The End of 'Lowest-Low' Fertility?

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Abstract

In the 1990s, period total fertility rates (TFRs) fell below 1.3 in Eastern and Southern Europe and East Asia, and along with this fall came the idea of "lowest-low fertility". These new lows in fertility inspired a large literature, notably Bongaarts and Feeney's (1998) work on tempo-adjusted fertility, Kohler, Billari, and Ortega's (2002) exploration of the causes of lowest-low fertility and reasons why it might be easier for fertility to fall than to rise, and Lutz et al.'s (2005, 2006) notion of a low-fertility trap in which falls in fertility could be self-reinforcing. Even some official forecasts have shifted to the idea that fertility would stay low. It comes as news therefore that the TFR in the lowest-low countries in Southern Europe, Eastern Europe and East Asia is now on the rise and the list of lowest-low fertility countries have shrunk substantially. We describe the extent of this rise and explore how it is associated with the tempo effect, migration, economic and policy improvements in these countries.

Contents

1. Introduction

In the 1990s, period total fertility rates fell below 1.3 children per woman in Eastern and Southern Europe and East Asian countries, and along with this fall came the idea of "lowest-low fertility". These new lows in fertility inspired a large literature, notably Bongaarts and Feeney's (1998) work on tempo-adjusted fertility, Kohler, Billari, and Ortega's (2002) exploration of the causes of lowest-low fertility which included reasons why it might be easier for fertility to fall than to rise, and Lutz et al.'s (2005, 2006) notion of a low-fertility trap in which falls in fertility could be self-reinforcing. Since this fall in fertility, some official forecasts have also shifted to the idea that fertility would stay low and do not predict any substantial increase. For example, in Japan official forecasts are for fertility to stay below 1.3 until at least 2050 (Kaneko et al. 2008). In Hong Kong, the total fertility is projected to decrease to 0.9 children per woman by 2016 (Census and Statistics Department 2007:44).

Kohler, Billari, and Ortega (2006) expected that lowest-low fertility is likely to be a persistent pattern lasting several decades and presenting a considerable challenge for many developed countries. It comes as news therefore that fertility in most lowest-low fertility countries has been steadily rising after 2000 (Figure 4.2). Countries as diverse as Spain, Italy, Russia, the Czech Republic, and Japan all have their lowest fertility rates behind them (even if slightly). Now there are only a handful of countries with TFRs below 1.3, compared to 21 in 2003 (Figure 3.1). Fertility has clearly risen from its lowest levels in Central and Eastern Europe. In Bulgaria, the Czech Republic, Latvia, and East Germany—where fertility below the lowest-low level persisted for 10 to 13 years (Table 3.1)—TFRs reached 1.4 or were very close to this level by 2007. East Germany whose TFR was as low as 0.77 in 1994 had 1.37 in 2007. In Southern Europe, period TFRs have risen over 1.3 for Italy, Spain, and Greece, leaving only Portugal on a downward-trend. In East Asia, there are signs that the TFRs in lowest-low fertility countries have begun to rise. Japan's TFR has risen above 1.3 and the trends are upward in Singapore and South Korea, and even in Hong Kong. Only in Taiwan, lowest-low fertility was still falling in 2007.

In this paper we provide a demographic analysis of this apparent reversal in lowest-low fertility and explore a variety of factors that help explaining the observed changes. We address the following issues:

1. To what extent the end of tempo effects explains the retreat of lowest-low fertility.
2. To what extent increases in the percentage of more fertile group of foreign-born mothers explains the reversal in the TFR.
3. To what extent improving economic conditions (measured by unemployment rates) explains the reversal.
4. To what extent the TFR reversals are related to new policy initiatives.

A theme running through our analysis is that lowest-low fertility should be thought of as a transitional phenomenon closely linked to the postponement of childbearing from younger to older ages.

We have followed Kohler, Billari and Ortega (2002) and used the benchmark period TFR of 1.30 to distinguish lowest-low fertility. Although this is now a conventional definition it is important to keep in mind that there is nothing magical about this frontier. The difference between the TFR slightly under 1.3 and slightly over 1.3 is only definitional, and is not a difference in kind. Still, it is useful to recall that the effects of fertility levels on population growth and age structure are proportional. In terms of population halving times, the difference between relatively close levels of low fertility is dramatic. Stable populations with a TFR of 1.3 take about 45 years to halve, whereas those a TFR of 1.6 take nearly 90 years.

2. Explanations of lowest-low fertility

Beginning in the 1990s it looked as if a new era of extremely low birth rates had taken hold. While below-replacement fertility has appeared in various forms on and off since the 1930s, the fertility rates seen in the 1990s were so low that, if continued, could lead to rapid depopulation, or as Chesnais (2001) termed it 'population implosion'.

The prospect of prolonged periods of very low fertility has frightened and fascinated generations of demographers, journalists, and general public in Europe and in the United States over the last century. The interest in extreme low fertility lies in its hypothetical consequences for long-term population trends, involving both accelerated rate of population ageing and population decline. In the literature demography most commonly creeps in through the "twin horrors of population decline and population excess" (Shriver 2003: 153) and the first of these 'horrors,' coupled with the notion that human species (or Europe, 'Western civilization', etc.) may fail to reproduce themselves, was commonly evoked in the 1920s-1930s and, more recently, since the 1970s onwards (see Teitelbaum and Winter 1985). Even in the United States, which record the highest fertility among industrialized countries and experience sustained population growth, books like "The Empty Cradle" by Philip Longman (2004) warn of population decline, loss of economic prosperity and innovativeness. In Europe, Pope Benedict XVI proposed in 2006[1] that its problem seems to be that "it no longer wants to have children" and it "seems to be wishing to take its leave from history."[2] A specific area of concern is how low fertility can decline (Golini 1998) and whether there might be a recurrent further decline in fertility rates in the future (Lutz, Skirbekk, and Testa 2006).

Much of the sensationalism about extremely low fertility has come as a result of public misunderstanding of the period Total Fertility Rate, which is often simply described as the number of children per woman (e.g., Sobotka and Lutz 2009).[3] As has been known among demographers since the works of Hajnal (1947) and

[1] Christmas Greetings to the Roman Curia, accessed at <http://www.vatican.va/holy_father/benedict_xvi/speeches/2006/december/documents/hf_ben_xvi_spe_20061222_curia-romana_en.html>.

[2] A nice example of a similarly dramatic vision is J.J. Spengler's (1932 [1991: 169]) warning of an imminent decline of Western civilization due to human unwillingness to bear children, brought about by the competition for wealth under capitalism: "Western civilization has altered the psychology of man. It has destroyed the motive which (…) has induced man to procreate its kind."

[3] The distinction between period and cohort fertility and the potential misinterpretations of the period TFR produced headlines and controversy even in relatively high-fertility France in the debate between Calot and Le Bras (see Keyfitz 1993).

especially Ryder (1964), and recently repopularized by Bongaarts and Feeney (1998), delays in the timing of childbirth can have dramatic effects on cross-sectional measure such as the period Total Fertility Rate. Delays which shift births from a year to the next result in fewer children being born so long as they continue.

Within the discipline of demography, a broad agreement exists among demographers that the era of lowest-low fertility emerged as a direct consequence of rapid fertility postponement (Kohler et al. 2002, Lutz et al. 2003, Morgan 2003, Sobotka 2004a, Billari 2008). But the questions of how permanent lowest-low fertility would be and whether other factors than postponement can sustain such a low fertility have produced a divided set of predictions and interpretations. Not surprisingly, the proponents of the prominent role of tempo effects tend to argue that lowest-low fertility would end once delays in fertility weaken or come to an end. Bongaarts (2001 and 2002) and Sobotka (2004a) both suggested that lowest-low fertility was a transient phenomenon, which they expected to end soon. The majority of official population projections followed this view, projecting increases in lowest-low fertility from observed levels under 1.3 children per woman to levels above 1.5. The earlier examples of the United States and the Netherlands, where postponement lowered period fertility temporarily, after which fertility rose again were used as examples of short-lived 'tempo transitions.'

Many researchers, however, offered arguments on why lowest-low fertility may prove persistent.[4] These views can be roughly divided into two streams. The first one acknowledges the prominent role of tempo effects in initially pushing the period TFR towards the lowest-low level, but suggests that other factors than postponement may later keep fertility at very low levels, whereas the second stream sees lowest-low fertility as a consequence of particular social, cultural or economic forces. Consistent with the former view, Lesthaeghe and Willems (1999: 227) propose that once postponement of childbearing stops and the associated tempo distortion disappears, the quantum effect may become dominant and prevent the TFR from rising to the level of BF adjusted TFR (see also Bongaarts 2002). Consequently, the period of lowest-low fertility could become long-lasting or even permanent. Kohler, Billari, and Ortega (2002 and 2006) pointed out that in some countries, especially in Eastern Europe, postponement could continue for many decades; early childbearing during the communist period created much room for postponement, even without a change in desired family size. Furthermore, they emphasized that underlying levels of cohort fertility quantum were also likely to decline as a result of postponed fertility. Reasons for continuation or even further decline of lowest-low fertility were put forth in the form of the 'low fertility trap' (Lutz, Skirbekk, and Testa 2006). This is a theory of negative feedback, in which tempo-induced declines in the birth rate lead to further declines in desired family size and population aging creates further economic hardships for young adults.

A number of scholars view very low fertility as a long-lasting outcome of socio-economic and cultural conditions that are disadvantageous for childbearing. McDonald (2006: 487) suggested that waiting for tempo effect to disappear "is beginning to look like waiting for Godot" and proposed that there is a cultural divide

[4] Although our paper focuses on lowest-low fertility, we also refer here to the contributions that are concerned about 'very low fertility' or 'extreme low fertility,' without making explicit reference to lowest-low fertility or to the TFR threshold of 1.3.

between populations that can maintain period fertility above 1.5 and those that cannot, with the possibility of increasing fertility becoming harder and harder in less child-friendly societies. He repeatedly stressed (McDonald 2000, 2002, 2006) low-levels of gender equity in the family and a strong reliance of individuals on their family networks in countries where families are expected to support their own members and universal welfare support is less developed as reasons for sustained low fertility. Suzuki (2003: 12) argues that "[o]ne way to look at lowest-low fertility is to see it as a normal response to socioeconomic changes in the postmaterial era." In a twist to McDonald's arguments about the role of the family as a welfare institution, he proposes that only countries with weak family ties, such as north-western Europe, have developed a sufficient network of non-family care, which enables women to have more children and mothers to participate easily in the labour force. Reher (2007) and Chesnais (2000) also view extremely low fertility and the concomitant prolonged population decline as irreversible, long-term aspects of the developed world, although for different reasons. Reher sees it essentially as an outcome of demographic transition, while Chesnais stresses the role of social atomisation, individualism and consumerist culture.

Although we cannot review here all the other relevant factors that have been put forward to explain extreme low fertility levels we shall selectively outline some of them. Adserà (2004 and 2005) emphasizes the role of labor market institutions, especially of unemployment, in driving fertility to very low levels. She found that a combination of low (but growing) female labour participation, high unemployment (especially among women), low prevalence of part-time work, moderate size of public sector and unstable contracts for young workers, strongly depresses fertility rates. In her simulation, the TFR in countries with high and persistent female unemployment was estimated as low as 1.28 (Adserà 2005: 192).

Kohler et al. (2006) and Billari (2008: 171) highlight the heterogeneity of lowest-low fertility settings and suggests that lowest-low fertility in Southern Europe is qualitatively different from lowest-low fertility in Eastern Europe and that these differences are subject to "path-dependent evolution that is likely to persist". In Southern Europe, especially in Italy and Spain, lowest-low fertility is associated with the persistence of more traditional family patterns, late home leaving, a shift to a very late first birth timing, relatively low female employment, and also disadvantaged labour market position and high unemployment among young adults (Billari and Kohler 2004, Billari 2008; see also Baizán et al. 2002, Simó Noguera et al. 2005). Dalla Zuanna (2001) perceives strong family ties in Italy as decisive for Italian lowest-low fertility by preventing an early partnership, family formation and home leaving of young adults, discouraging mother's economic activity and supporting unequal division of gender roles.

Many analogies can be drawn between the more traditional family system in Southern Europe (which has been nevertheless eroding rapidly in the last decade, e.g., Rosina and Fraboni 2004, Billari 2008, Castiglioni and Dalla Zuanna 2009) and East Asia. In Japan, non-marital fertility is negligible and remains stigmatised; at the same time, marriages have been increasingly postponed or foregone (Raymo 1998) and once commonly arranged marriages have virtually disappeared (Retherford et al. 2001). A combination of declining marriage attractiveness – in part driven by higher education and work aspiration of women who are more reluctant to follow a normative pathway of a married housewife with children (Raymo 1998)–, non-acceptance of extramarital childbearing and higher sexual permissiveness that has led to a rise of non-cohabiting partnership relations (Iwasawa 2004) constitutes a compelling reason for very low fertility in Japan (e.g., Ogawa 2003). Other analogies between Japan and Southern Europe can be made with respect to disadvantaged labour market position of young adults and mothers, who are often offered low-paid irregular jobs (OECD 2003, Boling 2008). In addition, Japanese women face an uphill struggle when trying to combine work and motherhood. The normative expectations that women do all the housework, childrearing and care work makes it almost impossible for mothers to pursue a work career (Boling 2008). Finally, Shirahase (2000) suggests that Japanese society is characterised by "systematically and hierarchically ordered timetable based on age," which limits individuals' flexibility in making important life course decision and further depresses the birth rate.

In Central and Eastern Europe, family behaviour has changed faster and earlier than in Southern Europe and Eastern Asia. Especially Central Europe has experienced a remarkable shift to later childbearing, but lowest-low fertility in this region is also frequently perceived as a consequence of a painful economic transition after the collapse of state socialism around 1990 (e.g., Sobotka 2004b, Frejka 2008). This argument is most compelling for the former Soviet Union. In a study on Ukraine, Perelli-Harris (2005) suggested that lowest-low fertility there has been largely driven by the decline in second birth rates as economic factors like poverty and unemployment "make a second child prohibitively expensive for the average family" (p. 68). Furthermore, in analogy to Southern Europe and East Asia, conservative gender roles attitudes combined with a need for female employment also contributed to very low fertility.

The long-lasting view of lowest-low fertility rates has also appeared in official population projections, often as a 'Low scenario', but at least in the case of Japan as the central 'Medium scenario'. As a series of projections predicting a recovery of fertility proved repeatedly wrong, the latest version of Japan's official populating projection, released in 2006, predicts period fertility rates below 1.3 out to at least 2055 (Kaneko et al. 2008 and 2009; the low variant envisions a TFR below 1.1 between 2009 and 2055). In Germany, official projections include a sustained decline to 1.2 children per woman through 2050 as part of their 'Low scenario'. (The Medium scenario has a TFR of 1.4). The 'Low variant' of the 2008 UN world population projections (UN 2009) shows extreme low TFR levels throughout the whole projection period, often falling below 1.0 in Eastern Europe and East Asia. For instance, this scenario envisions that in Belarus the TFR would hit a trough of 0.86 in 2020-25, whereas in Hong Kong it would fall as low as to 0.61 in the same period. Also cohort fertility is occasionally projected to fall to 1.3 or below. Frejka and Sardon (2004: 376) expected that women born in 1975 may reach a completed fertility of 1.2 in Italy, 1.2-1.3 in Austria, Germany and Switzerland, and 1.3-1.4 in Croatia and Slovenia.

In this paper, we build on the original work of Kohler, Billari, and Ortega (2002), Billari and Kohler (2004), Bongaarts (2002), and Sobotka (2004a), as well as more recent commentaries on very low fertility such as Billari (2008), which explores the factors behind increasing fertility in Italy. Our main contribution is that we are now able to provide a detailed analysis of the path that fertility has taken in almost all of the countries that have or at one time had "lowest-low" levels of fertility. This analysis allows us both to describe what has happened and to advance the modeling of postponement transitions.

In addition to description and tempo-quantum analysis, we also examine the power of economic, policy, and migration-related factors to explain changes in birth rates among the 'lowest-low' countries. The concluding general discussion offers a new look at the idea of 'tempo-transitions' and discusses the prospects for a resumption of lowest-low fertility as a result of the economic crisis.

3. The spread and the subsequent retreat of lowest-low total fertility rate

With the exception of wars and extreme events, the lowest-low fertility[5] is a relatively recent phenomenon (e.g., Billari 2008). Among larger countries it first took place in Western Germany (by then Federal Republic of Germany), where the period TFR briefly fell below 1.3 in 1984-1985 (Table 3.1). At the same time, several European countries experienced a TFR falling below 1.5. It was only a decade later that the lowest-low fertility became widespread in many regions of Europe and later also in Armenia and in East Asia. Excluding countries with population below one million and countries with unreliable population statistics (most notably, Bosnia and Herzegovina), the number of countries with the lowest-low fertility increased rapidly from two in 1991-92 (East Germany and Hong Kong) to 21 in 2003 (Figure 3.1, we consider East and West Germany as separate regions in this analysis). By then, Italy, Spain, most post-communist countries of Central and Eastern Europe, as well as Japan, Korea, Singapore and Taiwan joined this group. In total, 479 million people lived in countries with the lowest-low period fertility level (Figure 3.2); in Europe more than half of the total population lived in these countries in 2001 (Sobotka 2004a).[6] Staring in 2003, the number of European countries with lowest-low fertility fell steadily, from 16 in 2002 to three in 2007 (with Romania remaining the only larger country in the group), whereas in East Asia, four out of five countries ever experiencing lowest-low fertility still retained it in 2007 (Hong Kong, Singapore, (South) Korea, and Taiwan, whereas Japan recorded higher fertility rates in 2007). Since the threshold of 1.3 is arbitrary, Table 3.1 also lists countries that experienced the TFR decline below 1.4. This is a mixed group of middle-sized countries from different parts of Europe, but it also includes Georgia and the lowest-fertility country of the Americas, Cuba, where the TFR fell to 1.39 in 2006 (ONE 2008).[7] Among these countries, Denmark stands out for both an early fall in the TFR to very low levels (the TFR fell to 1.38 in 1983) and its steady subsequent recovery to 1.85 in

[5] Although we think that the period TFR is a problematic measure of fertility level (see also Sobotka and Lutz 2009), for simplicity we often refer to it as "period fertility" and also consistently adhere to the "lowest-low" fertility definition based on the period TFR.

[6] Total population of all countries that have experienced a spell of lowest-low fertility after 1980 amounts to 715 million in 2008 (Table 3.1).

[7] Our list of very low fertility countries would not change much if we included all the countries that have experienced a TFR decline below 1.5, seen by McDonald (2006) as marking a 'cultural' divide between countries with 'very low fertility' and 'moderately high fertility'.

2007, which brought Denmark into the group of countries with the highest period TFR in Europe.[8]

The phenomenon of the lowest-low fertility differed widely between countries in duration as well as in the lowest level of the period TFR reached. Some countries encountered a very brief period of the TFR below 1.3 (e.g., Armenia, Estonia, Japan, and Hungary), while ten countries including Italy, Russia, Spain and Ukraine experienced ten or more years of such low TFR level (Table 3.1). Most notably, Hong Kong experienced 17 years of such low fertility as of 2008. Some countries have seen the period TFR temporarily plummeting below 1.0, with Eastern Germany going down to 0.77 in 1993-94, shortly after German unification (Witte and Wagner 1995, Conrad et al. 1996). Also Hong Kong reached an extreme low TFR of 0.90 in 2003 (Table 3.1). Russia, with a population of 142 million in 2008 was the most populous country experiencing a spell of the lowest-low fertility between 1996 and 2002 and again in 2005-2006; Japan with a population of 128 million briefly experienced lowest-low fertility in 2003-2005, as did five countries with population of 38-48 million (Italy, Korea, Poland, Spain, and Ukraine). By 2007, however, the global population living in countries with lowest-low fertility shrank to less than one quarter of its peak value in 2003, to 114 million, out of which only 31 million resided in Europe (Figure 3.2). At the same time, several very low fertility countries still experienced a continuing fall in the TFR in the most recent period. This was the case of Taiwan and also Portugal which may soon join the lowest-low fertility group. In Hungary, Romania and Slovakia, no clear trend towards a sustained TFR increase could be traced until 2007.

Although we focus mostly on individual countries, regional-level variation should also be highlighted. China as a whole has a sub-replacement fertility level at least since the 1990s, but the levels of the TFR are highly uncertain as serious underreporting of births occurs in vital statistics.[9] Our estimate, based on the 2000 population Census data and the analysis published by National Bureau of Statistics and East-West Center (NBS 2007) is presented in Table 3.2 (see Appendix 1 for more details and for an alternative estimate). Using different thresholds of the reported TFR, we arrive at the estimate of six to twelve provinces with 12 to 37 percent of China population having lowest-low fertility in 2000, with the main variant estimate of eight provinces with almost one fifth of China population (245 million). All these provinces except Hubei are situated alongside the Eastern coast and include the capital city of Beijing and the most populous city, Shanghai.[10] Adding China provinces to the countries with lowest-low fertility, and assuming that the findings for China for the year 2000 pertain also to the subsequent period, the global population of countries and regions with the TFR below 1.3 can be estimated in its peak period around 2002 at 700-900 million, i.e, 11-14 percent of global population.

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[8] Denmark also constitutes an exception in cohort fertility trends as it is probably the only industrialized country where women born in the 1960s actually experienced a slight increase in their completed fertility (e.g., Frejka and Sobotka 2008).

[9] Different estimates of the TFR in China around 2000—when population census was conducted—range from 1.22 to 2.3 (Lutz et al. 2007), with a number of experts converging at 1.5 to 1.6 (e.g., Retherford et al. 2005; Zhang and Zhao 2006).

[10] In Shanghai, and plausibly also in other large cities of China, the originally coercive one-child policy has become widely internalised and led to the spread of one-child family preferences (see Nie and Wyman 2005 for an example of Shanghai).

Quebec, Canada's second most populous province is also notable for its low levels of the period TFR, which reached a low of 1.37 in 1987 but has since risen, reaching 1.67 in 1992, later declining and rising again (INSPQ 2008). While Italy and Spain can be counted among the 'trend-setters' of lowest-low fertility, some of their regions deserve attention for their particularly early onset and long spells of lowest-low fertility as well as for their recent remarkable and rather unexpected recovery (see also Billari 2008). Northern Italy, which has a long history of persistent low fertility, experienced 23 years of lowest-low fertility, starting in 1981 as compared with 'only' 12 years for Italy as such. North Italian province of Emilia-Romagna, which used to be a 'showcase' of very low fertility throughout the post-WW II period, recorded 25 years of TFR below 1.3 between 1979 and 2003 (Figure 3.3). In this view, a recent reversal, when the TFR in the North of Italy as well as in the province of Emilia-Romagna got slightly ahead of the Italian TFR, is remarkable. In these regions, the estimated TFR for 2008 was 1.45 as compared with 1.41 for Italy, up from 1.04 reached in the North in 1994 and 0.94 reached in Emilia already in 1987 (ISTAT 2009a and 2009b; see also Caltabiano 2008). In Spain, a number of regions experienced onset of lowest-low fertility in the second half of the 1980s and by 1990 already 10 out of the 17 autonomous communities had a TFR below 1.3, with Asturia and the Basque country falling below 1.0. In five of these regions fertility recovered above 1.3 as of 2007 (INE 2009c), increasing by 0.3-0.4 from the lowest level reached around then mid-1990s.

As the number of countries with the TFR below 1.3 shrank rapidly, the TFR in most of them recovered only slightly by 2007, often reaching close to 1.4 (Figure 3.4). However, in some countries the TFR showed more than just a small uptick: five former communist countries of Europe and Armenia experienced a TFR increase of 0.3 or more; in Eastern Germany the TFR increased by 0.6 to 1.37 in 2007, and in Estonia it rose by 0.42 and reached 1.63 in 2007, a level that is above an average for Europe of 1.49 (Table 3.1). This trend as well as the regional analysis above clearly show that there is nothing inevitable about the lowest-low fertility and that many countries experiencing spells of extreme low TFR may later see a relatively strong recovery of period fertility to moderately low fertility levels. Interestingly, the recent TFR growth in Europe was not confined to the countries with very low TFR levels. In contrast, many countries with initially higher TFR have recently registered its stronger increase than most of the lowest-low fertility countries. Belgium, France, the Netherlands, Sweden, and the United Kingdom experienced a TFR rise by 0.25 to 0.35 from the year of the lowest TFR level. As a result, considerable regional diversity in fertility levels has not diminished in Europe (e.g., Frejka and Sobotka 2008).

The rapid reversal of a seemingly unstoppable trend of the spread of the lowest-low fertility in Europe and East Asia is remarkable and deserves detailed analysis. However, it was not entirely unforeseen (see Section 2 above). The next parts of our paper will analyze four most plausible explanations of this trend, specifically, 1) slowing-down or ending of fertility postponement and the related decline in the tempo effect depressing the period TFR; 2) the influence of higher-fertility immigrants on fertility trends; 3) the influence of improving economic climate and declining unemployment; and 4) the impact of specific pronatalist and family-related policies. We do not analyze factors that have been suggested as possible long-term drivers of fertility increase, such as cultural and value changes making societies more conducive to family formation (Billari 2008, Sobotka 2008b), or the rise in gender equality in economic opportunities and the division of household tasks. These trends unfold gradually and are not precisely documented; therefore, they cannot be included in our analysis of recent fertility reversals.

4. The role of tempo effects in explaining the TFR increase

A trend towards later timing of childbearing constitutes the most prominent explanation of the TFR decline to very low levels and also of its subsequent moderate recovery (see also Section 2 above). This trend negatively affects conventional period fertility indicators such as TFR, pushing them well below the eventually achieved completed fertility during the whole period when childbearing takes place at progressively later ages (e.g., Bongaarts 2002). Such a negative distortion, frequently labeled 'tempo effect' can last three decades or even longer, as has been the case in many European countries and Japan (Sobotka 2004b). Kohler, Billari and Ortega (2002) proposed that developed countries are undergoing a distinct 'postponement transition' from an early to a late timing of motherhood. The end of fertility postponement should eventually lead to an elimination of the tempo effect and a subsequent increase in the period TFR, provided that the underlying fertility level (net of tempo effect) remains stable (Bongaarts 2002: 437-8, see also below). Sobotka's (2004a) analysis suggested that all the lowest-low fertility countries of Europe were affected by negative tempo effect in the second half of the 1990s and none of them would experience a TFR below 1.4 without fertility postponement.

This section analyzes the extent to which the recent TFR rise and the concomitant shrinkage of the lowest-low fertility group is explained by diminishing tempo distortion in the period TFR. We proceed in two steps. First, we look to what extent was the TFR increase driven by the trend in the first-order TFR. Second, we analyze tempo effects and tempo-adjusted TFR for the period through 2006, using a modified version of adjustment method proposed by Bongaarts and Feeney (1998).[11] Our special focus on first births is motivated by a hypothesis that the cycle of fertility postponement and recuperation, linked to the process of delayed childbearing, should be most clearly manifested in the first-order TFR (TFR1). If period fertility rates in many developed countries in the 1970s-1990s declined due to a combination of a real fertility decline and temporary tempo effects, it is likely that most of the quantum decline was concentrated in second or third and higher-order births, whereas first births trends were predominantly affected by birth postponement.[12] In addition, fertility postponement often leads to a distinct parity-distribution effect that may enhance the TFR1: it leads to an increase in the number of childless women at advanced reproductive ages, which would eventually push the TFR1 back to higher

[11] Note that this analysis provides only a rough estimation of the role of tempo effect, depending on the validity of underlying assumptions in the Bongaarts-Feeney formula. Especially the assumption of a period-driven shift that leads to the same postponement across all age groups is likely to be violated if the postponement and recuperation process is at least partly cohort-driven (see Section 8.2). Consequently, the importance of diminishing tempo effect may be underestimated in our analysis.

[12] This reasoning can also be linked to the finding that many low-fertility countries of Southern and Eastern Europe experienced a rapid decline in the progression rate to second birth, but not a particularly steep increase in childlessness (e.g., Billari and Kohler 2004).

levels if the underlying first birth intensity (as measured by parity-specific fertility rates) remained constant (Sobotka 2004b). Hence, we expect that the TFR1 increased steeper than the overall TFR and that it had contributed more than the higher birth orders to its recent increase, provided that the tempo effects indeed had a prominent influence on this trend.

4.1 Transition in first-birth TFR and its contribution to the overall TFR increase

At the time when the period TFR reached the lowest level, its first-order component typically fell to 0.6 or even lower; Slovakia had a TFR1 of 0.52 in 2001-2002, whereas the Czech Republic reached 0.52-0.54 in 1996-2001 (see also Table 4.1). Nowhere are the distortions in the period TFR and the problems of interpreting such an erratic indicator more clearly visible than in its first-order component.[13] If taken at a face value, such low TFR1, especially when prevailing over longer periods of time would imply childlessness exceeding 40%. Such levels contrast with the actual childlessness in Europe and East Asia. Various analyzes and projections indicate that only few of the lowest-low fertility countries are likely to experience childlessness higher than 20% among the late 1960s and the early 1970s cohorts (Sobotka 2005; Frejka and Sardon 2006, Sardon 2006)[14] and only in Germany and Japan childlessness may eventually rise to very high levels of 25-30% (Kreyenfeld and Konietzka 2007, Dorbritz and Ruckdeschel 2007, Iwasawa and Kaneko 2007).[15] Clearly, first-order TFR in lowest-low fertility countries became strongly depressed by fertility postponement in the 1990s and declined well below any plausible levels of cohort first birth rates. This finding suggests that some increase in the period TFR would be expected solely because of strong tempo distortions in first-order TFR. We propose that the lowest-low TFR has its analogy in its first-order component, where the values below 0.75 can be labeled as lowest-low first birth levels.

All the countries analyzed in Table 4.1 recorded lowest-low TFR1 at the time of reaching the lowest TFR level.[16] In 2007, first-order TFR increased in all of these countries, but only in four of them—Bulgaria, Estonia, Russia, and Spain—did the TFR1 rise above 0.75. This signals that in most countries the period TFR, especially its first-order component, was still negatively affected by tempo effect around 2007 (we provide a more detailed analysis below). In line with our expectations first-order TFR increased in all the analyzed countries that have seen some recovery in the overall period TFR and its increase was typically more rapid than the increase in the

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[13] Ryder (1990: 440) has proposed that "the period total first-order fertility rate is so obviously distorted that nobody pays attention to it."

[14] Sardon's (2006: Table 7) data should be used with caution for the younger cohorts born in 1968 and later, for whom the projection method used – assuming no further change in first birth 'incidence rates' by age (i.e., non-parity specific rates, where all women of a given age are included in the denominator) – could have inflated their projected childlessness values

[15] In Germany, childlessness is particularly elevated in Western Germany, but the proportion childless can only be estimated from various surveys as precise data are lacking. Most estimates for West German women born in 1965 and 1970 suggest a childlessness rate of 24-29% (Sobotka 2005: Table 3, Kreyenfeld and Konietzka 2007: Table 4, Dorbritz and Ruckdeschel 2007: Table 1)

[16] These countries were selected on the basis of data availability; only those experiencing by 2007 at least two years of the TFR increase from its lowest level are featured in Table 4.1.

TFR for second and higher order births, both in absolute and relative terms. However, there is a clear regional differentiation in this pattern. In Southern and Central Europe (except Slovenia), the TFR recovery was dominantly driven by an increase in first-order TFR. In contrast, in the countries of the former Soviet Union, including Baltic states (except Lithuania), an increase in the TFR for second and later births was more prominent (Estonia, Latvia, and Ukraine), or at least as important as an increase in first-order TFR (Russia; see Table 4.1). This peculiar pattern of fertility recuperation may be explained by a widespread postponement of second births and the resulting prolongation of second birth intervals in some Eastern European countries after the political regime change around 1990. This phenomenon was repeatedly observed in Russia and Ukraine (e.g., Barkalov 2005, Perelli-Harris 2005, Philipov and Jasilioniene 2008), where first births were initially not postponed as vigorously as in other regions of Europe. Since the delay and decline in second birth rates can be linked to the economic crisis and uncertainty during the economic and social transition in the 1990 (Perelli-Harris 2005), it is not surprising that a sizeable economic recovery after 2000 also brought a rapid rise in second and higher-order TFR there. In addition, this increase may be also linked to family policies supporting larger families (see Section 7).

Because first birth rates are usually more affected by childbearing postponement than higher-order birth rates, we propose that the TFR1 follows in most lowest-low fertility countries a distinct trajectory during this process that broadly conforms to the *postponement transition* framework of Kohler, Billari and Ortega (2002). First, countries start with relatively high TFR1 and an early mean age at first birth. When postponement kicks in, TFR1 falls, often to the lowest-low levels below 0.75 and the mean age at first birth begins its long-term rise. Once this 'postponement transition' comes to the end, the mean age at first birth tends to stabilize at a high level (typically, at age 28 or older) and the TFR1 bounces back, although not as high as it was at the start of the process (allowing for some decline in fertility levels). This process is graphically displayed for selected countries in Figure 4.1, separately for the former communist countries with initially very early first birth patter, and for Southern European and East Asian countries (see also Sobotka 2004b: 180-182). Denmark and the Netherlands are added for an illustration as well.[17] Most of the analyzed countries indeed seem to follow the outlined trajectory quite well, although there are some irregular ups and downs, especially in Russia, Taiwan, and in Denmark. All the analyzed countries except Russia have already moved toward the 'late' first birth pattern; however, by 2007, most analyzed countries have not reached the envisioned final stage of the TFR1 recovery above 0.75. The Netherlands constitutes an 'ideal case' of the complete pathway, whereas Spain shows a recent upsurge in the TFR1 above the threshold of 0.75. A future completion of this final stage in first birth timing transition is likely to push the TFR further upwards, although in some countries, especially Japan, first birth rates may eventually stabilize at the lowest-low levels.

[17] The two graphs have a different dividing line between the 'early' and the late' first birth pattern (at ages 25 and 27, respectively), reflecting differences in the mean age at first birth at the onset of first birth postponement.

4.2 Changes in tempo-adjusted TFR: did tempo effects decline in importance?

Our investigation of tempo effects is primarily based on the time series of tempo-adjusted TFR (adjTFR), computed using Bongaarts and Feeney's (1998 and 2000) method.[18] To increase stability in the time series of the adjTFR, which display large annual fluctuations (e.g., Sobotka 2003), we use three-year moving average of the adjTFR and compute the adjustment only for birth orders up to 3. The overall adjTFR is then estimated as a combination of the adjTFR for birth orders 1-3, and the ordinary TFR for birth orders 4+.[19] By applying the adjTFR we lose the last year of observation and by using a three-year moving average we lose yet another year. Thus, for the time series that end in 2007 we were able to derive the most recent adjTFR for 2005 only. This is a serious obstacle for our analysis, which aims to study the most recent period of increasing fertility. Therefore we derived a simple procedure of estimating the adjTFR for an additional year in the time series, extending our analysis in most countries up to 2006; this last year estimation is described in Appendix 2.

There is a considerable difference between countries in their trajectories of the TFR and tempo-adjusted TFR (Figure 4.2). Japan, Poland, Russia and Spain experienced a continuous parallel decline in both indicators, with the adjTFR tracing the ordinary TFR at a somewhat higher level. Eventually, both indicators stabilized and the TFR increased above the lowest-low threshold, but the scope for its potential further increase, as suggested by the adjTFR, is not very wide. In Spain, both indicators have already converged by 2006 (see also Sobotka and Lutz 2009). In contrast, a number of Central European countries, especially the Czech Republic, Hungary, Slovakia, and Slovenia experienced period of a pronounced contrast between the TFR and its adjusted version, indicating a huge tempo effect depressing the TFR by 0.3-0.6 in absolute terms. This gap has been narrowing recently in the Czech Republic and Slovenia, as the TFR registered a notable increase there, whereas it remained large in Hungary and Slovakia, where practically no recovery in the TFR took place by 2007. In Bulgaria and Estonia, both the TFR and the adjTFR increased in parallel after reaching a trough around 1997-1998; some increase in the adjTFR occurred also in Romania, where the tempo effect increased after 2000. Several countries encountered more irregular trends; for instance, in Taiwan, the adjTFR and the TFR first declined in parallel until around 2000 and then took a diverging trend, with the TFR plummeting to 1.10 in 2006, while the adjTFR is estimated to have increased to 1.6 in that year.

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[18] The adjTFR is computed a sum of order-specific adjusted TFRs, which take order-specific changes in the mean age of fertility schedule, $r_i(t)$ as an adjustment factor: $adjTFRi(t) = TFRi(t) / (1-ri(t))$. Following Bongaarts and Feeney (2000: 563, fn. 1), this is estimated as follows: $ri(t) = [MABi(t+1) – MABi(t-1)] / 2$; $MABi(t)$ is the mean age at birth order *i*, calculated from age and order-specific fertility rates of the second kind (incidence rates).

[19] This method, omitting an adjustment for birth orders 4+, not only leads to a slightly more stable adjTFR, but also reduces the amount of order-specific fertility data necessary for the computation. Although it disregards tempo effect in fourth and higher-order fertility rates, the resulting error is negligible, as fourth and higher-order births constitute only a small portion of births in low-fertility countries (typically less than 10%) and fertility postponement is least pronounced for high-order births (partly because these births often take place at late reproductive ages and there is therefore less scope for their further postponement).

Our analysis of the adjusted TFR, which needs to be seen as an approximation and interpreted with caution, confirms the hypothesis that declining tempo distortions were instrumental in explaining the recent TFR increase. Declining tempo effect contributed at least to some extent to the TFR increase from the lowest level reached in 12 out of 15 countries analyzed in Figure 4.3. Bulgaria, Lithuania and Japan constitute exceptions where tempo effect actually increased during the observed period and all their TFR recovery can be explained as an outcome of rising fertility quantum. In contrast, in Belarus, Hungary, Poland, Romania, and Spain, all of the recent TFR increase can be attributed solely to diminishing tempo effect, with the adjTFR actually declining in the analyzed period. In Estonia, Greece, Latvia, Russia, and Slovenia, declining tempo effect contributed to most of the registered TFR rise.

Further investigation of trends in the tempo-adjusted TFR in Table 4.2 provides two key insights. First, tempo effect still remained an important force pushing the period TFR in 2006 downwards by 0.15 (Greece) to 0.44 (the Czech Republic) in all the analyzed countries where the TFR has bounced back above the 1.3 threshold; Spain constitutes the only country where tempo effect has almost disappeared by 2006.[20] Second, it is surprising that the tempo-adjusted TFR in a majority of analyzed countries increased after the year when the lowest TFR was reached. This observation was unexpected in that the 'classic' argument about the potential increase in the TFR level envisioned that the TFR may eventually increase to its adjusted level once the tempo distortion stops. Bongaarts (2002: 437, Figure 8b) also offered an illustration of an alternative scenario, where the fertility quantum declines over time and reduces thus the potential scope for the TFR decline linked to the ending of fertility postponement. Thus, the finding that both the TFR and the adjTFR actually increased, rising thus the scope a further TFR recovery, gives a new perspective to our hypotheses about the future fertility trends.[21]

5. The contribution of immigrant women to rising total fertility rates

More affluent parts of Europe have experienced substantial immigration, especially in 2001-2008 when the European Union experienced net migration between 1.3 and 1.9 million annually, representing a net annual population gain of 0.3-0.4% (Eurostat 2006, 2008b, and 2009). Since immigrant women in most European countries have on average higher fertility rates than the native ones (Sobotka 2008a, Coleman 2006, Haug et al. 2002), it is possible that fertility rates in many European countries have been recently pushed upwards by a compositional effect of the rising share of high-fertility immigrants, whereas the fertility rates of the native-born women might have remain unchanged. Although data on immigrants' fertility remain relatively scarce in Europe, several contributions have discussed this possibility in the case of England

[20] It is likely that the adjusted and the observed TFR have also converged in Italy, for which we do not dispose with recent data to perform this analysis. In the past three decades, trends in fertility tempo and quantum in Italy and Spain were remarkably similar.

[21] An example of Denmark provides a good illustration of this point: in 1983, when the TFR reached a low of 1.38, the adjTFR was 1.75. Thus, an analyst expecting that fertility quantum, as measured by the adjTFR, would not decline further, might have predicted a recovery in the TFR up to that level. Twenty years later, in 2003, the actual TFR did indeed reach this level (1.76), but in the meantime, the tempo-adjusted TFR increased to 2.0, signaling a scope for further increase in the TFR.

and Wales, France, Italy, the Netherlands and Spain (Héran and Pison 2007, Gabrielli et al. 2007, ONS 2008, Sobotka 2008a). In fact, the argument on immigrants' fertility is relevant only for a small set of lowest-low fertility countries in Southern Europe (Greece, Italy, and Spain) as other countries with such low fertility either experience very limited immigration (Eastern Asia, south-eastern Europe, Eastern Europe except Russia and some countries of Central Europe), or their large-scale immigration experience is very recent (the Czech Republic and Slovenia) or no reliable data on immigrants' fertility are available (Russia). Therefore we look at the evidence for three Southern European countries and then briefly summarize the findings for several higher-fertility countries of Western and Northern Europe with good-quality data on migrants' fertility.

All the larger countries in Southern Europe, including Portugal, collect data on births to foreign mothers, which do not cover all immigrants—they exclude immigrant women that have received nationality of their country of residence. However, because mass immigration to Southern Europe is a relatively recent phenomenon, occurring mostly after the mid-1990s, most immigrants still retain the citizenship of their country of origin and data on foreign women thus give a relatively good picture of immigrants' fertility. Only Spanish Statistical Office (INE) provides detailed birth and population data for foreign women covering most of the period of the rising TFR, starting in 1998. Spanish data are particularly interesting, since Spain experienced the largest migration gain in Europe in the period 2000-2008, with estimated net migration of 5.1 million (Eurostat 2009b). Italian statistical office publishes age structure of foreign residents only since 2004 and Greek statistical office collects vital statistics data by citizenship only since 2005 (Tsimbos 2008) Combining the most recent data for all three countries Table 5.1 compares the shares of births to foreign mothers and the TFR for foreign, native and all women in 2005-2007. A relatively large fraction of births, almost 15% in Italy and 16.5% in Greece and Spain, was attributable to foreign women, a huge increase from fewer than 5% in Italy and Spain in 1998. More important for our analysis, the TFR of native women remained slightly below the lowest-low threshold in Greece and Italy, whereas it has hit the 1.3 threshold in Spain. In other words, without the contribution of foreign women, Greece and Italy would still record the lowest-low TFR in 2005 and 2007, respectively, whereas the relatively high TFR of foreigners helped to push their TFR just above the lowest-low threshold. At the same time, its absolute boost to the TFR was rather modest, between 0.05 (Spain) and 0.09 (Greece and Italy).

This analysis does not reveal, however, whether immigrant women had a decisive influence on the TFR rise from the lowest recorded levels. We can provide such analysis only for Spain, comparing the TFR for foreign, native and all women in 1998, 2002, and 2006.[22] In 1998, Spanish TFR was at the lowest recorded level of 1.16, recovering subsequently to 1.38 in 2006 (Table 3.1 and Figure 4.2 above, computations based on Eurostat data). Computations based on INE (2009a and 2009b) show somewhat lower values of the TFR in Spain (by 0.01-0.03 in absolute terms), but otherwise display a very good correspondence with Eurostat data. Spanish TFR increase between 1998 and 2006 was by and large driven by the rise in fertility rates among native women, whose TFR rose from 1.12 to 1.30 (Table 5.2). Its absolute

[22] For detailed and very informative analysis of fertility of immigrants in Spain see Roig Vila and Castro Martín 2007.

change was 0.17 (after rounding), just below the overall TFR rise of 0.20. The net impact of foreign women on the TFR in Spain rose only slightly, from 0.02 to 0.05, and contributed a very modest 16% to the TFR increase after 1998. This surprisingly small contribution resulted from a rapid fall in foreign-women TFR, from 2.4 in 1998 to 1.7 in 2006. Provided that the data on foreign population can be trusted[23], such a fall in migrants' fertility could be attributed either to the change in the composition of the foreign population (more recent immigrants coming from lower-fertility countries, especially from Eastern and South-eastern Europe) or to the decline in migrants' fertility with their longer duration of stay, observed in many other countries (e.g., Toulemon 2004, Andersson 2004). If foreign women retained their level of age-specific fertility in 1998, Spanish TFR would increase to 1.44 in 2006 and the contribution of foreign women would be considerably stronger, although still not dominant (Table 5.2).[24]

In contrast to Spain, migrant women had a much more important role in pushing the Italian TFR upwards. According to the estimates by Gabrielli et al. 2007, a combination of their increasing fertility and increasing share in the population between 1996 (when the TFR was close to its lowest point) and 2004 contributed about two-thirds of the Italian TFR rise of 0.11 in that period. This finding corresponds well with the high TFR level recorded among foreign women in Italy in 2007 (Table 5.1). Also in many Italian and Spanish regions that once experienced extreme low fertility levels, immigrants helped to push fertility close to or above the lowest-low levels.[25]

The evidence for some other countries in Europe that are comfortably above the lowest-low fertility threshold and that have relatively good statistics on migrant fertility indicates that Italian case is not very typical and that more countries conform to the Spanish case. An analysis of the recent increase in the TFR in England and Wales, Denmark, France, and Sweden shows that it was mostly or fully fuelled by a rise in native women's fertility, whereas immigrants have contributed by less than one third to this increase (but only 5% in Sweden and negatively in Denmark, Table 5.3).

[23] Gabrielli et al. (2007: Fn 12) discuss the possibility that there may be a mismatch in Spain between birth registration system and municipal registration system of foreign population, especially with respect to illegal and unregistered migrants. Such a mismatch can lead to erroneous estimates of fertility trends and levels among foreign women.

[24] Even with their more modest contribution, foreign women have an appreciable influence on age-specific pattern of Spanish fertility. Their young childbearing schedule, peaking at age 22, strongly contrasts with the schedule of Spanish women that peaks at age 32 and pushes fertility rates in Spain markedly upwards at ages 18-27 (more detailed analysis available from T. Sobotka upon request).

[25] In the case of the Italian province of Emilia-Romagna, discussed in Section 3, native women have contributed most to the recovery of the TFR from the low of 0.94 in 1987, but it was the contribution of immigrants that helped to push the TFR well above the lowest-low threshold: While native Italian women living in this province retained a lowest-low TFR 1.27 in 2007, fertility of foreign women had a net positive effect of 0.18 on the overall TFR of 1.45 (ISTAT 2009c, Table 2.9).

6. The role of improving economic conditions on the end of lowest-low fertility

6.1 Overall description

In the past two decades, the lowest fertility levels have often been accompanied by challenging economic conditions. In difficult times, couples postponed the birth of a next child or stopped having children altogether as a way of economizing. In this section, we look at whether the reversal of lowest-low fertility may have come as a result of improving economic conditions. In a number of countries, this appears to have been the case.

Figure 6.1 shows three examples of the turn-around in low fertility along with the time series of unemployment, which we use as a measure of general economic conditions.[26] The analysed countries—Spain, Poland, and Japan—come from different parts of the world; and the turn-around occurred at different points in time. In each of these three cases, we see that the fertility began to rise at about the same time or soon after unemployment began to fall.

Figure 6.2 shows that bivariate relationship between fertility and unemployment in the nine OECD countries that currently have or have in the past had lowest-low fertility. The unemployment is lagged by one year, so that economic conditions in year t are compared with births in year t+1. We see that higher unemployment is associated with lower fertility in eight of the nine countries considered, with Hungary being the exception. In some cases—Italy, Spain, Greece, and Japan—the relationship is extraordinarily linear. In Hungary and the Czech Republic, the unemployment rate does not appear to be a good predictor of the fertility rate.

The median effect of a change in the logarithm of the unemployment on the total fertility rate in these countries is -0.23. This means a halving of unemployment is associated with an increase of the TFR of about log(1/2)*(-0.23) = 0.16 children. This estimate is larger than in the literature (Kravdal 2002, Adserà 2004, Ermisch 1990, and other), because unemployment serves as a proxy for a larger set of variables measuring economic conditions and also perhaps because the influence of economic conditions may be larger for low fertility countries or has become larger in recent years.

Using this estimate of the effect of unemployment on fertility, we can try to answer how much of the increase in fertility in recent years might be due to improving economic conditions. We do this by predicting the increase in TFR that would have occurred solely as a function of improving unemployment. Taking Spain as an example, the lowest level of the TFR was 1.16 in 1996. By 2007, the TFR rose to 1.39, an increase of 0.23 children per woman. Over this same period, unemployment fell from 22.1% to 8.3%. The predicted change in the TFR is thus log(8.3/22.1)*(-.23)

[26] This analysis also conforms to the importance of unemployment for depressing fertility rates, stressed by Adserà (2004 and 2005, see Section 2). Using GDP growth as a measure of general economic conditions produces similar results.

= +0.23. So in the case of Spain, the increase in fertility happens to be exactly what one would have expected from improving economic conditions.

The extent to which improving economic conditions have explained the turn-around in lowest-low fertility can be seen in Figure 6.3, ordered so that the countries where economic conditions explain the largest share of the increase are farthest to the left. We can see in Slovakia, Poland, Spain, and Italy, economic conditions explain fully the turn-around in fertility. In Japan, Greece and Korea, improving economic conditions provide a partial explanation, accounting for a minor portion of recent fertility increase. In the Czech Republic and Hungary, economic conditions—at least as measured by the unemployment rate—provide no explanation of fertility increase.

6.2 The current crisis

The analysis of the role of economic conditions is useful not only for understanding the past fall and rise of lowest-low fertility, but also for predicting the future. The world-wide economic crisis is expected to bring about a substantial worsening of economic conditions. The OECD (2009: 61) has estimated that unemployment will increase in the OECD area from 5.6% in 2007 to 9.9% in 2010. This increase would—using the same estimate as above—produce a decline in the TFR of about 0.13 children. We can also make such estimates on a country-by-country basis, using country-specific forecasts of unemployment along with a common estimate the effect of unemployment on fertility. This approach predicts that at least four countries, Hungary, Italy, Japan, and Spain, would all fall back below the threshold of lowest-low fertility, while Slovakia would fall yet deeper below the threshold. In these countries, largest TFR decline, of 0.14 children, is expected in Spain, where the unemployment rate was forecast in November 2008 to climb from 8.3 % in 2007 to 14.8% in 2010 (OECD 2008).

Such calculations are clearly speculative. There is great uncertainty both in the forecast of future unemployment and in the effect of any change on fertility. Still, if we accept the magnitudes of these two estimates, it would seem reasonable to expect yet another, although temporary, reversal of fertility trends in a number of formerly lowest-low fertility countries, producing an increase in the number of countries that fall again below this arbitrary threshold.

The above analysis has been premised on a very simple relationship between economic conditions and the level of fertility. Such a simple relationship may help to explain short-term fluctuations in fertility, but would clearly be less successful in the longer term. More complicated formulations are needed to understand the role of economic conditions when combined with social influence and value changes (Kohler et al. 2002, Billari 2008). Another factor that probably matters is the potential for further tempo effects, which should depend on how much postponement has already occurred. Goldstein (2006) argues that current populations are still far from the upper age limits of fertility. Most of the lowest-low fertility populations still have room for continued postponements, but how much remains an open question..Some of them, namely Italy, Japan, and Spain, are already among the oldest-childbearing populations of the world.

7. Is there any merit of policy in the upturns of fertility?

The effect of different family policy measures on fertility is an unsettled issue and different studies come up with contradictory conclusions on policy effectiveness and the magnitude of its impact (Gauthier and Hatzius 1997, Hantrais 1997, Gauthier 2000, 2002, 2007, Neyer 2003, Castles 2003). There are many methodological challenges related to the assessment of the effectiveness of family-related policies as they are linked to fertility behavior in a very complex manner. The impact on fertility depends on "the type of policies, the levels of benefits, the conditions of eligibility, and the income and opportunity sets of individuals, as well as the norms, stigma, and sanctions associated with the receipt of benefits" (Gauthier 2007: 324).

Gauthier's (2007) analysis of policy effects on fertility in industrialized countries (2007) concludes that public policies frequently influence fertility, but their impact is usually small, i.e., less than 0.2 children per woman. Policies influence especially the timing of childbearing rather than the completed family size and their effects are frequently short-lived. On the other hand, family policies contribute to improving the well-being, employment and income of individuals with children.

This section does not aim to assess quantitatively the effects of specific policies on the upturns of fertility observed in the lowest-low fertility countries. Given the complexity of this matter, it is obviously beyond the scope of our study. Instead, by way of examples for seven lowest-low fertility countries we explore the stand of governments towards low fertility, discuss new policy initiatives that have taken place in these countries, and hypothesize whether they could have played a part in the fertility reversals.

Despite some common features, the low-fertility countries exhibit a wide variety of family policies, determined by historically different traditions of family policy and by different socio-cultural and economic context (e.g., Gauthier 1996, Esping-Anderssen 1999, OECD 2007). Even nowadays, in the presence of seemingly similar demographic challenges, each country seeks its own solutions, but in fact many governments attempt to introduce policies that—although not overtly pronatalist—are conducive to higher fertility.

Low fertility has increasingly become a matter of policy concern for the governments of many developed countries as well as for the whole EU (European Commission 2005). Judging from the official policy monitoring reports published by the United Nations, the governments of all the countries that have ever experienced lowest-low fertility have eventually embraced the view that fertility in their country is too low and declared that policies should aim to raise its level. By 2007 this was the case in all the 22 lowest-low fertility countries that are listed in the UN publications (Figure 7.1). Such a unanimous consensus across a broad group of countries is striking, and it indicates a wide acceptance of pronatalism in both East Asia and Europe. If we broaden our analysis and include the group of seven countries ever reaching the TFR below 1.4 (see Table 3.1), only two of these countries declared in 2007 that their fertility is satisfactory and embraced the 'no intervention' policies (Cuba and Denmark) and, in addition, Switzerland did not have a policy aim to raise its fertility. There appears to be some time gap with which many governments react to very low fertility and embrace pronatalist views: in several countries including Spain this happened only at the time when the TFR actually bounced back above the lowest-low level. The newly introduced measures aimed at stimulating higher fertility range from baby bonuses, family allowances, maternal and paternal leave up to subsidized child care, tax incentives, subsidized housing, and flexible work schedules. Our examples below look first at five lowest-low fertility countries of Europe—Spain and four former state-socialist countries, the Czech Republic, Estonia, Lithuania, Russia—and then at two Asian societies, Japan and Singapore.

Examples of recent policy initiatives in the lowest-low fertility countries

Fertility in Spain has been increasing gradually since the late 1990s and most of this increase was concentrated among native Spanish women (see Section 5 above). In 2007, Spain launched a financial incentive scheme to encourage families to have more children. The parents of each newborn or adopted child are paid a baby bonus of 2,500 Euros from 2007. It is difficult to predict the effectiveness of this family support scheme because in Spain there are other, arguably more important obstacles, forcing young people to postpone union formation and childbearing. There was no obvious immediate effect on fertility trends and the TFR in Spain increased slightly in 2007 (by 1%), broadly in line with a trend established since 1999. The policy for balancing work and family received increasing attention in recent years—there were more job guarantees provided to employees temporarily withdrawing from the labor force because of family care. However, all childcare related costs basically lie on family shoulders, which in combination with expensive housing and high youth unemployment contributed to the postponement of childbearing and small family size (e.g., Simó Noguera et al. 2005, Delgado et al. 2008).

Baby bonuses of similar type as in Spain were also introduced in Australia, Singapore, and Russia, and it seems that they had some—although probably temporary—effect. For example, in Australia the baby bonus of $3,000 was introduced in 2004 and an upturn in fertility rates was observed thereafter: the TFR increased from 1.75 to 1.93 between 2003 and 2007 (Australian Bureau of Statistics 2008). However, the largest rise in the TFR took place only in 2007 and the baby bonus probably played a minor role in this increase, since "it was only one element of a package of other measures whose generosity has also increased substantially (such as Family Tax Benefit)" (Lattimore and Pobke 2008).

Estonia, besides East Germany, experienced the largest TFR increase among the analyzed countries, from 1.28 to 1.64 children between 1998 and 2007. It is plausible that newly adopted policies contributed to this rise in fertility. In Estonia as well as in some other countries of Central and Eastern Europe (Hungary, Poland, Latvia, Romania, Slovenia can be mentioned), there is a noticeable tendency to return to pronatalist principles and to (re-)introduce policies that encourage larger families (Rostgaard 2004). Estonia repeatedly modified its family benefits scheme, increasing their levels and making them dependent on the number and age of children. An important turn in Estonian family policy took place in 2004 when the parental benefit compensating for the income lost by the parent staying with children at home (sometimes called "mother's salary") was introduced. The parental benefit amounts to 100% of previous salary, it is subject to income tax and is paid for a 455-day period, starting after the end of maternity leave (UNICEF 2006). It was a great improvement for the parents compared to the previous flat rate benefit of slightly above 50 Euros. There was a concurrent noticeable rise in the TFR observed in 2004 (by 0.09 as compared to 2003), which took place at all birth orders, but was largest for third births in relative terms (+14%). The upward trend persisted into later years: the absolute increase in the TFR was 0.17 between 2004 and 2007 (see Figure 4.2) and the relative increase was most rapid for the second and third births.

Significant changes in parental leave have also been made in Lithuania, where it starts at the end of the maternity leave and lasts until the child reaches 3 years of age. During the period 2004-2008 the parental leave benefit was repeatedly increased from 65% to 100% of the previous salary paid until the child's first birthday and to 85% until the child reaches 2 years of age (100% if more than one child is born). Additionally, Lithuania launched a one-month paternity leave in 2006, during which fathers are paid 100% of their previous salary. Compared to other countries in Europe, this constitutes a generous parental leave provision (e.g., OECD 2007). In 2004, the government also introduced child benefits paid to families according to age and number of children. The TFR increase in Lithuania has been much more moderate than in Estonia, but some acceleration is visible starting from 2005.

In the Czech Republic, an important shift in the development of family policy occurred after the 1998 election, when the new government started paying attention to family support. This policy shift occurred at the time when the TFR dropped to its all-time low of 1.13. The promotion of family-friendly policies started playing a significant role in the political competition for votes of the electorate as well. In 2005, shortly before the parliamentary elections, the parliament agreed to double the birth allowance as well as the parental leave benefit. Apart from these changes, since 1995, the paid parental leave was extended until the child reaches four years of age, which is a very long period compared to other countries in Europe (Sobotka et al. 2008). However, no clear relationship between family policies and fertility swings can be established: the TFR in the Czech Republic started rising steadily after 2003, i.e., before the more generous system of birth allowances and parental leave benefits came into effect in 2007.

Russia has a rather long history of pronatalist policy measures. A most comprehensive package was introduced in the early 1980s, extending the period of maternity leave and broadening the options for mothers to take childcare leave until the child reached age 3 (see Zakharov 2006 and 2008). These policies had a strong, but temporary effect on period fertility, however, their influence of on the number of children different cohorts of women had at the end of their reproductive life was very limited (Avdeev and Monnier 1995, Zakharov 2006 and 2008). These measures mostly lost effect during societal transformation and economic crisis of the 1990s and no major changes in family policy were implemented until 2007. The new policy measures were prepared in response to President Putin's urgent demand to look for the means to counteract the decline in fertility, expressed in his speech in May 2006 (PDR 2006). The implemented changes involved significant increases in the levels of various types of benefits (maternity leave benefit, childbirth grant, child benefit and other) as well as the introduction of so-called 'maternal capital,' equal to 250,000 roubles (5,560 Euros as of March 2009). It is transferred to women who have given birth or have adopted a second child as well as to women who have a third or higher-order child and who have never received this payment before.[27] The very preliminary reading of the data for 2007 suggests that the new policies have accelerated the ongoing shift towards later childbearing and their main effect was on the second and higher-order birth rates among women at older childbearing ages (see also Zakharov 2008a). The TFR, which was on a slowly rising trajectory before 2007, jumped from 1.30 to 1.41 between 2006 and 2007. At the same time, at least part of this rise may be attributable to the effects of (by then) positive economic situation, as the TFR rose significantly also in the neighboring Belarus and Ukraine that did not implement so vigorous pronatalist measures.

To reverse the decline in fertility rates, Japan enacted numerous policies and programs supporting childcare and parental leave starting from the early 1990s (e.g., Ogawa 2003): the 1991 Child Care Leave Act, the 1995 Child Care and Family Care Act, the Angel Plan for 1995-1999[28], the New Angel Plan for 2000-2004 and then for 2005-2009, the "new generation laws" of 2003, etc. Through introducing parental leave, expanding child care services and similar measures, the government aimed to facilitate childbearing among working married women (Retherford and Ogawa 2006). Nevertheless, for quite a while, Japan along with Singapore has been referred to as an example of the policy failure (McDonald 2006). Among the usually noted reasons are inconsistencies in the family support scheme, the failure to target all women irrespective of their income and education, and to achieve higher family-friendliness in workplaces.

Singapore started introducing openly pronatalist policies in the 1980s. The objective of these policies was not only to raise fertility, but also to reduce fertility differentiation by education. The government was concerned about too low fertility among highly educated women and much higher fertility among those with low education. Incentives were introduced to encourage better-educated women to have at least three children and, at the same time, to discourage low-income and low-educated women to have larger families through sterilization bonuses (Yap 2002). This selectively pronatalist approach did not work well; there was a small effect on fertility only shortly after the introduction of new policies. In addition, the government launched baby bonuses for the second and third child and payment for the third-child maternity leave in 2001, but these incentives do not really seem to give any appreciable results so far.

Much more research is needed to examine all aspects of newly introduced policies and their role in the whole system of family support. More effort also needs to be done to disentangle the policy effects from other determinants of fertility. Our tentative findings suggest that (i) there are instances where policies seem to be plausibly related to the rise in fertility (Estonia, Lithuania to some extent, and also Russia as far as the launch of 'maternal capital' in 2007 is concerned), (ii) there were fertility rises where there were no major policy changes (Spain before the introduction of the baby bonus in 2007, Russia in 2000-2004), (iii) there were policies that came after the rise in

[27] 'Maternal capital' is paid once in mother's lifetime, and she can start making use of the money three years after the childbirth. It can be spent for a limited range of purposes, which include paying for children's education, purchasing housing, investing for retirement and the like (Zakharov 2008).

[28] For instance, the so-called Angel Plan introduced in 1994 aimed both at improving the conditions for childcare at home and at reducing the costs and improving the availability of institutional childcare (Ogawa 2003).

fertility started and thus have no obvious role in facilitating it (the Czech Republic), and (iv) there were policies which do not seem to have had any palpable influence on fertility (Singapore, Japan, at least until recent years).

Most of the policies that are likely to have contributed to the fertility increase belong to the category of family-friendly measures aimed at facilitating work and family reconciliation. The length of maternity and parental leaves as well as the level of benefit paid during the leave seem to matter in childbearing decision-making. Childrearing and childcare may be prohibitively expensive for many couples, and therefore the provision of generous financial support appear to be an important incentive for having a(nother) child as well, especially in less affluent countries of Eastern Europe and among low-income population groups. State support in the form of baby bonuses and child benefits was introduced or increased in many cases. The effect of specific policies should not be overestimated, however, since it is not a single measure that influences fertility, but an entire system of measures. Obviously, the rise in fertility resulted from the mutual effect of a whole set of factors, including those thoroughly discussed in the other sections of this paper: economic growth and general improvement in living standards, declining tempo distortions in fertility, higher immigrants' fertility in several cases, and also other factors that are not analyzed here. In addition, fertility postponement has been weakening in many countries about the same time as the new policy interventions were launched, and it is possible that many rises in fertility that coincided with policy introductions would have occurred anyway as a result of slowing fertility postponement.

8. Modeling postponement transitions

The idea of a 'postponement transition' was introduced by Kohler, Billari, and Ortega (2002), based in large part on the theories of Kohler (2001) emphasizing the role of social interaction effects on fertility behavior (see also Bratti and Tatsiramos 2008). According to the theory, individuals do not only optimize their own behavior in isolation, but rather receive utility by doing what is socially normative. In other words, the desirability of actions is linked to how close they are to those of others. Applying this theory to fertility timing is appealing both because age-norms about when it is appropriate to have children are known to be powerful and because the appeal of childbearing or remaining childless may depend on what one's peers are doing.

Here we further develop the idea of a postponement transition in two directions. First, taking the logistic model as the parametric form of the transition, we estimate the pace of postponement transitions based on data for the lowest-low fertility countries through 2007. This helps us to understand why postponement can occur over many decades, but lowest-low fertility usually last only about 10 or 15 years.

Second, we address the issue of whether fertility postponement is primarily a 'period' or 'cohort' driven process. Using illustrative examples of a cohort-based model we show that the use of period-based measures can lead to mistaken interpretations about the quantum of fertility over the course of a cohort-driven postponement transition. We believe that this approach helps to explain some of the apparent increase in quantum associated with the end-of-lowest-low-fertility. It shows the limitations of Bongaarts-Feeney type of period-based tempo adjustment and the need for continued research on 'tempo effects.'

8.1 How long does lowest low fertility last?

We can use the combined experience of populations with lowest-low fertility to obtain a generalized and stylized description of the 'postponement transition.' Figure 8.1 shows the relationship between the rate of postponement of first births and the mean age at first birth. The inverted U-shape means that postponement is slowest when first births occur quite early or quite late and fastest when ages of first birth are intermediate. The typical trajectory of a postponement transition can be obtained by fitting a line to the scatter plot. In the case of Figure 8.1, we fit a quadratic line.[29] The ages at which the curve crosses zero can be thought of as corresponding to the equilibrium of early and late childbearing.

The estimate of the typical relationship between age at first birth and postponement also permits us to estimate the intensity of the postponement transition with respect to calendar time. The coefficients of the quadratic curve shown in the figure provide constants for a logistic differential equation.[30] Solving this differential equation transforms the relationship between mean age and pace of postponement into statements about how the mean age and pace of postponement vary over time. The next two panels of the figure show this relationship: first, the S-shaped transition from low to high ages at first birth, and second, the rise and fall in the pace of postponement.

We can now characterize the duration of the postponement transition. If we mark the beginning of the postponement transition at the time when the increase in the mean age at first birth surpassed one tenth of a year per calendar year, and the end of the transition similarly, we can see that the entire transition lasts on the order of three to four decades. This is in line with the view of a long transition by Kohler, Billari, and Ortega (2002) or Goldstein (2006). Importantly, however, the rise and the fall in the pace of postponement means that the duration of high levels of postponement—say about 0.2 years of age per year of time—will be only a fraction of the entire transition. When cohort fertility is averaging 1.6, then rates of postponement above 0.2 are needed in order to drive observed period fertility to lowest-low levels below 1.3. In the case of the typical transition, such high levels of postponement are seen only for

[29] The line shown here is for the pooled sample, but adding separate effects for each country produces nearly the same result

[30] The solution to this quadratic differential equation is the S-shaped logistic growth curve. Writing our differential equation as $m' = am^2 + bm + c$, and letting $r = \sqrt{b^2 - 4ac}$, then the solution is

$m(t) = \frac{-b+r}{2a} + \frac{e^{tr}}{C - \frac{a}{r}e^{tr}}$, where C is determined by the initial condition for the differential

equation $C = \frac{a}{r} + \frac{1}{m(0) - \frac{-b+r}{2a}}$, where $m(0)$ is given.

16 years. This corresponds well with the observed duration of lowest-low fertility levels, which are typically on the order of 10 years. An important observation is that the end-of-lowest low fertility does *not* mark the end of the postponement transition. During the two decades following the end of lowest-low fertility the period TFR rises by another 0.3 children.

Our model, as stylized as it is, allows us to distill what seem to be the essential features of the tempo transition. First, a shift from a low to high equilibrium level of the timing of first birth. Second, an acceleration and deceleration of postponement over the course of the transition. And third, a relatively short period of postponement that is rapid enough to create lowest-low fertility in many low-fertility countries. We have only focused on first births and described the typical case here, from which the experience of individual populations can vary. Especially the data pertaining to the end of the transition are scarce so far as only few countries have gone through the whole process. An area for future research is to study this variation across populations and regions in the pace of postponement and in equilibrium timing of birth.

8.2 Cohort postponement, recuperation, and apparent increases in period quantum

The Bongaarts-Feeney tempo adjustment procedure is specifically designed for period postponement, when women at all childbearing ages delay births by the same amount in a given period. The amount of postponement can vary from period to period, as long as the shifts are 'proportional' by age. An alternative way in which postponement can be modeled is to think of all postponement occurring on a generational basis—with a given cohort postponing equally over all ages.[31] This cohort model is consistent with life-cycle perspectives in which, say, an increase in education cascades into a series of delays in the remaining life course. The period model is consistent with the introduction of a new contraceptive or the ups and downs in the business cycle.

More work needs to be done in order to give us the ability to distinguish empirically between cohort and period shifts in timing. Meanwhile, the cohort model is at least in theory as plausible as the period model. Most probably, there is a combination of period and cohort postponement. But since the cohort model has received little attention, it is worth considering what happens when we apply period-adjustment procedures to change which is cohort-driven in nature. The result, we argue, can be a quite dramatic misinterpretation of the ups and downs in fertility levels over the course of the postponement transition (see also Schoen 2004).

Our approach shows how tempo-adjustment using the period-based methods of Bongaarts and Feeney performs when confronted with such 'cohort postponement.' However, the phenomenon of temporarily depressed birth rates as a result of cohort postponement is an old idea, dating from at least Ryder (1956). More recently,

[31] In terms of constant shift models, the period-based model with constant rate of postponement r transforms age α and time τ into age a and time t according to $a = \alpha + r \cdot \tau$ and $t = \tau + r \cdot \tau$. The analogous cohort model at constant shift rate s for cohort $\gamma = \tau - \alpha$ is $a = \alpha + \gamma \cdot s = \alpha \cdot (1-s) + \tau \cdot s$ and $t = \tau + \gamma \cdot s = \tau \cdot (1+s) - \alpha \cdot s$. The Jacobian of this transformation is 1, and so there is not the same kind of compression or dilation of events over time as is the case with the period transformation.

Lesthaeghe and Willems (1999) and Lesthaeghe (2001) have advocated a cohort perspective on fertility postponement, emphasizing that the extent of 'recuperation' is the major determinant of cohort fertility. Our findings are supportive of Kohler and Philipov's (2001) earlier results that differential period postponement by age can have a potentially large impact on the Bongaarts-Feeney measure.[32]
A simple stylized case illustrates what is going on, particularly the way in which at the end of the transition births increase as cohorts 'recuperate' their postponed fertility. This recuperation increases the period TFR, but, because it drives up the mean age of birth, is mistaken by a period-adjustment procedure as evidence of further postponement. The result is a brief dramatic increase in the tempo-adjusted TFR in the latter phases of the transition.

In the simplest case, we have just three age classes, with fertility occurring equally in classes 1 and 2 before the transition and equally in classes 2 and 3 afterwards. The transition occurs from one cohort to the next. For computational convenience, we assume one birth in each of two age classes, for a total fertility of two births over each cohort. The reader can also interpret these as rates of 1 birth per time period lived, with a lifetime TFR of 2 births.

The following table illustrates this simple case:

	Births in period t					
Period	1	2	3	4	5	6
Age class						
III	0	0	0	0	1	1
II	1	1	1	1	1	1
I	1	1	0	0	0	0
Total	2	2	1	1	2	2
Mean age	1.5	1.5	2	2	2.5	2.5
d/dt mean*		0.25	0.25	0.25	0.25	
Tempo-adj total	2	2.67	1.33	1.33	2.67	2

Note: * Here we have centered the pace of postponement, as recommended by Bongaarts and Feeney. If we use simply the lagged change in the mean, this shifts quantum fluctuations in time but in this case increases their magnitude.

We see that the postponement transition causes fertility to drop rapidly and then rises. The effect of the first postponing cohort is seen in period 3, as the cohort entering age class I postpones its fertility. The result is that the total number of births falls by half from period 2 to 3 and remains as low during period 4. Recuperation occurs in period 5, and total period births resume their earlier level, equal to cohort totals.

The period-based method of Bongaarts and Feeney does very well when averaged over very long periods of time but can be misleading about short-term changes. Over the entire course of the transition (here from periods 1 to 6) tempo-adjusted period fertility averages 2 births, exactly equal to cohort fertility. However, during the time when births are being postponed, each period's adjusted fertility differs systematically from the benchmark cohort measure of quantum. Specifically, at the beginning of the

[32] Our findings differ from those of Yi and Land (2001), who found that the Bongaarts-Feeney method was quite robust to violations of the constant-shape assumption. See Kohler and Philipov (2001) for a discussion.

transition (in period 3), the tempo-adjustment to 2.67 is too large, making it look as if the quantum of fertility has increased. During the middle of the transition (in periods 4 and 5), the adjustment to 1.33 is too small, giving the appearance of large declines (33 to 50%!) in the quantum of fertility. Finally, at the end of the transition, the recuperation of fertility makes it appear to the BF method as if there is continued postponement because the mean age increases from periods 4 to 5. This produces an overestimate of quantum for period 5.

The combined effect of underestimation of quantum in the midst of the transition and overestimation of quantum toward its end produces the impression of an enormous increase in quantum. This appearance of large quantum swings is attributable to the BF model's assumption that postponement is happening on a period, not a cohort basis. It thus uses period measures of change in the mean age, an approach which can produce misleading results during the whole course of postponement transition.

The above example illustrates what can go wrong when the period-based BF approach is applied to demographic change that is fundamentally of cohort character. To see the potential magnitude of error with realistic fertility schedules and paces of postponement, we performed an additional simulation. In the simulation, we have used an age schedule of fertility based on the schedule of the French cohort of 1945; differently from Section 8.1 above we look at all birth orders combined. Rather than sudden change from one cohort to the next, we assumed that postponement transition happened gradually over 10 cohorts, increasing the cohort mean age at childbearing from about 24 to about 27. This cohort transition produces an increase in the period schedule by the same amount over the course of about 30 years. In order to make the simulation relevant for lowest-low fertility, the cohort quantum of fertility was kept constant at 1.6 children per woman.

The first panel of Figure 8.2 shows the entire Lexis surface during the cohort transition of fertility to older ages. We see that the change happens over a narrow number of cohorts but a wider number of periods. The verisimilitude of the simulation can be seen in the path of the observed TFR shown in the second panel. The period TFR begins at 1.6 and then falls rapidly to lowest-low levels, under 1.3, where it remains for about a decade. Full recovery of period fertility then occurs over an additional two decades.

The rise in the mean age of the period schedule is shown in panel 3, along with the pace of postponement in panel 4. The mean rises rapidly as the transition begins because the youngest women are suddenly bearing many fewer children. The pace of postponement slows after ten years, when postponement effectively ends at the younger ages. About 20 years after the first cohort began postponement we see that the pace of period postponement briefly picks up again. This is the result of 'recuperation', when the first postponing cohorts reach older ages and fertility rates at old ages thus begin to increase. After about 50 years the transition comes to an end.

The Bongaarts-Feeney tempo-adjusted TFR produced by this more realistic cohort-postponement transition is shown by the dashed line in the panel with the TFR (Panel 2). We see qualitatively the same M-shaped pattern in tempo-adjusted fertility that we saw in the simple tabular illustration above: first an overestimate, then an underestimate, and finally again an overestimate of quantum. Our simulation allows us to see that the magnitudes of over and underestimation can be large. There appears to be a large decline in quantum of something between 0.2 and 0.4 children during the postponement (depending on whether one takes seriously the early rise in tempo-adjusted TFR or not). This is what appears to have happened in many lowest-low fertility countries. Then as postponement continues there is a rise in quantum that is nearly equally dramatic, also what we observe in many cases when lowest-low fertility came to an end.

These examples are illustrative of what can happen if postponement is purely of a cohort nature. More work needs to be done to apply such models to real-world fertility change, but we believe that the story of cohort recuperation here is a potentially large part of the explanation for why there appear to be substantial increases in quantum, as estimated with the BF adjustment, in the later stages of the postponement transition. It may also be responsible for some of the apparent rise and decline in quantum during the early stages of postponement and fertility decline. The Bongaarts-Feeney adjustment works on average, over the course of 50 years in our example, but can be systematically misleading over periods lasting a decade or more.[33]

The distinction between period-based and cohort-based postponements may help explain some differences in 'recuperation' observed by Lesthaeghe and Willems (1999). In Northern Europe and France, the decline in cohort fertility at younger ages was offset by subsequent increases in fertility when postponing cohorts aged. In Southern Europe, there was less recuperation. One can speculate that the reason for this is that in the North, postponement was closer to the cohort-based examples given here, with impetus for postponement coming from changes in the female life-course, particularly increases in schooling and pre-motherhood work experience. In Southern Europe, where increases in postponement were partly triggered by high rates of unemployment and then eased thereafter, the period-based model might be more appropriate. In Eastern Europe, there might also be a combination of period and cohort-driven shifts as economic hardship of the 1990s produced period postponement but the economic and social transformation of post-communist societies created strong cohort effects. At this point, such hypotheses remain speculative, but worthy of further investigation.

9. Conclusions

We asked at the beginning of this paper if the era of lowest-low fertility has ended. Our answer, to sum up, is a cautious "yes": it appears that the widespread decline in period fertility to extreme low levels that began in many parts of Europe and in East Asia in the early 1990s is nearly over. The clear message coming from our analysis confirms what Morgan (2003: 599) proposed in his PAA presidential address: "lowest-low fertility is not our inevitable destination and demise." In Europe, from the

[33] These errors are systematic in that they are driven by a violation of the proportionality assumption of period-based tempo effects. The BF adjustment as well as other methods that have been proposed are also susceptible to large year-to-year fluctuations, which are conventionally smoothed. Smoothing could in theory correct the errors we see here but it would have to be so great as to hide all ups and downs in fertility lasting less than a generation or so in length.

Atlantic to the Urals, there were few lowest-low fertility countries left as of 2007.[34] In Eastern Asia, there are still countries with Total Fertility Rates below 1.3, but fertility is rising in all of these, with the exception of Taiwan. Many parts of China, most of them well above the size of an average European country, probably retain sustained lowest-low fertility, but reliable data are unavailable and lowest-low fertility there is largely 'dictated' by strict government policies promoting one-child families. The increases in fertility between the year when the TFR dropped to the lowest point and 2007 have ranged from slight (0.01 in Moldova, 0.03 in Singapore, 0.04 in Romania and Hungary) to substantial (0.60 in East Germany, 0.42 in Estonia, and 0.30-0.33 in Bulgaria, the Czech Republic and Latvia). The average fertility in formerly lowest-low countries is now about 1.4. This is still a very low fertility level, however, and it suggests neither an end of sub-replacement fertility across most of the developed world nor a disappearance of considerable regional variation in low fertility.

For most of the formerly lowest-low countries, the era of sub-1.30 TFR is behind them because the 'postponement transition' has begun to run its course and, for the time being, the fear of an accelerated downward spiral of fertility seems unsubstantiated. Postponement still continues but at a decelerating pace. The importance of tempo effect for explaining lowest-low fertility, illustrated also by exceptionally low levels of first-order total fertility, has three important implications. First, an extended re-emergence of lowest-low fertility is likely to require a new acceleration, not just a continuation, of postponement. Second, lowest-low fertility countries still have room for fertility to increase as postponement continues to slow and eventually, some day, to stop. Completed cohort fertility rates of younger women in lowest-low countries will not be known for some time, but the fertility of cohorts born about 1970 tends to be considerably above 1.5 children per women. We expect nearly all lowest-low countries to have completed cohort fertility rates in the 1.5 to 1.8 range, with some exceptions ranging between 1.4 and 1.5. Third, although lowest-low fertility countries have many features contributing to their low fertility, distinguishing them from their neighbors that never recorded such low total fertility rates, none of them would had experienced longer spells of lowest-low fertility without a decisive downward push provided by tempo effects.

The period of lowest-low fertility typically lasted less than a dozen years. Fertility rates, as measured by the period TFR, dipped below 1.3 for only a few years in Estonia, Hungary, and Japan. More typical experience was about a ten-year period of lowest-low fertility in Italy, Spain, the Czech Republic, Slovenia, Bulgaria, Latvia, and other countries. Exceptional Hong Kong is the only 'country' with lowest-low fertility levels lasting substantially more than a decade. In addition, a number of Italian and Spanish regions experienced more than 20 years of such low TFR levels; however, most of them have also recovered above the 1.3 threshold by 2007.

The rather short-lived nature of lowest-low fertility is consistent with what we would expect from a predominantly cohort-driven 'postponement transition' from early to late childbearing, and the accompanying depression in period fertility that comes from tempo effects. Moreover, the postponement transition appears to consist of an acceleration and deceleration of postponement over its course. Judging from cross-

[34] Moldova had a TFR of 1.22 in 2007 and Slovakia 1.25 (however, a preliminary estimate for 2008 puts it at 1.32 (information from Michaela Potančoková). Romania still remained at 1.30.

national observations, the amount of time that a country might expect to have tempo effects larger than 20% is between one and two decades. Although postponement can last for three or four decades, perhaps even five, the period of rapid postponement is much shorter.

What would it take for fertility rates to fall once again? First, we should not be surprised if fertility continues to fall in countries that have not yet seen a reversal—namely in Taiwan and Portugal. Second, with the world entering a wide-spread economic crisis, it is likely that birth rates will fall again in many of the formerly lowest-low fertility countries. For countries that are still close to the threshold of the TFR of, this could mean a re-entry into lowest-low fertility. We expect, however, this fall in fertility to be temporary, lasting as long as the crisis permits but not inducing the resurgence of long-term fertility postponement in the form of a 'second postponement transition'. Indeed, since the end of lowest-low fertility corresponds not to an end in postponement but rather to a reduction in the pace of postponement, almost all of the formerly lowest-low countries continue to have tempo-adjusted fertility rates that are substantially higher than observed fertility. Unless these are due to artifacts in the measurement of tempo-adjusted fertility, there is still plenty of room for fertility to rise in of these countries even after they cross the 1.30 TFR line.

We saw that economic conditions, as captured by unemployment rates, played an important role in the emergence and end of lowest-low fertility. Pronatalist policy has played a role in some cases of recent TFR recovery as well, although their influence cannot be easily quantified. A clear result of lowest-low fertility is a change in the attitude of governments, with almost universal concern that national fertility was 'too low' emerging among lowest-low countries according to the United Nations monitor of population policy. In some countries, recent fertility increase is plausibly linked to specific government policies, while in others the turnaround in fertility occurred only after repeated and rather fruitless rounds of pronatalist benefits and urgings.

The role of migration—highlighted by Billari (2008) in the case of Italy—was to us a plausible factor in the increase of fertility in Greece, Italy, and Spain. However, our analysis suggests that although migration played the expected effect of increasing fertility in these countries, this effect was not large, although it helped to push Greek and Italian TFR slightly above the lowest-low threshold around 2005. In Spain, the one country where we were able to look at trends in the fertility of the native-born, we saw that fertility was also increasing among the native born. Migration of higher-fertility migrants was clearly not a universal factor in the end of lowest-low fertility, as made clear from the many Eastern European and East Asian countries with negligible migration. Even in the Mediterranean countries, the end of lowest-low fertility looks as if it would have eventually occurred even among the native population, but migrants can help sustaining higher fertility there and in other parts of Europe in the coming decades

The end of wide-spread levels of extremely low fertility does not mean an end to the need to research on fertility trends in the developed world. Here we list some of the topics we feel need more study. First, we have seen here that in many countries there appears to have been a strong relationship between economic trends and fertility. This is not generally what has been found for earlier periods (Ermisch 1990). In general, more needs to be known about the relationship between economic conditions and fertility, including whether births are postponed during difficult economic times or foregone altogether. A further issue here is whether fertility policies such as generous paid-parental leave for employed mothers may strengthen the pro-cyclical nature of fertility, depending on the ease or difficulty of obtaining full-benefit employment (Adserà 2004).

Second, more demographic modeling work needs to be done on the issue of cohort postponement and recuperation and the measurement of tempo effects. We have seen here—albeit in a stylized way—that cohort postponement even with constant completed cohort fertility can produce the illusion of large fluctuations in period quantum as measured by the Bongaarts-Feeney tempo-adjusted TFR. This 'recuperation' process needs to be studied formally in more detail, and the BF period-postponement framework needs to be expanded to include the possibility of cohort-postponement. Ideally, demographers would figure out ways to distinguish between these two kinds of postponement empirically.

Third, more research should be conducted on alternative period fertility indicators that can complement and even substitute the total fertility rate which is so strongly affected by tempo distortion and therefore can give very misleading signals about fertility levels, trends and cross-country differences (Ní Bhrolcháin 1992, Sobotka and Lutz 2009).

Fourth, the consequences of the era of lowest-low fertility need to be studied. In terms of the number of births during these years the question of how much of the decline was due to tempo is largely irrelevant. The reality is that generations of small cohorts were born in a large number of countries around the world. What will be the consequences of smaller generation size for education, labor markets, partnership, and parenthood, and also for the size of future generations resulting from somewhat higher fertility rates? All of these are topics that will need to be studied in the years ahead.

A final word of caution is also in order. First, there is a chance that the current study of low-fertility which includes data through 2007 may prove to have been a temporary high-water mark and that the current economic crisis will be large enough to restart the trend toward low period fertility. We would be surprised by this, but it is still possible. Second, we have largely emphasized the role of postponement in creating extremely low period fertility rates. But the reader should also keep in mind that the long term determinant of fertility levels will be changes in fertility quantum, namely cohort fertility. We are confident that cohort fertility levels in the analyzed countries will be substantially higher than lowest-low period fertility rates. However, cohort fertility of women born in the 1970s will be lower than in the past, and it is not impossible that it will continue to decline.

With these caveats in mind, we feel that the bulk of evidence to date points to a recovery of fertility well above lowest-low levels. The mainstream forecasting agencies such as the United Nations and Eurostat are likely to be right in their prediction that the TFR levels in most countries will rise close to 1.5 or even above in the decades ahead.

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APPENDICES

Appendix 1:
Estimating lowest-low TFR in the regions of China

The uncertainty about national-level period TFR in China (Retherford et al. 2005; Zhang and Zhao 2006, Lutz et al. 2007) makes it even more difficult to analyze regional fertility differences.[35] We use two different sets of estimates of province-level TFR in 2000, based on the 2000 population Census and published by National Bureau of Statistics and East-West Center (NBS 2007) and Gu et al. (2007, based on NBS 2003). Because both of these datasets are most likely distorted downwards by an undercount of young children in the census (e.g., NBS 2007: 6), we used different thresholds of the published TFR to estimate the number and population of provinces with the actual TFR below 1.3. Table 2a shows results based on the NBS—East-West Centre dataset.

The second estimate, based on a dataset by Gu et al. (2007), comes very close in its high and low variant, but diverges in the main variant, according to which 32% of China population (403 million in total) lived in ten provinces with lowest-low fertility (Table AP-1).

Table AP-1: Provinces of China estimated to experience the TFR below 1.30 and their population, 2000 (Alternative estimate based on Gu et al 2007)

	Reported TFR	Provinces	Population (million)	% China's population
Low estimate	1.0 or lower	6	179.1	14.2
Medium estimate	1.1 or lower	10	402.9	31.8
High estimate	1.2 or lower	12	473.4	37.4
Total		30	1265.8	100

Appendix 2:
Describing the estimation of the adjTFR in the last year of observation

To be drafted

[35] The variation in fertility rates between provinces of China is partly fuelled by different province-level policies specifying whether there are exceptions from a nationwide one-child-per couple policy and which ethnic groups and other population groups qualify for these exceptions (Gu et al. 2007).

TABLES AND FIGURES

Table 3.1: Countries experiencing the TFR below 1.30 and at 1.30-1.39 during the period 1984-2007

Region / country	Population in 2008 (million)	Lowest TFR Year	Lowest TFR TFR	TFR in 2007 TFR	TFR in 2007 Change TFR from the lowest point	Total years of TFR<1.30 until 2007
Southern Europe	**116.1**					
Greece	11.2	2001	1.25	1.41	0.16	8
Italy	59.6	1995	1.19	1.34	0.15	12
Spain	45.3	1998	1.16	1.39	0.23	10
Western Europe	**82.2**					
Germany	82.2	1994	1.24	1.37	0.13	4
East Germany	*14.5 (est.)*	1994	0.77	1.37	0.60	13
West Germany	*67.7 (est.)*	1985	1.28	1.38	0.10	2
Central Europe	**65.8**					
Czech Republic	10.3	1999	1.13	1.44	0.30	11
Hungary	10.0	2003	1.27	1.32	0.04	3
Poland	38.0	2003	1.22	1.31	0.08	5
Slovakia	5.4	2002	1.19	1.25	0.06	8
Slovenia	2.0	2003	1.20	1.38	0.18	11
Eastern and south-eastern Europe and the former USSR (population 240.7 mill.)						
Bulgaria	7.6	1997	1.09	1.42	0.33	10
Romania	21.4	2002	1.25	1.30	0.04	6
Estonia	1.3	1998	1.21	1.63	0.42	3
Latvia	2.3	1998	1.10	1.42	0.32	10
Lithuania	3.4	2002	1.24	1.35	0.12	5
Belarus	9.7	2004	1.20	1.37	0.17	9
Moldova	3.6	2002	1.21	1.22	0.01	7
Russia	142.0	1999	1.16	1.41	0.25	10
Ukraine	46.2	2001	1.08	1.33	0.25	10
Armenia	3.2	2000	1.11	1.42	0.31	4
Eastern Asia	210.9					
Hong Kong	7.0	2003	0.90	1.02	0.12	16
Japan	127.8	2005	1.26	1.34	0.08	3
Korea	48.3	2005	1.08	1.26	0.18	6
Singapore	4.8	2005	1.26	1.29	0.03	5
Taiwan	23.0	2007	1.09	1.09	0	5
Countries that have ever experienced TFR<1.4 (population 52.0 mill.)						
Austria	8.3	2001	1.33	1.38	0.05	..
Croatia	4.4	2003	1.33	1.38 (2006)	0.05	..
Cuba	11.2	2006	1.39	1.43	0.04	..
Denmark	5.5	1983	1.38	1.85	0.47	..
Georgia	4.3	2005	1.39	1.45	0.06	..
Portugal	10.6	2007	1.33			..
Switzerland	7.6	2001	1.38	1.45	0.07	..

Note: Computations of the TFR change shown in the table do not necessarily correspond to the computations based on the absolute TFR values displayed, as the data shown are rounded to two decimal points.

Table 3.2: Provinces of China estimated to experience the TFR below 1.30 and their population, 2000 (Estimate based on NBS 2007)

	Reported TFR	Provinces	Population (million)	% China's population
Low estimate	below 1.10	6	147.1	11.6
Medium estimate	below 1.20	8	245.3	19.4
High estimate	below 1.30	12	464.0	36.7
Total		30	1265.8	100

Note: Alternative estimate is shown in the Appendix 1

Table 4.1: Change in order-specific components of the TFR and the contribution of first-order TFR to TFR increase (lowest-low fertility countries with available data)

	Lowest TFR		Most recent data		Absolute changes			Relative changes (year of the lowest TFR = 100)			% contribution TFR1 to the TFR rise
	Year	TFR1	Year	TFR1	TFR	TFR1	TFR2+	TFR	TFR1	TFR2+	
Southern Europe											
Greece	2001	0.60	2007	0.68	0.16	0.09	0.07	113	115	111	*55*
Italy	1995	0.60	2004	0.70	0.07	0.09	-0.02	106	115	96	*100*
Spain	1998	0.59	2006	0.77	0.22	0.17	0.05	119	129	109	*77*
Central Europe											
Czech Republic	1999	0.53	2007	0.69	0.30	0.17	0.14	127	132	123	*55*
Hungary	2003	0.57	2007	0.62	0.04	0.04	0.00	103	108	100	*100*
Poland	2003	0.59	2007	0.65	0.08	0.06	0.02	107	111	103	*74*
Slovakia	2002	0.52	2007	0.59	0.07	0.07	0.00	106	112	100	*97*
Slovenia	2003	0.60	2007	0.68	0.18	0.07	0.10	115	112	117	*42*
Eastern and south-eastern Europe											
Bulgaria	1997	0.63	2007	0.81	0.33	0.18	0.14	130	129	131	*57*
Romania	2002	0.64	2007	0.69	0.04	0.05	-0.01	103	108	99	*100*
Estonia	1998	0.65	2007	0.76	0.42	0.11	0.31	135	117	155	*27*
Latvia	1998	0.57	2006	0.68	0.26	0.11	0.14	123	120	127	*45*
Lithuania	2002	0.61	2007	0.70	0.12	0.09	0.03	110	115	104	*78*
Russia	1999	0.68	2006	0.75	0.14	0.07	0.07	112	110	115	*50*
Ukraine	2001	0.65	2007	0.74	0.25	0.10	0.16	124	115	136	*39*
Japan	2005	0.62	2007	0.66	0.08	0.03	0.04	106	106	107	*45*

Note: Computations of the absolute and the relative changes in the TFR shown in the table do not necessarily correspond to the computations based on the absolute TFR values displayed, as the data shown are rounded to two decimal points.

Table 4.2: Tempo-adjusted TFR, tempo effects and the estimated contribution of tempo components to the TFR change between the year of reaching the lowest TFR and 2006

Region / country	Lowest TFR year	Lowest TFR TFR	Lowest TFR adjTFR	Lowest TFR tempo effect	2006 data TFR	2006 data adjTFR	2006 data tempo effect	Change in adjTFR through 2006	Contribution of tempo to TFR change (%)
Southern Europe									
Greece	2001	1.26	1.49	-0.23	1.38	1.53	-0.15	0.04	67
Spain	1998	1.17	1.40	-0.22	1.35 1)	1.38 1)	-0.03 1)	-0.02 1)	(>100)
Central Europe									
Czech Republic	1999	1.14	1.66	-0.51	1.35	1.79	-0.44	0.13	37
Hungary	2003	1.28	1.75	-0.46	1.32	1.69	-0.37	-0.06	(>100)
Poland	2003	1.23	1.60	-0.37	1.27	1.48	-0.21	-0.12	(>100)
Slovakia	2002	1.20	1.58	-0.39	1.25	1.67	-0.42	0.09	(<0)
Slovenia	2003	1.22	1.56	-0.34	1.32	1.58	-0.26	0.02	79
Denmark	1983	1.40	1.76	-0.36	1.78 2)	1.99 2)	-0.21 2)	0.23 2)	40
Eastern and south-eastern Europe and the former USSR									
Bulgaria	1997	1.14	1.38	-0.24	1.37	1.74	-0.37	0.35	(<0)
Romania	2002	1.26	1.57	-0.31	1.31	1.54	-0.23	-0.03	(>100)
Estonia	1998	1.24	1.70	-0.45	1.56	1.85	-0.30	0.16	50
Latvia	1998	1.17	1.54 ('99)	*-0.4*	1.30	1.59	-0.28	0.05	66
Lithuania	2002	1.26	1.58	-0.32	1.31	1.74	-0.43	0.16	(<0)
Russia	1999	1.19	1.48	-0.29	1.29	1.50	-0.21	0.02	83
Ukraine	2001	1.11	1.36	-0.26	1.28	1.46	-0.18	0.10	44
Japan	2005	1.29	1.43	-0.14	1.30	1.49	-0.19	0.06	(<0)

Notes: To make the data as comparable as possible, three-year moving averages were used for both the TFR and the adjTFR. Therefore the TFR values in this table do not correspond to those shown in Table 3.1. The adjTFR for the last year included was estimated using the procedure described in the paper.
1) Data pertain to 2005; 2) data pertain to 2004.

Table 5.1: Percentage of births to foreign mothers and the period TFR for foreign, native and all women in Greece, Italy and Spain, 2005-2006

	Greece 2005	**Italy 2007**	**Spain 2006**
Percent births to foreign mothers	16.5	14.7	16.5
TFR: native women	1.24	1.28	1.30
TFR: foreign women	2.12	2.40	1.70
TFR: total	1.33	1.37	1.35
Net effect foreign women on the TFR	0.09	0.09	0.05

Sources: Tsimbos (2008: Table 2) for Greece, ISTAT (2009c) for Italy, and own computations based on INE (2009a and 2009b) for Spain.
Note: National-level TFR is taken from the sources listed above and may therefore differ from our computations based mostly on Eurostat (2009) data.

Table 5.2: The net impact of foreign-women TFR on the period TFR in Spain, 1998-2006

	TFR: native F	TFR: foreign F	TFR: total	Net effect foreign F (abs.)	Percent births to foreign women
1998	1.12	2.42	1.15	0.02	4.2
2002	1.19	1.77	1.23	0.04	10.6
2006	1.30	1.70	1.35	0.05	16.5
Change 1998-2006	0.17	-0.72	0.20	0.03	12.3
Hypothetical TFR in 2006 if foreign-women TFR remained constant at the 1998 level					
	1.30	*2.42*	*1.44*	*0.14*	*22.6*

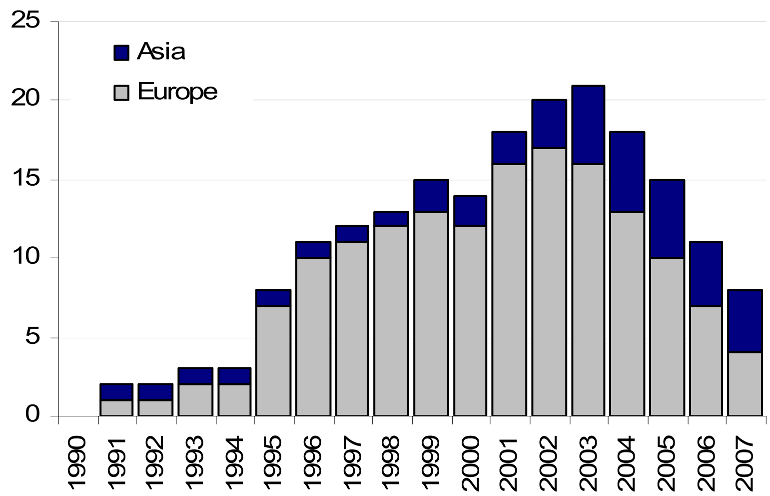
Source: Own computations based on INE (2009a and 2009b).
Note: The TFR data presented here differ slightly from our computations based on Eurostat (2009) data presented above.

Table 5.3: Contribution of immigrant women to the TFR rise in selected countries of Europe

	Country and period			
	Denmark 2001-2005[1)]	England and Wales 2004-2007	France[2)] 1999-2004	Sweden 2002-2007
TFR change: all women	0.09	0.14	0.11	0.23
TFR change: native women	0.10	0.11	0.08	0.21
TFR change due to immigrants	-0.01	0.03	0.03	0.01
Percent change due to immigrants	-15	19	27	5

Source: Own computations based on Statistics Denmark 2004 and 2008, ONS 2008, Héran and Pison 2007, and Statistics Sweden 2003 and 2008.
Notes: 1) Danish data are reported for 5-year periods centered around the years indicated (i.e., 1999-2003 and 2003-2007); 2) French data pertain to foreign women only and not to all immigrant women

Figure 3.1: Number of countries with TFR below 1.30, 1990-2007



Notes: Small countries with population below 1 million (including Cyprus, Macao, and Malta) are excluded. Countries with low-quality data on births and population, including Albania and Bosnia-Herzegovina, are excluded. East and West Germany are counted as separate countries; Hong Kong is also considered a separate country.

Figure 3.2: Population living in countries with the TFR below 1.30 (million)

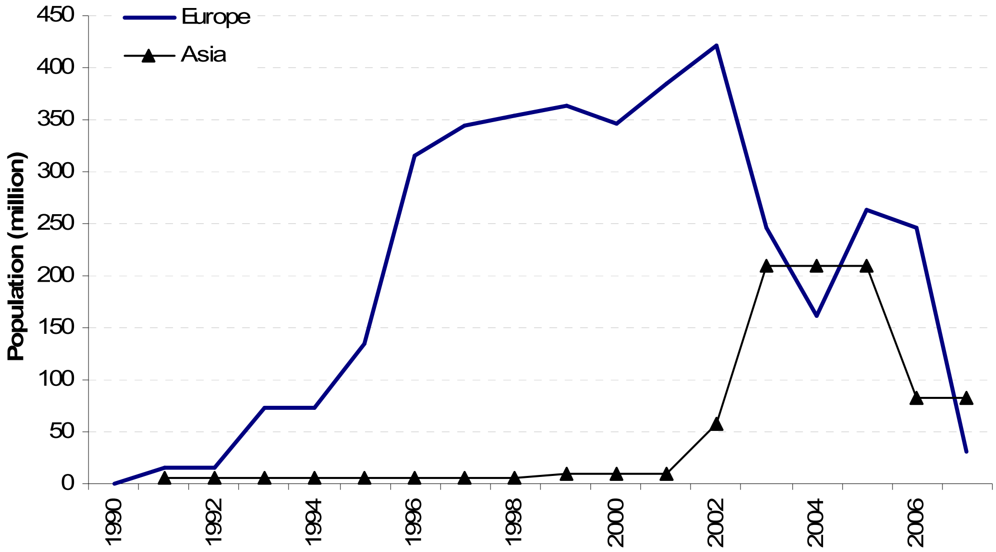
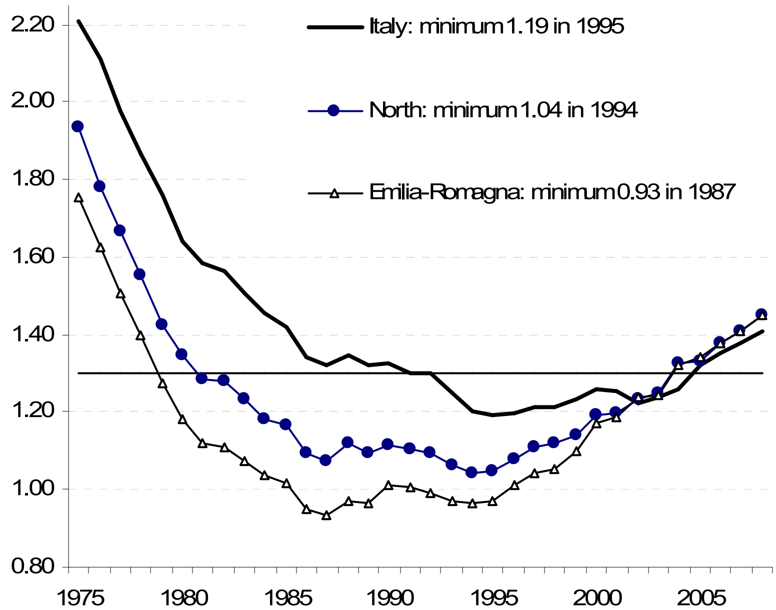
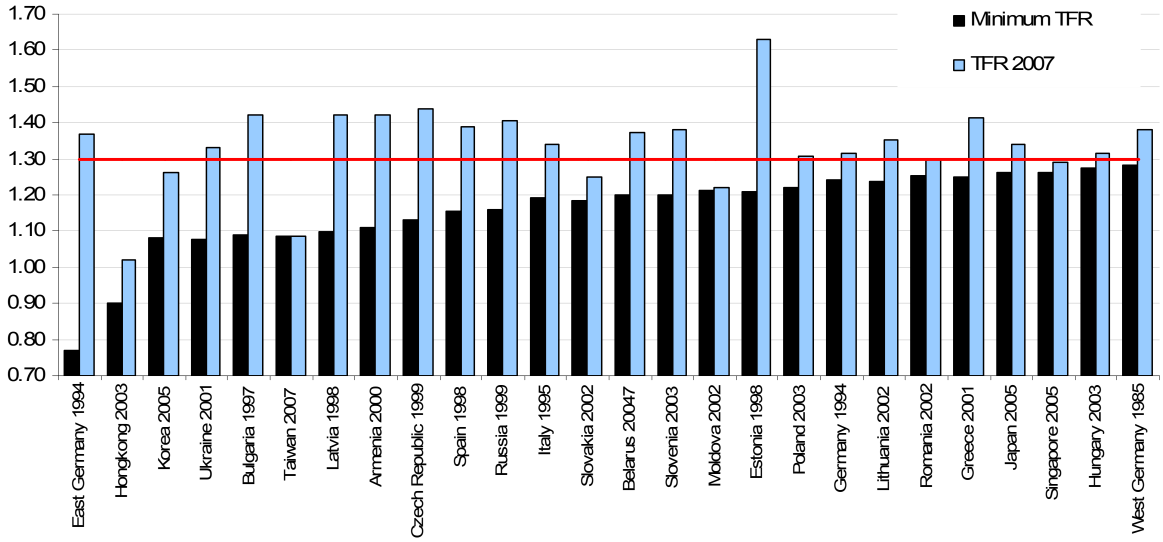


Figure 3.3: Period TFR in Italy, Northern Italy, and in the province of Emilia-Romagna, 1975-2008



Note: Data for 2007-2008 are preliminary estimates
Source: ISTAT 2008, 2009a and 2009b

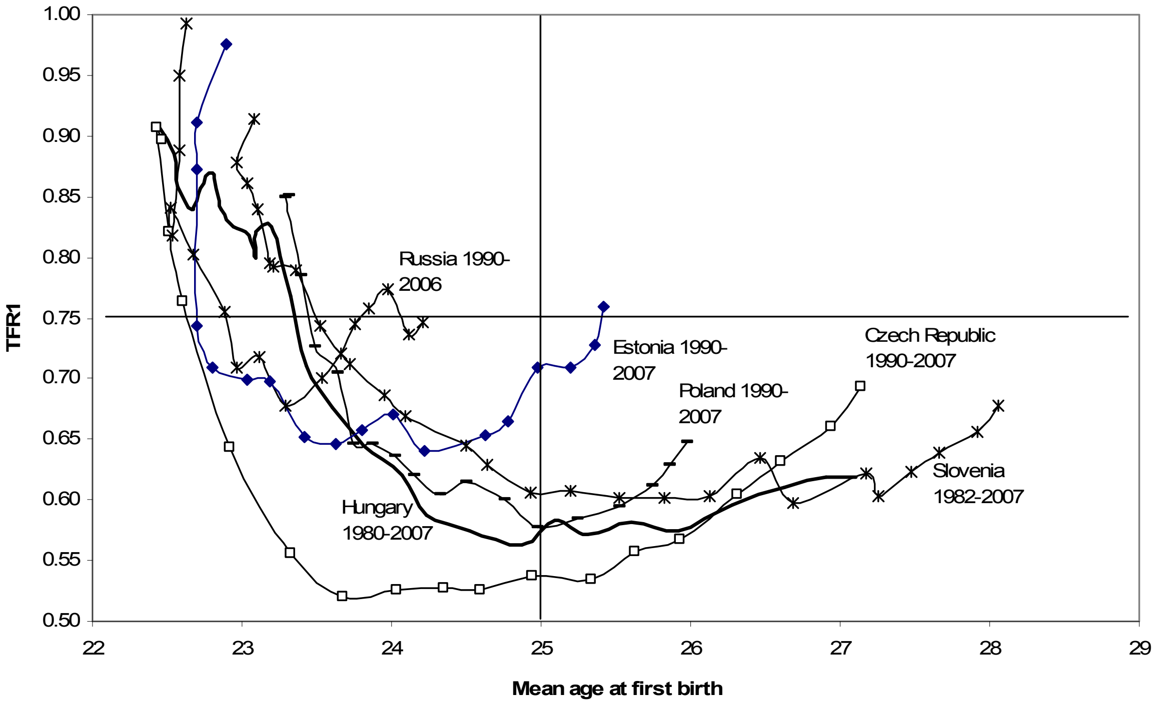
Figure 3.4: Lowest TFR recorded and the TFR in 2007, 26 countries ever experiencing a TFR below 1.30



Note: Each country also label also shows a year when the lowest TFR was reached

Figure 4.1: **Transition from an early to the late age at first birth and the first-order TFR**

a) Selected lowest-low fertility countries of Central and Eastern Europe (Czech Republic, Estonia, Hungary, Romania, Russia and Slovenia)



b) Italy, Spain, Japan, Taiwan, Denmark and the Netherlands

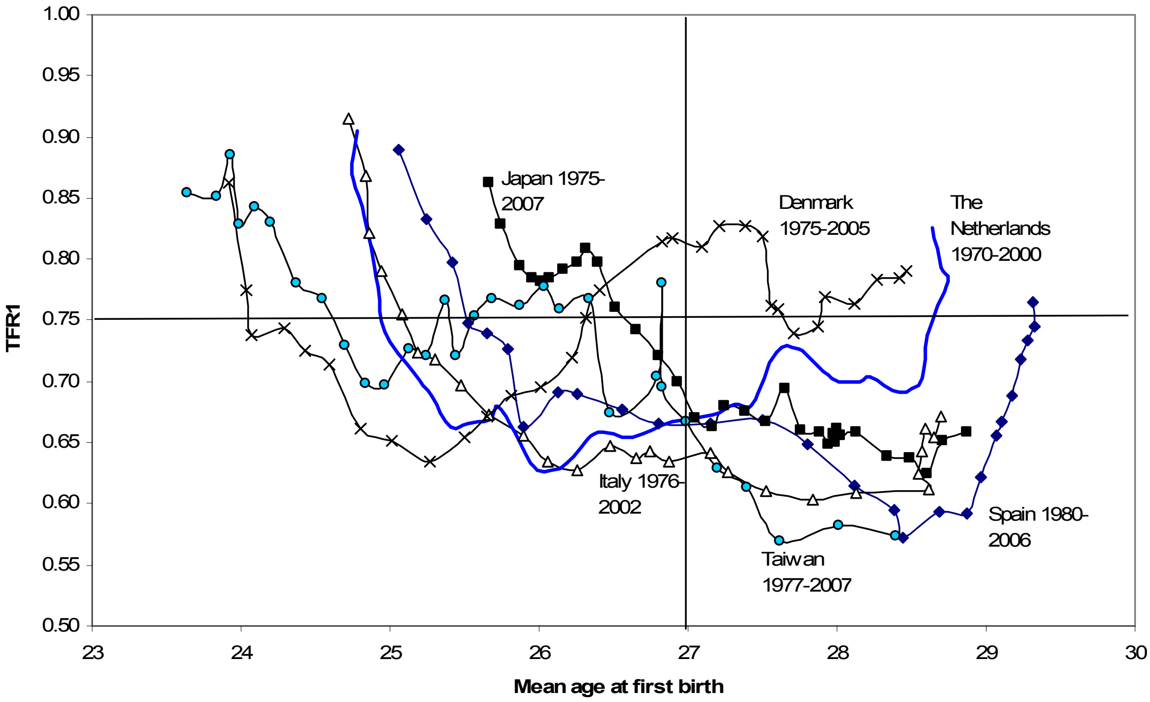
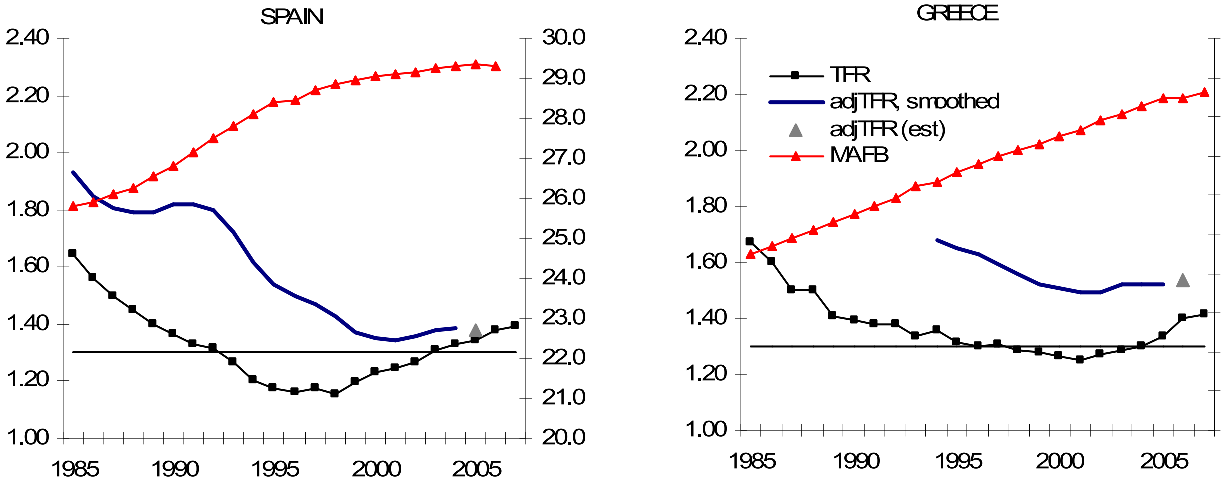
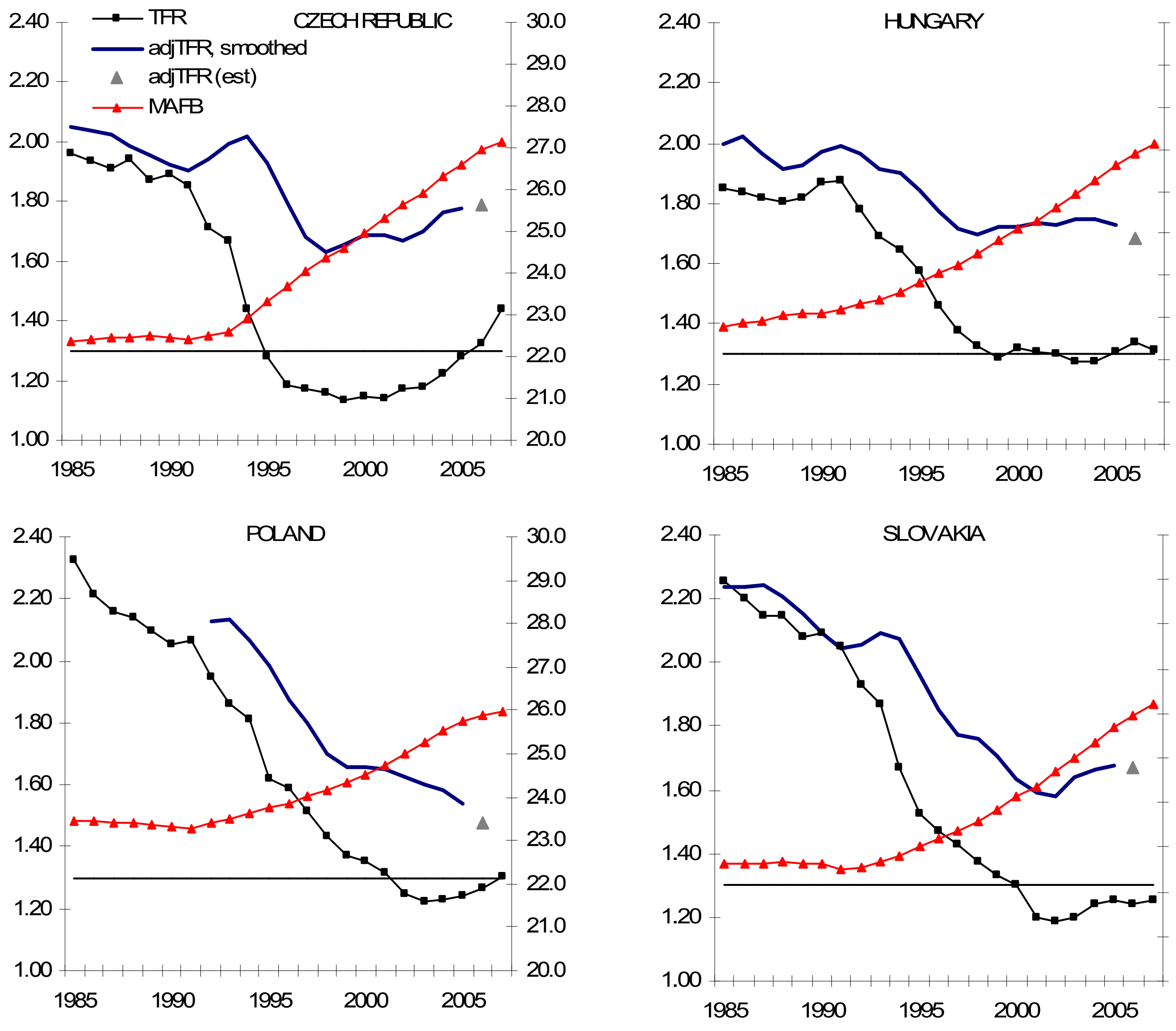


Figure 4.2: TFR, adjusted TFR, and mean age at first birth, 1985-2007

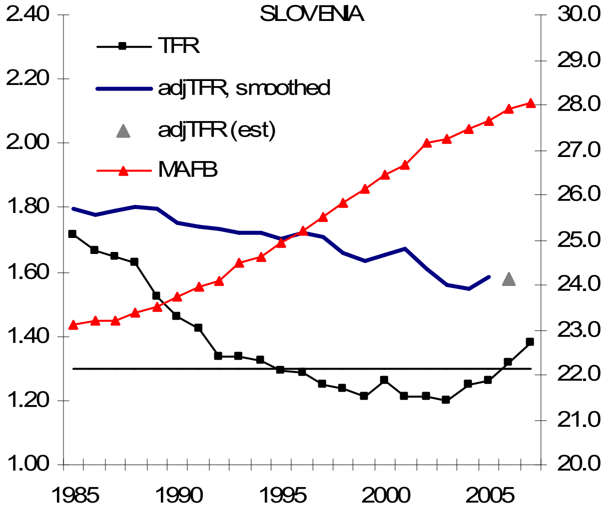
Southern Europe

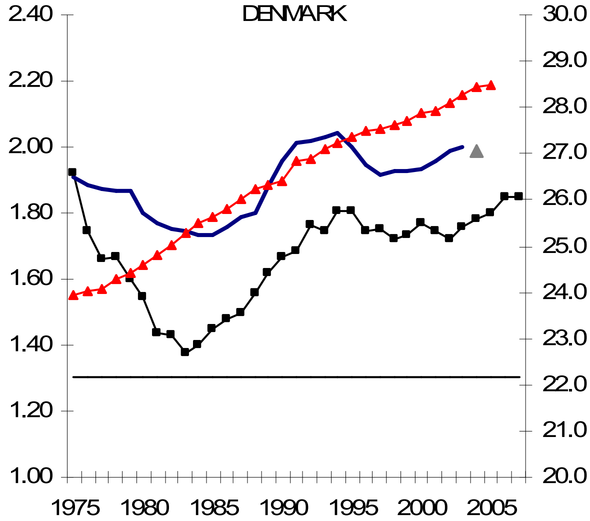


Central Europe and Denmark

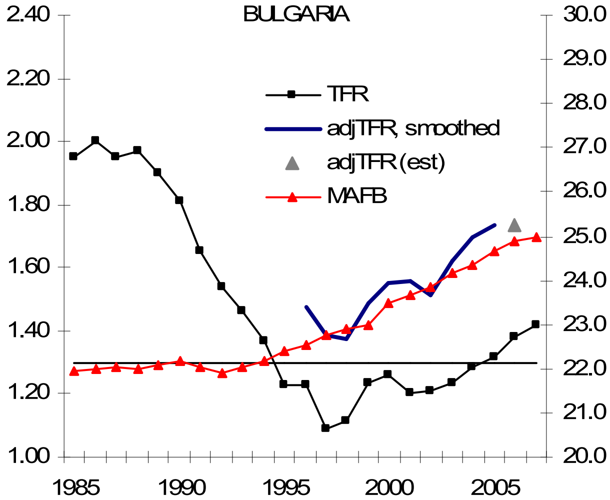


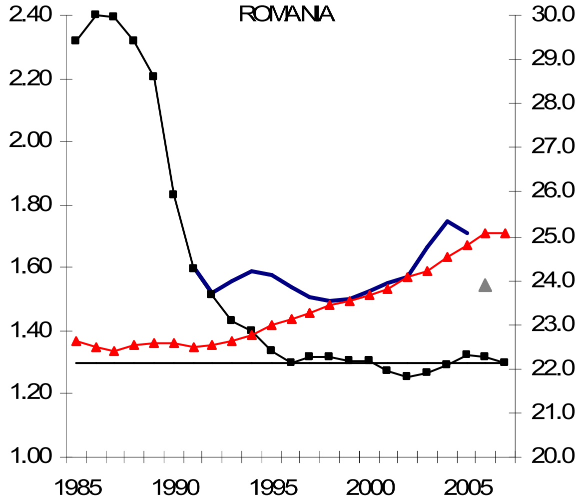
Central Europe and Denmark (*continued*)



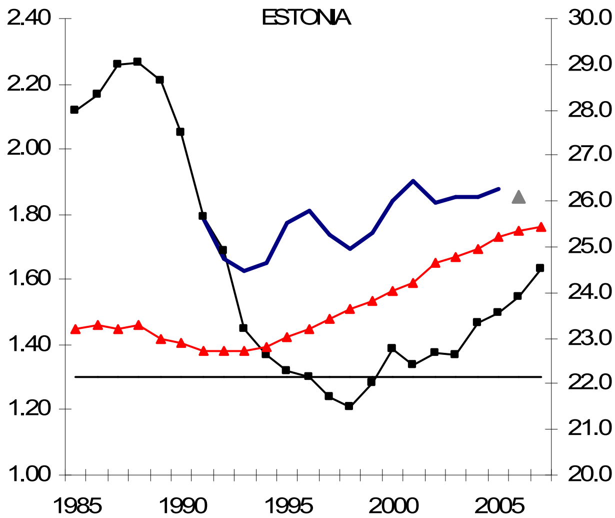


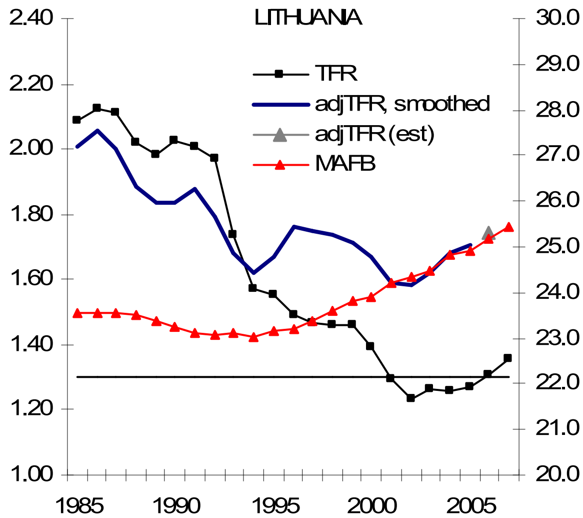
South-eastern Europe



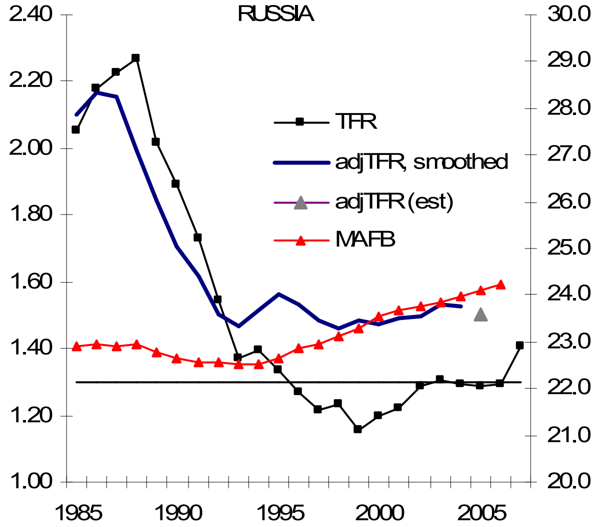


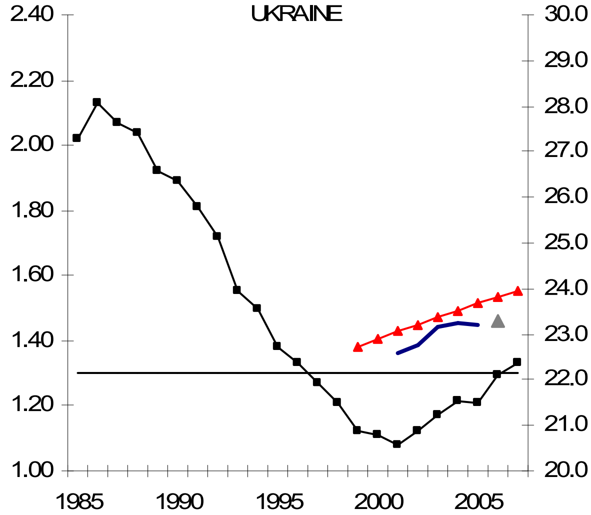
Baltic states



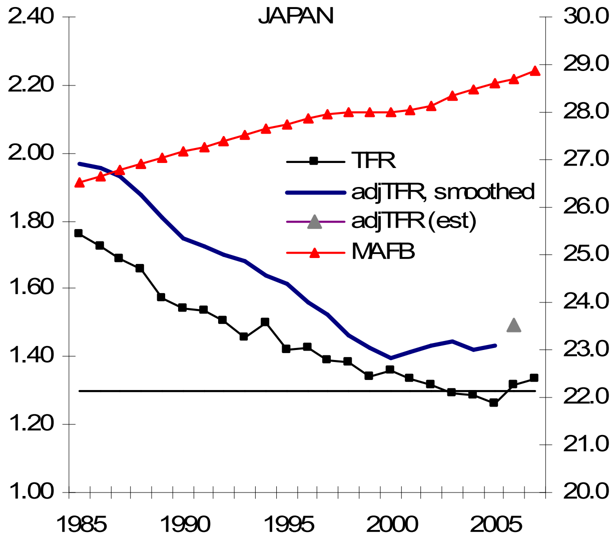


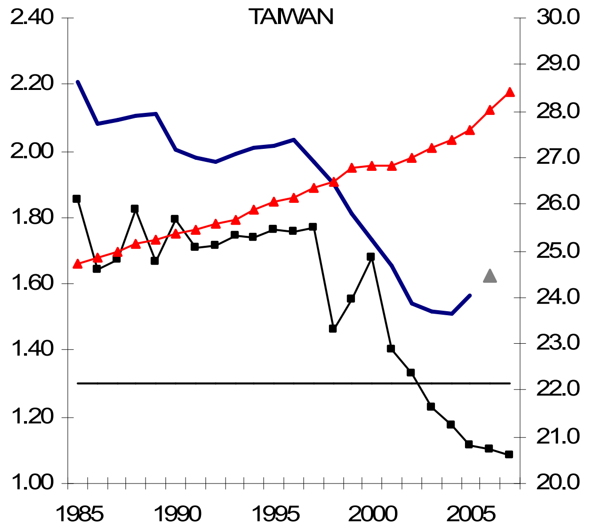
Eastern Europe





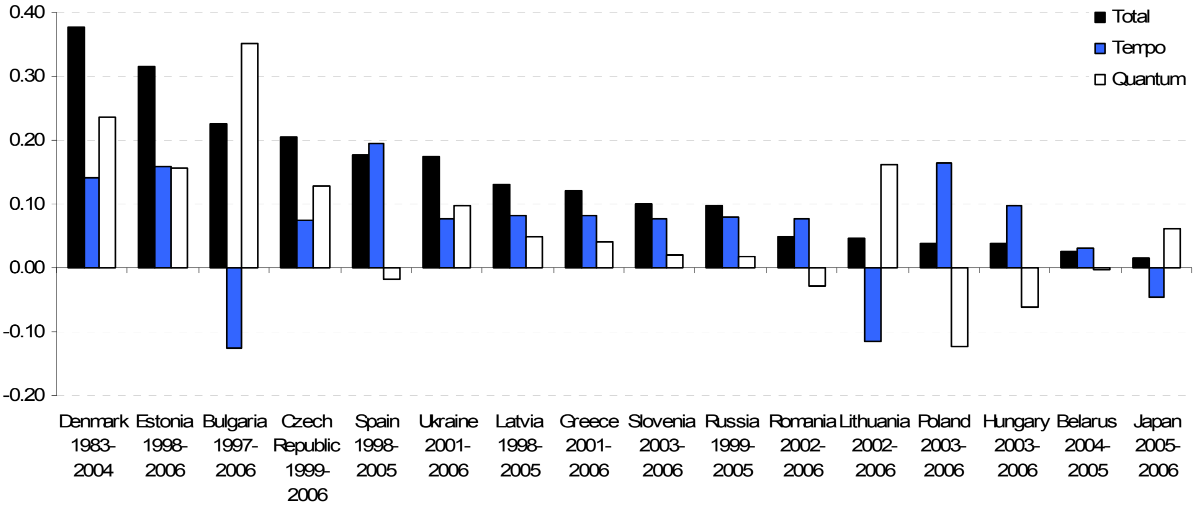
Eastern Asia





Notes: The graph for Denmark covers a longer period, 1975-2007.

Figure 4.3: Estimated contribution of tempo and quantum change to the TFR increase from the lowest level reached; lowest-low fertility countries and Denmark



Notes: To make the data as comparable as possible, three-year moving averages were used for both the TFR and the adjTFR. The adjTFR for the last year included was estimated using the procedure described in the paper.

Figure 6.1: Three examples of the turn-around in low fertility along with the time series of unemployment

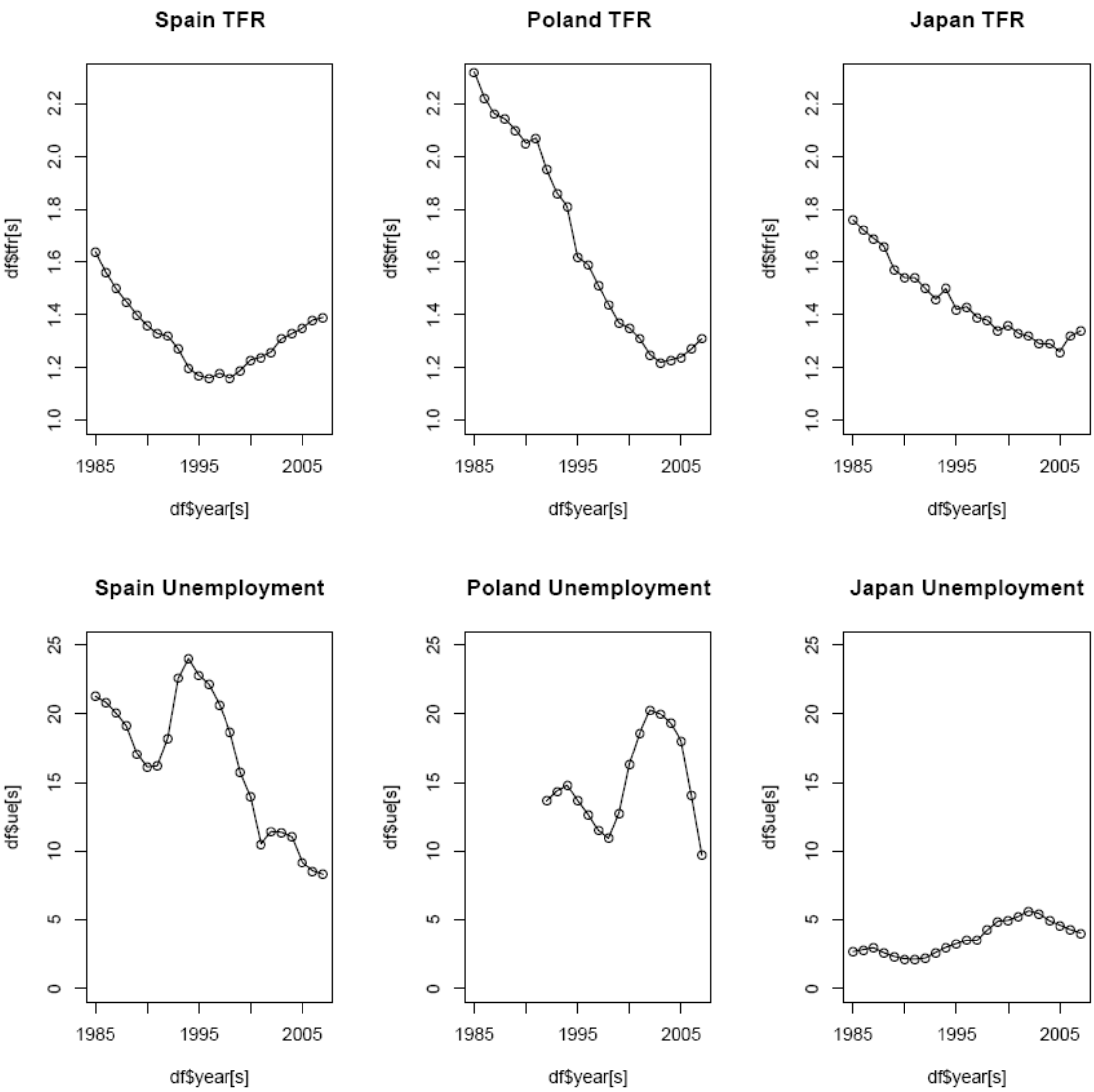


Figure 6.2: Bivariate relationship between fertility and unemployment in 9 lowest-low fertility countries

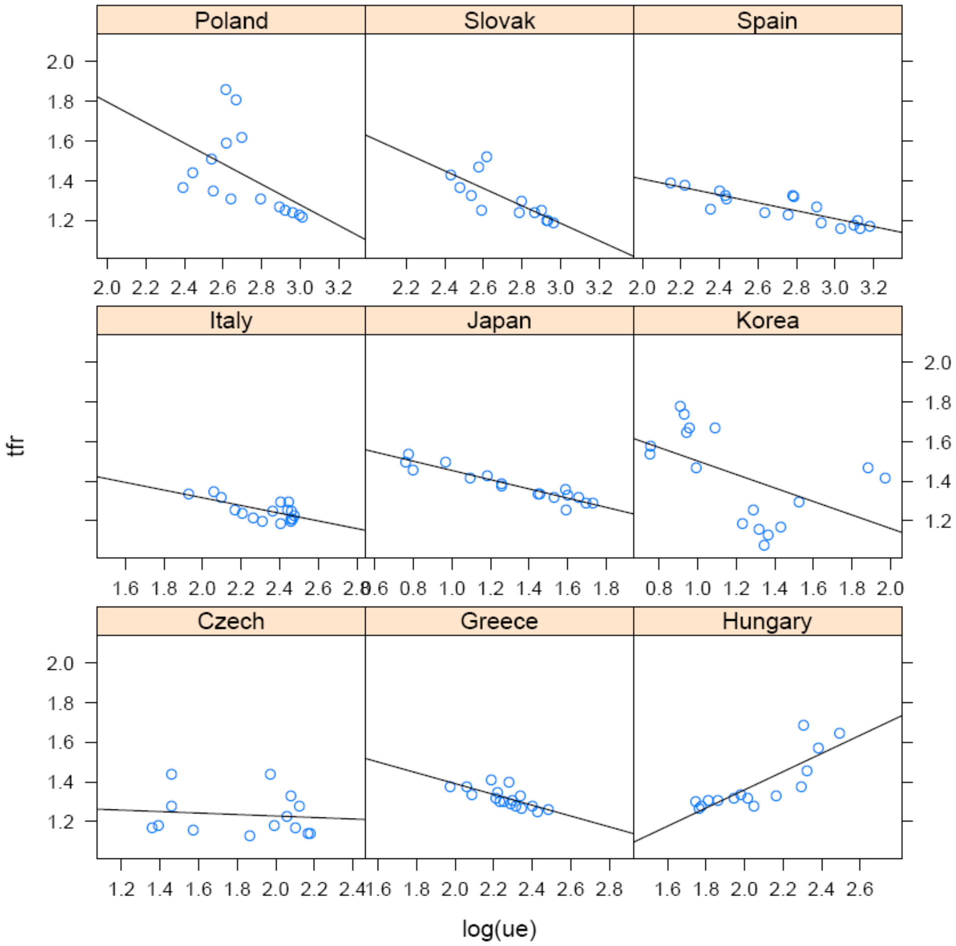


Figure 6.3: Recent rise in the TFR, observed and predicted from economic conditions (OECD countries)

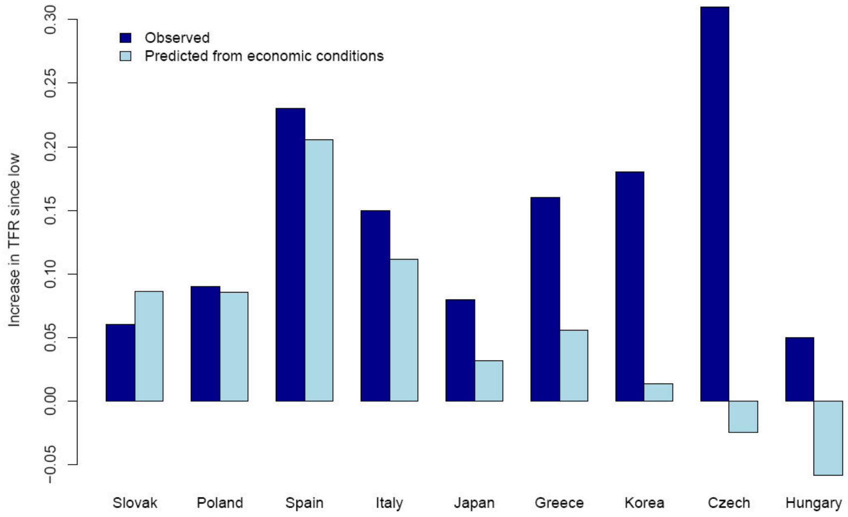
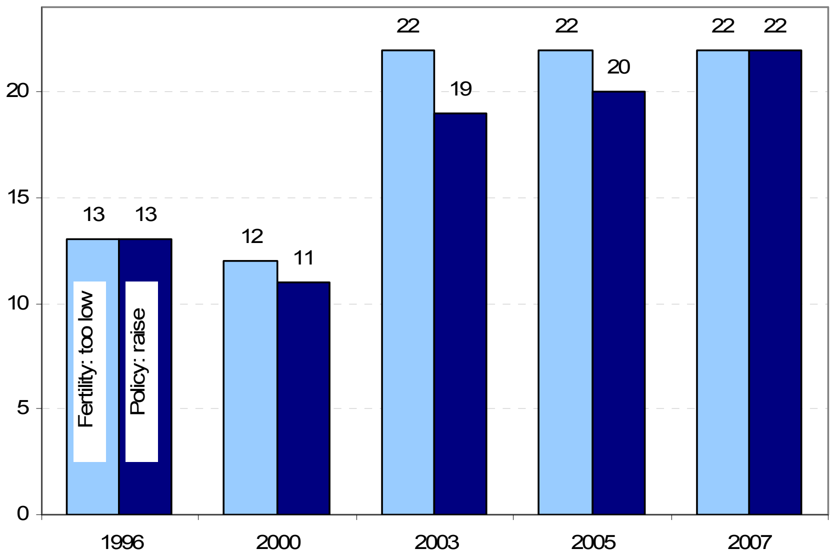


Figure 7.1: Number of countries whose governments consider their fertility too low and support policies to raise fertility, 22 countries ever reaching lowest-low fertility



Sources: UN 2001, 2004, 2006, and 2007.

Notes: The figure includes all the countries that ever reached the TFR below 1.3 (see Table 3.1) and that are listed in the regular UN reports on policies. Germany is treated as one country; data for Hong Kong and Taiwan are not available. In 2000, Moldova, Slovakia, and Slovenia did not provide information on their fertility and policy view; we used 1998 data instead.

Figure 8.1: Relationship between the mean age at first birth and the rate of postponement of 1st births

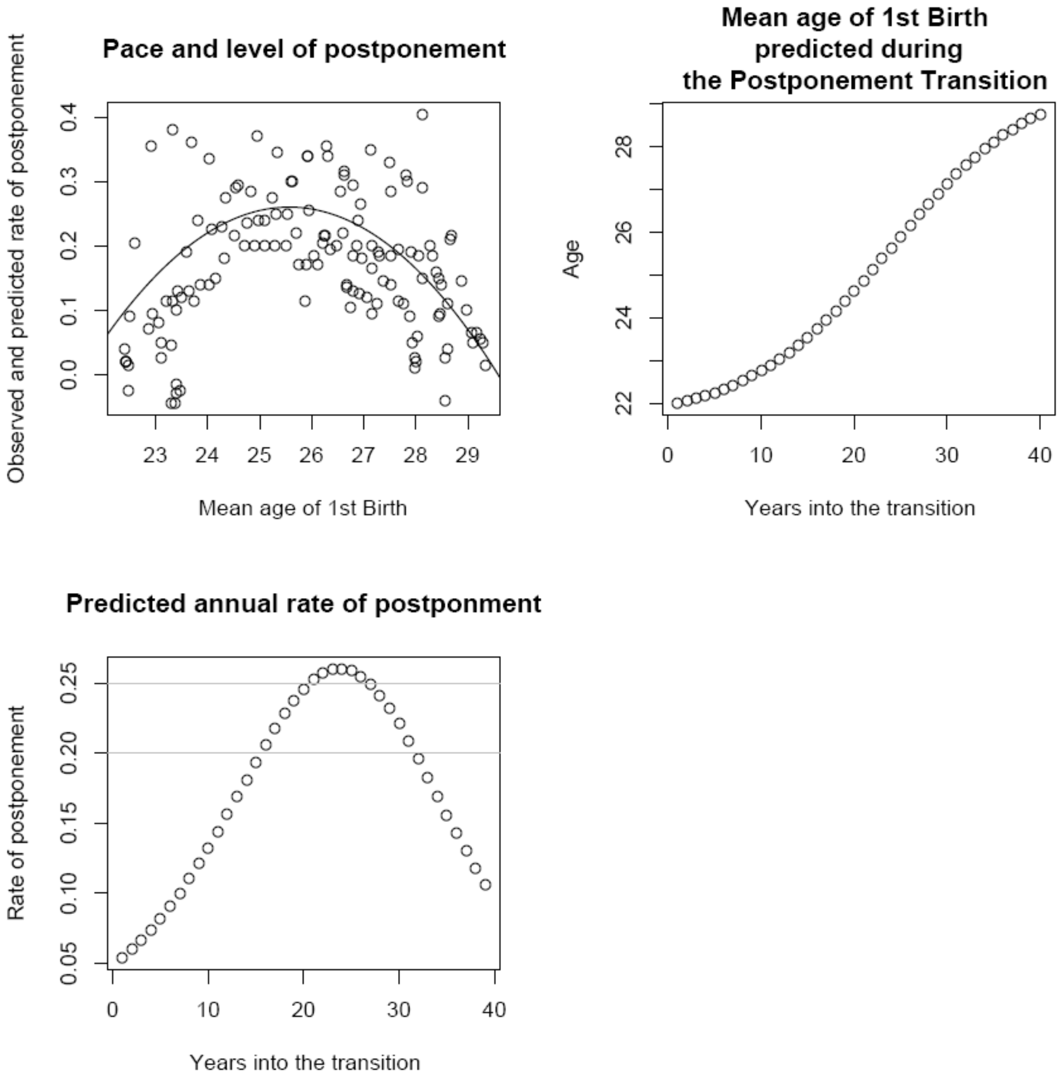


Figure 8.2: Simulation of cohort-based postponement and period based tempo adjustment