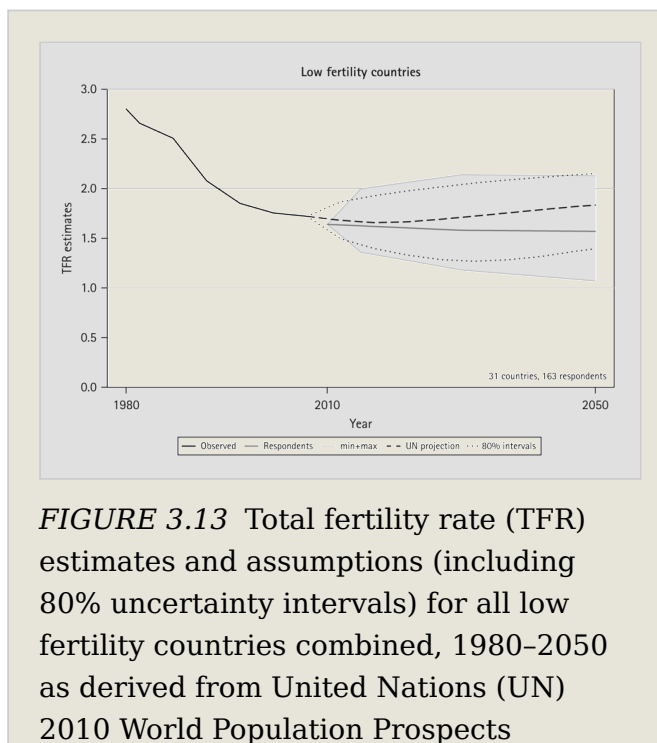
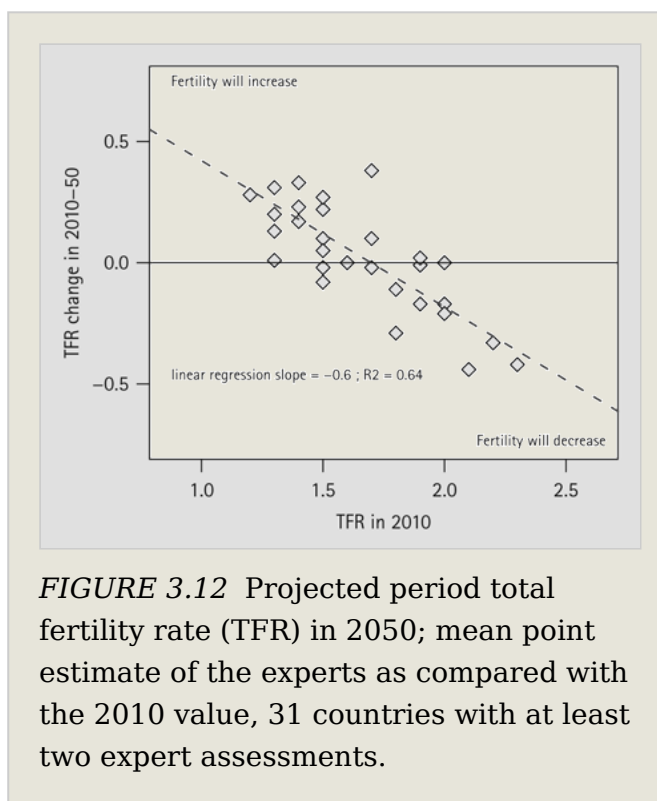
**FIGURE 3.10** Projected period total fertility rate (TFR) in 2050; mean point estimate of the experts as compared with the United Nations (UN) medium value, 31 countries with at least two expert assessments.



**FIGURE 3.11** Distribution of the observed (2010) and projected (2030 and 2050) period total fertility rate in 31 low fertility countries with at least two expert assessments (point estimate, mean value across all experts for each country).

expectations contrast with much higher projected values by the UN. Given China's high share of the population of low fertility countries and, indeed, of the global population, these low expected fertility rates have strongly contributed to overall low projected TFR across the entire group of analysed countries.

(p.102)



**3.4.2.2 Regional trends**

In Appendix 3.5 we present graphs for each low fertility region analysed in this chapter (data are weighted by population size). Here, we give a brief overview of the general trends (see also Table 3.5; the list of countries included in each region is provided in Appendix 3.3).<sup>24</sup>

(probabilistic scenarios) and expert survey.

**Notes:** Only countries with at least two expert assessments included. Global mean weighted by population size of countries included. See Appendix 3.5 for similar graphs by regions.

For Western and Nordic Europe, the respondents broadly concurred with the UN projections of stabilization, with the predictions centred on marginally below replacement fertility (TFR approximately 1.9 by 2050). Meanwhile, in the lower fertility areas of Europe a more mixed picture emerges. The respondents for ‘German-speaking’ countries predicted a constant increase in TFR to 2050, albeit below those predicted by the UN. Similarly, in Southern Europe, the respondents envisaged a general increase in TFR **(p.103)**

**Table 3.5 Observed Period Total Fertility Rate (TFR) in 2010 and Projected Period TFR in 2050 in Largest Low Fertility Countries and in Selected Countries Representing Broader Regions; Expert's Expectations (Mean Value of Point Estimates and 80% Uncertainty Interval (UI)) and United Nations World Population Prospects (UN WPP) 2010 Medium Projection Variant**

Country	N <sup>‡</sup>	2010: observed TFR <sup>§</sup>	2030: mean		2050		
			Expert	UN WPP 2010	Expert: mean	80% CI: min.-max. <sup>¶</sup>	UN WPP 2010: mean
USA	22 (19)	1.93	1.93	2.09	1.83	1.38-2.30	2.09
China	13 (7)	1.45	1.41	1.61	1.42	0.93-2.09	1.79
Australia	5 (4)	1.89	1.83	2.01	1.73	1.48-2.06	2.05
Brazil	7 (2)	1.94	1.83	1.61	1.79	—	1.68
Mexico	5 (1)	2.30	1.95	1.80	1.92	—	1.70
Iran	8 (1)	1.90	1.77	1.36	1.54	—	1.64
Japan	6 (2)	1.39	1.30	1.68	1.31	—	1.86
Turkey	5 (2)	2.04	1.82	1.74	1.66	—	1.69
Czech Republic	6 (6)	1.49	1.63	1.74	1.72	1.39-2.28	1.90
Germany	9 (4)	1.39	1.57	1.71	1.58	1.23-2.06	1.89
Italy	12 (7)	1.40	1.55	1.72	1.57	1.30-1.92	1.89
Russia	4 (2)	1.54	1.46	1.76	1.48	—	1.91
Spain	6 (4)	1.39	1.58	1.74	1.68	1.34-2.12	1.90

## Future Fertility in Low Fertility Countries

Country	N <sup>‡</sup>	2010:	2030: mean	2050			
		observed TFR <sup>§</sup>	Expert	UN WPP 2010	Expert: mean	80% CI: min.–max. <sup>¶</sup>	UN WPP 2010: mean
Sweden	7 (6)	1.99	1.90	2.00	1.89	1.47–2.23	2.04
UK	4 (4)	1.98	1.99	1.96	1.92	1.31–2.65	2.02
All countries—weighted*	31 countries	1.64	1.58	1.70	1.57	1.07–2.13	1.84
All countries—average <sup>†</sup>	174 (105)	1.69	1.70	1.77	1.68	1.27–2.21	1.88

(\*) These data show global mean TFR for all the countries with at least two expert evaluations (see Appendix 3.3), weighted by population size of these countries in 2010; these computations are based on 163 expert assessments.

(<sup>†</sup>) These data show simple average across all experts participating in the IIASA-Oxford survey and the corresponding value for the UN projection (weighted by the number of respondents in each country).

(<sup>‡</sup>) Number of respondents giving valid 80 per cent uncertainty interval shown in brackets.

(<sup>§</sup>) 2010 TFR values are based on VID (2012), Eurostat, national statistical offices, and, for China, on Zhongwei Zhao's estimate. Note that the experts participating in the online survey were shown slightly different values published by Population Reference Bureau (PRB, 2011); see Appendix 3.1, Section A1.1 for more details.

(<sup>¶</sup>) Figures shown only for countries with at least four respondents providing CIs.



to 2030 and 2050, although again generally not at the speed predicted by the UN. Central Europe also sees notable increases in TFR, which are more closely matched to the UN model. In Eastern Europe the experts predicted a general stagnation or very slight increase in fertility. For Russia and Ukraine, the respondents expected a slight decline in TFR to 2030 followed by recuperation to 2010 levels by 2050.

**(p.104)** For North America, 22 of the 25 respondents made predictions for the USA. For both 2030 and 2050, while the UN predicts stagnation at around replacement level, the respondents predicted an overall slight TFR decline from 2.0 in 2010 to the means of 1.93 in 2030 and 1.83 by 2050. The lower boundary of 80 per cent CI in 2050 (1.38) was predicted to be significantly lower than the low variant of the UN model (1.59).

In East Asia, the respondents generally predicted either stagnation or decline in TFR. In particular, the views of these respondents are at odds with the UN model for 2050, in that almost all the survey responses predicted a lower TFR than the UN. The 13 respondents for China generally expected stagnation at or around 1.4–1.5, while the UN's medium variant is 1.79 and the low variant 1.31. Respondents for Japan were even more sceptical about the possibility of future fertility increases, and with the mean predicted TFR of 1.31 in 2050 they differed most from the UN medium variant projection of 1.86.

Finally, for the rather heterogeneous group of Latin America (15 responses, 3 countries), there is a general concurrence with the UN model of continuing fertility decline.

### 3.5 Projecting future fertility

The preparation of fertility scenarios involved a complex decision-making process engaging several research teams working on the WIC projections, as well as multiple interactions with selected experts outside the teams. The key decisions concerned defining the main variant of the period TFR in 2030 and 2050, agreeing on long-term fertility pathway through 2200, projecting fertility trajectories by level of education, formulating low and high variants of fertility scenarios for each educational category, and, finally, coordinating the teams working on the low and high fertility countries in order to achieve a degree of uniformity in the methods used and data analysed. This section describes the development of these fertility scenarios, as well as contrasts to the fertility scenario-making for the countries with higher fertility levels. More detailed materials and descriptions appear as appendices.

#### 3.5.1 Formulating main scenario point projections for 2030 and 2050

This section outlines the process of deriving the main TFR projection scenario for 2030 and 2050 for all countries and regions covered in this chapter except for Latin America and parts of the Middle East (only Iran, Israel, and Turkey are projected here), which are projected following the model employed for the higher fertility countries (see Chapters 4 and 9). Additional information is provided in Appendix 3.1. The observed TFR data for the base year of the

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projection, 2010, originate from a variety of sources. For most low fertility countries, these data were derived from the PRB database or national **(p.105)** vital statistics, and are relatively precise, computed annually, and usable without further adjustments, given good and practically complete vital statistics coverage. Only in a few cases, such as Iran and the Caucasus countries, is data coverage patchy, meaning the initial TFR data should be treated as 'qualified estimates', based mostly on the UN (2011) and PRB (2011) databases. The most notable exception from relatively good data coverage is the most populous country, China, where past numbers of births and fertility rates remain highly uncertain (see Box 3.1).

The point estimates of the period TFR in 2030 and 2050 (main scenario) were derived in several steps. Following experts' predictions gathered in the IIASA-Oxford online survey and at the Vienna meeting where the TFR scenarios for the key countries were settled, the coordinating team (i.e. the three main authors of this chapter), in collaboration with other teams, formulated the point estimates for all low fertility countries. This was done by selecting one or two key countries in each region for which the fertility rates in 2030 and 2050 were defined by experts. Within each region, countries for which no projected TFRs were available by the online survey experts (at least two per country) or invited experts were assumed to follow an identical TFR trajectory as one of the key countries in that region. For instance, countries in Central Europe for which no future TFR were available from the experts survey were assumed to follow the same trajectory as either the Czech Republic (a higher fertility pathway) or Hungary (lower fertility pathway); the definition of the key countries and the decision to which 'key country' each individual country was attached was mostly done by the low fertility coordinating team (see details on deriving future TFR trends by country in Appendix 3.1 and in Basten et al., 2013).

Finally, a complete TFR trajectory has been constructed for five-year periods from 2010–14 to 2045–49, assuming a linear trend between the starting year value and the two years for which the TFR was already projected, 2030 and 2050. However, the initial five-year projection period, 2010–14, constitutes an exception whereby in countries with an increasing TFR trajectory through 2030, the rise occurs only after 2015 and the TFR in 2010–14 remains identical with the most recent observed data, usually for 2011 and, in some cases, for 2012. This is a simple effort to account partly for the effect of the recent economic recession, during which fertility rates were likely falling in most countries (see section 3.2.4). As there was heterogeneity of country-specific TFR trends in Europe during the recession (see Box 3.3) and the future course of the recession and economic recovery were unknown at the time fertility scenarios were developed, a 'conservative' strategy was employed, assuming no TFR increase in the initial period rather than modelling its potential temporary decline.

To derive uncertainty intervals around the main (point) TFR estimates, two possibilities were considered. First, the more flexible and less standardized option was to define low and high projected TFR representing 80 per cent CI on the basis of experts' assessment of country-specific CI in 2030 and 2050 (see sections 3.4.2.1 and 3.4.2.2). The second option followed quite 'traditional' solutions, providing a standardized and easily-derived estimate for all countries, namely using either a relative or a fixed absolute interval around the main TFR estimate. Initially, the first option was selected, which allows both reflecting **(p. 106)** the experts' views and mirroring the likely future regional differences in uncertainty about fertility trends, which should be higher in regions undergoing rapid fertility changes in recent decades, such as the Middle East. However, this solution became impractical owing to low response rates in some countries where many respondents did not provide assessments of the likely future uncertainty in their TFR estimates, and also owing to implausibly high variation of these estimates between some countries belonging to the same region. As a result, a standardized (although somewhat simplistic) solution has been chosen, assuming a low versus high TFR interval of 20 per cent around the main TFR projection in 2030, increasing to 25 per cent in 2050 (see also Chapter 9, section 9.3.6). This roughly reflects the uncertainty interval in 2050 averaged across all experts providing its assessment (Table 3.5, last line): starting with an average TFR value of 1.68 predicted by the experts for that year, a 25 per cent range around that mean, representing 80 per cent CI gives a TFR from 1.26 to 2.10 compared with the average of expert-defined 80 per cent CI of 1.27–2.21. To reflect an initial sharp increase in projection uncertainty in the early projection period, further exacerbated by unstable fertility rates during the economic recession after 2008, two thirds of the estimated 80 per cent CI observed by 2030 would open up during the first projection period, 2010–14.

The outlined TFR projections differ considerably from how projection scenarios have been derived for the countries with high fertility, which relied less on the online survey of experts and more on the input given at an expert meeting in Kathmandu and on the modelling of future TFR trajectories. This modelling was based on the most recent observed fertility level and on the previous trajectories of fertility decline in the presently low fertility countries (Chapter 4, section 4.5.3). As we have been able to collect comprehensive expert input covering most low fertility regions, and also given that there are no systematic experiences of long-term TFR changes in post-transitional societies with low fertility on which such a model can be based, the scenarios for low fertility countries did not utilize such a model. However, to prevent coherent geographical regions from following two different projection set-ups, all Latin American and most Middle East and East-Asian countries were merged and their future TFR scenarios modelled by the team covering high-fertility countries (Chapter 4).

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### 3.5.2 Long-term futures: preparing fertility scenarios beyond 2050

Fertility forecasting has been dominated by the paradigm of the demographic transition. Fertility was thought to fall from a high comparatively stable level to a low comparatively stable level. This transition was considered to be irreversible, so once a low enough level of fertility was achieved it would never increase. The textbook versions of the demographic transition generally show a crude birth rate and crude death rate converging, leading to a cessation of natural population growth (Caldwell, 1976). This homeostatic convergence towards long-term stationary population would imply, given **(p.107)** current and projected very low (and further declining) mortality levels, fertility rates stabilizing at around two births per woman.

However, this stylized model does not fit the empirical evidence on post-transitional fertility and, arguably, gives no guidance about future fertility trends (Lutz, 2006). In one country after another, this post-transitional stage has been associated with at least a brief, but often persistent, era of fertility being below the replacement threshold (see section 3.1). Therefore, achieving a long-term equilibrium of fertility and mortality levels remains very uncertain.<sup>25</sup> The key issue is whether below replacement fertility is a temporary phenomenon or whether the long-term future of most rich countries features a continuation of low fertility rates.

Four arguments are commonly put forth to suggest that fertility rates may eventually increase in countries with low rates. First, period TFR declines to very low levels have been, to a large extent, fuelled by the postponement of childbearing to higher ages (Kohler et al., 2002; see section 3.2.2). This postponement will eventually come to an end, paving the way for a modest rise in period TFRs fuelled by fertility increases ('recuperation') at higher childbearing ages (Frejka, 2011; Sobotka, 2004a), as observed in many rich countries between the late 1990s and 2008 (Goldstein et al., 2009). Second, CFRs in most countries with low fertility never declined to such low levels as period TFRs did. Indeed, recent fertility trends for some countries could be extrapolated into slight increases in the completed cohort fertility of women born in the 1970s (Myrskylä et al., 2013; see section 3.1.3). Third, intended family size among men and women of reproductive ages in Europe, as well as North America, remains remarkably stable at or slightly above two children (Testa 2012; see sections 3.2.3.1 and 3.1.4.1); if couples were to fully realize their fertility intentions, fertility rates would increase. Finally, low fertility rates may be seen as a transitory stage during which society adjusts to the host of factors associated with the SDT (Lesthaeghe, 2010). Once societies adapt to this new reality by, for instance, promoting gender equality and developing policies, institutions, and norms that allow an easier combination of work and childrearing for couples, and possibly also medical interventions expanding the

biological limits of human reproduction, fertility rates may recover (Esping-Andersen, 2009, Myrskylä et al., 2011).

There are more general arguments and mechanisms that explain why fertility may rise, including long-term fertility cycles, changes in population composition through migration or fertility differentials, and the concept of homeostasis, which suggests that 'demographic systems' tend to converge in the long run towards an equilibrium that assures their maintenance and survival (Billari and Dalla-Zuanna, 2012; Lutz, 2006). There are also many cogent arguments succinctly summarized by Lutz (2006) of why fertility **(p.108)** rates may fall further or remain at very low levels for extended periods of time. The most prominent among these arguments is the 'Low Fertility Trap' hypothesis, which suggests that the long-term experience of low fertility may generate a downward spiral of declining family size ideals, births, and fertility rates determined through both the normalization of small family sizes and a political realignment towards the needs of increasingly older populations (Lutz et al., 2006; see also section 3.2.1). Other potential determinants of low fertility in the future, including current trajectories of female educational attainment, are examined in sections 3.2, 3.3.2, 3.3.4, and 3.5.3.

Despite a wealth of arguments and hypotheses highlighted here and in other parts of this chapter, there exists little settled theory concerning the long-term future of fertility, especially in the period beyond 2050 when generations not yet born will be responsible for the reproduction of future generations. The main scenarios of global population projections produced by the UN continue to embrace the idea that, in the long term, fertility rates in different global regions will fluctuate around the replacement level and eventually stabilize. The 2010 medium projection variant envisions that in the more developed regions period TFR will reach 1.97 in 2045–50 and 2.07 in 2095–2100 (UN, 2011, p. 11, Table ii. 1). Also, the probabilistic projection model of fertility developed on behalf of the UN by Alkema et al. (2011, 2010) assumes that global fertility change proceeds in distinct phases, which include a spell of sub-replacement fertility and an eventual recovery, leading to a final convergence and an oscillation around the replacement level.

The debate with selected experts in November 2011 in Vienna on the long-term future of fertility addressed two possible alternative futures: Will most countries become more like the USA or Sweden today, with close-to-replacement fertility levels, or will they follow the path of South Korea, reaching very low fertility levels at advanced stages of development? By definition, the long time horizon selected makes the nature of fertility scenarios highly speculative and limits the forecasters' ability to draw lessons and conclusions from the currently observed fertility trends and determinants, as well as those predicted in the next decades.

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Besides the arguments and evidence highlighted earlier, the following facts and considerations informed the discussion on long-term fertility future.

- The cohort fertility forecasts by Myrskylä et al. (2013) showed that the average completed cohort fertility of women in 37 developed countries born in 1979 would be 1.77 (see section 3.1.3 for more details). This figure is well above the period TFRs experienced in many of these countries during the last few decades. More importantly, Myrskylä et al. showed that cohort completed fertility had either stopped falling or that its decline had slowed significantly in developed countries in every region of the world, with the exception of East Asia and some countries in Southern Europe and CEE.
- The consensus among the experts participating in the online survey was that fertility rates in most of the low fertility countries will stay below the replacement level threshold by 2050. The overall average of the projected TFR in 2050 (main scenario) across all experts reached 1.68, that is, 20 per cent below the replacement **(p.109)** level. These expectations deviated strongly from the UN World Population Prospects 2010 projection model (section 3.4.2).
- It is unlikely that fertility levels will be the same across different countries or that fertility will remain at a stable level in one country over an extended period of time (Bongaarts and Bulatao, 2000). However, in the absence of a commonly agreed unifying theory on how fertility will differ between countries or how will it change over time in a distant future, a simplistic assumption of long-term cross-country convergence and eventual stabilization can be justified.

These considerations resulted in two competing scenarios based on the notions of long-term convergence and stabilization: one of a convergence to the fertility level of 2.0 children per woman by 2200, that is, close-to-replacement fertility level, and the other of a convergence to 1.75 by 2200, that is, a fertility level that remains moderately below the replacement level.<sup>26</sup> The idea that fertility could fall and stabilize at very low levels close to 1.5 or below did not find support as a main scenario. Following a short discussion, a majority of experts participating in the Vienna meeting chose the scenario with a fertility level at 1.75, corresponding roughly to current cohort fertility levels, as well as the projected TFRs in 2050 in the set of countries analysed. This projected 'target' TFR served for projecting the fertility trajectories between 2050 (an endpoint of the expert-based projection, differentiated by region and country) and 2200, using linear interpolation.<sup>27</sup> The long-run TFR level of 1.75 might be consistent with keeping populations in many countries stable if they experience further increases in life expectancy and modest levels of in-migration. Myrskylä et al. (2012), using mortality rates forecasted by the UN, show that Europe would be able to keep its population stable by bringing in one migrant for every seven live

births. The mortality rates for developed countries that we use in our forecasts are generally lower than those forecasted by the UN, so population stability would be reached with even fewer immigrants.

A plausible higher scenario is suggested by the analysis in Myrskylä et al. (2012). They show, using the World Economic Forums' Global Gender Gap Index, that gender inequality is a good predictor of cohort completed fertility among younger cohorts **(p.110)** analysed. This is consistent with the arguments made by our source experts. In the scenario where gender gaps slowly disappear in the future, TFRs would converge to a higher level of around-replacement fertility, which is consistent with that currently observed in countries with low gender gaps. A lower scenario could be driven by improvements in contraception. This is also consistent with the arguments made by the source experts reflecting remarkably high rates of unintended pregnancies in some regions, including the USA and Latin America (sections 3.1.4.1 and 3.1.4.2). Improvements in contraceptive technologies would reduce the number of unintended pregnancies and result in fewer births. However, it is impossible to say precisely what the effects of improved contraception would be.

### 3.5.3 Defining TFR assumptions by level of education

This empirically oriented section complements a more theoretical discussion on the relationship between education and fertility in section 3.2.8 and gives background analysis informing fertility projection scenarios by level of education. We also discuss evidence for Latin America and the Middle East, regions for which projection scenarios are formulated separately using the model for high fertility countries (except for Iran, Israel, and Turkey).<sup>28</sup>

#### 3.5.3.1 Education-fertility differentials in low fertility settings: empirical evidence

In order to produce global population projections differentiated by level of education, it was necessary to quantify current and the likely future educational differentials in fertility. Given limited data availability and the fact that education categories are often not readily comparable between countries (see Chapter 9), we have mostly focused on three broad education categories:

'Low' (International Standard Classification of Education (ISCED) levels 0-2),<sup>29</sup> 'Medium' (ISCED 3 or 3-4), and 'High' education (ISCED 5-6). When possible, especially in countries with a high proportion of women with primary or lower level of education, we have divided the 'Low' category into 'Very low' education (ISCED 0-1) and 'Lower secondary' education (ISCED 2). To increase data comparability between countries, we primarily used data on completed or almost completed cohort fertility collected from censuses, large-sample surveys, or registry data, using the data sets for the most recent five-year cohorts aged 40-44 or 45-49 and over (see also Appendix 6 in Basten et al., 2013 and Chapter 9 for more details about data and data sources). This allowed us to avoid problems inherent in estimating period fertility data by level of education, especially **(p. 111)** the instability of the data over time; problems with classifying educational

categories at younger ages, especially for women still in education; and tempo distortions that vary by level of education. However, the use of cohort data brings an obvious drawback: these data pertain to women whose prime childbearing period was 10–20 years ago and who therefore may not represent the most recent trend. We first focus on analysing the existing differentials in fertility by level of education, which serve as a baseline for the formulation of projection scenarios, as well as for the assessments of the likely future trends in countries that still have above replacement fertility levels. Rather than analysing absolute fertility levels, we are primarily interested in relative fertility differentials. For each country and cohort (or calendar year) analysed, we computed relative fertility indexes (RFI), which are related to the group of women with medium education ( $\text{RFI} = 1$ ). Our main questions and findings are summarized in the next three sub-sections.

### **3.5.3.2 Do fertility differentials by level of education vary by region?**

Table 3.6 features the RFI for broader regions, computed for recent cohorts past prime reproductive age, as simple averages across all countries with available data (see Appendix 6 in Basten et al. 2013 for further details about data coverage by country, region, cohorts, and/or period). The expected fertility gradient shows up in all regions except Nordic countries, where the three categories analysed have identical fertility levels. Furthermore, the fertility gradient is relatively small in Western Europe, ‘German-speaking’ countries, and Southern Europe, especially for women with higher education. In the USA, women



**Table 3.6 Relative Fertility Index by Level of Education in Major Low Fertility Regions; Evidence for Female Birth Cohorts Past Reproductive Age**

Region	# Countries	Education category				High
		Low	of which: Very low	Lower secondary	Medium	
North America	1 (USA)	1.34	—	—	1.00	0.97
Latin America	8	1.44	1.63	1.20	1.00	0.81
East + South East Asia (except China)	3	1.29	—	—	1.00	0.89
Middle East	3	1.51	1.57	1.18	1.00	0.89
Western Europe and German-speaking	5	1.15	—	—	1.00	0.96
Nordic countries	3	1.01	—	—	1.00	0.98
Southern Europe	2	1.16	1.24	1.11	1.00	0.91
Central Europe	8	1.22	1.23	1.22	1.00	0.85
Eastern Europe	4	—	1.47	1.39	1.00	0.85

See more details about the data and countries included in Appendix 6 in Basten et al. (2013). Regretfully, no data are available for China.

**(p.112)** with low education have elevated fertility levels that contrast strongly with the other two categories. The strongest education gradient in fertility is observed in Latin America and the Middle East which are in the late stage of fertility transition. In these regions highly-educated women still form a select group the low fertility of which contrasts starkly with much higher fertility among women with primary or lower education.

### 3.5.3.3 Is there a distinct trend in education-fertility differentials once the overall fertility declines below a threshold of 2.2?

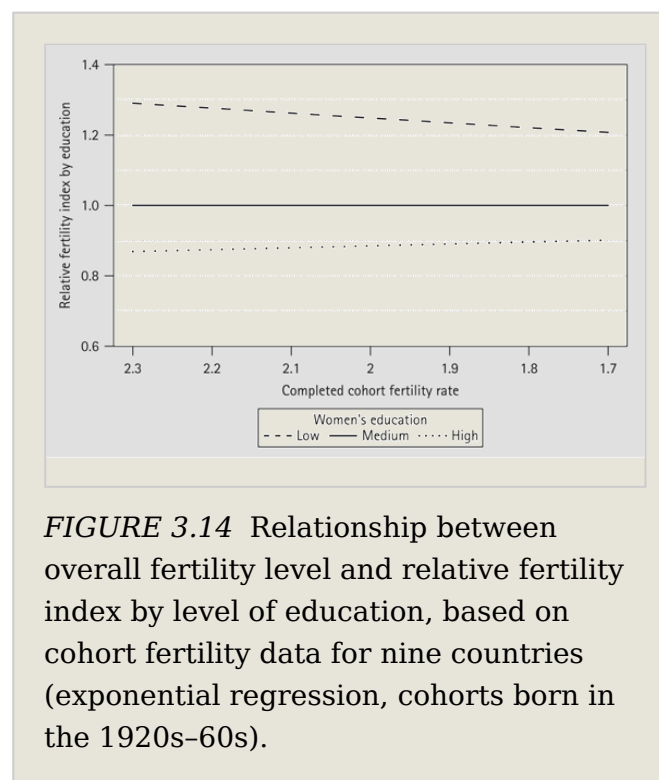
This question is important for the formulation of education-fertility scenarios in the higher fertility countries that are expected to undergo a transition to sub-replacement fertility in the coming decades. The empirical evidence can be elucidated on two levels. First, purely cross-sectional data from recent surveys and censuses (figures available upon request) suggest that the differentials tend to diminish. But the correlation is weak and the spread is wide; for instance, a cohort TFR level around 1.8 is associated with a RFI of the lower-educated women of between 1.0 and 1.4. The same 'weak' evidence of diminishing differential applies to women with higher education.

Second, more valid evidence comes from the analysis of changes in fertility differentials across cohorts experiencing declining fertility. We have assembled data for nine European countries. Focusing on what happens when completed cohort fertility declines from around 2.3 to around 1.7, the data suggest diminishing distinctiveness of the low-education group (with smaller 'surplus' fertility as the overall fertility level declines)

**(p.113)** and a minor trend of diminishing distinctiveness of the higher-educated category (but with very weak significance; data and graphs available upon request). Exponential trends<sup>30</sup> are shown in Figure 3.14.

### 3.5.3.4 Is there a distinct trend in education-fertility differentials across cohorts?

This question is addressed in Figure 3.15 with an expanded data set for 19 countries in 3 broader regions. In parallel to the evidence on gradually declining education-fertility differentials with declining fertility level described earlier, there is a continuous RFI decline among the lower-educated women in each of the



**FIGURE 3.14** Relationship between overall fertility level and relative fertility index by level of education, based on cohort fertility data for nine countries (exponential regression, cohorts born in the 1920s-60s).

three regions analysed. This fall was particularly impressive in Singapore, where the RFI fell from above 1.6 in the cohorts born around 1935 to below 1.2 in the cohorts born around 1960. A similar trend occurred in the Republic of Korea, although from a lower initial RFI level. Also, in some countries of CEE, especially Hungary, the RFI fell rapidly across cohorts. However, this region retains elevated fertility among women with low education, with the mean RFI still above 1.3 in the cohorts born around 1955. In contrast, the mean RFI in Western and Northern Europe (including Austria, Germany, and Switzerland, as well as Greece; no data available for other Southern European countries), has fallen below 1.1.

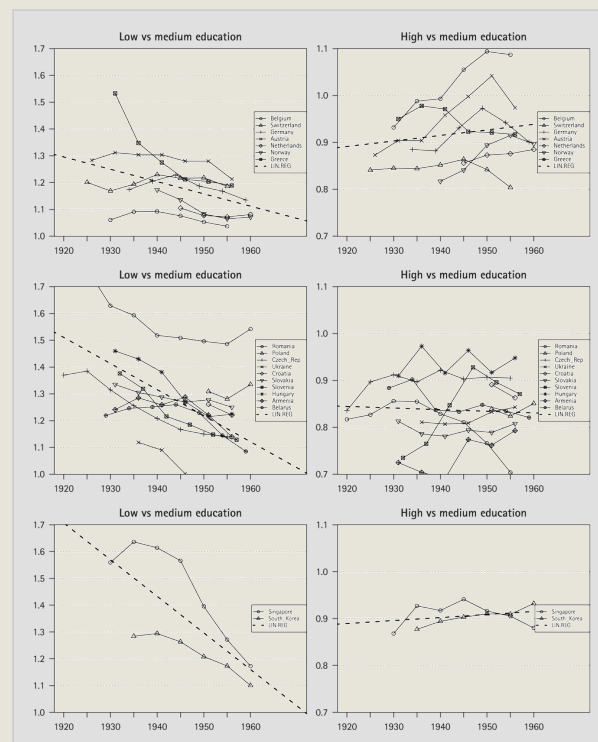
The RFI trends are less uniform when women with higher education are analysed in comparison with those having medium levels of educational attainment. The average mean trend in the analysed regions can be best described as a stable differential, with highly educated women having slightly lower fertility. A few countries in Western and Northern Europe (especially Belgium and Austria) registered a rapid rise in the RFI, leading in Belgium to a crossover whereby fertility among the higher-educated surpassed that of women with a medium level of education (data exclude immigrant women). In the cohorts born around 1955 the average RFI among women with higher education oscillates around 0.9 in many countries and at a lower level closer to 0.8 in CEE. Romania shows a particularly steep gradient in education-fertility differentials, with relative fertility falling to very low levels among the higher-educated women.

#### **3.5.3.5 Expected and projected future trends in education-fertility differentials**

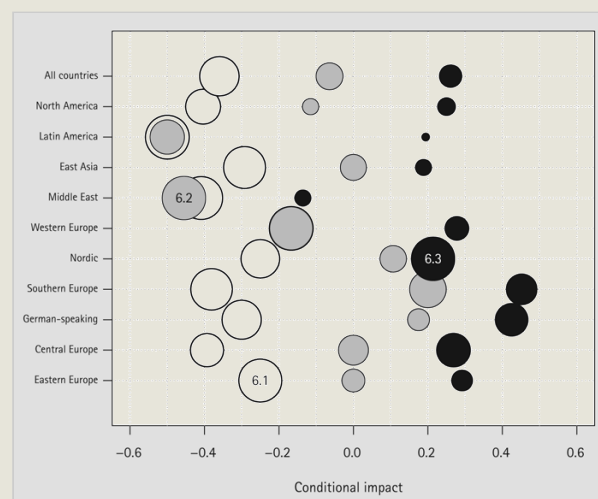
Are future education-fertility differentials likely to diminish? A simple extrapolation of cohort trends described earlier suggests that in most countries the fertility rates of women with low levels of education may eventually converge with those with a medium level (upper secondary) education. The trend is much less clear-cut for tertiary-educated women, with a slight (but incomplete) convergence in Western, Northern Europe, and East Asia, and mixed trends, mostly marked by a slight rise of the negative gradient, in CEE.

**(p.114)**

The experts' views about regional trends are summarized in Figure 3.16 (see section 3.4.1 for a global overview). The experts expect diminishing education-fertility differentials especially in Latin America, the Middle East, and Southern Europe. In the former two regions, these differentials are still pronounced (Table 3.6; KC and Potančoková, 2013) and the experts expect that they will diminish through a decline in **(p. 115)** fertility among lower educated women, bringing a negative pressure on the overall fertility rate. In contrast, in Southern Europe the experts expect that a reduced education-fertility differential will materialize owing to an increase in the fertility of the women with tertiary education, which will have a positive effect on fertility. Additionally, experts indicated that a convergence in educational-fertility differentials is unlikely in the USA (argument validity of 0.39). More specific responses about the possibility of better educated women having higher fertility in the future while pursuing their career depict a strong agreement (validity = 0.75) among experts on the Nordic countries (where tertiary-educated women already record relatively high fertility; Table 3.6 and Figure 3.15) and also considerable agreement in selected other regions of Europe, German-speaking countries, Southern Europe, and Central Europe (validity index above 0.6). A rather strong positive net impact of this trend on overall fertility is expected **(p.116)** in the former two regions. Latin America shows a contrasting pattern as a majority of experts there



**FIGURE 3.15** Trends in relative fertility index by cohort in three broader regions (Western and Northern Europe, Central and Eastern Europe, and East Asia); low- and high- vs medium-educated women.



**FIGURE 3.16** Validity and conditional impact of education-related arguments 6.1-6.3 by region. Diameter of the bubbles corresponds to squared value of

disagreed with the expectation of increasing fertility among better-educated women (validity = 0.32). Different possibilities of how to combine the observed trends in education-fertility differentials by region with the experts' insights and expectations were considered by the project's coordinating team. Given regional variation in experts' expectations and a need to produce a global set of projections (lacking expert assessments for the higher fertility countries analysed in Chapter 4), a simple model that is not based on expert opinion was produced (see also Chapter 9). It assumes that countries with a currently higher fertility level will converge by the time they reach a low fertility level

with a TFR around 1.8 to average education-fertility differentials experienced at present in the set of low fertility countries analysed here. The model combines the most recent observed education-fertility differentials in low fertility countries (Table 3.6) and the trends in these differentials at sub-replacement fertility levels (Figure 3.14). Expressed in RFI, fixed at the level of 1.00 among the women with high (tertiary) education, women with very low education (completed primary and lower) will have a RFI of 1.42, women with lower secondary education will have a RFI of 1.35, and those with upper secondary education a RFI of 1.14. Countries with the current TFR below 1.8 will converge to these relative differentials by 2030. Countries where lower differentials are observed at present form an exception—they are not projected to experience increasing fertility differentials in the future, but their most recently observed differentials are kept constant in the projection.

### 3.6 Conclusion

In this chapter, we have attempted to present a comprehensive, state-of-the-art overview of both the regional context of fertility decline in currently low fertility settings and the possible contributions of the theoretical and empirical drivers that underpin them. Many sections have demonstrated that the locus of low fertility is increasingly moving away from 'Old Europe' and towards the rapidly developing economies of East Asia, Latin America, and the Middle East. In this

the validity of each argument (ranging from 0.32 to 0.82).

#### Note:

- Argument 6.1 (white bubbles with bold border): people will spend ever more years of their young adult life enrolled in education and professional training on the job.
- Argument 6.2 (light-grey bubbles): fertility differentials by level of female education will diminish.
- Argument 6.3 (dark bubbles): there will be a new trend for better educated women to have more children and simultaneously pursue a professional career.

respect, any understanding of the forces behind recent fertility decline needs to take into account changes in these settings and their particular contexts.

In view of the wide variation of fertility levels in contemporary rich and middle-income countries, a global convergence of fertility to around replacement level appears unlikely. Either continuing bifurcation in future trends of low fertility or a stronger movement towards the low fertility rates seen in East Asia—especially in rapidly developing settings—is a possible future scenario. In absolute terms, **(p.117)** contemporary variation in post-transitional fertility in the order of one birth per woman is small. In relative terms, a period TFR of 2.0–2.1 in France, New Zealand, and, until recently, the USA, is almost twice as high as the period TFR of 1.0–1.2 recently recorded in Hong Kong, Korea, and Taiwan. This range between East Asia on one side and France and New Zealand on the other side also roughly corresponds to the global average of the 80 per cent CI of the period TFR in 2050 predicted by the experts participating in the online survey, which ranged from 1.07 to 2.13 (data weighted by population size).

These vast relative differences, if they persist, will have negative repercussions for the group of lowest fertility countries, which will face accelerated population ageing and protracted population declines, especially if they do not attract sizeable immigration. Even if period fertility rates recover somewhat, as they did in much of Europe in the early 2000s, replacement level is seen by many experts as an upper boundary for the post-transitional fertility levels. However, a return of above replacement fertility cannot be completely ruled out, although it seems incompatible with contemporary economic uncertainty, as well as lifestyles, career, and consumer aspirations of the majority of populations in rich countries. Past experience shows that baby booms may occur unexpectedly, taking demographers by surprise.

### Acknowledgements

The completion of this chapter would not have been possible without the committed involvement of different contributors—researchers, contributing authors, experts participating in the IIASA–Oxford survey, and those participating in the expert meeting in Vienna—who have organized the survey of experts or contributed to it, were involved in the debates on fertility scenarios presented here, and who have directly contributed to this chapter, or helped in checking and reviewing it.

Special thanks are due to Bilal Barakat, who helped design the survey of experts and provided first analyses of survey results; Michaela Potančoková who helped us collect data on the education–fertility differentials analysed in sections 3.5.3.1–3.5.3.4; Nikola Sander who operationalized the Circos plots used in Figures 3.7 and 3.8; Bill Butz, Josh Goldstein, and Tomas Frejka who provided detailed comments on the first draft of this chapter; and Jim Dawson and Jayne MacArthur who copyedited the draft.

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We discuss only countries and regions for which Wittgenstein Centre for Demography and Global Human Capital (WIC) projections scenarios were formulated using input provided by experts on low fertility countries. Fertility scenarios for Latin American countries, for most of the Middle East region (except Iran, Israel, and Turkey), and for some other low fertility countries have been formulated jointly with the higher fertility countries, using a scenario model described in Chapters 4 and 9. As a result, the following low fertility countries are not discussed here: Thailand, all Latin American and Caribbean countries, Algeria, Tunisia, Mauritius, Brunei, Kuwait, Qatar, United Arab Emirates, and Lebanon. Here we provide a condensed description; full details can be found in Appendix 1 of the working paper by Basten et al. (2013).

### A3.1.1 The initial total fertility rate in 2010

Most of the total fertility rate (TFR) data for European countries were computed by the Vienna Institute of Demography for the European Demographic Data Sheet 2012; for a few countries, the TFR data originate from Eurostat or national statistical offices.

For most non-European countries, the 2010 TFR data are based on the 2010 edition of the World Population Data Sheet published by the Population Reference Bureau (PRB, 2011). Additional data sources for some countries are listed in Basten et al. (2013).

### A3.1.2 Deriving medium (point) total fertility rate estimates

The derivation of the 'medium' (point) TFR estimates proceeded in several steps described as follows. First, simple data cleaning took place to exclude data where the experts left the expected TFR values for 2030 and 2050 at the predefined values (which were identical to the 'starting' values for 2010). These exclusions occurred only for the experts who did not change any of the six projected TFR values (minimum, maximum, and median for 2030 and 2050), assuming that they did not want to deal with this empirical part of the survey or could not effectively manipulate the sliders with TFR estimates on their computer. For experts who changed at least one of these predefined TFR values, the medium TFR estimates were counted, even when they were identical with the predefined values.

### A3.1.2.1 The representative countries

The 'representative countries' were the 13 most populous countries or countries with distinct fertility patterns representative of the broader region (and with at least four respondents per country): China, the USA, Japan, Iran, Turkey, Russia, Italy, Spain, Germany, the UK, Sweden, the Czech Republic, and Australia.

**(p.119)** Mean values of experts' responses to the online survey were presented at the expert meeting in Vienna. These values were either accepted or revised, if a sufficient number of participating experts thought there was a strong case for such revision. Most efforts concentrated on settling the 2050 values, while less attention was paid to the 2030 values. Revisions were mostly upwards, except for Spain. All values were rounded to the nearest 0.05. Most changes were small, except for Russia (0.30). Further details are provided in Basten et al. (2013).

### A3.1.2.2 The countries with at least one expert response (additional 26 countries)

The average across experts of the expected TFR in 2030 and 2050 was assessed. It was left the same if it fit well the broader regional pattern or was close to the regional 'representative country', as defined in section A3.2.1. It was also left the same if it differed from some other countries in the region, but represented well a specific pattern of a given country or more countries in the region.

The coordinating team changed the projected TFRs suggested by experts in cases where the projected TFRs for a given country differed from a broader regional pattern (as defined by the 'representative countries' discussed at the Vienna workshop, but also from other countries in the region) or when it diverged from the overall higher and lower boundaries expected for the medium estimates of the future TFR.

Specifically, the following rule was applied: the medium TFR estimate in 2030 and 2050 will fall between 1.4 and 2.00 (except in Israel).

For 11 countries, the coordinating team made minor adjustments (generally, by <0.20) to the initial experts' mean values for 2030, 2050, or both (see Basten et al., 2013 for details).

### A3.1.2.3 The countries that were not assessed by experts

The remaining low fertility countries were 'attached' to a representative country for a broader region, and their projected TFR values for 2030 and 2050 defined as identical to this representative country (see Table A3.1.1 listing all countries by region).

### A3.1.3 Projecting the TFR values in 2010–15

The recent economic recession, which hit, in particular, the most developed countries, and the subsequent cuts in government spending have led to a huge increase in economic and employment uncertainty. This uncertainty affects, in



particular, younger men and women, and is likely to negatively influence their childbearing decisions and thus also aggregate fertility rates, as evidenced in many European countries and the USA (see Box 3.3). As of 2013, many low fertility countries remained characterized by high unemployment and an uncertain economic outlook. Consequently, it is unlikely their period fertility rates will resume an increasing trajectory in the near future.

In light of this evidence, our projections assume that in the countries where a TFR rise is expected between 2010 and 2030, the TFR will initially remain at the most recent observed level (for 2011 or 2012) until 2015, and only then follow a linear increase up to the projected values for 2030. In countries where a TFR decline is expected between 2010 and 2030, it is assumed to follow a linear trajectory, without any recession-induced interruption or acceleration between 2010 and 2015. A more sophisticated set of fertility assumptions for the near future, reflecting sizeable cross-country differences in their economic trends and experiences of economic recession, was ruled out because it would require separate assessments of each individual country. **(p.120)**

**Table A3.1.1 List of Low Fertility Countries for which Projection Scenarios were Formulated Here (Countries Listed by Reference Region; Representative Countries Shown in Bold)**

Reference region	Country	Reference region	Country
<b>North America</b>	<b>USA</b>	<b>Southern Europe (high)</b>	<b>Italy</b>
	<b>Canada</b>		Cyprus
<b>Australia and Oceania</b>	<b>Australia</b>		Greece
	New Caledonia		Malta
	New Zealand	<b>Southern Europe (low)</b>	<b>Spain</b>
<b>East Asia (high)</b>	<b>Japan</b>		Portugal
	Korea PDR	<b>Central Europe (high)</b>	<b>Czech Republic</b>
	Republic of Korea		Estonia
	Singapore		Lithuania
<b>East Asia (low)</b>	<b>Hong Kong SAR</b>		Slovenia

Reference region	Country	Reference region	Country
	Macao SAR	<b>Central Europe (low)</b>	<b>Hungary</b>
	Taiwan		Latvia
	<b>China</b>		Poland
<b>Middle East</b>	<b>Turkey</b>		Slovakia
	Iran		<b>Croatia</b>
	<b>Israel</b>	<b>Eastern Europe (high)</b>	<b>Bulgaria</b>
			<b>Ukraine</b>
			Belarus
<b>Western Europe (high)</b>	<b>UK*</b>		Macedonia
	Ireland		Montenegro
	France <sup>†</sup>		Serbia
<b>Western Europe (low)</b>	<b>Netherlands</b>	<b>Eastern Europe (low)</b>	<b>Romania</b>
	Belgium		Albania
	Luxembourg		Bosnia-Herzegovina
<b>German-speaking</b>	<b>Austria</b>		Republic of Moldova
	Germany		<b>Russian Federation</b>
	Switzerland	<b>Caucasus</b>	<b>Georgia</b>
<b>Nordic countries</b>	<b>Sweden</b>		Armenia
	Denmark		Azerbaijan
	Finland		
	Iceland		
	Norway		

SAR: Special Administrative Region.

(\*) Including Channel Islands.

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(<sup>†</sup>) Including French Polynesia, Guadeloupe, Martinique, and Réunion.

#### A3.1.4 Projecting TFR values beyond 2050

The WIC projections extend beyond the year 2050, which was the endpoint in the online expert survey. The Vienna workshop with invited experts discussed such long-range scenarios. A simple method has been proposed, assuming a uniform global convergence in medium TFR to a sub-replacement level of 1.75 by 2200 (section 3.5.2). Using a linear approximation between the projected medium value for 2050 and this 'target' endpoint in 2200, the medium TFR can be derived for any period between these two years.

Two sets of arguments pertaining to fertility have been formulated within the WIC project on argument-based global population projections: one for low fertility settings with more advanced levels of development, and another for higher fertility settings with a lower level of development. This division is somewhat subjective, with a number of countries potentially falling on the border between the two groups. We used the period TFRs estimated for the period of 2005–10 by the United Nations (UN) World Population Prospects 2010 and the UN Human Development Index (HDI) for 2010 to rank the countries by their levels of fertility and development.<sup>31</sup> The main motivation behind considering an additional selection criterion based on human development was the need to differentiate between the more affluent and more developed set of countries and all other countries in order to formulate suitable sets of arguments pertaining to likely future fertility trends. For instance, some of the questions the experts were asked on low fertility countries pertained to immigration, assisted reproduction or family policies, and were largely irrelevant in less developed settings. Similarly, the questions on the role of child's and mother's health and child survival are largely irrelevant in higher income settings with very low maternal and child mortality, even when they register above replacement fertility, such as Israel.

The following criteria were used to divide countries into the 'low fertility, higher development' (90 countries and territories) and 'higher fertility, lower development' (100 countries and territories) groups.

The former group of countries with low fertility includes:

- Countries with sub-replacement period fertility (total fertility rate (TFR) <2.10) and moderate or high level of development (HDI at  $\geq 0.650$  or higher). Only three countries with a TFR <2.10 had a HDI level <0.65 (Maldives, Myanmar, and Vietnam) and were therefore included in the higher fertility group analysed in Chapter 4.
- Countries with moderate period fertility (TFR between 2.10 and 2.49) and a higher level of development (HDI at  $\geq 0.670$ ). The following countries with a TFR between 2.10 and 2.49 were included:

Brunei, New Zealand, Uruguay, Turkey, Azerbaijan, Argentina, Kuwait, Algeria, Mexico, Jamaica, Qatar, and Colombia.

- Countries with moderate period fertility (TFR between 2.10 and 2.49) and unknown level of the HDI (which has not been computed for them). The following countries and territories with the TFR between 2.10 and 2.49 were included: Guadeloupe, French Polynesia, New Caledonia, and Réunion.

**(p.122)** • Countries with higher period fertility (TFR at  $\geq 2.50$ ) and with very high level of development (HDI  $> 0.85$ ). Only one country, Israel, was included on this basis.

All other countries fall into the high fertility group, which therefore comprises:

- All countries with a TFR at  $\geq 2.50$  except Israel.
- Countries with a TFR between 2.10 and 2.49 and HDI  $< 0.670$ : Indonesia, Guyana, Salvador, Sri Lanka, Morocco, Bangladesh, Suriname, and Uzbekistan.
- Three countries with a TFR  $< 2.10$  with low HDI values ( $< 0.65$ ): Maldives, Myanmar, and Vietnam.

Table A3.2.1 ranks all the countries by their TFR (ranking from the lowest fertility up) and lists their TFR in 2005–10, their HDI in 2010, and their distribution into the low or high fertility module of the survey.

**Table A3.2.1 Country Ranking by the Period Total Fertility Rate (TFR) in 2005-10 (from the Lowest Level to the Highest) and their Inclusion into the 'Low Fertility' Module Only Countries with a TFR <2.50 and Israel are Listed)**

	Country	Period TFR (UN) 2005- 10	HDI, 2010	Fert. mod.		Country	Period TFR (UN) 2005- 10	HDI, 2010	Fert. mod.
1	Hong Kong SAR	0.99	0.900	Low	50	Finland	1.84	0.871	Low
2	Macao SAR	1.02	n.a.	Low	51	Denmark	1.85	0.866	Low
3	Bosnia-Herzegovina	1.18	0.710	Low	52	United Arab Emirates	1.86	0.815	Low
4	Singapore	1.25	0.846	Low	53	Lebanon	1.86	0.743	Low
5	Slovakia	1.27	0.818	Low	54	Vietnam	1.89	0.572	High
6	Republic of Korea	1.29	0.905	Low	55	Sweden	1.90	0.885	Low
7	Poland	1.32	0.795	Low	56	Brazil	1.90	0.699	Low
8	Japan	1.32	0.884	Low	57	Chile	1.90	0.783	Low
9	Malta	1.33	0.815	Low	58	Maldives	1.90	0.602	High
10	Romania	1.33	0.767	Low	59	Bahamas	1.91	0.784	Low
11	Hungary	1.34	0.805	Low	60	Martinique	1.91	n.a.	Low
12	Germany	1.36	0.885	Low	61	Costa Rica	1.92	0.725	Low

## Future Fertility in Low Fertility Countries

	Country	Period TFR (UN) 2005- 10	HDI, 2010	Fert. mod.		Country	Period TFR (UN) 2005- 10	HDI, 2010	Fert. mod.
13	Portugal	1.36	0.795	Low	62	Norway	1.92	0.938	Low
14	Italy	1.38	0.854	Low	63	Australia	1.93	0.937	Low
15	Austria	1.38	0.851	Low	64	France	1.97	0.872	Low
16	Slovenia	1.39	0.828	Low	65	Netherlands Antilles	1.98	n.a.	Low
17	Belarus	1.39	0.732	Low	66	Tunisia	2.04	0.683	Low
18	Ukraine	1.39	0.710	Low	67	North Korea	2.05	n.a.	Low
19	Czech Republic	1.41	0.841	Low	68	USA	2.07	0.934	Low
20	Lithuania	1.41	0.783	Low	69	Myanmar	2.08	0.451	High
21	Spain	1.41	0.863	Low	70	Ireland	2.10	0.895	Low
22	Latvia	1.41	0.769	Low	71	Iceland	2.10	0.869	Low
23	Croatia	1.42	0.767	Low	72	Brunei	2.11	0.805	Low
24	Russian Federation	1.44	0.719	Low	73	Uruguay	2.12	0.765	Low
25	Bulgaria	1.46	0.743	Low	74	New Zealand	2.14	0.907	Low
26	Switzerland	1.46	0.874	Low	75	Guadeloupe	2.14	n.a.	Low

## Future Fertility in Low Fertility Countries

	Country	Period TFR (UN) 2005- 10	HDI, 2010	Fert. mod.		Country	Period TFR (UN) 2005- 10	HDI, 2010	Fert. mod.
27	Greece	1.46	0.855	Low	76	Turkey	2.15	0.679	Low
28	Macedonia	1.46	n.a.	Low	77	Azerbaijan	2.16	0.713	Low
29	Cuba	1.50	0.775	Low	78	French Polynesia	2.16	n.a.	Low
30	Moldova	1.50	0.652	Low	79	Indonesia	2.19	0.600	High
31	Cyprus	1.51	0.810	Low	80	New Caledonia	2.19	n.a.	Low
32	Barbados	1.53	0.788	Low	81	Argentina	2.25	0.775	Low
33	Georgia	1.58	0.698	Low	82	Kuwait	2.32	0.771	Low
34	Albania	1.60	0.719	Low	83	Guyana	2.33	0.611	High
35	Luxembourg	1.62	0.852	Low	84	Salvador	2.35	0.659	High
36	Serbia	1.62	0.735	Low	85	Sri Lanka	2.36	0.658	High
37	Thailand	1.63	0.654	Low	86	Morocco	2.38	0.567	High
38	Estonia	1.64	0.812	Low	87	Bangladesh	2.38	0.469	High
39	China	1.64	0.663	Low	88	Algeria	2.38	0.677	Low
40	Trinidad and Tobago	1.64	0.736	Low	89	Réunion	2.40	n.a.	Low

## Future Fertility in Low Fertility Countries

	Country	Period TFR (UN) 2005– 10	HDI, 2010	Fert. mod.		Country	Period TFR (UN) 2005– 10	HDI, 2010	Fert. mod.
41	Canada	1.65	0.888	Low	90	Jamaica	2.40	0.688	Low
42	Mauritius	1.67	0.701	Low	91	Qatar	2.40	0.803	Low
43	Montenegro	1.69	0.769	Low	92	Mexico	2.41	0.750	Low
44	Armenia	1.74	0.695	Low	93	Suriname	2.42	0.646	High
45	Netherlands	1.75	0.890	Low	94	Colombia	2.45	0.689	Low
46	Iran	1.77	0.702	Low	95	Uzbekistan	2.46	0.617	High
47	Belgium	1.79	0.867	Low	...	...	...	...	...
48	Puerto Rico	1.83	n.a.	Low	119	Israel	2.91	0.872	Low
49	UK	1.83	0.849	Low					

UN: United Nations; HDI: Human Development Index; Fert. mod.: fertility module; SAR: Special Administrative Region; n.a.: not available.

*Note:* Taiwan is missing from the list as it is a territory not recognized by the UN; also excluded are all countries and territories with populations below 100,000 and the following countries and territories with populations over 100,000: Aruba, the Channel Islands, Grenada, Saint Lucia, and Saint Vincent and the Grenadines. The ranking of countries by period TFR in 2005–10 was based on the UN (2011) data set released with the World Population Prospects 2010.



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Total respondents: 184	Country (and region) of projection:		
Gender:	Central Europe (15)	Czech Republic	6
81: Male			
62: Female		Hungary	3
41: Blank		Poland	2
		Croatia	2
Field:		Slovenia	1
135: Academia		Lithuania	1
14: Government	Eastern Europe (13)	Russia	4
11: Think tanks/Policy Institute		Romania	3
5: Other		Ukraine	2
2: National NGO		Bulgaria	2
1: NGO		Georgia	2
16: Blank	Southern Europe (21)	Italy	12
		Spain	6
Country of work:		Greece	1
26: USA		Portugal	1
14: Austria	Western Europe (9)	UK	4
7: Australia, France, Italy, Spain, Sweden		Netherlands	4
6: Brazil, Germany		Belgium	1
5: China, Iran, UK	Nordic (14)	Sweden	7
4: Canada, Netherlands, Turkey		Norway	2
3: Argentina, Japan, Mexico, Romania		Finland	2
2: Belgium, Czech Republic, Hungary, Poland, Switzerland, Thailand	German-speaking (10)	Iceland	1
		Germany	9

1: Colombia, Croatia, Finland, Georgia, Greece, Lithuania, New Zealand, Portugal, Russia, Slovenia, Ukraine, Uruguay	East Asia	Austria Switzerland China	7 3 14
34: Blank	(including Thailand, 27)	Japan	6
		Thailand	4
Age of respondents (y): 25-29: 8		Korea (Rep.) Hong Kong SAR	2 1
30-34: 21	Latin America (18)	Brazil	7
35-39: 20		Mexico	5
40-44: 20		Argentina	3
45-49: 15		Uruguay	1
50-54: 4		Colombia	1
55-59: 20 60-64: 8	North America and Australia (31)	USA Australia	22 5
65-69: 16		Canada	4
70-74: 3	Western Asia/ Middle east (14)	Iran	8
75+: 4		Turkey	5
	Others (2)	Algeria Israel	1 1

**NGO: non-governmental organization; SAR: special administrative region.**

1. Cultural and social forces in fertility ideals, norms, and desires
  - 1.1 Voluntary childlessness is becoming increasingly socially accepted
  - 1.2 One-child families will become a dominant cultural norm
  - 1.3 Society will become yet more individualistic
  - 1.4 It is a human constant that people will always desire at least one surviving child in order to 'continue living' in the future
  - 1.5 The share of population groups with larger families will increase
  - 1.6 The availability of grandparents for childcare and family care will decline

- 1.7 Religious views on family and reproduction will gain importance
- 1.8 High fertility will become a status symbol among the wealthy
- 1.9 Globally, there will be a convergence of all populations towards a two-child family as an ideal and actual family size

2. Partnerships, living arrangements, and gender differences

- 2.1 Men are increasingly reluctant to become fathers, even when they live with a partner
- 2.2 Men and women will increasingly share the burden of housework and childcare
- 2.3 People are increasingly unable to find the right partner to form a family
- 2.4 Women will increasingly pursue lifestyles and activities not compatible with motherhood
- 2.5 Marriage will further decline and will become a minority experience
- 2.6 Partnership dissolution and 're-partnering' will become yet more common among women of reproductive age
- 2.7 Women will achieve complete equality with men with respect to their education, employment, career, and income
- 2.8 Cross-border partnership and marriage migration will increase in importance
- 2.9 Adults in their 20s, and even 30s, will spend ever longer periods of life living with their parents

**(p.126)** 3. Role of policies (in this case, 'government' entails national government unless stated otherwise)

- 3.1 Government will raise child subsidies and tax benefits, or introduce birth bonuses
- 3.2 Government will take an increasingly pro-natalist stance (e.g. through communication campaigns and family policies)
- 3.3 Government will provide universal nursery/kindergarten access
- 3.4 Provision of affordable housing for families and young adults will become an important part of social policies
- 3.5 New policies will allow young parents to significantly reduce their working hours for several years with some compensation of income
- 3.6 Mothers will be increasingly expected and encouraged to return to work, even when their children are small
- 3.7 Family-related policies, including childcare provision, will be increasingly pursued by local governments and employers
- 3.8 Governments will cut back on family support when economic conditions worsen.
- 3.9 As populations age government funds will become increasingly directed toward the elderly and away from the young

#### 4. Employment and economy

- 4.1 Unemployment and job instability among the under-30s will further increase
- 4.2 Increasing average household income will lead to higher fertility
- 4.3 Employers will put more pressure on their employees in terms of higher working hours and more work commitments
- 4.4 Work practices will become more flexible in the future (e.g. telecommuting, working from home, flexi-time, part-time)
- 4.5 Geographical mobility, especially work-related, will further increase
- 4.6 Immigration from high fertility countries will increase
- 4.7 Continuing economic unpredictability will make individual life course planning ever more uncertain
- 4.8 Informal childcare will shift from grandparents to paid domestic workers
- 4.9 Cities will become more child-friendly

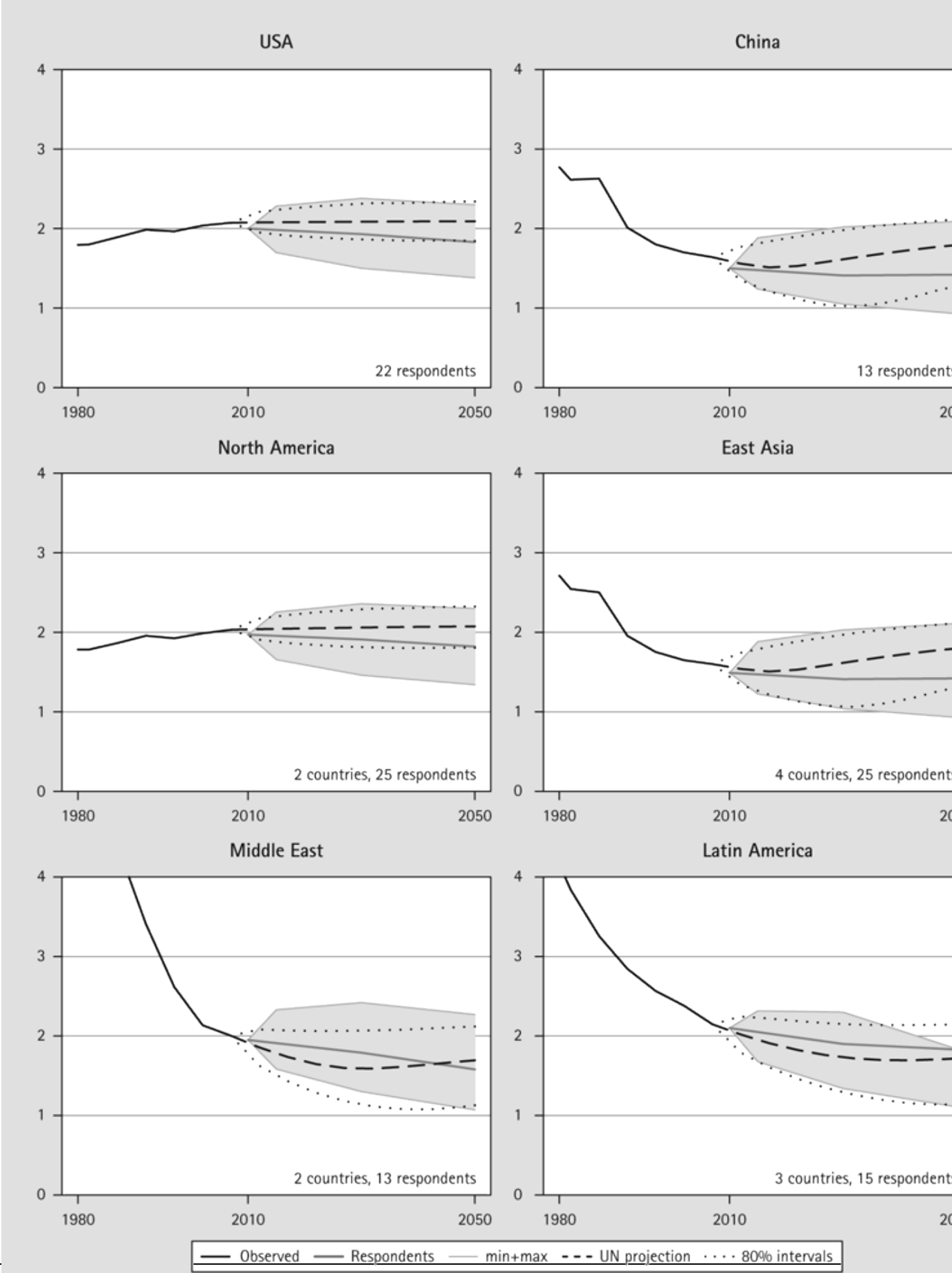
#### 5. Biomedicine and the timing of parenthood

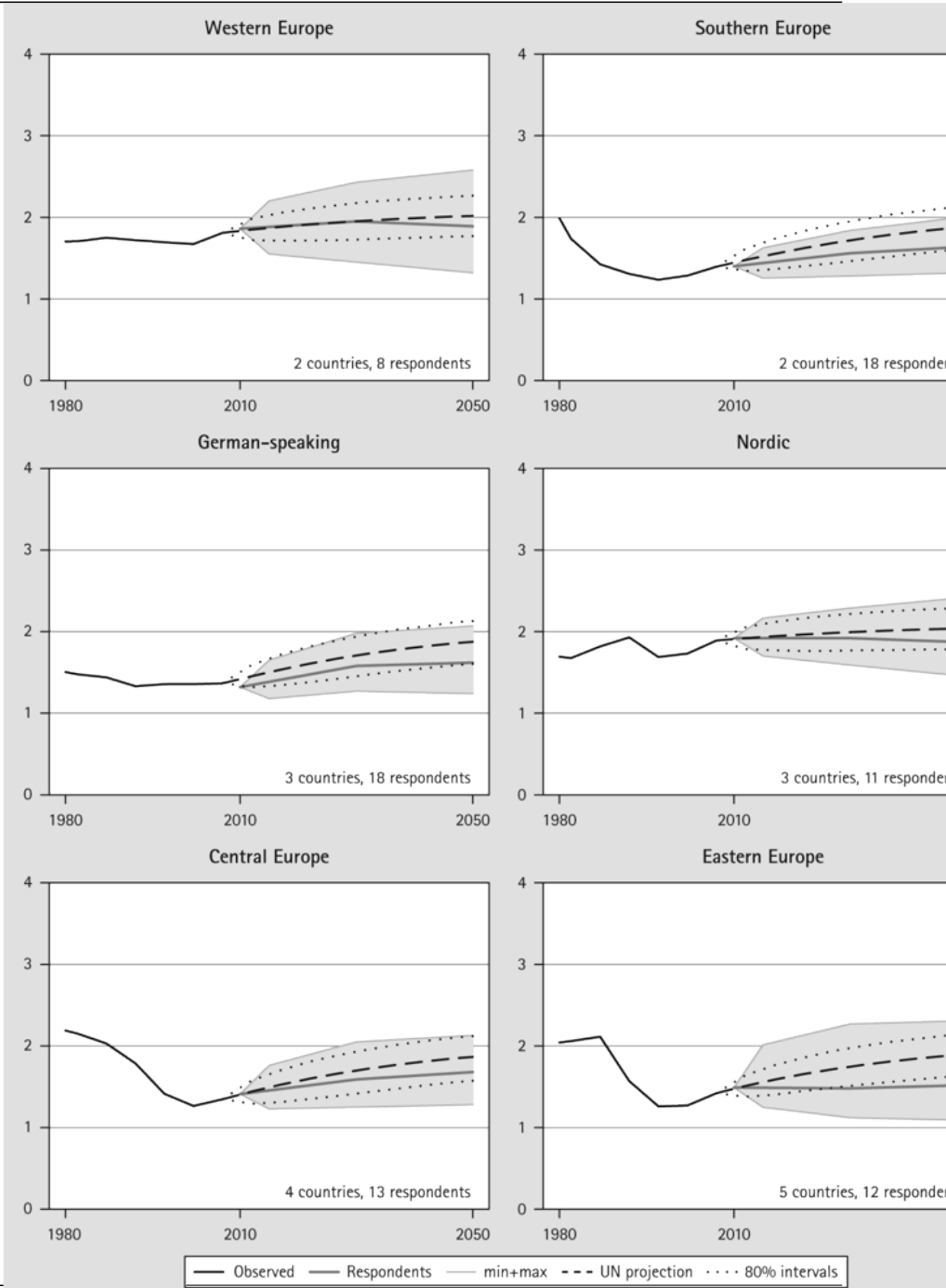
- 5.1 Men are becoming less fecund owing to declining sperm counts or quality
- 5.2 Delayed childbearing will become yet more common among women
- 5.3 Having children under the age of 25 will be rare
- 5.4 The broad availability and use of efficient contraception, including post-coital methods, will make mistimed and unwanted pregnancies rare
- 5.5 Financial, normative, and institutional barriers to assisted reproductive technologies (ART) will keep their application limited
- 5.6 Assisted reproduction and selective abortion will be increasingly used to achieve a desired sex composition, as well as other characteristics of children
- 5.7 The technology and availability of ART will improve sufficiently that women in their 40s who want a child will routinely be able to have one

#### **(p.127)** 6. Education

- 6.1 People will spend ever more years of their young adult life enrolled in education and professional training on the job
- 6.2 Fertility differentials by level of female education will diminish
- 6.3 There will be a new trend for better educated women to have more children and simultaneously pursue a professional career

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#### Notes:

(1) The contributing authors have drafted considerable parts of sections 3.1.4 and 3.2. They were selected as lead experts in respective topics and regions. Specifically, they have provided texts to the following sections: M. Jalal Abbasi-Shavazi to section 3.1.4.8 ('The Middle East'); Alicia Adsera to sections 3.1.4.7 ('Southern Europe') and 3.2.4 ('Employment, economic uncertainty, and fertility'); Jan Van Bavel and Ronald R. Rindfuss to section 3.2.8 ('Education'); Caroline Berghammer to section 3.2.3.2 ('Religion'); Minja Kim Choe to section



3.1.4.9 ('East Asian countries and territories') and Box 3.2 ('Living arrangements, gender roles, and their relationship to fertility in East Asia'); Melinda Mills to section 3.2.3.3 ('Gender equality'); S. Philip Morgan to section 3.1.4.1 ('The USA, Australia, Canada, and New Zealand'); Anna Rotkirch to section 3.1.4.6 ('Nordic countries'); Warren C. Sanderson to section 3.5.2 ('Long-term futures: preparing fertility scenarios beyond 2050'); Louis Rosero-Bixby to section 3.1.4.2 ('Latin America'); Maria Rita Testa to section 3.2.3.1 ('Fertility intentions'); Olivier Thévenon to section 3.2.5 ('Family policies'); and Zhongwei Zhao to sections 3.1.4.10 ('China') and Box 3.1 ('Finding China's period fertility rate'). Henri Leridon reviewed section 3.2.7 ('Biomedical factors'). Tomas Frejka provided detailed comments on the first draft of the chapter and produced regional cohort fertility estimates. The lead authors have modified these texts in order to achieve higher uniformity and reduce overlaps, and consulted with the contributing authors and book editors over these modifications. In addition, the whole chapter has been distributed to selected experts for additional comments and revisions.

(2) An extended version of this chapter containing expanded references, as well as additional background information about the survey of experts, is available as a working paper (Basten et al., 2013).

(3) The period TFR is a widely available, but also problematic, indicator that is affected by changes in the timing of births and parity composition of the female population of reproductive ages (Bongaarts and Feeney, 1998; Sobotka and Lutz, 2011; see also section 3.2.1). In conformity with its dominance in the literature and data sources we employ it frequently in this chapter, but also complement it with cohort fertility indicators, as well as alternative measures of period fertility.

(4) The most remarkable TFR upturn took place in Eastern Germany (former German Democratic Republic) where period TFR plummeted well below 1.0 after German unification in the early 1990s and then almost doubled, reaching 1.46 in 2010 (Goldstein and Kreyenfeld, 2011; see also section 3.1.4.5).

(5) Regional data weighted by 2012 population size of all the countries in each region.

(6) For details regarding the selection of countries for the low and high fertility modules, respectively, see Appendix 3.1. To keep text concise and informative, we focus especially on main countries in each region and pay only marginal attention to small countries and territories, especially those with a population below 1 million.

(7) Although the lack of reliable vital statistics in most LAC countries limits monitoring demographic trends in a timely way, data from population censuses of 2010 and 2011 make estimates for 2005–10 robust in most countries. The

*2012 World Population Datasheet* estimates the region's TFR level at 2.2 (PRB, 2012).

(8) Courbage (1999) argued that high fertility in some of the Middle East countries has been linked to their oil-driven economy, which allowed governments to establish subsidies leading to the reduction of the costs associated with children and reinforcing preferences for large families. The fall of the oil price in the 1980s, followed by cut-backs in subsidies, also coincided with the fall of fertility in these countries.

(9) Since the late 1990s new marriage behaviour has emerged in Taiwan, Singapore, and South Korea where men, especially with lower levels of education, are increasingly marrying foreign-born women (Kim, 2007).

(10) This has not prevented, however, the spread of sex-selective abortion, leading to skewed sex ratios at birth (SRB) estimated at around 120 males per hundred females in 2005–7 (Das Gupta et al., 2009, Figure 1). Mini-census data for 2005 show that in 5 out of 31 provinces there were over 125 males per 100 females born as of 2005, while only three provinces reported 'normal' SRBs of around 105 (Eberstadt, 2011).

(11) One of the main well-documented exceptions is Australia where most migrant groups showed fertility below the level recorded among Australian-born women between 1977 and 1991 (Abbasi-Shavazi and McDonald, 2000).

(12) As one of the contributing authors observed, 'this topic is an unresolvable dilemma. Knowledge is continuously accumulating on specific factors and mechanisms operating to shape fertility trends. In hindsight, we appear to be reasonably successful in analysing various specific situations. But a definitive comprehensive model that can be used to determine future trends is eluding us'.

(13) For a complete list of all of the arguments, see Appendix 3.4.

(14) The order of the arguments was randomized within the forces, and the order of the forces was also randomized to minimize the fatigue effect.

(15) A zero net impact is achieved either because the respondent considered the given argument invalid ('very likely to be wrong') or expected that the argument would have no impact on fertility. For the example given, the net impact would be calculated as  $0.75 \times 0.50 = 0.375$ .

(16) Several broader factors have been repeatedly mentioned as missing in the IIASA-Oxford survey: ethnic and socio-economic population diversity within a country, urban-rural differences, changes in family planning policies, adolescent fertility, microeconomic cycles and economic crises, and climate change and environmental disasters.

(17) The respondents were explicitly asked to consider the effects of the given argument on cohort fertility—in that case it might be argued that they expected that the negative influence of prolonged education and postponed childbearing will be permanent, also affecting cohort fertility quantum (e.g. via increased infertility related to shifting childbearing to late reproductive ages). It is likely, however, that some of the respondents focused on period fertility, expecting that education and the related fertility postponement will temporarily reduce it, mainly through the tempo effect.

(18) Note, however, that there is considerable variability in answers to the presented questions, and even the arguments generally deemed as ‘most likely to be wrong’ were found ‘likely to be right’ by a significant share of respondents. For instance, regarding the third ‘most invalid argument’ that men will be increasingly reluctant to become fathers, almost a quarter of respondents (22 per cent) thought it is more right than wrong and another quarter (27 per cent) indicated that it is as likely to be right as it is to be wrong.

(19) As we discuss in the next section, there was a very high level of disagreement among experts over the conditional impact of this likely trend and therefore mean net impact happened to average out at zero.

(20) For regional differences in validity and conditional impact, see Figure 3.15.

(21) Altogether, the organizers (Basten, Sobotka, and Zeman) and 20 invited experts participated in the meeting, of which 12 were from abroad and 8 from the Vienna area (researchers from the Wittgenstein Centre for Demography and Global Human Capital (WIC), a collaboration among the International Institute for Applied Systems Analysis, IIASA; the Vienna Institute of Demography of the Austrian Academy of Sciences, VID/ÖAW; and the Vienna University of Economics and Business, WU). Here we provide the complete list of all participants and their institutional affiliation at the time of the meeting: Alicia Adsera, Princeton University; Margareth Arilha, Universidade Estadual de Campinas (Brazil); Bilal Barakat, WIC (IIASA, VID/ÖAW); Jan Van Bavel, University of Leuven; Francesco Billari, Bocconi University, Milan; Stuart Basten, University of Oxford; William Butz, WIC (IIASA, VID/ÖAW); Minja Kim Choe, East West Center, Hawaii; Joshua R. Goldstein, Max Planck Institute for Demographic Research, Rostock; K.S. James, Institute for Social and Economic Change (India); Leiwen Jiang, National Center for Atmospheric Research, Boulder; Samir K, WIC (IIASA); Tomáš Kučera, Charles University, Prague; Wolfgang Lutz, WIC (IIASA, VID/ÖAW, WU); Elsie Pamuk, WIC (IIASA); Dimiter Philipov, VID; Anna Rotkirch, Population Research Institute, Helsinki; Warren C. Sanderson, State University of New York at Stony Brook, WIC (IIASA); Tomáš Sobotka, WIC (VID/ÖAW); Vegard Skirbekk, WIC (IIASA); Olivier Thévenon,

Institute National Etudes Démographiques, Paris, and Organisation for Economic Co-operation and Development, Paris.

(22) For more details on deriving the UN set of probabilistic fertility projections, see Alkema et al. (2011), Raftery et al. (2012), and the supporting documentation to the UN population projections (UN, 2012).

(23) Population-weighted average (using 2010 population size) for 31 countries with two or more respondents; see Table 3.5 for an alternative estimate of future TFR trends based on a simple average across all experts.

(24) Note that the experts focused in their assessment on individual countries, and regional trends are subsequently built up from these country-specific trajectories that can also be seemingly inconsistent and moving in opposite directions.

(25) Other macro-level uncertainties—some of which are referred to in section 3.2.9—contribute to this. Furthermore, in the long-run, climate change might also affect fertility trends with a varied impact in different settings. However, considering uncertainties about its progression, potential (often yet unforeseen) adaptations to it, and diverse pathways of how it might affect fertility and reproduction, we have not produced explicit scenarios linking climate change and projected fertility.

(26) There has been much debate regarding the justification of convergence as a ‘belief’ in the specific course of future global population trends as opposed to a computational tool. In some ways, the deployment of convergence takes elements of both of these uses and interpretations. In our exercise, we embrace the latter interpretation, acknowledging that the future variance in fertility across countries will be underestimated. The debate on the global convergence in fertility levels during the last half century has been inconclusive, partly depending on the measurement and methods used (see Dorius, 2008; Wilson, 2011).

(27) To some observers, projecting fertility and population change up to 2200 seems to encompass an absurdly long time horizon. One of the contributing authors, reviewing this chapter stated ‘there are limits to our imagination. When we think in 2013 about fertility in 2200 we are in the same position as Malthus trying to make forecasts for 2000’. Because of this huge uncertainty about the very long-term future, most of our projection exercise focuses on the time horizon through 2050. Likewise, education-fertility differentials are not projected beyond 2050, as their longer-term development in low fertility countries is very uncertain.

(28) For an analysis of fertility differentials in (mostly) higher fertility settings based on Demographic and Health Survey data, see KC and Potančoková (2013).

(29) In the group of countries with high fertility and generally lower levels of education, this broad category has been subdivided into four distinct categories (Chapter 4).

(30) Exponential trend of RFI (related to 1) can be understood as linear trend of logarithm of RFI (related to 0) with intercept at [0;0], which prevents the crossover and enforces the convergence of RFIs.

(31) Note that the series of the period total fertility rates (TFR) used for this selection differed from the estimates of the period TFR used in the survey to provide the initial TFR level for all countries in 2010. For the latter purpose, the more recent (2010) estimates published by Population Reference Bureau (PRB) (2010, <[http://www.prb.org/pdf10/10wpds\\_eng.pdf](http://www.prb.org/pdf10/10wpds_eng.pdf)>) were used. However, the division of countries into the higher and lower fertility groups would remain identical if the PRB data were used instead of the UN estimates.

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