Is Lowest-Low Fertility in Europe Explained by the Postponement of Childbearing?

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When the period total fertility rate fell below the replacement level in the majority of European countries in the 1970s and 1980s, appropriate demographic terminology was readily available: "low fertility," "below-replacement fertility," and "sub-replacement fertility" soon became the keywords describing European fertility trends. The unexpected decline of total fertility rates to levels close to 1.0, experienced by an increasing number of European societies over the 1990s, has revealed the need to discriminate between different levels of below-replacement fertility. Recently, Kohler, Billari, and Ortega (2002) have proposed the term "lowest-low fertility" to denote a total fertility rate (TFR) of 1.3 or below and offered a detailed analysis of this phenomenon. This is a somewhat arbitrarily selected level, distinguishing between the extremely low TFR reached in many countries of Central, Eastern, and Southern Europe in the 1990s and the somewhat higher TFR in Western and Northern Europe. Persistent low and very low levels of period fertility are to a large extent coupled with the postponement of childbearing, which has gradually spread to all regions of Europe. In fact, the effects of the increasing age at childbearing form a crucial part of the explanation of lowest-low fertility as well as of the relatively large differences in the TFR level between European countries and regions.

That the shifts in the timing (tempo) of childbearing may cause considerable fluctuations in period fertility rates has been known at least since Hajnal's (1947) analysis of changes in period fertility in a number of European countries following the baby bust of the 1930s. High fertility of the baby boom era between the mid-1950s and the mid-1960s was in many countries of Western and Northern Europe partly driven by the advancement of childbearing to younger ages of women. However, the unprecedented pace and duration of the current postponement of childbearing, which in many European countries has been progressing for more than three decades, challenge traditional approaches to fertility analysis and raise many questions. How are we to interpret the conventional TFR, considering that it may provide misleading impressions about the underlying level and trend in period fertility quantum?[1] Is lowest-low fertility a temporary phenomenon or is it likely to become a permanent feature of many low-fertility countries?

A growing number of contributions have addressed the effects of increasing age at childbearing on period fertility in developed countries (see e.g., Lesthaeghe and Willems 1999; Lesthaeghe 2001; Philipov and Kohler 2001; Bongaarts 2002; Kohler, Billari, and Ortega 2002; Smallwood 2002a; Lutz, O'Neill, and Scherbov 2003; Sobotka 2003a; UN 2003). Most researchers studying European fertility trends agree that current TFR levels across Europe are distorted by tempo effects and that some recovery is likely in the future; at the same time they are skeptical about the possibility of a TFR increase to the replacement level. Nevertheless, the extent of the tempo distortions and the potential scope for a recovery of period fertility remain disputed, and some scholars envision only a very limited recovery of fertility rates (e.g., Frejka and Calot 2001 in their analysis of cohort fertility trends). In many countries, the range of possible total fertility levels between the two poles—sustained extremely low fertility levels on the one side and a TFR recovery to replacement level on the other—is large and implies vastly different consequences in terms of population structure, size, and the pace of population aging. Based on the most extensive estimate of tempo effects to date, compiled by Bongaarts (2002) for 19 industrialized countries, Lutz, O'Neill, and Scherbov (2003: 1991) assumed that the postponement of childbearing depressed the period TFR in the countries of the European Union by 0.3 births per woman and predicted that the end of the fertility delay would therefore result in a recovery of the current TFR level from 1.5 to 1.8.[2] However, in the absence of data, Bongaarts's analysis omitted some of the most populous European countries, namely France, Germany, Ukraine, and Great Britain. It looked at the period 1990–97, which was characterized by a strong shift both in fertility quantum (considerable decline) and in timing (the onset of the postponement of childbearing) in the post-communist countries of Central and Eastern Europe (see Sobotka 2003b) and therefore might have masked substantial shifts over time. Furthermore, calculations of the tempo-adjusted TFR were partly based on estimated data for birth orders two and higher (see appendix in Bongaarts 2002).

This study goes beyond the focus of existing studies and addresses the issue of tempo distortions on a European scale. It employs a relatively simple procedure for estimating the adjusted TFR free of tempo distortions, proposed by Bongaarts and Feeney in 1998. The main objective is to analyze differences between European countries and regions in their period fertility levels in 1995–2000 after accounting for the influences caused by tempo shifts. A particular issue of interest is whether the TFR decline to lowest-low levels can be explained purely as a consequence of the continuing postponement of childbearing.[3] In other words, does the tempo-adjusted period TFR (also denoted below as adjTFR) in all European countries remain above the suggested threshold of 1.3? If so, lowest-low fertility in Europe may be considered a temporary effect of delayed motherhood, likely to fade away once the fertility postponement ceases. In this case the fears of sustained extremely low levels of fertility affecting an increasing number of European societies would be unsubstantiated. A comparison between countries and regions makes it possible to address another important issue: To what extent are the relatively large TFR differences across Europe explained by a differential pace of the shift in fertility timing? Billari and Kohler (2004) suggest that "the postponement of childbearing—particularly for first births—has emerged as a crucial determinant of differences in fertility levels among developed countries." Therefore, the adjusted TFRs are expected to indicate a lower variability than the unadjusted ones. The analysis paves the way for a more general discussion about the future period fertility recovery and completed cohort fertility in European countries.

A brief description of the adjustment method and the data is followed by an overview of the spread of lowest-low period fertility in Europe. Subsequent sections provide estimates of the tempo-adjusted TFR levels and the size of tempo distortions in the TFR in European countries with population size above 1 million. These findings are compared for the main European regions. Potential inferences are drawn about future period fertility recovery and cohort fertility. Finally, wider implications of current period fertility levels for population change in Europe and its regions are addressed.

The Bongaarts–Feeney adjustment

The adjustment proposed by Bongaarts and Feeney (1998) to estimate the TFR free of tempo distortions has been applied in a number of studies (e.g., Philipov and Kohler 2001; Zeng and Land 2001; Bongaarts 2002; Sobotka 2003b; UN 2003); therefore only a brief description is provided here. The adjusted order-specific total fertility rates ($adjTFR_i$) are calculated as follows:

$$adjTFR_{i,t} = TFR_{i,t} / (1 - r_{i,t}), \qquad (1)$$

where $r_{i,t}$ is the change in the mean age at childbearing of birth order i between the beginning and the end of the year t. Bongaarts and Feeney (2000: 563, note 1) recommend that $r_{i,t}$ be estimated as

$$r_{i,t} = (MAB_{i,t+1} - MAB_{i,t-1}) / 2 \,, \qquad (2)$$

where $MAB_{i,t}$ is the mean age of fertility schedule of order i, calculated from age- and order-specific fertility rates. This computation is followed in the analysis of birth orders 1, 2, and 3. Conventional TFRs are used for birth orders 4 and higher to reduce random fluctuations. Because fertility at birth orders 4+ is very low and the increase in the mean age at childbearing is less intensive at higher birth orders in virtually all European countries, such a procedure should not lead to an underestimation of the adjTFR.[4] The overall tempo-adjusted TFR for all birth orders is computed as the sum of the adjusted order-specific total fertility rates.

A typical interpretation of the adjusted TFR is that it is a period indicator which gives an "accurate estimate of the total fertility rate that would be observed in the absence of changes in the timing of childbearing," provided that its underlying assumptions are valid (Bongaarts 2002: 434). Two features of this method are problematic (see e.g., van Imhoff and Keilman 2000): (1) it assumes that all cohorts postpone childbearing to the same extent and that the shape of the fertility schedule by age remains constant over time; and (2) it is based on order-specific fertility rates (also called reduced rates, frequencies, and central birth rates), which are not the real exposure measures and do not take into account the distribution of women by parity. The importance and sensitivity of these assumptions have been broadly discussed. An additional disadvantage of this method, linked with the above-mentioned shortcomings, lies in rather large fluctuations in the adjTFR levels, which show considerably larger year-to-year changes than observed TFRs. While some researchers see no advantage to using the Bongaarts–Feeney framework (e.g., van Imhoff and Keilman 2000; van Imhoff 2001; Smallwood 2002a), many others perceive it as a useful instrument to estimate the tempo-free level of the period TFR (e.g., Lesthaeghe and Willems 1999; Kohler and Philipov 2001; Zeng and Land 2001).

Although more sophisticated methods of period fertility adjustment were developed recently by Kohler and Philipov (2001) and Kohler and Ortega (2002), lack of data for a number of European countries prevents calculation of age- and order-specific exposure indicators of period fertility (birth probabilities and occurrence-exposure rates, also known as birth intensities), which constitutes the major condition for a more advanced analysis.[5] Despite its drawbacks, the Bongaarts–Feeney adjustment is relatively well suited for the purpose of this study. Given the available data, it enables an estimate of tempo effects and tempo-adjusted TFR for a majority of European countries. To overcome some pitfalls in the adjustment method, in particular the irregularities over time, this contribution looks at the mean TFR values over a period of six years (1995–2000) and does not adjust the TFR for birth orders 4+. While the country-specific indicators may still be affected by some irregularities, the estimates for broader regions mirror well the size of the tempo effects in the TFR in different parts of Europe.

Data

The adjusted TFR was estimated for 26 European countries with population size over 1 million and for Iceland, which represents an interesting example of relatively high fertility. The data cover all regions of Europe except the former Soviet Union (excluding the Baltic countries), where only Russia published detailed fertility indicators prior to 1998. Countries with populations below 1 million, as well as Albania and Bosnia-Herzegovina, were omitted from the analysis. In the case of Germany, data are available for the western part of the country only (excluding the territory of the former German Democratic Republic); in the case of Britain, only data for England and Wales are used. Whenever possible, the adjusted indicators are presented as average values for the 1995–2000 period. For a number of countries, however, less recent data or shorter time series were collected. Most of the primary data on births by age of mother and birth order and on the age distribution of women come from official vital statistics. The single most important data source is EUROSTAT (2002 and 2003a). The period fertility data for England and Wales were estimated by Smallwood (2002b); data for West Germany were estimated by Kreyenfeld (2002).[6] The Appendix details data and data sources.

The progression of lowest-low fertility in Europe

Judging from trends in total fertility rates since 1990, depicted in Table 1, the spread of lowest-low fertility in European countries has been spectacular. In 1990 not a single country in Europe had a TFR at or below 1.3. Seven countries, representing more than a quarter of Europe's population,[7] had reached such a low level by 1995; the most recent data, for 2001, indicate that 15 countries with more than half of Europe's population fell within this category. In 1995 Spain, Italy, and Germany were the largest countries experiencing lowest-low fertility levels. A large part of the rapid spread of lowest-low fertility after that date was due to the addition of Russia (population of 145 million in 2001) since 1996, Ukraine since 1997, and Poland since 2001. In contrast, the TFR in Germany rose above 1.3 in 1996 and has remained above this threshold since then. The TFR in Russia increased to an estimated 1.31 in 2002 (EUROSTAT 2003b). These examples illustrate that the spells of extremely low TFR are not necessarily long-lasting: in some cases lowest-low fertility may occur for a brief period of several years (e.g., Germany) while in other cases the TFR may fluctuate around the threshold level (e.g., Romania since 1995).

When we include countries that are very close to the lowest-low fertility benchmark, with a TFR between 1.31 and 1.4, the spread of very low fertility across Europe appears even more dramatic. While only three Medi-

TABLE 1 The spread of lowest-low fertility (TFR at or below 1.3) and very low fertility (TFR at or below 1.4) in European countries in 1990–2001

TFR	1990	1995	2000	2001
1.3 or lower				
Number of countries	0	7	12	15
Population (millions)	0	201.3	339.0	409.4
Total European population	711.5	719.1	718.7	718.8
Percent of European population	0	28.0	47.2	57.0
1.4 or lower				
Number of countries	3	14	20	20
Population (millions)	105.6	453.5	516.6	515.8
Total European population	711.5	719.1	718.7	718.8
Percent of European population	14.8	63.1	71.9	71.8

NOTE: Table is based on data from 33 European countries, i.e., all European countries with a population size above 1 million, excluding Albania and Bosnia-Herzegovina. Total population figure includes Asian part of Russia.
SOURCES: Council of Europe (2003), EUROSTAT (2003a).

terranean countries, namely Greece, Italy, and Spain, fell into this category in 1990, 20 countries with a total population of 516 million, representing 72 percent of the European population, had fertility at or below 1.4 by 2001. All European countries of the former Soviet bloc recorded such low fertility levels (Sobotka 2003b).

As Kohler, Billari, and Ortega (2002) noted, the spread of lowest-low fertility in the 1990s was restricted to Southern, Central, and Eastern Europe. However, lowest-low fertility has recently been recorded in non-European countries as well: in Armenia among the Asian successor countries of the former Soviet Union (official TFR 1.02 in 2001: EUROSTAT 2003b) and in South Korea following the recent economic crisis (TFR declined to 1.17 in 2002: KNSO 2003). Several countries of Southeast and East Asia are close to the lowest-low fertility threshold: the TFR in Taiwan dropped to 1.34 (DGBAS 2003) and in Japan to 1.37 in 2002 (EUROSTAT 2003b).

An overview of adjusted total fertility in 1995–2000

Table 2 provides an overview of the TFR, adjusted TFR, and an estimate of the tempo effect in the TFR—computed as the difference between the first two—in European countries in 1995–2000. For illustration, the table also includes completed cohort fertility (denoted as CTFR) of women born in 1960, who were in their prime childbearing years by the late 1980s. The estimated tempo effect was negative in all 27 countries for which the adjTFR was computed, indicating that the total fertility rate was deflated in all countries by the ongoing shift toward later parenthood. The size of the tempo effects varied considerably, however. In some countries with very low TFR, increasing age at childbearing appears to have played a minor role in fertility decline. This is particularly so in Russia, where the difference between the TFR (1.37) and the adjusted TFR (1.45) was the smallest among the countries in this study. However, the estimates for Russia pertain to 1992–96, a period that was characterized until 1994 by a slight advancement of first births, and only since 1995 by the postponement of childbearing (see CDEC 2001). More recent indicators would show stronger tempo effects and a larger difference between adjusted and conventional total fertility. Very strong tempo distortions are characteristic of some countries of Southern and Central Europe and the Baltic region. The Czech Republic had the largest absolute difference between the adjusted and conventional TFR (0.55), a consequence of a very rapid increase since 1994 in the mean age at first birth (see Sobotka, Zeman, and Kantorová 2003). While the Czech TFR in 1995–2000 (1.18) was one of the lowest in the world, the adjusted TFR (1.73) occupied an intermediate position among European countries. These findings illustrate that tempo effects may considerably distort not only the absolute values of the TFR in particular countries, but also the overall ranking of European countries in terms of their fertility quantum. Not surprisingly, many of the countries with lowest-low TFRs form the lowest-fertility group in terms of adjusted TFRs as well (e.g., Bulgaria, Russia, and Spain). On the other hand, some of the lowest-low TFR countries, such as the Czech Republic and Slovenia, have a moderate level of period fertility quantum, as captured by the adjTFR, and their "membership" among the lowest-fertility countries in Europe appears to be triggered by the exceptional intensity of fertility postponement rather than by the very low quantum of period fertility.

Although the adjusted TFR remains low in many countries—between 1.4 and 1.5 in Spain, Bulgaria, and Russia (most likely also in Ukraine and Belarus, for which no appropriate data were available), and between 1.5 and 1.6 in Austria, (West) Germany, Romania, and Latvia—in all cases it remains well above the lowest-low fertility benchmark. Given the available estimates, the decline of the TFR to the lowest-low level in many European countries could be explained as a temporary phenomenon, driven by the ongoing postponement of childbearing. Interpreted within the Bongaarts–Feeney framework, the findings suggest that absent a continued delay of childbearing, none of the countries analyzed here would have reached the lowest-low TFR level in the second half of the 1990s. One populous country, Ukraine, has been left out of the analysis for lack of detailed fertility data. As measured by the TFR, which dropped to 1.1 in 1999 and 2000, Ukraine has recorded the lowest period fertility in Europe, while still re-

TABLE 2 Country-specific values of period fertility (1995–2000 or last period available) expressed in TFR and adjTFR, estimated tempo effect, and completed cohort fertility (CTFR) for women born in 1960

Region and country	Period	TFR	adjTFR	Tempo effect	CTFR (cohort born 1960)
Western Europe					
Austria	1995–2000	1.36	1.58	–0.22	1.70
Belgium	1995–2000	1.60	—	—	1.86
France	1999	1.79	1.96	–0.17	2.11
Germany	1995–2000	1.34	—	—	1.65
West Germany (former FRG)	1992–1994	1.38	1.51	–0.13	1.60
East Germany (former GDR)	1995–2000	1.05	—	—	1.80
Ireland	1995–2000	1.89	2.18	–0.29	2.41
Netherlands	1995–2000	1.60	1.73	–0.13	1.85
Switzerland	1995–2000	1.48	—	—	1.78
England and Wales	1995–2000	1.71	1.85	–0.14	1.97
Northern Europe					
Denmark	1993–1995	1.79	2.04	–0.25	1.90
Finland	1995–2000	1.75	1.89	–0.14	1.96
Iceland	1995–2000	2.06	2.34	–0.28	2.48
Norway	1995–2000	1.85	2.07	–0.22	2.09
Sweden	1995–2000	1.57	1.85	–0.28	2.04
Southern Europe					
Greece	1995–1998	1.30	1.63	–0.33	1.93
Italy	1993–1996	1.21	1.64	–0.43	1.67
Portugal	1995–2000	1.47	1.73	–0.26	1.89
Spain	1995–1999	1.18	1.46	–0.28	1.76
Central Europe					
Czech Republic	1995–2000	1.18	1.73	–0.55	2.03
Hungary	1995–1998	1.44	1.76	–0.32	2.02
Poland	1995–2000	1.48	1.76	–0.28	2.18
Slovakia	1995–2000	1.40	1.74	–0.34	2.18
Slovenia	1995–2000	1.26	1.68	–0.42	1.87
Baltic countries					
Estonia	1996–2000	1.28	1.77	–0.49	2.03
Latvia	1998–2000	1.17	1.55	–0.38	1.94
Lithuania	1995–1999	1.40	1.65	–0.25	1.88
Southeastern Europe					
Bulgaria	1995–2000	1.20	1.48	–0.28	1.95
Croatia	1995–2000	1.53	—	—	1.98
Macedonia	1995–1999	1.91	2.13	–0.22	2.29
Romania	1995–1999	1.31	1.52	–0.21	2.15
Serbia and Montenegro	1995–2000	1.75	—	—	2.30

(continued)

TABLE 2 (continued)

Region and country	Period	TFR	adjTFR	Tempo effect	CTFR (cohort born 1960)
Eastern Europe					
Belarus	1995–2000	1.30	—	—	1.90
Moldova	1995–2000	1.56	—	—	2.35
Russia	1992–1996	1.37	1.45	–0.08	1.83
Ukraine	1995–2000	1.22	—	—	—

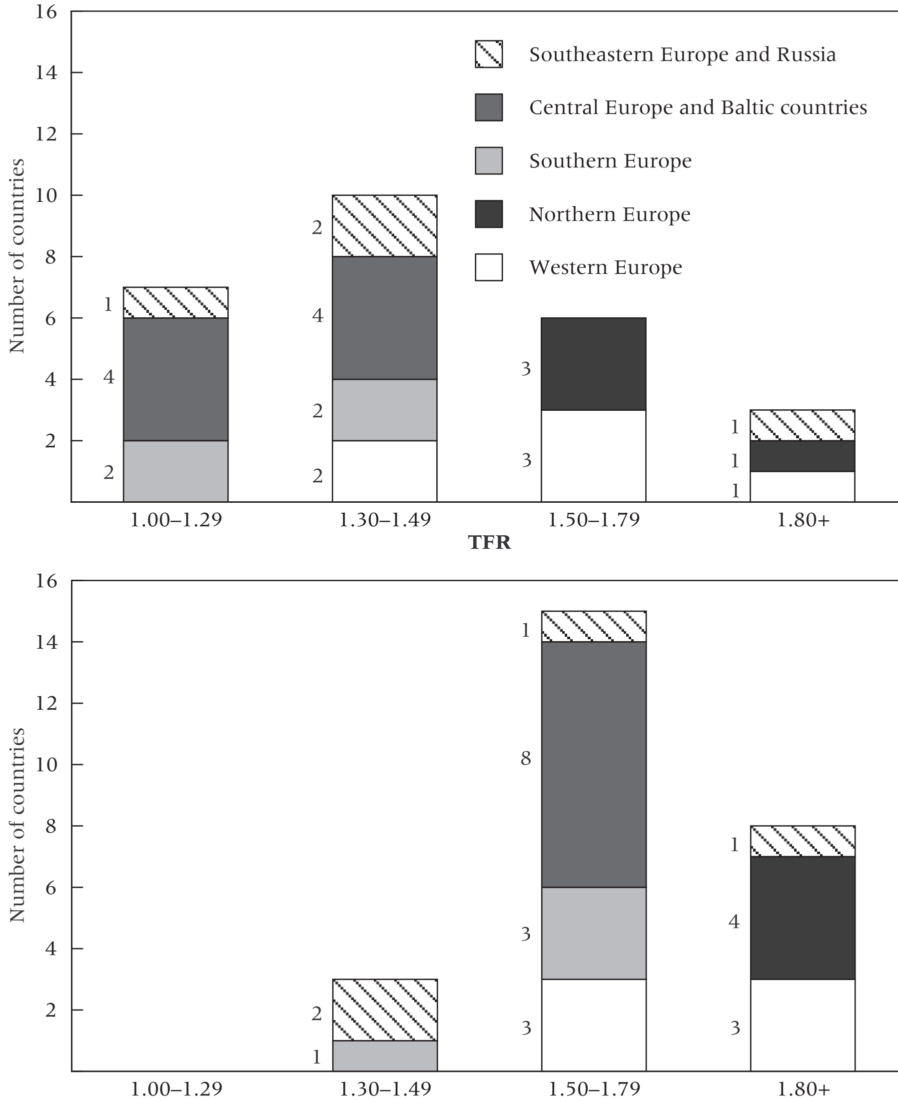
SOURCES: Author's calculations based on EUROSTAT (2002, 2003a), Council of Europe (2003), Smallwood (2002b), and Kreyenfeld (2002).

taining a young age pattern of fertility and a strong normative pressure for early childbearing. Perelli (2003) suggests that the case of Ukraine challenges the notion that lowest-low fertility is closely linked with the postponement of first births. Although fertility delay in Ukraine indeed did not take place until recently, few available data indicate that the trend toward later childbearing has started there as well. It is likely that the tempo-adjusted TFR in Ukraine has remained above 1.3 since 1997, when the total fertility rate declined below the lowest-low threshold.[8]

What comes as a surprise is that even when adjusted fertility is taken into account, the variability in fertility rates remains considerable. In contrast with the countries maintaining relatively low levels of fertility quantum, several countries have an adjTFR close to or above replacement level (around 2.08). In France, the adjTFR reached 1.96 (data refer to 1999 only), in Denmark 2.04 (1993–95), Norway 2.07, Macedonia 2.13, Ireland 2.18, and in the sparsely populated Iceland as high as 2.34. As a result, the difference between the maximum and minimum values—excluding the exceptional case of Iceland—remained roughly the same for both adjusted and conventional TFRs (above 0.7). Nevertheless, the relative differences in fertility level are lower in the adjTFR: the coefficient of variation, indicating the relative dispersion, was reduced from 0.16 for the TFR to 0.12 for the adjTFR.[9] These findings support Billari and Kohler's (2004) argument that some of the cross-country differences in the TFR may be attributable to the pace of fertility postponement, and consequently the considerable variability in period fertility in Europe is likely to decline once the postponement of childbearing ends.

The adjusted TFR is usually well below the level of cohort fertility of women born in 1960, which exceeded 1.8 in all but five countries. Although it is risky to draw straightforward inferences about cohort fertility from a period-based measure like adjTFR, the consistent differences between adjTFR in 1995–2000 and CTFR of women born in 1960 indicate that the decline in cohort fertility is likely to continue in most European countries. Such an ex-

FIGURE 1 Distribution of 26 European countries by their level of TFR and tempo-adjusted TFR in 1995–2000 or last period available



NOTE: The 26 countries are distributed into the following categories of TFR and adjTFR: TFR 1.00–1.29: Italy, Spain (Southern Europe), Czech Republic, Slovenia, Estonia, Latvia (Central Europe and Baltic countries), and Bulgaria (Southeastern Europe and Russia); 1.30–1.49: Austria, West Germany (Western Europe), Greece, Portugal (Southern Europe), Hungary, Poland, Slovakia, Lithuania (Central Europe and Baltic countries), Romania, and Russia (Southeastern Europe and Russia); 1.50–1.79: France, Netherlands, England and Wales (Western Europe), Denmark, Finland, and Sweden (Northern Europe); 1.80+: Ireland (Western Europe), Norway (Northern Europe), and Macedonia (Southeastern Europe and Russia). AdjTFR 1.30–1.49: Spain (Southern Europe), Bulgaria, and Russia (Southeastern Europe and Russia); 1.50–1.79: Austria, West Germany, Netherlands (Western Europe), Greece, Italy, Portugal (Southern Europe), Czech Republic, Hungary, Poland, Slovakia, Slovenia, Estonia, Latvia, Lithuania (Central Europe and Baltic countries), and Romania (Southeastern Europe and Russia); 1.80+: France, Ireland, England and Wales (Western Europe), Denmark, Finland, Norway, Sweden (Northern Europe), and Macedonia (Southeastern Europe and Russia). Only countries for which data on both the TFR and the adjTFR were computed (except Iceland) are included.
SOURCES: Author's calculations based on EUROSTAT (2002, 2003a), Council of Europe (2003), Smallwood (2002b), and Kreyenfeld (2002).

pectation is also supported by an analysis of cohort fertility trends (see Frejka and Calot 2001). The major exception is Denmark, where the adjTFR in 1993–95 was actually higher than the cohort TFR of women born in 1960. In fact, Denmark is one of the few European countries that experienced a slight increase in cohort fertility among women born after 1955 (Council of Europe 2003; Frejka and Calot 2001: 107).

Figure 1 offers a simplified comparison of the distribution of cross-country fertility differences in the TFR and adjTFR. The total fertility values of 1.3, 1.5, and 1.8 were chosen as arbitrary benchmarks to distinguish between different levels of low fertility. Note that, in contrast to the lowest-low fertility category, the lowest category here does not include the value of 1.3. As already noted, many countries have TFRs below 1.3; the largest number of countries (ten) fall within the range of 1.3–1.49. Total fertility above 1.8 has become unusual and may even be considered as "high fertility" in the current European context. The use of the adjusted TFR changes this distribution considerably: the largest number of countries (15) fall within the "moderate" range of 1.5–1.79, and eight out of the remaining 11 countries belong to the highest category of 1.8 and above. Interesting regional differences emerge here: all countries of Northern Europe have high (1.8+) adjusted TFR levels and all Central European and Baltic countries belong to the moderate category (1.5–1.79) despite their very low TFR levels. Three Western European countries (France, England and Wales, and Ireland) are in the highest fertility category.

Regional differences in adjusted total fertility

How do the major European regions differ with respect to the tempo effects on fertility rates? To provide estimates representative of the main regions of Europe as well as the European Union, I have made several assumptions. First, all country-specific total fertility rates represent the mean values of the 1995–2000 period, and all adjusted TFR indicators listed in Table 2 are treated as representing the 1995–2000 period as well. Second, data for West Germany and England and Wales are assumed to be representative of the whole of Germany and Great Britain. Third, adjusted TFRs had to be "assigned" to countries with no available data to compute this indicator. More information on these estimates is provided in the Appendix. For most parts of Europe, this procedure did not significantly change the overall picture of the tempo effects, since the countries involved were relatively small: Belgium, Switzerland, Croatia, and Serbia and Montenegro. The region of the former Soviet Union is a major exception, however, since no detailed data were available for Belarus, Moldova, and Ukraine and no recent data for Russia. Findings and conclusions related to this region are speculative. All regional indicators were weighted by the population size of given countries and regions in 2001, as published by the Council of Europe (2003). The division of countries into larger regions is shown in Table 2.

Table 3 reinforces the finding that Europe is characterized by considerable regional differences in the estimated tempo effects and in the level of the adjusted TFR. For Europe as a whole, the adjTFR in 1995–2000 is estimated to be 1.63, higher by 0.23 than the (conventional) TFR value of 1.40. This estimate is quite robust with regard to different estimates of adjusted fertility in Eastern European countries of the former Soviet Union.[10] The values are slightly higher for the European Union, with practically no differences between the area prior to the May 2004 enlargement (15 countries) and the current area (25 countries). The adjTFR for the EU in its 2004 borders is estimated to be 1.71, which is 0.25 higher than the conventional TFR (1.46). These are somewhat lower figures than the above-mentioned estimate by Lutz, O'Neill, and Scherbov (2003), which put the adjusted TFR in the EU in 1990–97 at 1.8.

The well-documented differences in total fertility between Southern and Northern Europe (e.g., Coleman 2002) are reduced by only a quarter if the differential pace of postponement of childbearing is taken into account: even after the adjustment, the gap between the total fertility rate in Northern and Southern Europe remains substantial (1.94 vs. 1.59). Northern Europe is the only region where the adjusted TFR appears to be close to the

TABLE 3 Estimates of the total fertility rate and the tempo-adjusted TFR compared with the completed cohort fertility (CTFR) of women born in 1960, European regions

Region	Population size (millions, 2001)	Average of 1995–2000			CTFR (cohort born 1960)
		TFR	adjTFR	Tempo effect	
Western Europe	246.6	1.57	1.74	–0.17	1.88
Northern Europe	23.9	1.70	1.94	–0.24	2.00
Southern Europe	118.8	1.23	1.59	–0.36	1.74
Central Europe	66.5	1.41	1.75	–0.34	2.12
Baltic countries	7.2	1.30	1.64	–0.34	1.92
Southeastern Europe	47.7	1.43	1.67	–0.24	2.14
Eastern Europe	208.1	1.25	1.46	–0.21	1.85
Europe	718.8	1.40	1.63	–0.23	1.89
EU (15 countries)	377.6	1.47	1.70	–0.23	1.84
EU (10 accession countries)	73.7	1.39	1.74	–0.35	2.10
EU (25 countries)[a]	451.3	1.46	1.71	–0.25	1.88

NOTE: Indicators are weighted by the population size of countries within given regions.
[a]Represents the 25 members of the European Union as of May 2004.
SOURCES: Author's calculations based on EUROSTAT (2002, 2003a), Council of Europe (2003), Smallwood (2002b), Kreyenfeld (2002); see Appendix for details.

replacement level and very close to the completed fertility level achieved by women born in 1960 (2.0). Together with France, Ireland, and Britain, and closely followed by the Netherlands and Belgium, this may become the future European "high-fertility belt," insofar as TFR levels above 1.8 may be considered "high." Among the countries of the former Eastern bloc, Central Europe and the Baltic republics have recently experienced rapid increases in the mean age at childbearing, and the estimated tempo effects are thus considerable: the adjusted TFR in Central Europe (1.75) slightly exceeds the EU average, and in the Baltic countries it reaches the average European level. Less sizable tempo effects are estimated for Southeastern Europe and Eastern Europe, the latter category representing four successor states of the former Soviet Union. Given the scarcity of data in the latter region and considering that the postponement of childbearing is only a recent phenomenon there, this estimate must be considered tentative. What remains likely, however, is that the adjusted TFR in Eastern Europe, estimated here as 1.46, is lower than in any other European region.

What can be inferred about future period and cohort fertility?

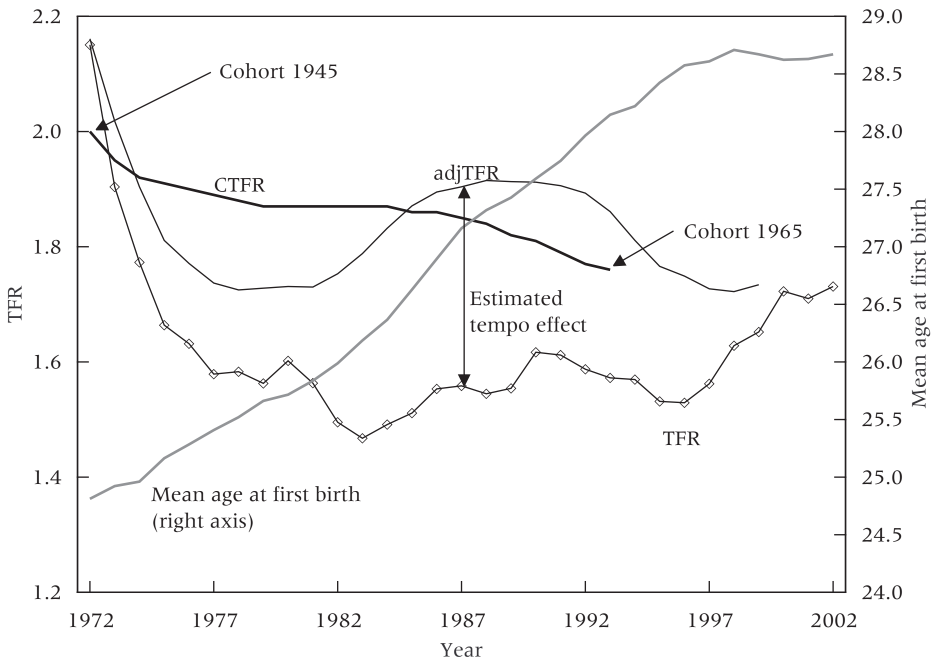
This analysis has identified a notable gap between the total fertility rate and the adjusted total fertility rate in practically all European countries in the second half of the 1990s. Does the TFR adjustment provide us with greater insight about the long-term trends in period fertility quantum than the ordinary TFR? Do the findings on tempo distortions in fertility have any relevance for projections of the future recovery of period fertility and trends in completed cohort fertility? Bongaarts (2002: 437–438) outlined two scenarios of change in period fertility once the mean age at childbearing stops rising. The first scenario assumes that the quantum, captured by the adjusted TFR, will remain constant and the observed TFR will eventually increase to this level. This is a "complete period recovery" scenario.[11] The second scenario assumes that the increase in TFR will be partly offset by a continuing decline in fertility quantum, and recovery will thus be only partial. This is often perceived as a more realistic possibility, especially because delayed childbearing is not always made up when women reach later ages of childbearing. Kohler, Billari, and Ortega (2002: 652) propose that owing to this "postponement–quantum interaction"—a reduction of fertility rates resulting from additional delays in childbearing toward older ages—completed cohort fertility is likely to be lower than the tempo-adjusted period measures. Similarly, Lesthaeghe and Moors (2000: 124) suggest that the TFR as adjusted by Bongaarts–Feeney may "give a too optimistic estimate of any prospective fertility level" and that actual recovery will fall short of it in many countries.

The question whether the adjusted indicators can provide insights about completed cohort fertility is controversial. Most scholars are particularly skeptical with regard to the use of the adjusted TFR for a straightforward cohort CTFR approximation, and Bongaarts (2002: 432) himself asserts that the adjusted TFR does not attempt "to estimate the completed fertility of any actual birth cohort," nor does it attempt "any prediction of future fertility." There are two ways to evaluate empirically whether the adjusted TFR provides clues to future period TFR and completed cohort fertility. The first, linked with the recovery of period fertility, is to investigate whether the end of fertility postponement leads to an increase in the TFR that comes close to the adjusted levels. The second way, linked with completed cohort fertility, is to investigate whether the adjTFR provides some approximation of the cohort fertility of women who were in their prime childbearing years during the period of interest.

The possibilities to scrutinize empirically the performance of the adjTFR with regard to the eventual recovery of fertility are limited. The Netherlands is the only European country where the delay of childbearing, as captured by an increasing age of women at the birth of their first child, has come to a halt. Thanks to the availability of a long time series of detailed fertility data, the case of the Netherlands has been discussed in several evaluations of the adjusted TFR (see Bongaarts 2002; van Imhoff and Keilman 2000). Figure 2 concentrates on the period after 1972, which was marked by the postponement of first births until 1998 and a subsequent stabilization of the mean age at first birth at a high level just above 28.5 years. To smooth random fluctuations in the adjTFR, I present five-year moving averages. To refine the argument, I look at two aspects of the relationship between the timing shifts in period fertility and TFR levels. A crucial question is whether the period TFR increased notably after the postponement of childbearing stopped. This question goes to the core of the debates concerning tempo distortions in the TFR. A sizable recovery of period fertility would support arguments that total fertility will increase considerably once the tempo effects end. A more specific question is whether the extent of this recovery was reflected in the levels of the adjusted TFR in the preceding period.

In general, the case of the Netherlands supports the recovery hypothesis. Although the period TFR falls well short of the replacement level, reached for the last time in 1972, the recent increase is clearly delineated in the figure. The end of fertility postponement was associated with the rise in the TFR from 1.53 in 1995–96 to an average level of 1.72 in 2000–02. A similar pattern of TFR increase was documented by Bongaarts and Feeney in the United States around 1990 (1998: Figure 3), when the rise in the mean age at childbearing temporarily stopped. Figure 2 also reveals that the shifts in the period TFR after 1972 resulted from a gradual decline in

FIGURE 2 Mean age at first birth, TFR, adjTFR, and completed cohort fertility (CTFR) of women born in 1945–65 in the Netherlands, 1972–2002



NOTES: The cohort fertility curve shows completed cohort fertility of women who reached age 27 in a given year. This corresponds to the mean age at childbearing among the birth cohorts born around 1950. A five-year moving average of the adjusted TFR is shown in the figure.
SOURCE: CBS (2003).

the fertility quantum—manifested by a slight downward trend in cohort fertility—combined with the temporary tempo effects related to the increasing age at childbearing. These tempo effects pushed the TFR well below the corresponding cohort fertility rates. The sequence of fertility postponement and subsequent recovery was particularly pronounced in the first-order total fertility rate, where the reduction in fertility quantum was very slight and tempo effects constituted the major cause of the strong TFR swings after 1970.

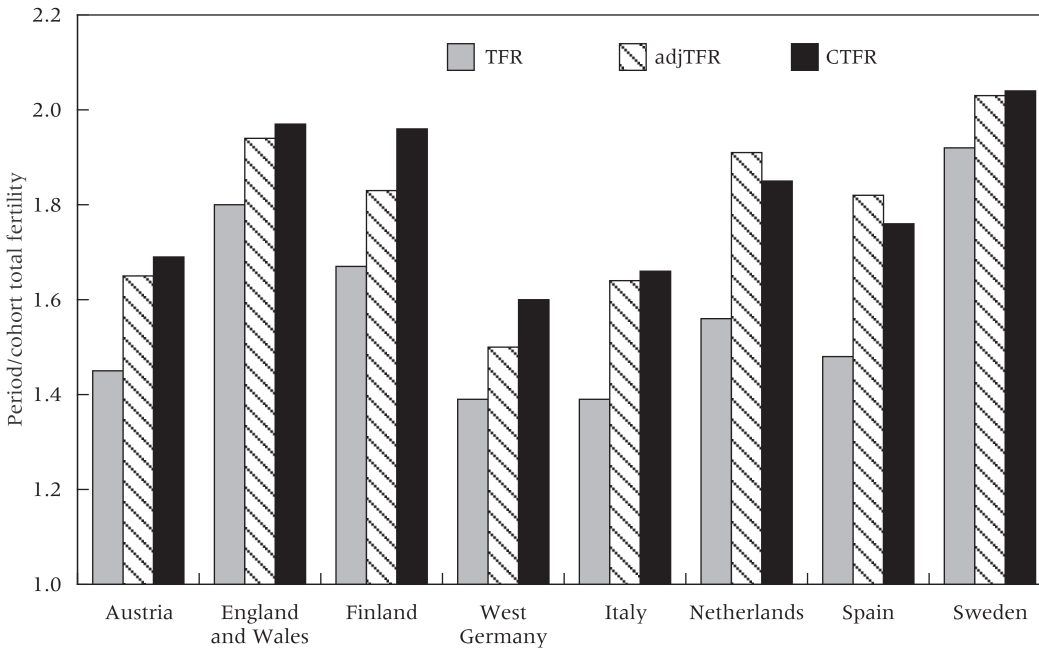
For the most recent period, since the mid-1990s, the adjusted TFR provides a very good estimate of the eventual fertility recovery: the 1995 value of 1.77 was only slightly above the TFR subsequently reached in 2000–02. The data reveal clearly, however, that although the adjTFR was closer to the cohort TFR than to the (conventional) period TFR during the entire period between the mid-1970s and the mid-1990s, it has often failed to approximate the trends and levels of the cohort TFR. Even in its smoothed form, the adjTFR has shown the boom–bust sequence emphasized by van

Imhoff and Keilman (2002), which could hardly be interpreted as a result of changes in the underlying quantum of fertility. Interestingly, the adjusted TFR does not necessarily indicate "optimistic" (i.e., high) fertility levels, which would not be matched by the experiences of real birth cohorts. In fact, the adjTFR in 1974–84 was well below the completed fertility of women born in the first half of the 1950s, who realized most of their childbearing between the mid-1970s and the mid-1980s. With the cycles of booms and busts leveling off, the adjusted TFR appears to come very close to the completed cohort fertility in the long-term perspective. The average values of the adjusted TFR in 1972–93 (1.85) are almost identical with the average completed cohort fertility of women born in 1945–65 (1.87), whereas the average TFR in that period was only 1.62.

This evidence brings us back to the issue of whether the adjusted TFR can provide insight about the completed fertility of women who are in their prime childbearing ages during the period of interest. Because both the TFR and the adjTFR are period indicators, they should reflect period, not cohort, fertility levels and trends. However sophisticated and complex, period measures are not a substitute for cohort fertility indicators. Nevertheless, does not the elimination of tempo distortions, responsible for a substantial part of the divergence between period and cohort total fertility in the last three decades, bring the adjTFR considerably closer to the completed cohort fertility? The range of findings on this issue is wide. Smallwood (2002a) observed that the shape of the adjusted TFR in England and Wales is not closely related to the shape of completed cohort TFR and emphasized the volatility of the adjustment measures. Van Imhoff and Keilman (2000: 550), looking at fertility trends in the Netherlands, concluded that the adjusted TFR came "somewhat closer to the 'true' underlying average number of children of 'real women,'" but still displayed a pronounced boom–bust sequence. Elsewhere (Sobotka 2003a) I found that the adjTFR in four European countries on average removed less than half of the difference between the TFR and the corresponding completed cohort fertility and that this approximation was considerably closer during the periods of fertility postponement.

To elaborate on this point, Figure 3 compares the average adjusted and conventional TFRs in 1985–90, together with the completed cohort fertility of women born in 1960, in eight European countries experiencing an increasing mean age at first birth during that period.[12] In all cases, the adjTFR gives a considerably better approximation of the cohort TFR values. While the TFR was always below the level of the 1960 completed cohort fertility, the adjTFR did not show a consistent pattern of over- or underestimating the cohort TFR. On average, the TFR was 0.23 below the level of the 1960 CTFR, with the shortfall in individual countries ranging from 0.13 in Sweden to 0.29 in Spain. In contrast, the absolute average difference between the adjTFR and the CTFR was only 0.06. The only two countries showing a

FIGURE 3 TFR and adjusted TFR in 1985–90 in eight European countries as compared with the completed cohort fertility (CTFR) of women born in 1960



SOURCES: CBS (2003), EUROSTAT (2003a), Council of Europe (2003).

larger difference—West Germany (0.11) and Finland (0.13)—had adjTFRs lower than the cohort CTFRs. Austria and West Germany also displayed somewhat lower adjTFR levels, whereas only in the Netherlands and Spain were the CTFRs of women born in 1960 below the 1985–90 adjTFR values. Despite expectations that the Bongaarts–Feeney adjustment is likely to overestimate the eventual cohort fertility level, the evidence for the second half of the 1980s suggests that it is at least equally likely to produce estimates that are too low.

The cases presented here are too few to offer conclusive evidence on the potential insights provided by the Bongaarts–Feeney method. They should rather be seen as hints and illustrations of the potential usefulness of the adjustment approach. It would be naive to presume that the quantum of fertility will remain constant over time, even were it to be closely approximated by the adjustment formulas. The adjTFR has drawbacks and, ideally, it should be complemented with other period fertility indicators, in particular parity-specific indicators mirroring the real exposure of women. For projection purposes, a detailed inspection of cohort fertility is as important as an analysis of period fertility trends (Lesthaeghe and Willems 1999). However, given that the adjustment indicators largely eliminate the most important distortion from the TFR, they represent one possible scenario of the future recovery of fertility, which is much more realistic than expecting current total fertility levels to prevail in the long run.[13]

Summary and conclusions

Changes in total fertility rates provide a vivid impression of European fertility trends. In 2001 more than half of Europe's population lived in societies with TFRs at or below the threshold of lowest-low fertility, put at 1.3. This fall in total fertility rates is perceived by some demographers to mark a new period of rapid population decline, for which Chesnais (2001) coined the phrase "population implosion." Detailed analysis of the tempo-adjusted TFR in the second half of the 1990s offers a nuanced perspective on European fertility trends. In all countries analyzed, the TFR was negatively affected to some extent by the postponement of childbearing, which has continued uninterrupted in some of these countries for more than three decades. The pace of fertility postponement varied substantially across Europe, and estimates of the extent of the tempo effects in the TFR differed accordingly. Nevertheless, none of the countries analyzed had an adjusted TFR below 1.4. I interpret this finding as an indication that lowest-low fertility in Europe is a result of increasing age at motherhood and, therefore, a temporary phenomenon that will fade once the postponement of childbearing stops. A possible future decline of fertility quantum to lowest-low levels cannot be ruled out, but an examination of fertility rates and of the pace of fertility postponement in the late 1990s indicates that this has not happened so far. The explanation for the TFR decline to lowest-low levels—a decline in fertility quantum coupled with substantial tempo distortions due to the shift toward later childbearing—makes this study relevant for non-European countries as well. Many societies in East and Southeast Asia are experiencing a substantial rise in the mean age at first childbearing, and this factor, in combination with low fertility quantum, could lead to a geographic spread of lowest-low fertility.

The preceding analysis indicates that despite a slight reduction substantial regional differences in period fertility persist across Europe even when one takes into account the differential pace of the postponement of childbearing. This finding sheds more light on the debate on convergence in European demographic trends (e.g., Coleman 2002; Billari and Wilson 2001). While Northern European countries together with France, Britain, and Ireland appear to form a "high-fertility belt" in Europe, with adjusted TFRs above 1.8, Austria, Germany, European countries of the former Soviet Union, Bulgaria, Romania, and most of Southern Europe form a heterogeneous group of countries with low period fertility quantum. These countries may face serious consequences of very low fertility, in particular if coupled with relatively high mortality and a negative migration balance, as is the case in the post-communist countries of Eastern and Southeastern Europe. Recent evidence of declining family-size ideals in Austria and Germany, presented by Goldstein, Lutz, and Testa (2003), signals that populations in some of these societies may increasingly prefer very small families, a development that makes potential increase in fertility quantum even more unlikely.

The tempo-adjusted indicator of total fertility has methodological shortcomings and cannot be treated uncritically. Nevertheless, in comparison with the commonly used total fertility rate, it provides more realistic insights about the level of potential recovery in period fertility, related to the eventual halt in the delay of childbearing. Particularly on the larger scale of Europe and its major regions, recent levels of the adjusted TFR constitute one possible scenario for this recovery. This may commence relatively soon in Western, Northern, and Southern Europe, while in the post-communist countries of Central and Eastern Europe, where first-time mothers are still fairly young, the increase in the mean age at childbearing is likely to continue for another decade or two.

How serious is the problem of very low fertility on a European scale? The estimated adjusted TFR for Europe as a whole, 1.63 as opposed to the TFR value of 1.40, and for the European Union, 1.71 as contrasted with a TFR of 1.46, may be interpreted in different ways. Without doubt, period fertility rates in most parts of Europe—and consequently also cohort fertility levels—are set to remain well below the replacement threshold even after the end of fertility postponement. Persistent low fertility and continuing regional differences seem to be the hallmarks of future European fertility. In a global perspective, Europe will inevitably become a demographically marginalized continent (Demeny 2003: 4) with a rapidly aging population. On the other hand, relatively minor differences in fertility levels may have serious consequences in the long run. The intrinsic rate of population growth associated with a given level of the TFR may serve as an illustration. Following the approximation in Kohler, Billari, and Ortega (2002: 672),[14] and assuming a mean age at childbearing of 30 years, the European TFR level in 1995–2000 (1.40) is associated with an annual rate of population decline of 1.27 percent in a stable population with no external migration. However, the European adjusted TFR level of 1.63 is associated with a considerably less intensive population decline of 0.76 percent per year. The adjusted TFR in the European Union (1.71) implies an annual decline of 0.60 percent, more than half of the value associated with the (conventional) TFR of 1.46 (1.13 percent). While the persistence of the current TFR level in many European countries could ultimately lead to the demographic implosion envisioned by Chesnais, the adjusted TFR levels are associated with modest rates of population decline, which may be largely offset by immigration. Recent estimates of net migration in the European Union, 0.30 percent of the total population in 2001 and 0.26 percent in 2002 (EUROSTAT 2003b), suggest that the current fertility level coupled with moderate immigration levels could lead to a stable or very gradually declining population size in the long run (see also Lutz and Scherbov 2003). These findings are in line with Morgan's (2003) argument that low fertility in Europe is not a major societal crisis, but rather a serious problem that deserves creative solutions through public policies and institutional adjustments.

Appendix

Data and data sources

Age-specific fertility rates and mean age at childbearing, specified by birth order, were computed from the data on live births by age of mother and birth order and age structure of women. Age was specified for single age groups, usually for ages 14 to 49 years. For some countries, data were expressed in completed age (age at last birthday, age-period perspective), denoted here as AP; whereas indicators for other countries were based on cohort age (age reached during the calendar year, period-cohort perspective), denoted here as PC. Birth order always refers to biological birth order of a child; data were collected for birth orders 1, 2, 3, and 4+.

To estimate the adjusted TFR for the period 1995–2000, order-specific fertility indicators of the mean age at childbearing had to be computed for the period extended by one year on both sides of the time interval in focus (see equation 2 in text). The primary data thus pertain to the period 1994–2001. For some countries, however, only shorter time series were available.

Most of the primary data come from EUROSTAT (2002, 2003a). The following list of countries is ordered according to the sequence of countries listed in Table 2. Complete time series covering the period 1994–2001 were available for Austria (PC), Ireland (AP), Netherlands (PC), Finland (PC), Norway (PC), Sweden (PC), Portugal (PC), Czech Republic (AP), Poland (AP), Slovakia (AP), Slovenia (AP), Bulgaria (AP), and Iceland (PC).

Only shorter or less recent time series were available for the following countries: France (1998–2000, PC), Denmark (1992–96, PC), Greece (1994–99, PC), Italy (1992–97, PC), Spain (1994–2000, PC), Hungary (1994–99, AP), Macedonia (1994–2000, AP), Romania (1994–2000, AP), Estonia (1995–2001, AP), Latvia (1997–2001, AP), and Lithuania (1994–2000, AP).

The estimates of live births by age of mother and birth order in England and Wales (data for 1994–2001, AP) were provided by Steve Smallwood (see Smallwood 2002b); similar estimates for West Germany (data for 1991–95, PC) were supplied by Michaela Kreyenfeld (see Kreyenfeld 2002). Age- and order-specific fertility rates in Russia in 1991–97 (AP) are based on unpublished Goskomstat data, provided by Sergei Zakharov.

Completed cohort TFRs of women born in 1960 and period TFRs for countries and regions where order- and age-specific fertility indicators were not available

(Belgium, East Germany, Switzerland, Croatia, Serbia and Montenegro, Belarus, Moldova, and Ukraine) come from Council of Europe (2003).

Country-specific values of the adjusted TFR in regional estimates

To calculate regional estimates of the tempo-adjusted total fertility rate, specific values of this indicator were "assigned" to countries lacking the data necessary for the TFR adjustment. All the TFR data are for 1995–2000 and, therefore, may differ from the data used in Table 2, where some figures refer to a different period. When the adjTFR was set at the average value of a region (Belgium and Croatia), it is a simple arithmetic average of the adjTFR before the inclusion of data specified in this section and thus not comparable with weighted averages presented in Table 3. The adjusted TFR in 1995–2000 was estimated as follows (countries are ordered in correspondence to Table 2):

Belgium: The adjTFR was set at the average (unweighted) value for Western Europe (excluding Ireland, 1.72). The TFR in Belgium in 1995–2000 (1.60) was slightly above the Western European average, while the pace of the increase in the mean age at first birth, published for births within marriage and only through 1996, was slower than in most other Western European countries (Council of Europe 2003).

Germany: The adjTFR for West Germany in 1992–94 (1.51) is assumed to be representative of the whole German territory in 1995–2000. While the East German TFR in 1995–2000 was still well below the West German level (1.05 vs. 1.40), the pace of fertility delay in East Germany—and thus the size of the tempo effects—was considerably more pronounced than in West Germany (Kreyenfeld 2001).

Switzerland: The adjTFR was estimated as 1.60, which is below the Western European average and close to the adjusted TFR in neighboring Austria (1.58). This estimate corresponds to the long-term TFR level, which is below the Western European average.

England and Wales: The adjTFR for England and Wales in 1995–2000 (1.85) is assumed to be representative of the whole of Great Britain. This is a realistic assumption given that the TFR levels in England and Wales (1.65 in 2000) and the whole of Great Britain (1.64 in 2000) are almost identical (see Population Trends 2003: Table 2.2)

Croatia: The adjTFR was set at 1.74, which is the average (unweighted) level of Central Europe. Croatia's fertility patterns are closer to Central European countries (e.g., Hungary and Slovenia) than to other countries of Southeastern Europe. While the 1995–2000 TFR level (1.53) was well above the Central European average (1.34), the increase in the mean age at first birth was less intensive in this period (0.46 years as contrasted to the average of 1.27 in five countries of Central Europe).

Serbia and Montenegro: The adjTFR was set at 2.00, mirroring a relatively high TFR level in 1995–2000 (1.75) and a moderate increase in the mean age at first birth (see Council of Europe 2003).

Belarus, Russia, and Ukraine: The adjTFR in Russia in 1992–96 (1.45) is assumed to be representative of the 1995–2000 period in Russia as well as in Belarus and Ukraine. In Russia, the continuing gradual TFR decline in 1995–99 is assumed to be matched by the accelerating pace of the postponement of childbearing. Because no recent data on order-specific fertility rates are available for Russia, this is only a tentative estimate. Fertility patterns and changes in Belarus and Ukraine apparently have been closely linked to those in Russia; therefore both Belarus and Ukraine are assumed to have the same level of the adjTFR as Russia. Given a large degree of uncertainty in these estimates, sensitivity analysis was performed to evaluate the impact of three alternative scenarios of the adjTFR in Belarus, Moldova, Russia, and Ukraine on the adjTFR in Europe (see endnote 10).

Moldova: The adjTFR in Moldova is set at 1.70, above the average TFR in 1995–2000 (1.56), reflecting a gradual increase in the mean age at childbearing that started after 1995.

Notes

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1 The conventional period total fertility rate (TFR) is computed as a sum of age-specific fertility rates among women in a given year. This most widely used indicator of period fertility is commonly interpreted as the average number of children that would be born to a woman in her lifetime if she were to pass through her childbearing years experiencing the age-specific fertility rates of a given period. The term "quantum of fertility" stands for the "level" of fertility, which may, however, have ambiguous interpretations (van Imhoff 2001: 24). Following Bongaarts and Feeney (1998: 272), (period) fertility quantum is used throughout this article to denote "the TFR that would have been observed in the absence of changes in the timing of childbearing during the period in which the TFR is measured." In a cohort perspective, the completed cohort total fertility rate (CTFR) is an unambiguous measure of cohort fertility quantum. The term "(period) fertility tempo effect" represents the distortions caused by the changing timing of childbearing among women.

2 This scenario is based on the assumption that the adjusted TFR, representing fertility quantum, remains constant at 1.8, which would lead to the eventual recuperation of the TFR to this level. Different scenarios are further discussed in the Appendix of Lutz, O'Neill, and Scherbov (2003).

3 The possibility that lowest-low fertility is a transient phenomenon was discussed by Kohler, Billari, and Ortega (2002: 668–670). Without taking an explicit stand on this issue, they envision that the postponement of fertility and thus also the timing distortions can continue for a considerable period of time (p. 669), and the already late childbearing patterns in Italy and Spain leave "little scope for a recuperation of fertility" (p. 670).

4 The TFR at birth orders 4 and higher typically accounts for about 5 percent of the overall TFR, with a substantial cross-country variation ranging from 2.6 percent in Spain (2001) to 12.2 percent in Ireland (2000, author's calculations). In absolute terms, the TFR at birth orders 4+ does not exceed 0.1 in the majority of European countries. Furthermore, the trend toward later childbearing is slower at high birth orders because women having large families start childbearing at an

earlier age and because of biological limits to fertility at higher ages. The underestimation of the adjusted TFR resulting from this non-accounting for tempo effects is typically below 0.01 in absolute terms.

5 While the commonly employed age- and order-specific fertility rates relate the number of births of birth order *i* to all women of a given age irrespective of their parity status, birth probabilities and other exposure indicators relate births of order *i* to the population of women with *i*–1 children, that is, only to women who are exposed to having a birth of parity *i*. However, official statistical agencies usually do not provide such detailed data on the age and parity structure of the female population.

6 In both cases, survey data (German Socio-Economic Panel in 1985–95 and the UK General Household Surveys in 1986–2000) served as a basis for redistribution of births by age of mother and marital birth order, recorded by the vital statistics, to produce the "true" (biological) birth-order estimates. Various fertility indicators computed from these estimated data, such as order-specific fertility rates and mean ages at childbearing, display realistic values and show relatively smooth trends over time; the extent of annual changes is comparable with order-specific data in countries that provide the "true" birth-order statistics. As a result, I consider estimated order-specific data for England and Wales and West Germany to be reliable and well suited for the purpose of this study.

7 The Asian areas of Russia are also included in the analysis; the total population size of all European countries and regions analyzed was 718.8 million in 2001.

8 Empirical evidence pertaining to the postponement of childbearing in Ukraine is rare. There are few data on mean age at first birth, which is a standard indicator of changes in fertility timing. According to Steshenko (2000: 354), mean age declined from 22.1 to 21.7 years between 1989 and 1994, signifying a slight advancement of childbearing, typical of other countries of the former Soviet Union during that period (Sobotka 2003b). Perelli (2003: 11) puts the mean age at first birth at 22.7 years in 1999 and 22.8 in 2000. If the data from these two sources are compatible, they indicate that the postponement of childbearing may have begun in the second half of the 1990s. Available statistics on fertility rates by five-year age groups (Council of Europe 2003 for data until 1998 and Demoscop 2002 for data in 2000) show that since 1996 fertility rates continued to decline among young women below age 30, but stabilized among older women, leading to a slight increase in the overall age at childbearing (from 24.4 in 1996 to 25.0 in 2000). In this case, Ukraine appears to be following Russia, where a stabilization of fertility among women at later ages took place after 1994, followed more recently by an increase in the frequency of late childbearing (CDEC 2001). Perelli (2003: 25) also considers the possibility that fertility postponement in Ukraine might have been more pronounced at higher birth orders, hypothesizing that the profound economic uncertainty did not lead to a delay of first births, but rather to the postponement or limitation of additional childbearing.

9 The standard deviation, which measures absolute dispersion, declined only slightly from 0.24 for the TFR to 0.21 for the adjTFR.

10 A sensitivity analysis was performed with three alternative scenarios of the adjusted TFR. The low adjusted TFR scenario assumed that tempo effects remained very small and the adjTFR in 1995–2000 was 0.1 below the baseline estimate (1.45 in Belarus, Russia, and Ukraine, and 1.7 in Moldova; see Appendix for further specification). The high adjTFR scenario assumed that the tempo effects were more pronounced and the adjTFR was 0.1 above the baseline estimate. The third scenario took into account the possibility that the adjTFR in Ukraine remained lower than that in Russia, despite the very close resemblance in TFR level in 1995–2000 (1.24 in Russia vs. 1.22 in Ukraine). This scenario captures a more accelerated pace of fertility delay in Russia as contrasted with a somewhat later onset of fertility postponement and smaller tempo effects in Ukraine (see endnote 8), putting the adjTFR at 1.50 in Belarus and Russia, 1.70 in Moldova, and 1.35 in Ukraine. The overall adjTFR for Europe remains quite insensitive to these scenarios. As contrasted with the benchmark estimate of 1.63, the first (low) scenario puts the European adjTFR at 1.60, the second (high) scenario at 1.66, and the third scenario at 1.64.

11 Here, fertility "recovery" is a relative concept, linked to any period of interest (in this case, 1995–2000). In a strict sense, the extent of recovery should be measured in relation to the period fertility level at the onset of the postponement of childbearing.

12 The selection of these eight countries was based on two criteria: 1) availability of parity-specific fertility data for the period 1985–90 and 2) evidence of postponement of childbearing during that period.

13 Although the eventual recovery in period fertility rates cannot be taken for granted, a large body of evidence supports this view. Most importantly, at least some "postponed" births are eventually "made up" when women reach higher ages. This process is manifested by increasing birth rates among women past age 30, a development taking place in the majority of European countries. Once the postponement of childbearing comes to an end, fertility rates stabilize or increase slightly among younger women, while the "catching up" among older women continues for several years. The "recovery argument" is further supported by a comparison with fertility indicators other than the TFR. Not only are the cohort fertility rates consistently and considerably higher than the period TFR, but other period fertility indicators, such as a fertility index based on order-specific birth probabilities, remain above the TFR level during periods of continued fertility postponement (Sobotka 2003a). This effect seems to be linked to the way in which the TFR is computed: change in the timing of childbearing induces a shift in the parity distribution of women by age and this in turn affects the TFR, which does not take parity distribution into account (see also Kohler, Billari, and Ortega 2002: 644). Furthermore, empirical evidence for some European countries, such as Denmark, France, and the above-mentioned case of the Netherlands, indicates that the recent slowing down in the pace of increase in the mean age at childbearing is indeed connected with an upward trend in total fertility rates (see Council of Europe 2003).

14 The growth rate r in a stable population is approximated as $r = log(NRR)/m$, where m is the mean age at childbearing (assumed here to be 30 years) and *NRR* denotes the net reproduction rate, estimated as NRR = 0.4886*TFR (Kohler, Billari, and Ortega 2002: 672, endnote 2).

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