The End of "Lowest-Low" Fertility?

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In the 1990s, period total fertility rates (TFR) fell below 1.3 in Eastern and Southern Europe and in East Asia. It seemed that a new era of extremely low birth rates had taken hold. While TFRs below the replacement level of 2.1 have been recorded in various countries since the 1930s, the fertility rates seen in the 1990s were so low that, if continued, they could lead to rapid population decline, or as Chesnais (2001) termed it, "population implosion." These lows in TFRs inspired a large body of literature, notably Bongaarts and Feeney's (1998) work on tempo-adjusted fertility, Kohler, Billari, and Ortega's (2002 and 2006) exploration of the patterns and causes of very low fertility, and Lutz and Skirbekk's (2005) and Lutz, Skirbekk, and Testa's (2006) notion of a low-fertility trap, with self-reinforcing fertility decline. Some official forecasts have also accepted the idea that TFRs will remain low and do not anticipate any substantial increase. Notably, Japan has officially forecast a TFR below 1.3 through 2055 (Kaneko et al. 2008).

Kohler, Billari, and Ortega (2002 and 2006) and Billari and Kohler (2004) coined the label "lowest-low fertility" for a period TFR below 1.3. The term does not refer to the lowest limit of TFRs, but rather to new lows in observed period fertility rates.[1] They concluded that such low fertility was "characterized by a rapid shift to delayed childbearing, a low probability of progression after the first child (but not particularly low levels of first-birth childbearing) [and] a 'falling behind' in cohort fertility at relatively late ages (in Southern Europe)" (Kohler, Billari, and Ortega 2006: 99). They expected that lowest-low fertility would be a persistent pattern for several decades, especially in Eastern Europe. They also predicted that lowest-low fertility was likely to spread, particularly to Austria, Germany, Switzerland, and selected countries of Central and Eastern Europe (Kohler, Billari, and Ortega 2006).

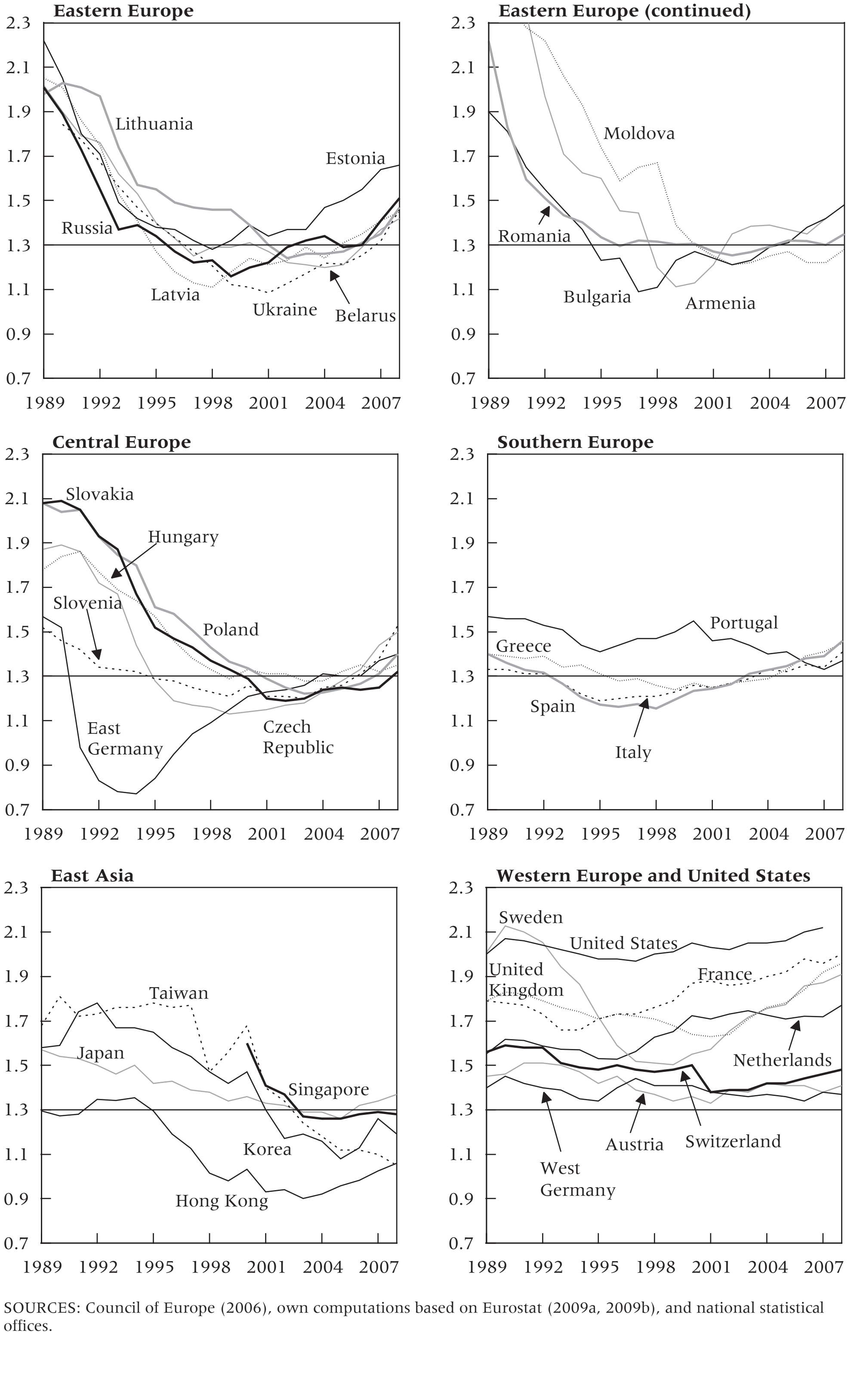
For over a century, the prospect of prolonged periods of very low fertility has alarmed and fascinated demographers, journalists, and the general public, who pondered its hypothetical consequences, including both an accelerated rate of population aging and population decline. Even in the United States, which records the highest fertility among industrialized countries and experiences sustained population growth, books like *The Empty Cradle* by Philip Longman (2004) warn of population decline and loss of economic prosperity and innovativeness. Pope Benedict XVI proposed in 2006 that Europe's problem seems to be that "it no longer wants to have children" and "seems to be wishing to take its leave from history."[2]

It comes as news therefore that period fertility in most low- and lowest-low-fertility countries has been steadily rising since 2000. Countries as diverse as Russia, Armenia, Poland, Italy, and Japan all appear to have their lowest fertility rates behind them (see Figure 1). Now only a handful of countries have TFRs below 1.3, compared to 21 in 2003; and only one European country, Moldova, remains in this category according to official estimates for 2008. Period fertility in Central and Eastern Europe has clearly risen from its lowest levels. In Bulgaria, the Czech Republic, Latvia, Ukraine, and in East Germany (the former German Democratic Republic)—where the TFR below 1.3 persisted for 10 to 13 years—TFRs reached 1.4 or above by 2008. East Germany, whose TFR was as low as 0.77 in 1994, had a level of 1.4 in 2008. In Southern Europe, period TFRs have exceeded 1.4 in Italy, Spain, and Greece. The record in East Asia is more mixed. Japan's TFR has risen above 1.3, but in South Korea a brief uptick from 2005 to 2007 was followed by a decline in 2008. In Taiwan, the TFR is still falling, reaching a level of 1.05 in 2008. Fertility has also risen in higher-fertility populations like Sweden, the United States, the United Kingdom, France, and the Netherlands. The German-speaking countries, where fertility has remained unchanged, are the only exception to this trend reversal in Europe.

In this article we provide a demographic analysis of this apparent reversal in lowest-low fertility and explore factors that help explain the observed changes. The threshold of defining lowest-low fertility as a TFR below 1.3 is arbitrary, but we consider it a useful marker of very low fertility, which may be seen as unsustainable in the long run. In terms of population halving times, the difference between relatively close levels of low fertility is large. Stable populations with low mortality and with no net immigration and a TFR of 1.3 take about 45 years to halve, whereas those with a TFR of 1.6 take nearly 90 years. At the same time, one must keep in mind that the difference between a TFR slightly under 1.3 and slightly over 1.3 is not a difference in kind.

Our main contribution is a detailed analysis of the path that TFRs have taken in most of the countries that have ever had lowest-low fertility. This allows us to describe the course of change and to model transitions from lowest-low fertility to TFRs above 1.3. We then examine the economic, policy,

FIGURE 1 Total fertility rates in countries that have experienced lowest-low fertility and in selected other developed countries, 1989–2008



SOURCES: Council of Europe (2006), own computations based on Eurostat (2009a, 2009b), and national statistical offices.

and migration-related factors that are frequently advanced to explain short-term TFR changes in countries with low and lowest-low TFRs.

Explanations of lowest-low fertility

Lowest-low fertility should be seen as a transitional phenomenon closely linked to the postponement of childbearing to older ages. Much of the concern about "low fertility" is the 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). As has been known to demographers since the work of Hajnal (1947) and Ryder (1964), and as reformulated by Bongaarts and Feeney (1998), delays in childbirth can have substantial effects on a cross-sectional measure such as the period TFR. The postponement of births to older ages reduces the number of births in a given period, making the TFR lower even if completed cohort fertility remains unchanged.

Broad agreement exists among demographers that the era of lowest-low fertility emerged as a direct consequence of widespread fertility postponement (Kohler, Billari, and Ortega 2002; Lutz, ONeill, and Scherbov 2003; Morgan 2003; Sobotka 2004a; Billari 2008). But the questions of how permanent lowest-low fertility would be, and whether factors other than postponement could sustain such low TFRs, have produced a divided set of views. Proponents of the prominent role of tempo, or timing, effects argue that lowest-low fertility would end once delays in childbearing cease. Bongaarts (2001 and 2002) and Sobotka (2004a) have suggested that lowest-low fertility is a transient phenomenon. Most official population projections followed this view, projecting increases in lowest-low fertility from observed levels under 1.3 to levels above 1.5.

Many other researchers have argued, however, that lowest-low fertility might prove persistent.[3] These views can be roughly divided into two camps. The first emphasizes the persistence of tempo-induced declines in TFR and their potential future consequences. The second emphasizes the socioeconomic and cultural conditions of lowest-low-fertility societies.

Consistent with the first view, researchers have argued that once postponement of childbearing stops and the associated tempo distortion disappears, additional decline in fertility quantum, or level, may prevent a significant recovery in the TFR (Lesthaeghe and Willems 1999; Bongaarts 2002). Consequently, 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, where the mean age at first birth is still low, postponement could continue for many decades. Furthermore, they emphasized that completed cohort fertility was also likely to decline as a result of later childbearing. Lutz, Skirbekk, and Testa (2006) suggested in their hypothesis of a low-fertility trap that very low fertility rates may continue or even decline further as a result of negative feedback, whereby tempo-induced declines in the birth rate lead to further declines in desired family size.

A number of other scholars view very low TFRs as a long-lasting outcome of socioeconomic and cultural conditions that are disadvantageous for childbearing. McDonald (2006: 487) suggested that waiting for tempo effects to disappear "is beginning to look like waiting for Godot" and pointed to a "cultural divide" between populations that can maintain TFRs above 1.5 and those that cannot, with the possibility of increasing fertility becoming harder and harder in less child-friendly societies. As reasons for sustained low fertility he cited low levels of gender equity in the family and a strong reliance of individuals on family networks in countries where families are expected to support their own members and where universal welfare systems are less developed (McDonald 2000, 2002, 2006). Suzuki (2003: 12) argues: "[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 argument, he proposes that only countries with weak family ties, such as those in Northwestern Europe, have developed a sufficient network of non-family caregivers that enables women to have more children and mothers to participate more easily in the labor force. Economic explanations also are often suggested. Adsera (2004 and 2005) emphasizes the role of labor market conditions, especially of persistent unemployment, in driving fertility to very low levels. More generally, Reher (2007) and Chesnais (2000) 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 low fertility essentially as an outcome of demographic transition, while Chesnais stresses the role of social atomization, individualism, and consumerist culture.

Kohler, Billari, and Ortega (2006) and Billari (2008: 171) highlight the heterogeneity of lowest-low-fertility settings. In Southern Europe, lowest-low fertility was associated with the persistence of traditional family patterns, late home-leaving, a shift to very late first births, relatively low female employment, and high unemployment among young adults (e.g., Billari and Kohler 2004; Billari 2008; Baizán, Michielin, and Billari 2002; Dalla Zuanna 2001). In Central and Eastern Europe lowest-low fertility is frequently perceived as a consequence of a difficult economic transition after the collapse of state socialism around 1990 (e.g., Sobotka 2004b; Frejka 2008; Perelli-Harris 2005).

Persistent lowest-low fertility rates have also appeared in official population projections, often as a "low scenario," but at least in the case of Japan and Hong Kong as the central scenarios. As projections predicting a recovery of fertility proved repeatedly to be wrong, the latest version of Japan's official population projections, released in 2006, posits period fertility rates below 1.3 through at least 2055 (Kaneko et al. 2008 and 2009); the low variant envisions a TFR below 1.1 between 2009 and 2055. In Hong Kong, the TFR is projected to decrease to 0.9 by 2016 and remain at that level long thereafter (Census and Statistics Department 2007: 44). In Germany, official projections envision a decline to 1.2 through 2050 in the low scenario (the medium scenario has a TFR of 1.4). The low variant of the 2008 United Nations world population projections (UN 2009) shows very low TFR levels throughout the projection period until 2050, often falling below 1.0 in Eastern Europe and East Asia. For instance, this scenario envisions that the TFR in Belarus will hit a trough of 0.86 in 2020–25, and in Hong Kong it will fall as low as 0.61 in the same period. Even completed cohort fertility has been occasionally projected to fall to 1.3 or below. Frejka and Sardon (2004: 376) suggested that women born in 1975 might 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.

The spread and subsequent retreat of lowest-low fertility

Except in times of war and other highly disruptive circumstances, lowest-low fertility is a relatively recent phenomenon (e.g., Billari 2008). Among larger countries it first occurred in West Germany, where the period TFR briefly fell below 1.3 in 1984–85 (see Table 1). At the same time, several other European countries experienced a TFR below 1.5. Only a decade later lowest-low fertility became widespread in Europe and subsequently also in East Asia. Excluding countries with a population below one million and countries with unreliable population statistics (most notably, Bosnia and Herzegovina), the number of countries with lowest-low fertility increased from two in 1991–92 to 21 in 2003 (see Figure 2; we consider East and West Germany and Hong Kong as separate regions in this analysis). By 2002, 479 million people lived in countries with lowest-low fertility; in Europe more than half of the total population lived in these countries (Sobotka 2004a).[4] Starting in 2003, the number of European countries with lowest-low fertility began to fall steadily, from 16 in 2002 to one (Moldova) in 2008, whereas in East Asia four out of five countries ever experiencing lowest-low fertility still retained it in 2008.

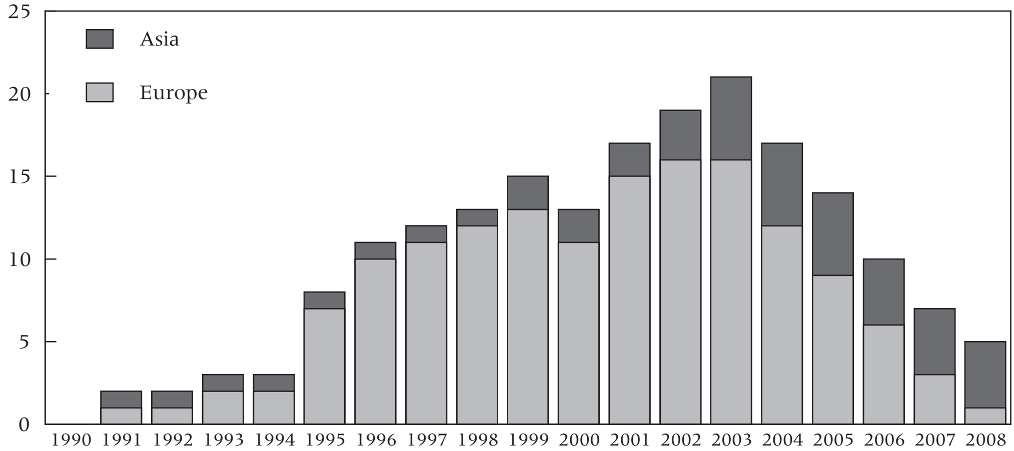
A list of countries experiencing lowest-low fertility during the period 1985–2008 is shown in Table 1. We also include other countries that have had a TFR below 1.4 in order to more clearly demonstrate the pervasiveness of the recent increase in fertility. This is a mixed group of middle-sized countries in 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).[5] Among these countries, Denmark stands out both for an early fall in the TFR to 1.38 in 1983 and for its steady subsequent recovery to 1.89 in 2008, which brought Denmark into the group of countries with the highest TFR in Europe.[6] Finally, the table shows selected higher-fertility developed

TABLE 1 Fertility recovery in countries that have ever had a total fertility rate below 1.3 or 1.4 and in selected other developed countries

Region/ country	Population in 2008 (million)	Lowest TFR		TFR in 2008		Total years of TFR<1.3
		Year	TFR	TFR	Change from lowest level	
Southern Europe						
Greece	11.2	2001	1.25	1.45[p]	0.20	8
Italy	59.6	1995	1.19	1.41[p]	0.22	12
Spain	45.3	1998	1.16	1.46[p]	0.30	10
Western Europe						
Germany	82.2	1994	1.24	1.38	0.14	4
East Germany	14.5 (est.)	1994	0.77	1.40	0.63	13
West Germany	67.7 (est.)	1985	1.28	1.37	0.10	2
Central Europe						
Czech Republic	10.3	1999	1.13	1.50	0.37	11
Hungary	10.0	2003	1.27	1.35[p]	0.08	3
Poland	38.0	2003	1.22	1.39[e]	0.18	5
Slovakia	5.4	2002	1.19	1.32	0.14	8
Slovenia	2.0	2003	1.20	1.53[p]	0.33	11
Eastern and South-eastern Europe and former USSR						
Bulgaria	7.6	1997	1.09	1.48	0.39	10
Romania	21.4	2002	1.25	1.35	0.10	6
Estonia	1.3	1998	1.21	1.66	0.45	3
Latvia	2.3	1998	1.10	1.45	0.35	10
Lithuania	3.4	2002	1.24	1.47	0.23	5
Belarus	9.7	2004	1.20	1.42	0.22	9
Moldova	3.6	2002	1.21	1.28	0.06	7
Russia	142.0	1999	1.16	1.51[p]	0.35	10
Ukraine	46.2	2001	1.08	1.46	0.38	10
Armenia	3.2	2000	1.11	1.42[2]	0.31	4
East Asia						
Hong Kong	7.0	2003	0.90	1.06	0.16	17
Japan	127.8	2005	1.26	1.37	0.11	3
Korea	48.3	2005	1.08	1.19	0.11	7
Singapore	4.8	2005	1.26	1.28	0.02	6
Taiwan	23.0	2008	1.05	1.05	..	6
Other countries ever with a TFR below 1.4						
Austria	8.3	2001	1.33	1.41	0.08	..
Croatia	4.4	2003	1.33	1.47	0.14	..
Cuba	11.2	2006	1.39	1.43[2]	0.04	..
Denmark	5.5	1983	1.38	1.89	0.51	..
Georgia	4.3	2005	1.39	1.45[2]	0.06	..
Portugal	10.6	2007	1.33	1.37[p]	0.03	..
Switzerland	7.6	2001	1.38	1.48	0.10	..
Selected other developed countries						
Australia	21.2	2001	1.73	1.97	0.24	..
France (metropolitan)[1]	62.1	1993	1.65	2.00	0.35	..
Netherlands	16.4	1983	1.47	1.77[p]	0.30	..
New Zealand	4.2	2002	1.89	2.18	0.30	..
Sweden	9.2	1999	1.50	1.91	0.41	..
United Kingdom	61.3	2001	1.63	1.96	0.33	..
United States	302.0 ('07)	1976	1.74	2.12[2]	0.38	..

NOTES: 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.
1) Excluding overseas territories; 2) Data pertain to 2007; p) Preliminary data; e) Estimate.
SOURCES: Council of Europe (2006), own computations based on Eurostat (2009a and 2009b), and national statistical offices.

FIGURE 2 Number of countries in Europe and Asia with a total fertility rate below 1.3, 1990–2008



NOTES: Countries with a population below 1 million (including Cyprus, Macao, and Malta) are excluded, as are countries with poor-quality data on births and population, including Albania and Bosnia-Herzegovina. East and West Germany are treated as separate countries, as is Hong Kong.

countries that also experienced notable recovery in the TFR during the last decade or two. Clearly, the trend of increasing TFR has not been limited to the countries with very low fertility, but took place across the developed world. Eight developed countries currently have TFRs above 1.9, with New Zealand (2.18) and the United States (2.12) having above-replacement fertility. The United States experienced its lowest TFR as early as 1976.

The nature of lowest-low fertility differed widely between countries in duration and in the lowest level of TFR reached. Some countries had a very brief period of TFR below 1.3, while ten countries including Italy, Russia, Spain, and Ukraine experienced a decade or longer of such low TFRs (Table 1). Some countries have seen TFRs temporarily plummeting below 1.0, with East Germany falling to 0.77 in 1993–94 (Witte and Wagner 1995; Conrad, Lechner, and Werner 1996). Russia, with a 2008 population of 142 million, was the most populous country to experience a period of lowest-low fertility, followed by Japan, with a population of 128 million, and five countries with populations of 38–48 million (Italy, Korea, Poland, Spain, and Ukraine). By 2008, however, the combined total population of countries with lowest-low fertility shrank to 88 million, out of which only 4 million resided in Europe.

Regional variation should also be highlighted. China as a whole has had sub-replacement fertility at least since the 1990s, but regional levels of the TFR are highly uncertain, given serious underreporting of births in vital statistics (Morgan, Guo, and Hayford 2009).[7] Based on China's 2000 population census data and the analysis published by China's National Bureau of Statistics and the East-West Center (NBS 2007), we produced our own estimate (see Goldstein, Sobotka, and Jasilioniene 2009 for more details). Using different thresholds of the reported TFR, we arrived at estimates of six to 12 provinces with between 12 and 37 percent of China's population having lowest-low fertility in 2000, with a main variant estimate of eight provinces with roughly 20 percent of China's 2000 population (245 million). All of these provinces except Hubei are situated along the eastern coast and include the capital city Beijing and the most populous city, Shanghai.[8] Adding these Chinese provinces to the countries with lowest-low fertility, the total population of countries and regions with TFRs below 1.3 can be estimated in its peak period around 2002 at 700–900 million, or 11–14 percent of the global population in that year.

Quebec, Canada's second most populous province, is also notable for its low TFR, which reached a low point of 1.36 in 1987 but has since risen to 1.74 in 2008 (ISQ 2009). While Italy and Spain can be counted among the trend-setters in lowest-low fertility, some of their regions recorded a particularly early onset and long duration of lowest-low fertility and, subsequently, a remarkable and unexpected recovery (Billari 2008). Northern Italy experienced 23 years of the TFR below 1.3, starting in 1981, as compared with 12 years for Italy as a whole. The Northern Italian region of Emilia-Romagna, a showcase of very low fertility for most of the post–World War II period, recorded 25 years below 1.3, reaching a trough of 0.93 in 1987 (ISTAT 2009a). A recent reversal brought the TFR in Northern Italy, including Emilia-Romagna, to 1.45, a level slightly exceeding the TFR for Italy as a whole. Many regions of Spain first experienced lowest-low fertility in the second half of the 1980s, and by 1990 ten out of the 17 autonomous communities had a TFR below 1.3, with Asturia and the Basque region falling below 1.0. In seven of these regions fertility had rebounded above 1.3 as of 2008 (INE 2009c).[9]

As widespread as the turnaround in TFR has been, the magnitude of the increase from lowest-low levels has varied from small to pronounced (see Figure 3a). Spain and nine former Communist countries, including Russia and Ukraine, experienced a TFR increase of 0.30–0.45; in East Germany the TFR increased by 0.63, to reach 1.40 in 2008 (Table 1). This trend and the regional detail given above clearly show that many countries experiencing periods of very low TFR may later see a vigorous recovery. Interestingly, a number of the higher-fertility countries, including France, Sweden, and the United Kingdom, have also recorded a TFR increase of 0.3–0.4, that is, larger in absolute terms than the increases recorded in most of the countries that ever experienced lowest-low fertility (Table 1, Figure 3b). Thus, considerable regional diversity in fertility, as measured by TFR levels, remains in Europe (e.g., Frejka and Sobotka 2008).

FIGURE 3a Lowest total fertility rate recorded, by calendar year, and total fertility rate in 2008 in 26 countries that have ever had a total fertility rate below 1.3

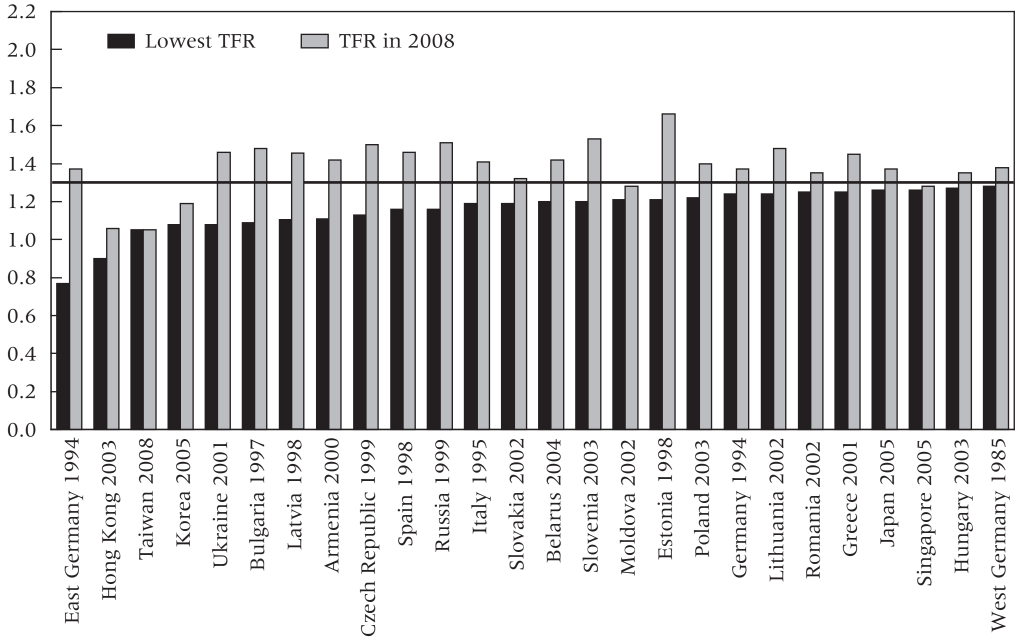
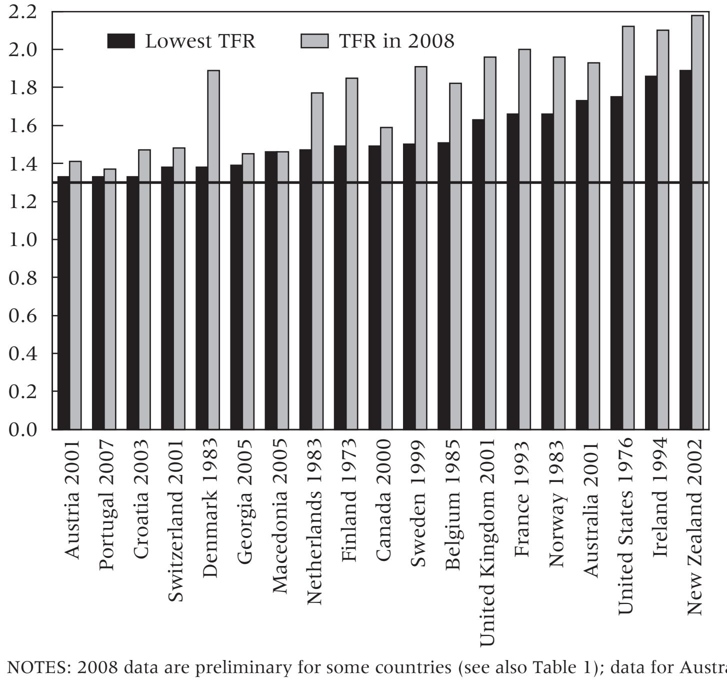


FIGURE 3b Lowest total fertility rate recorded, by calendar year, and total fertility rate in 2008 in selected other developed countries that have never had a total fertility rate below 1.3



NOTES: 2008 data are preliminary for some countries (see also Table 1); data for Australia, Canada, and the United States pertain to 2007.
SOURCES: See Table 1.

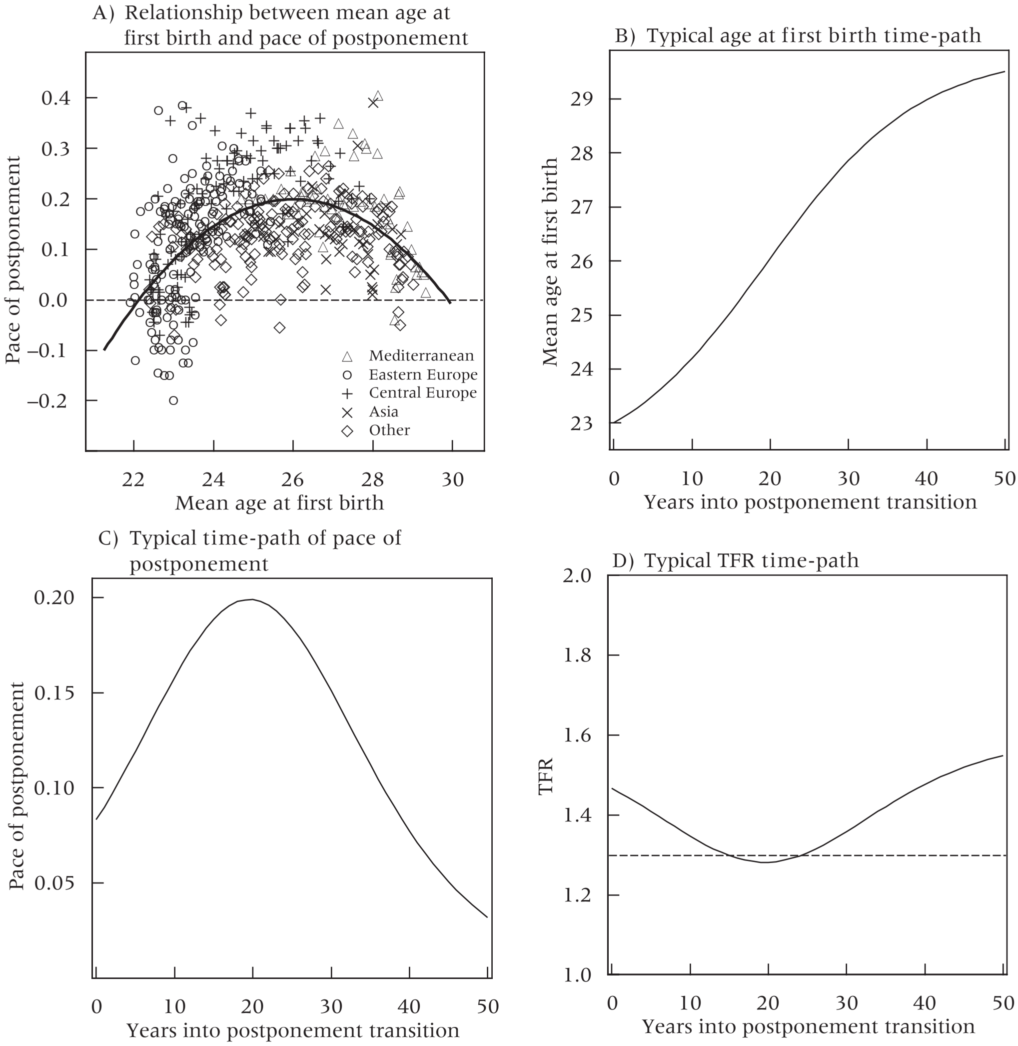
Tempo effects, postponement transitions, and the duration of lowest-low fertility

Almost without exception, low-fertility countries have been characterized by increasing average ages at motherhood. Demographers distinguish between two effects related to the changing timing of births. The popular notion of the biological clock—with women running out of time to have children—turns out not to be an important determinant of low TFRs: in low-fertility populations, even a relatively late onset of childbearing leaves most women with enough time to have the children they want (Goldstein 2006).[10] Instead, the major effect of later childbearing is a temporary depression of fertility during the time when ages of childbearing are changing (Bongaarts and Feeney 1998). This so-called tempo effect is proportional to the pace at which the average age at birth is increasing. When fertility postponement is fast, say at a rate of 3 months (one quarter) per year, the TFR will be depressed by 25 percent of the level that would have been observed in the absence of postponement. Gradual postponement—say at a month per year— will depress the TFR by about one twelfth.

To understand the emergence and end of lowest-low fertility, therefore, it is important to understand the time-path of the tempo of fertility postponement. The "postponement transition" described by Kohler, Billari, and Ortega (2002) emphasizes the social dynamics of a shift from younger to older average ages at motherhood. Once some women start postponing childbearing a bandwagon effect may come into play, encouraging other members of the population to follow.

The features of the postponement transition are shown in the panels of Figure 4. Panel A shows that postponement rates are low at young and old mean ages at birth but tend to be higher in between. Fitting a quadratic curve produces an estimate of the "typical" postponement transition. The coefficients of the quadratic curve provide constants for a logistic differential equation.[11] Solving this differential equation transforms the relationship between mean age at first birth and pace of postponement into statements about how the mean age at first birth and pace of postponement vary over time. In panel B, we show the trajectory of the mean age at first birth over the course of the postponement transition implied by the typical case. Panel C shows the pace of postponement—the slope of the curve shown in Panel B—that creates "tempo" effects. We see that large tempo effects are a short-lived feature of the longer postponement transition, which can last three to four decades (as measured by the period when the increase in the mean age at first birth surpassed one tenth of a year per calendar year). Panel D shows the implication of the time-path of the pace of postponement for a hypothetical population with a constant cohort TFR of 1.6. We see that this hypothetical population experiences lowest-low fertility (TFR < 1.3) for only about a decade, quite close to the duration of lowest-low-fertility spells shown in Table 1.

FIGURE 4 Typical postponement transition, as estimated from the observed relationship between mean age at first birth and the pace of postponement



NOTES: Pace of postponement is annual change (in years) in mean age at first birth. "Other" countries in Panel A are Denmark, Netherlands, Austria, Germany, Sweden, and the United States. The typical trajectory is estimated from the quadratic curve fitted to the data points in Panel A using the differential equation in endnote 11. Panel D assumes constant completed cohort fertility of 1.6.

Our model, though stylized, allows us to distill the essential features of the tempo transition: first, a shift from a low to a 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 generate lowest-low fertility in many low-fertility countries.

The role of tempo effects in explaining the increase in TFR

We analyze the role of the diminishing tempo effect in the recent turnaround in TFRs using Bongaarts and Feeney's (1998, 2000) tempo-adjusted measures of the TFR. The Bongaarts–Feeney approach allows us to decompose the change in the TFR into quantum and tempo effects. The approach, however, requires fairly strong assumptions to be made about the nature of postponement, in particular that in a given period all age groups postpone births by exactly the same amount. In practice, the method is more trustworthy when estimates are averaged over several years, and caution should be used when interpreting short-term variations in the tempo-adjusted TFR. Details concerning the computation of the tempo-adjusted TFR and the provisional nature of its estimates for the most recent year analyzed are described in the Appendix.

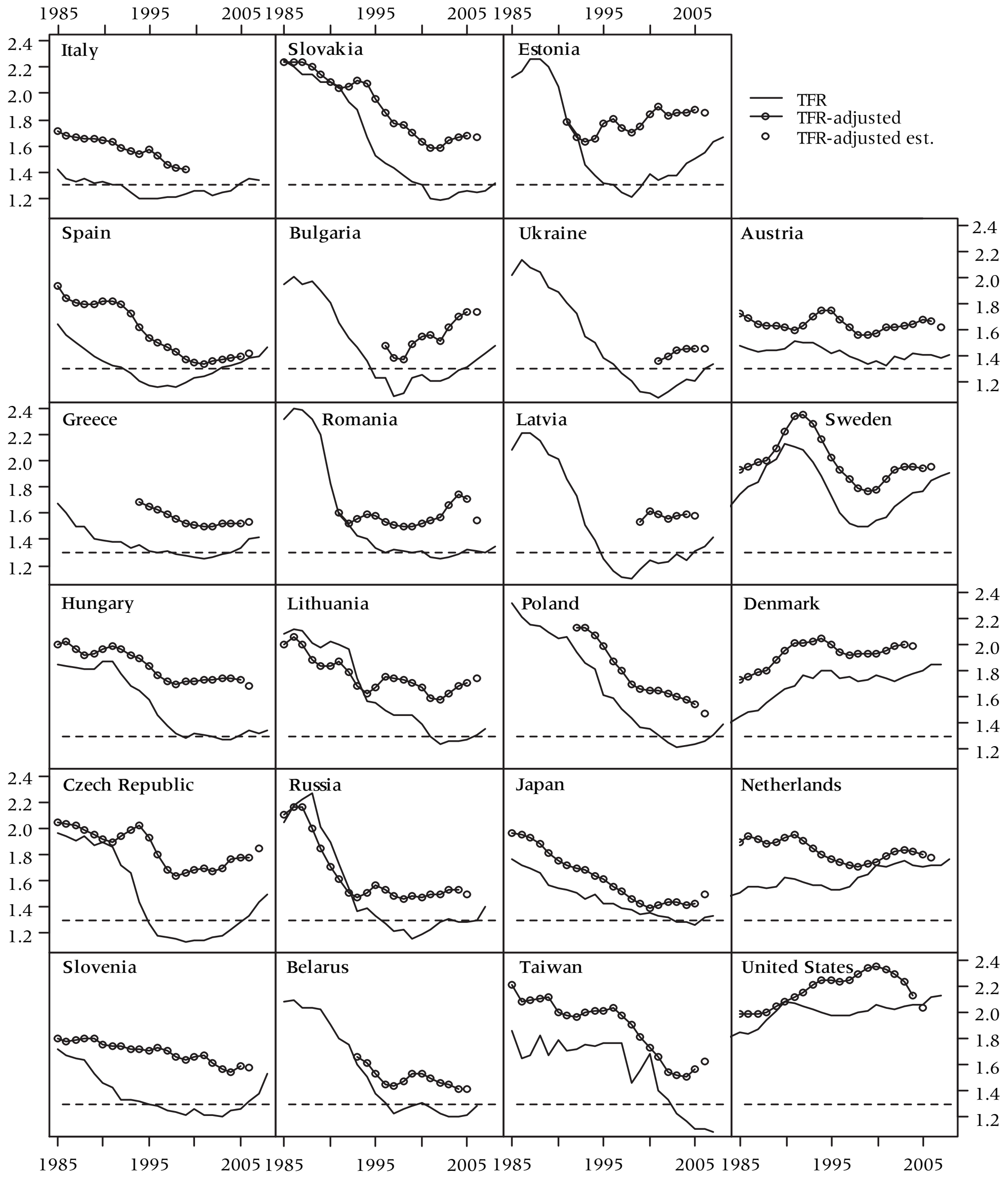
The tempo-adjusted TFR is intended to measure the level of fertility within a given period in the absence of postponement. As such, it aims to be a pure measure of period quantum. One can attribute an increase in the observed TFR to declining tempo effects if there is no accompanying increase in the tempo-adjusted TFR. On the other hand, if the observed and tempo-adjusted TFR rise in unison, then quantum changes can be held responsible.

The observed TFR and our tempo-adjusted estimates of the TFR are shown in Figure 5. Spain is an example in which the tempo-adjusted and observed TFR have converged in recent years, suggesting that a decline in the tempo effect—driven by the slowdown of postponement visible in women's mean age at birth—is responsible for the recent increase in the TFR. At the other extreme, Bulgaria has seen little slowdown in the rate of postponement over the course of the recent fertility increase, and so the tempo-adjusted TFR rises as fast as or faster than the observed TFR.

The share of TFR increase attributable to changes in quantum and tempo is shown in Figures 6a and 6b. In the large majority of cases some increase in fertility occurred as a result of a diminishing tempo effect. In some cases, such as Spain, Romania, and Slovenia, slowdowns in postponement appear to have been almost entirely responsible for recent increases in TFR. In a few other cases, such as Bulgaria, Lithuania, and Japan, however, the estimated effect of tempo changes is actually negative, with apparent increases in quantum being responsible for any rise in the TFR.

Our analysis of the rise in TFR in selected countries that never experienced lowest-low fertility shows that declining tempo effects largely contributed to this increase (Figure 6b). Declining tempo effects had a dominant role in the TFR increase in the United States, Netherlands, Norway, and Austria; roughly the same role as quantum increase in Sweden; and a smaller but important role (explaining about 40 percent of the TFR rise) in Denmark and Finland.

FIGURE 5 Total fertility rate and adjusted total fertility rate in lowest-low-fertility countries and selected other developed countries, 1985–2008



NOTE: Most recent data for the adjusted TFR, represented by open circles, are estimated (see Appendix.)
SOURCES: Own computations based on data from Eurostat (2009a, 2009b) and national statistical offices.

Further investigation of trends in the tempo-adjusted TFR provides two key insights. First, the tempo effect remains an important force lowering the TFR in all of the countries analyzed here except Spain.[12] Second, it is surprising that the tempo-adjusted TFR in a majority of countries we have examined increased after the year in which the lowest TFR was reached. This observation was unexpected in that the classic argument envisions that the TFR will 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 thus reduces the potential scope for the TFR increase linked to the end of fertility postponement. In practice, it appears that we often see the opposite—with increases in quantum accompanying TFR recovery.[13]

There are two competing explanations for the observed increases in the adjusted TFR. The first is to take the results of the Bongaarts–Feeney tempo-adjusted fertility rate literally as evidence that the intensity of childbearing really did increase over time. This increase in fertility could have resulted from a wide range of economic and social changes, some of which we discuss below. Similarly, one might also think the quantum measure suggests the level to which the TFR will return if and when postponement ceases. In this sense, the increases in the adjusted TFR are signals of higher future levels of TFRs, and perhaps even of higher completed cohort fertility.

The alternative is to take a more skeptical view of the Bongaarts–Feeney measures. The interpretation of the tempo-adjusted TFR as a pure quantum measure depends on all of the effects of changes in timing being controlled for in calculating the adjustment. Notably, the assumption of uniform postponement across all ages—a complete absence of cohort effects—can be critical (Kohler and Philipov 2001). Differential cohort behavior can be seen in the extent to which much of the recent upswings in TFR have come from increasing fertility at older ages. A possible explanation for the concentration of fertility increase at older ages is that we are witnessing the catching up ("recuperation") of births delayed by cohorts when they were younger (Lesthaeghe and Willems 1999; Lesthaeghe 2001; Frejka and Sardon 2009). When the postponement transition is driven by cohorts rather than periods, it is possible to observe apparent, but misleading, increases in the tempo-adjusted TFR as the postponement transition passes its peak.[14]

Nowhere are the tempo distortions in the TFR and the problems of interpreting such an erratic indicator as a measure of the underlying level of fertility more clearly visible than in its first-order component (Ryder 1990: 440). Should they remain constant, first-order TFRs recorded in many lowest-low-fertility countries between 1995 and 2005 would imply childlessness exceeding 40 percent. Such levels contrast with actual childlessness in Europe and East Asia, which remains in most countries below 20 percent among cohorts born in the late 1960s and early 1970s (Sobotka 2005; Frejka and Sardon 2006; Sardon 2006). Clearly, first-order TFRs in lowest-low-fertility countries reflect fertility postponement and parity composition effects in the 1990s and fail to indicate any plausible levels of what eventually will

FIGURE 6a Estimated contribution of tempo and quantum change to the increase in total fertility rate from its lowest level reached: lowest-low-fertility countries

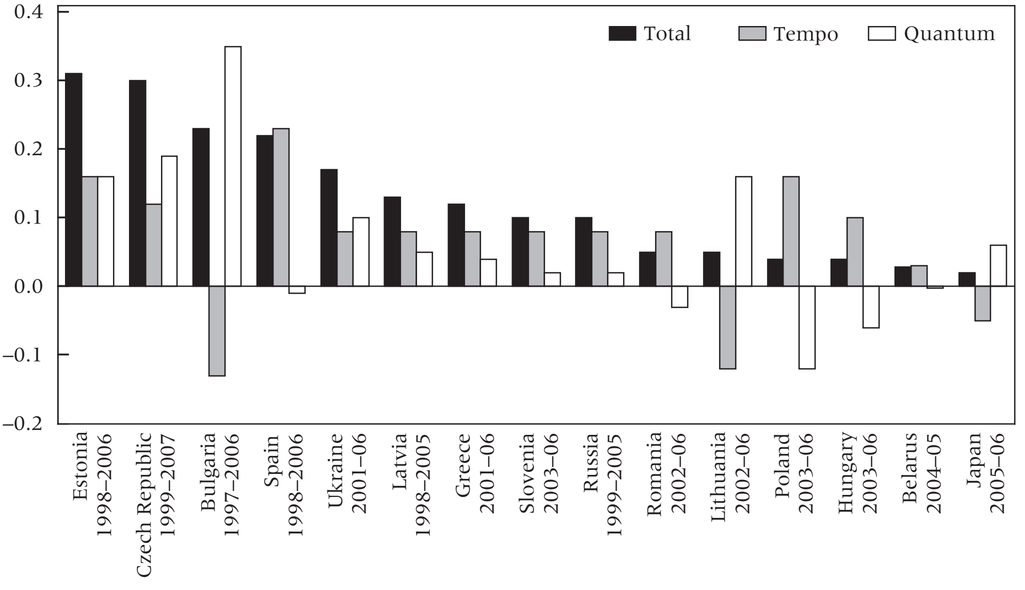
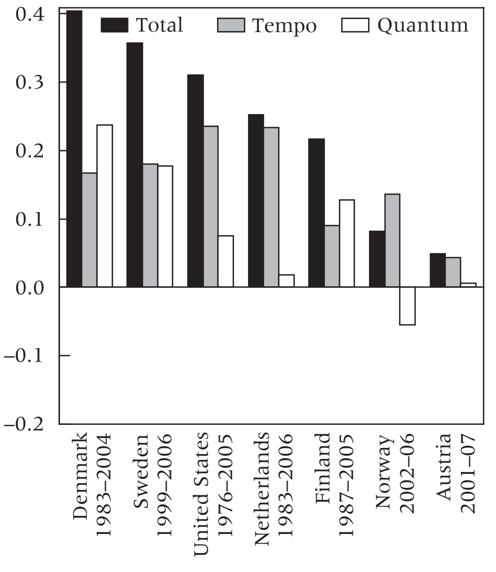


FIGURE 6b Estimated contribution of tempo and quantum change to the increase in total fertility rate from its lowest level reached: selected countries that never had a TFR below 1.3



NOTES: Data for Finland and Norway do not show a TFR change from its lowest level reached, but for a more recent period of TFR increase for which order-specific TFR data are available. To make the data as comparable as possible, three-year moving averages were used for both the TFR and the adjusted TFR. The adjusted TFR for the last year included was estimated using the procedure described in the Appendix.

be completed cohort first-birth rates. Some increase in the TFR would be expected solely because of a transitory depression and parity-composition distortions in first-order TFRs (see also Sobotka and Lutz 2009).[15] By analogy to a lowest-low TFR of 1.3, period first-order TFR levels below 0.75 can be labeled as lowest-low first-birth levels. A detailed analysis of trends in first births is available in Goldstein, Sobotka, and Jasilioniene (2009).

Our analysis of tempo-adjusted period fertility is generally supportive of the importance of declining tempo effect as part of the explanation for the recent turnaround in TFR. In many cases, a slowing of the pace of postponement has been instrumental for TFR increases. On the other hand, there are many examples where increases in quantum have driven TFR increases. Whether these increases are real or artifacts of the Bongaarts–Feeney adjustment method remains an open question. In any case, there is in almost all cases room for continued increase in the period TFR, if postponement slows even further.

Having described TFR increases in some detail, we now offer explanations for these increases, including a changing composition of the population owing to increased immigration, economic improvements, and pronatalist policy measures.

The contribution of immigrant women to rising total fertility rates

More affluent countries of Europe have experienced substantial immigration, especially in 2001–08 when the European Union saw net migration between 1.3 and 1.9 million annually, representing a net annual population gain of 0.3–0.4 percent (Eurostat 2006, 2008, and 2009b). Because immigrant women in most European countries have on average higher fertility rates than native women (Sobotka 2008; Coleman 2006; Haug, Compton, and Courbage 2002), fertility rates in many European countries may have been raised by the compositional effect of the rising share of higher-fertility immigrants. Although data on immigrants' fertility remain scarce in Europe, several studies have discussed this possibility in the case of England and Wales, France, Italy, Netherlands, and Spain (Héran and Pison 2007; Gabrielli, Paterno, and Strozza 2007; Tromans, Natamba, and Jefferies 2009; Sobotka 2008). In fact, however, the argument related to immigrants' fertility is relevant for only a small set of lowest-low-fertility countries in Southern Europe (Greece, Italy, and Spain), either because other countries with such low fertility experienced very limited immigration (East Asia, South-eastern Europe, Eastern Europe except Russia, and some countries of Central Europe), or large-scale immigration is very recent (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 immigrants' fertility.

All the larger countries in Southern Europe collect data on births to foreign citizens, which exclude immigrant women who have become citizens of their country of residence.[16] However, because mass immigration to Southern Europe is relatively recent, 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 good picture of immigrants' fertility. Only Spain's Statistical Office (INE) provides detailed birth and population data for foreign women covering most of the period of the rising TFR, starting in 1998. These data are particularly relevant because Spain experienced the largest level of immigration in Europe in the period 2000–08, with an estimated net immigration of 5.1 million (Eurostat 2009b).[17] Using the most recent data for Greece, Italy, and Spain, Table 2 compares the shares of births to foreign women and the TFR for foreign, native, and all women in 2005–07. A relatively large fraction of births, 15–17 percent, was attributable to foreign women, a substantial increase from fewer than 5 percent 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, and it has reached the 1.3 threshold in Spain. Therefore, without the contribution of foreign women, Greece and Italy would have recorded lowest-low fertility in 2005 and 2007, respectively; instead, the relatively high TFR of immigrants helped to push TFRs in those countries just above that 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.[18] In 1998, Spain's TFR was

TABLE 2 Percent of births to foreign women and total fertility rate for foreign, native, and all women in Greece, Italy, and Spain, 2005–07

	Greece 2005	Italy 2007	Spain 2006
Percent of births to foreign women	16.5	14.7	16.5
TFR			
Native women	1.24	1.28	1.30
Foreign women	2.12	2.40	1.70
All women	1.33	1.37	1.35
Net effect of foreign women on TFR	0.09	0.09	0.05

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

at its lowest recorded level of 1.16, recovering subsequently to 1.46 in 2007 (Figure 5 and Table 1). The TFR increase between 1998 and 2006 was largely driven by the rise in fertility rates among native women, whose TFR rose by 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 and contributed a very modest 16 percent to the TFR increase after 1998. This surprisingly small contribution resulted from a rapid fall in the TFR of foreign women, from 2.4 in 1998 to 1.7 in 2006. Provided that the data on the foreign population can be trusted,[19] such a fall in immigrants' fertility could be attributed either to a 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 residence, as observed in many other countries (e.g., Toulemon 2004; Andersson 2004). If foreign women retained the level of age-specific fertility seen in 1998, Spanish TFR would have increased to 1.44 in 2006 and the contribution of foreign women would have been considerably greater, although still not dominant (Table 3).[20]

In contrast to Spain, migrant women played a much more important role in raising the TFR in Italy. According to estimates by Gabrielli et al. 2007, a combination of their higher fertility and their rising 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 closely with the high TFR level recorded among foreign women in Italy in 2007 (Table 2). Also, in many Italian and Spanish regions that once experienced very low TFR levels, immigrants helped to raise that indicator close to or above the lowest-low levels.[21]

The evidence for some other countries in Europe that are comfortably above the lowest-low-fertility threshold and that have relatively good statis-

TABLE 3 Net impact of the total fertility rate of foreign women on the TFR in Spain, 1998–2006

	TFR			Net effect of	Percent of births
	Native	Foreign	Total	foreign fertility	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 TFR of foreign women remained constant at 1998 level	1.30	2.42	1.44	0.14	22.6

NOTE: Computations presented here show slightly lower TFR values (by 0.01–0.03 in absolute terms) than the Eurostat (2009a) data used in the comparative analyses.
SOURCE: Own computations based on INE (2009a and 2009b).

TABLE 4 Contribution of immigrant women to the rise of the total fertility rate in four European countries

	Denmark 2001–05[a]	England and Wales 2004–07	France[b] 1999–2004	Sweden 2002–07
TFR change				
All women	0.09	0.13	0.11	0.23
Native women	0.10	0.11	0.08	0.21
TFR change due to immigrants	–0.01	0.02	0.03	0.01
Percent change due to immigrants	–15	15	27	5

[a]Danish data are reported for 5-year periods centered around the years indicated (i.e., 1999–2003 and 2003–07).
[b]French data pertain to foreign women only and not to all immigrant women.
SOURCE: Own computations based on Statistics Denmark 2004 and 2008, Tromans et al. 2009, Héran and Pison 2007, and Statistics Sweden 2004 and 2008.

tics on migrant fertility indicates that the Italian case is not typical and that more countries resemble the Spanish case. An analysis of the recent increase in TFR in England and Wales, Denmark, France, and Sweden shows that it was largely caused by a rise in native women's TFR, whereas immigrants contributed less than one third to this increase (and only 5 percent in Sweden; their contribution was negative in Denmark, Table 4).

The effect of improving economic conditions on the end of lowest-low fertility

Difficult economic times preceded the fall to lowest-low fertility levels in many countries. In Eastern Europe, lowest-low fertility was precipitated by the economic and social shocks of the post-Communist transition. In Southern Europe, the recession of the early 1990s increased unemployment, particularly among young adults (e.g., Ahn and Mira 2001). Fertility decline in Japan intensified during the "lost decade" of the 1990s, and much of the later fertility decline in the rest of East Asia took place after the regional currency crisis in 1999. Just as the decline to lowest-low levels happened when economic conditions were difficult, the recovery has often coincided with economic growth. In this section, we investigate how much of the recent turnaround in low fertility can be explained by improving economic conditions and provide some predictions for effects of the current economic downturn.

To assess the importance of economic conditions for fertility trends, we gathered data on unemployment and GDP growth in 27 OECD countries from 1995 to 2008.[22] The sample includes lowest-low-fertility countries as well as the United States and other developed countries that never experienced such low fertility. We focus on the period since 1995 in order to include post-Communist countries of Central Europe for which comparable economic data were not available for an earlier period. Two variables, the unemployment rate (based on labor force survey data) and GDP growth, were used to identify the general economic conditions. We do not interpret the influence of unemployment on fertility behavior directly as the effect of being unemployed, but rather as signaling a general state of the economy, in particular employment security and prospects that a couple of childbearing age might face in the near future.

The results of our panel regressions are shown in Table 5. We used fixed country effects to control for unobserved variables that might influence the country-specific level of fertility or economic conditions. Logarithms of unemployment rates were used to account for the greater amount of change in economies with high unemployment. The unemployment rate and the rate of GDP growth were used to predict fertility in the following year.

Both unemployment and economic growth rates were found to be statistically significant predictors of the TFR, whether taken separately or in combination. The coefficient of –0.134 found for unemployment in the "combined" Model 3, for example, means that reducing unemployment from 10 percent to 5 percent would increase the TFR by 0.09 (computed as $-0.134 \cdot (\ln 0.10 - \ln 0.05)$). Thus, we calculate that such a large change in unemployment would have a measurable, but not large effect on TFR.

The apparent importance of economic conditions for the TFR upturn in the lowest-low-fertility countries is shown in Figure 7, where the observed increase in the TFR since its lowest level is compared to the TFR change predicted from the changes in unemployment and GDP using Model 3. In nearly all of these lowest-low-fertility countries, improving economic conditions seem to provide part of the explanation for the rise in TFRs. Economic improvement, as we measured it, appears to have played a larger role in Poland, Slovakia, and Spain and a smaller role elsewhere. On the other hand, the case of Hungary shows that fertility increase did occur even in the absence of measured economic improvement.

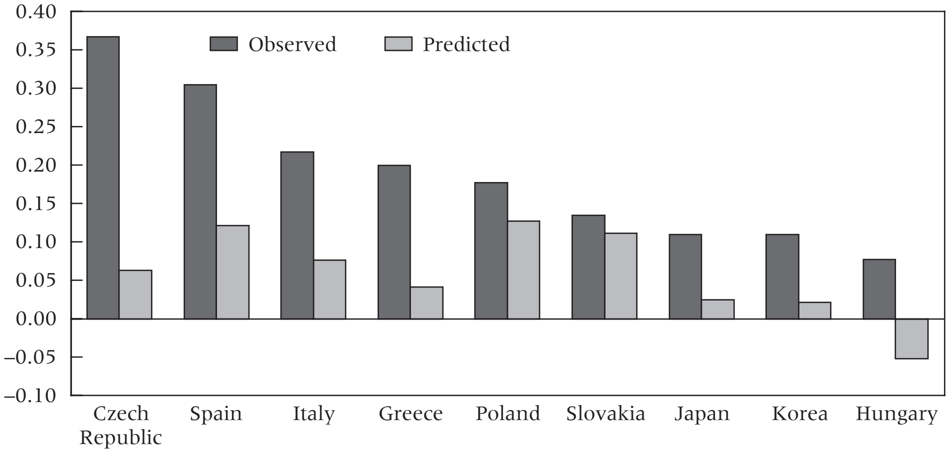
Our evidence of a pro-cyclical relationship in which difficult economic conditions lead to low fertility and improved economic conditions lead to

TABLE 5 Relationship between economic conditions and the total fertility rate, 1995–2008: Results of panel regressions for 27 OECD countries (coefficients and standard errors)

	Model 1		Model 2		Model 3	
	Coeff	SE	Coeff	SE	Coeff	SE
Unemployment rate (*ln*)	–0.136	(0.017)			–0.134	(0.016)
GDP growth			0.007	(0.003)	0.006	(0.003)
Constant	1.830	(0.031)	1.549	(0.010)	1.804	(0.033)

NOTES: One-year time lag is assumed between the economic indicators and TFR change. See text for interpretation of coefficients.
SOURCE: OECD database.

FIGURE 7 Rise from lowest total fertility rate reached since 1995 to TFR observed in 2008 and predicted from economic conditions (unemployment and GDP change), selected OECD countries (based on Model 3 in Table 5)



NOTE: One-year time lag is assumed between the economic indicators and TFR change.
SOURCE: Economic variables from OECD database.

increased fertility is in line with previous research (e.g., Macunovich 1996; Ahn and Mira 2001; Kravdal 2002; Adsera 2005; see Sobotka, Skirbekk, and Philipov 2009 for a review). Higher levels of aggregate unemployment have been repeatedly found to depress fertility levels, even when the individual employment situation was controlled for (Adsera 2004 and 2005; Kravdal 2002; d'Addio and d'Ercole 2005).

The recent worldwide economic slowdown provides a good test. If short-term fluctuations in the economy have a noticeable effect, as suggested by our model, then we should expect some declines in TFRs. The OECD (2009: 61) has estimated that unemployment will increase in member countries from 5.6 percent in 2007 to 9.9 percent in 2010. This increase would—using the same estimate as in Model 3 above—produce a decline in the TFR of about 0.08, pushing the TFR beneath the lowest-low threshold in a few cases such as Japan. Countries with a sharp rise in unemployment rates, including Spain and the Baltic states, may be particularly affected. Such calculations are clearly speculative, however. There is great uncertainty both in the forecast of future unemployment and in the effect of its change on the TFR in individual countries.[23] Still, if we accept the magnitudes of these estimates, it would seem reasonable to expect yet another, although temporary, reversal of TFR in a number of low-fertility countries. But unless the economic recession triggers a long-lasting acceleration of fertility postponement—something we regard as unlikely—we would expect TFRs to rise again once economic conditions improve and the trend toward decelerating postponement resumes.

Did policy play a role in the rise in fertility?

Low fertility has increasingly become a matter of policy concern for the governments of many developed countries as well as for the European Union as a whole (European Commission 2005). Judging from the policy monitoring reports published by the United Nations, the governments of all countries that 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 the 22 lowest-low-fertility countries listed in the UN publications—almost twice as many as in 1996 or 2000 (UN 2001, 2004, 2006, 2008). Such a unanimous consensus across a broad group of countries is striking, and it indicates a wide government-declared acceptance of pronatalism in both Europe and East Asia. If we broaden our analysis to include countries where the TFR ever fell below 1.4 (see Table 1), only two, Cuba and Denmark, declared in 2007 that their fertility is satisfactory and embraced policies of "no intervention"; in addition, Switzerland had no policy to raise its fertility. There appears to be some delay, however, in government responses to very low fertility. In several countries, including Spain, pronatalist views were embraced only after the TFR had rebounded above the lowest-low level.

A variety of new policies have been introduced in the lowest-low-fertility countries with the goal of stimulating higher fertility. By way of example, we explore policy initiatives that have been taken in six countries and their timing with respect to the fertility reversals and discuss whether they could have played a part in that reversal. We look at Spain, three former state-socialist countries, the Czech Republic, Estonia, and Russia, and two Asian societies, Japan and Singapore. Our tentative findings suggest that (i) there are instances where policies seem to be plausibly related to the rise in fertility (Estonia in 2004 and Russia in 2007); (ii) there are cases where fertility gains appeared in the absence of any major policy changes (Spain before 2007, Russia in 2000–04), or where policies were instituted after the rise in fertility started and thus had no obvious role in initiating it (Czech Republic); and (iii) there were policies that do not seem to have had any discernible influence on fertility (Singapore and, until recently, Japan). Similarly contrasting evidence pertains to the higher-fertility developed countries. At least in some of them, including Australia and the United Kingdom, new policies were enacted before a significant rise in the TFR began.

To encourage families to have more children, Spain launched a financial incentive scheme in 2007, when the parents of each newborn or adopted child became eligible for a generous bonus of 2,500 Euros. There was no obvious immediate effect on fertility trends: the TFR increased only slightly in 2007 (by 1 percent), broadly in line with an upward trend established since 1999. Plausibly, the larger TFR increase in 2008 (5 percent), double the rate of increase in Greece, Italy, and Portugal, might be partly explained by this new incentive. Baby bonuses of a type similar to Spain's were also introduced in Australia, Singapore, and Russia, and it seems that they had some—although probably temporary—effect. For example, a baby bonus was introduced in Australia 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" (Lattimore and Pobke 2008).

Estonia experienced one of the largest TFR increases among the countries examined here, from 1.28 to 1.66 between 1998 and 2008. It is plausible that newly adopted policies contributed to this rise. Estonia repeatedly modified the levels and eligibility criteria for its family benefits schemes. An important change in Estonian family policy took place in 2004 when a parental benefit was introduced to compensate for the income lost by the parent staying at home with children (sometimes called "mother's salary"). A concurrent noticeable rise in the TFR was observed in 2004 (by 0.09 as compared to 2003) at all birth orders, and the upward trend persisted into later years (see Figure 5).

In the Czech Republic, a shift in family policy occurred when the new government following the 1998 election placed a sharper focus on family issues. The TFR dropped to its all-time low of 1.13 in 1999. Since then the promotion of family-friendly policies has begun to play a significant role in the political competition for votes of the electorate. For example, shortly before elections in 2005, parliament agreed to double the birth allowance as well as the parental leave benefit (Sobotka et al. 2008). However, no clear relationship between family policies and fertility increases can be established: the TFR in the Czech Republic started rising steadily after 2003, well before the more generous system of birth allowances and parental leave benefits was introduced in 2007.

Russia has a long history of pronatalist policy measures. A comprehensive package, broadening childcare options for working mothers, was introduced in the early 1980s (see Zakharov 2006 and 2008). These policies had a pronounced, though temporary, effect on the TFR (Avdeev and Monnier 1995; Zakharov 2006, 2008). No further major changes in family policy were implemented until 2007 when new policies led to significant increases in various benefits and the introduction of so-called maternal capital.[24] The almost immediate upturn in TFR suggests that the new policies had their intended effect. The TFR, which was rising slowly before 2007, jumped from 1.30 to 1.51 between 2006 and 2008. However, at least part of this rise may be attributable to the effects of the positive economic situation at the time, as the

TFR in the same period rose rapidly also in neighboring Belarus and Ukraine, countries that did not implement vigorous pronatalist measures.

To reverse the decline in its fertility, starting in the early 1990s Japan enacted numerous pronatalist policies and programs supporting childcare and parental leave (e.g., Ogawa 2003). Through introducing parental leave, expanding childcare services, and similar measures, the government aimed to facilitate childbearing among working married women (Retherford and Ogawa 2006). Nevertheless, for some time, Japan along with Singapore has been referred to as an example of 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 the failure to achieve a more family-friendly environment in workplaces.

Singapore started introducing pronatalist policies in the 1980s. The objective was not only to raise fertility, but also to reduce fertility differentials by education. The government was concerned about extremely low fertility among highly educated women and much higher fertility among those with the least 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 poorly educated women from having larger families by offering sterilization bonuses (Yap 2002). This selectively pronatalist approach was unsuccessful, as only a small effect on fertility was seen after the introduction of new policies. In addition, the government offered baby bonuses for the second and third child, but these incentives seem not to have produced appreciable results so far.

Much more research is needed to examine all aspects of newly introduced policies and to disentangle the policy effects from other determinants of fertility. Policy change and economic change both follow a path. For policy, a problem is discovered, reactions to it are considered, and some time passes before new policies are established, let alone influence behavior. For economics, each downturn is eventually followed by an upturn. The postponement of the timing of childbearing also appears to have a rhythm: the pace of postponement starts slowly, accelerates, and then decelerates as a new equilibrium is reached. A difficulty in drawing inferences about the effect of economic and policy change on fertility is that the timing of these changes may coincide with the end of the postponement of childbearing to later ages.

Conclusions

We asked at the beginning of this article whether the era of lowest-low fertility has ended. Our answer is yes: it appears that the widespread decline of TFRs to very low levels that began in many parts of Europe and East Asia in the early 1990s is nearly over, at least in Europe. The clear message of our analysis confirms Morgan's (2003: 599) conclusion that "lowest-low fertility is not our inevitable destination and demise." In Europe, from the Atlantic to the Urals, only one lowest-low-fertility country—Moldova—remained as of 2008.[25] In East Asia, Hong Kong, Korea, and Taiwan still recorded fertility rates below 1.2 in 2008, but Japan's TFR has risen above the 1.3 threshold. Many provinces of China, most of them well above the population size of an average European country, probably experience sustained lowest-low fertility, but reliable data are unavailable and lowest-low fertility there may be largely dictated by strict government policies promoting one-child families.

The increases in fertility between the year when a country's TFR dropped to its lowest point and 2008 have ranged from slight to substantial. The average TFR in formerly lowest-low-fertility countries is now slightly above 1.4. This is still a very low 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. If anything, the cross-country differences have actually broadened, as many of the higher-fertility developed countries have also seen substantial increases in TFR since the late 1990s. This is a new and rather unexpected situation: for the first time since the baby boom of the 1960s there has been a parallel increase in the TFR across the whole of the developed world. A few industrialized countries, including the United States, have achieved TFR levels around the replacement threshold, levels not previously recorded since the 1970s. This evidence even lends some support to an optimistic interpretation of future fertility in the most developed countries: Myrskylä, Kohler, and Billari (2009) proposed that in these countries further economic development and prosperity may stimulate a modest increase in fertility rates.

For most of the formerly lowest-low-fertility countries, the period of TFRs below 1.3 is behind them because the postponement transition has begun to run its course. For the time being, therefore, the fear of an accelerated downward spiral of fertility seems unsubstantiated. Fertility postponement continues in most developed countries but at a decelerating pace. The importance of the tempo effect for explaining lowest-low fertility has three implications. First, although lowest-low-fertility countries have many characteristics contributing to their low fertility and distinguishing them from their neighbors that never recorded such low fertility, none of them would have experienced extended periods of lowest-low fertility without a decisive downward pressure exerted by tempo effects. Second, lowest-low-fertility countries still have room for the TFR to increase as postponement continues to slow and eventually to stop. Completed cohort fertility rates of younger women in lowest-low-fertility countries will not be known for some time, but the fertility of cohorts born around 1970 tends to exceed 1.5 in nearly every case. We expect nearly all lowest-low-fertility countries to have completed cohort fertility rates in the range of 1.5 to 1.8. Third, an extended re-emergence of lowest-low fertility is likely to require a new acceleration, not just a continuation, of postponement.

The period of lowest-low fertility in Europe typically lasted less than a dozen years. The rather short-lived nature of lowest-low fertility is consistent with what we would expect from a postponement transition from early to late childbearing and the accompanying depression in TFRs attributable to tempo effects. Moreover, the postponement transition appears to consist of an acceleration and deceleration of postponement over its course. Although postponement can last for three or four decades, perhaps even five, the period of rapid postponement, usually concentrated halfway through this course, is much shorter. Because the end of lowest-low fertility corresponds not to an end in postponement but rather to a reduction in its pace, almost all of the formerly lowest-low-fertility countries continue to have tempo-adjusted TFRs that are higher than observed TFRs. Unless these are due to artifacts in the measurement of tempo-adjusted TFRs, considerable room remains for TFRs to rise in most of these countries even after they exceed the level of 1.3.

What would be required for fertility rates to fall once again? With the world experiencing a widespread economic downturn, birth rates could fall again in many of the formerly lowest-low-fertility countries. However, we expect this fall in fertility, if it occurs, to be temporary, lasting as long as the economic downturn persists but not inducing a prolonged resurgence of fertility postponement.

We saw that tempo distortions provide an explanation of lowest-low fertility and play a key role in recent TFR reversals in the majority of developed countries. Favorable economic conditions, as exemplified by declining unemployment rates and economic growth, also helped to push TFRs upward and were correlated with an end of lowest-low fertility. In some countries, recent TFR increase is plausibly linked to specific government policies, while in others the turnaround in TFRs occurred only after repeated and fruitless rounds of pronatalist policies. A clear outcome of the experience of lowest-low fertility is a change in the attitude of governments, with an almost universal belief emerging within lowest-low-fertility countries that fertility rates were too low.

We found immigration to be a plausible factor contributing to the increase of TFRs in Greece, Italy, and Spain. However, our analysis suggests this effect was not large: although it helped to raise Greek and Italian TFR slightly above the lowest-low threshold around 2005, fertility rates were also increasing among native women in these countries. In any case, migration of higher-fertility migrants was clearly not a universal factor in the end of lowest-low fertility, simply because most Eastern European and East Asian countries that experienced TFRs below the 1.3 threshold had negligible immigration.

Our brief analysis of the TFR rise in developed countries with higher TFRs shows broad similarities with the group of lowest-low-fertility countries in the factors underlying increasing TFRs. In the countries with higher TFRs that we analyzed, disappearing tempo effects were an important, often a major, factor in the increase of the TFR. In many of them, other explanations were important as well. Obviously, the rise in TFRs in Europe, East Asia, North America, and Australia and New Zealand resulted from the combined effect of several factors, including economic growth, pronatalist and other family policies, declining tempo effects, higher immigrants' fertility in some cases, and also other factors not analyzed here. The major difference distinguishing countries that ever experienced lowest-low fertility from those that never did was found either in their underlying lower TFR level (net of the tempo effect) (especially in Southern Europe, Eastern Europe, and East Asia) or in their more intensive postponement of childbearing and stronger tempo effects (especially in Central Europe), or a combination of both factors (especially during the period of lowest-low fertility).

The end of widespread levels of extremely low TFRs does not mean an end to the need to analyze the determinants of fertility trends in the developed world. We conclude by mentioning some of the topics we feel need more study. First, we need to learn more about the relationship between economic conditions and fertility rates, including whether births are postponed during difficult economic times or forgone altogether. A related issue 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 (Adsera 2004).

Second, more demographic modeling is needed to address the issues of differential cohort postponement and recuperation and the measurement of tempo effects. One area of research emphasizes the prominence of period factors in driving fertility change (Ní Bhrolcháin 1992); this view is also explicitly adopted in the tempo-adjustment method of Bongaarts and Feeney (1998). A competing view stresses the prominence of a cohort-driven process of fertility recuperation (e.g., Lesthaeghe and Willems 1999; Frejka and Sardon 2009). Taking this cohort perspective, one can possibly interpret the recent increase in the TFR as a cohort-driven process in which the fertility of older cohorts is "recuperating" at the same time that younger cohorts have stopped postponing. Such a cohort-driven postponement transition needs to be studied formally in more detail, perhaps leading to an expansion of the period-postponement framework.

Third, more research should be conducted on alternative period fertility indicators that can complement and even substitute for 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 ascertained. In terms of the number of births during these years, the question of how much of the decline was due to tempo effects is largely irrelevant. The fact is that generations of small cohorts were born in a large number of countries around the world. What will be the consequences of smaller generational size for education, labor markets, marriage, and parenthood, and also for the size of future generations resulting from somewhat higher fertility rates?

Some final words of caution are also in order. First, it is possible that present levels of low TFRs, reflecting data through 2008, may prove to have been a temporary high-water mark and that the current economic downturn will be severe enough to induce a resumption of the trend toward low TFRs. We would be surprised if this occurred. Second, we have largely emphasized the role of postponement in creating very low TFRs and in setting the stage for their recent recovery. But readers 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 countries analyzed here 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 end up at comparatively very low levels in many countries.

With these caveats in mind, we feel that the bulk of evidence to date points to a recovery of TFRs well above lowest-low levels. The prominent forecasting agencies such as the United Nations and Eurostat are likely to be right in their medium variant assumption that TFR levels in most countries will rise to 1.5 or above in the decades ahead. The fear of an accelerated downward spiral of fertility, articulated on numerous occasions over the last decade, seems unsubstantiated.

Appendix: Estimation of the adjusted TFR and the estimated adjusted TFR in the last year of observation

The adjusted total fertility rate (adjTFR) is computed as a sum of order-specific adjusted total fertility rates (adjTFR_i), which take order-specific changes in the mean age of fertility schedule, $r_i(t)$, as an adjustment factor:

$$adjTFR_i(t) = TFR_i(t)/[1-r_i(t)].$$

Following Bongaarts and Feeney (2000: 563, fn. 1), this is estimated as follows:

$$r_i(t) = [MAB_i(t+1) - MAB_i(t-1)]/2,$$

where $MAB_i(t)$ is the mean age at birth order i, calculated from unconditional age- and order-specific fertility rates.

To increase stability in the time series of the adjTFR, which displays large annual fluctuations (e.g., Sobotka 2003), we use a 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 through 3 and the ordinary TFR for birth orders 4+:

$$adjTFR(t) = adjTFR_1(t) + adjTFR_2(t) + adjTFR_3(t) + TFR_{4+}(t).$$

This method 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 the tempo effect in fourth and higher-order fertility rates, the resulting error is negligible, as such births constitute only a small portion of births in low-fertility countries (typically less than 10 percent) and fertility postponement is least pronounced for high-order births (partly because these births often take place at late reproductive ages when there is consequently less scope for their further postponement).

By applying the Bongaarts–Feeney adjustment, we lose the last year of the time series, and we lose another year by using a three-year moving average. To obtain more recent data for our analysis of fertility trends, we developed a simple procedure that allows us to estimate the adjTFR for an additional year. First, we calculate a "crude adjTFR" using $r_i(t) = MAB_i(t) - MAB_i(t{-}1)$. This method alone is fairly unreliable, and our analysis of past data suggests that there can be huge instability in this indicator. To improve the last-year estimate slightly, we smooth it by computing an average of the last two full observations combined with this very last point:

$$adjTFR(est)(t) = [adjTFR(t{-}1) + adjTFR(t) + crude\_adjTFR(t{+}1)]/3.$$

We emphasize, however, that the adjTFR(est) is a provisional estimate pertaining to the most recent year of observation only. Therefore it is plotted separately in all country graphs in Figure 5.

Notes

An earlier, extended version of this article containing supplementary analyses and appendixes is available as a working paper (Goldstein, Sobotka, and Jasilioniene 2009). Previous versions of this article were presented at the 2009 Annual Meeting of the Population Association of America, Detroit, 30 April – 2 May and at the XXVI IUSSP International Population Conference, Marrakech, Morocco, 27 September – 2 October 2009. We thank Deniz Karaman Oersal for research assistance on the influence of economic conditions, Trifon Missov for mathematical assistance, session organizers, Hans-Peter Kohler and Francesco Billari, and colleagues who gave us comments, especially John Bongaarts, Tomas Frejka, Ron Lesthaeghe, Wolfgang Lutz, and Kryštof Zeman.

1 The term lowest-low fertility, introduced by Kohler and colleagues, has been subject to criticism. Early readers of this article objected to our use of the term. It is clear that there is no natural lowest limit to fertility, so the term does not refer to the lowest fertility that can be attained. Further, if the term is used only to designate the fertility rates seen among the lowest of the low-fertility countries, then it has a shifting meaning that does not correspond to an absolute cutoff below 1.3. However, we feel that the classification of populations with TFRs less than 1.3 is a meaningful one that identifies a phenomenon of period fertility that is far below replacement. One might wish that Kohler and colleagues had used a different term, but it is difficult to invent a better one: "extremely low fertility," "far-below-replacement fertility," "sub-sub-replacement fertility," and "ultra-low fertility" may all convey the same meaning but are not clearly better, and certainly none has the same catchiness.

2 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».

3 Although our article mostly focuses on lowest-low fertility, we also refer here to research that is concerned with "very low fertility" or "extreme low fertility" without making explicit reference to the TFR threshold of 1.3.

4 The population of all countries that have experienced a period of lowest-low fertility after 1980 amounts to 715 million in 2008.

5 Our list of very-low-fertility countries would not change much if we included all countries that have experienced a TFR below 1.5, seen by McDonald (2006) as marking a divide between countries with very low fertility and those with moderately high fertility.

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

7 Different estimates of the TFR in China around the time of the 2000 population census range from 1.22 to 2.3 (Lutz et al. 2007), with estimates by a number of experts converging at 1.4 to 1.6 (e.g., Retherford et al. 2005; Zhang and Zhao 2006; Morgan, Guo, and Hayford 2009).

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

9 Catalonia, the fourth richest and second most populous autonomous region in Spain (population 7.2 million in 2007), saw a particularly strong upturn in TFR from 1.15 in 1996 to 1.58 in 2008 (INE 2009c).

10 Estimates from data on twins, for example, show that delaying fertility by a year reduces completed fertility by only about 3 percent (Kohler, Skytthe, and Christensen 2001).

11 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.

12 The analyzed data for 15 countries are shown in Appendix 3 of our working paper (Goldstein, Sobotka, and Jasilioniene 2009). It is likely that the adjusted and the observed TFR have also converged in Italy. In the past three decades, trends in fertility tempo and quantum in Italy and Spain were remarkably similar.

13 An example from Denmark illustrates this point. In 1983, when the TFR reached a low of 1.38, the adjusted TFR was 1.75. Thus, an analyst expecting that fertility quantum, as measured by the adjusted TFR, 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 1.76, but in the meantime the tempo-adjusted TFR increased to 2.0, signaling a hypothetical scope for further increase in the TFR. However, some portion of the apparent quantum increase as measured by the adjusted TFR might be attributable to the fluctuations that are inherent in this indicator and that may reflect a violation of its underlying assumptions.

14 A simple example illustrating this effect is discussed in Appendix 6 of our working paper (Goldstein, Sobotka, and Jasilioniene 2009).

15 Parity composition distortions in the TFR are attributable to changes in the parity composition of women of childbearing ages. During the course of fertility postponement, the number of childless women at younger (and later also at older) reproductive ages rises rapidly, affecting the order-specific TFR, which does not control for parity distribution. In contrast, parity-specific fertility indicators such as the PATFR index (which controls for parity and age) (Rallu and Toulemon 1994) are affected by tempo distortions, but not by the parity composition effect.

16 Official statistics in many European countries do not collect data on immigrants (i.e., all persons born abroad), but on persons with foreign citizenship. This category is prob-

lematic, as it serves only as a crude approximation of the number of immigrants and their fertility behavior: it excludes all immigrants who obtained citizenship of their country of residence or were already born with it. However, in the absence of data on immigrants, we use data on foreign citizens instead, especially for Southern Europe where massive immigration is a relatively recent phenomenon and where until now only a few migrants received the citizenship of their resident countries.

17 Italy's statistical office has published data on the age structure of foreign residents only since 2004, and the statistical office of Greece has collected vital statistics data by citizenship only since 2005 (Tsimbos 2008).

18 For detailed and informative analysis of the fertility of immigrants in Spain see Roig Vila and Castro Martín 2007.

19 Gabrielli, Paterno, and Strozza (2007: fn 12) discuss the possibility of an inconsistency in Spain between the birth registration system and the municipal registration system of the foreign population, especially with respect to illegal and unregistered migrants. Such inconsistency can lead to erroneous estimates of fertility trends and levels among foreign women.

20 Even with their more modest contribution to fertility, foreign women have an appreciable influence on age-specific patterns of Spanish fertility. Their young childbearing schedule, peaking at age 22, contrasts strongly with the schedule of Spanish women that peaks at age 32 and raises fertility rates markedly at ages 18–27 (more detailed analysis available from tomas.sobotka@oeaw.ac.at).

21 In the case of the Italian region of Emilia-Romagna, discussed above, native women have contributed more than foreign women to the recovery of the TFR from the low of 0.94 in 1987, but the contribution of immigrants helped to push the TFR well above the lowest-low threshold. While native Italian women living in this region recorded a TFR of 1.27 in 2007, the fertility of foreign women had a net positive effect of 0.18 on the overall TFR of 1.45 (ISTAT 2009b, Table 2.9).

22 The following countries were analyzed: Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Korea, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovakia, Spain, Sweden, Switzerland, Turkey, United Kingdom, and United States.

23 This effect will be modified by country-specific institutional factors, and, in some cases when parental leave policies or welfare support are generous, the period of economic downturn may actually stimulate more women to take advantage of temporary non-employment and have children. Such an unexpected reaction to economic recession was observed in Finland in the early 1990s (Vikat 2004).

24 The "maternal capital" is 250,000 roubles (5,560 Euros as of March 2009). It is paid once in a mother's lifetime, and she can begin to use the money three years after 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).

25 Moldova has experienced massive emigration in the last 15 years, and it is estimated that up to one quarter of its population has lived abroad, at least temporarily (IOM 2008). Therefore, the official fertility data should be assessed with caution. It is possible that Moldova's lowest-low fertility is an artifact of computing fertility rates on the basis of inflated population data that do not properly account for emigration.

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