The Emergence of Lowest-Low Fertility in Europe During the 1990s

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The majority of the world's population is living in countries with near-replacement or below-replacement fertility. As a result the earlier distinct fertility regimes, "developed" and "developing," are increasingly disappearing in global comparisons of fertility levels (Bongaarts and Bulatao 2000; Lutz, Sanderson, and Scherbov 2001; Wilson 2001). At least three aspects of this convergence toward low fertility are particularly striking. First, the spread of below-replacement fertility to formerly high-fertility countries has occurred at a rapid pace and implies a global convergence of fertility indicators that has been quicker than the convergence of many other socioeconomic characteristics. Second, earlier notions that fertility levels may naturally stabilize close to replacement level have been dispelled.[1] In the early 1990s, for instance, Italy and Spain were the first countries to attain and sustain lowest-low fertility levels, which we define in this article as a level of the total fertility rate (TFR) at or below 1.3. At the end of the 1990s 14 countries in Southern, Central, and Eastern Europe with a total population exceeding 370 million had TFRs below 1.3. Third, recent fertility trends in developed countries have been accompanied by a remarkable divergence in fertility levels, ranging in the late 1990s from lowest-low fertility to TFR levels above 1.7 in France and Denmark and close to 2.1 in the United States.

In this article we investigate the emergence of lowest-low fertility in Europe, analyze its demographic patterns and socioeconomic determinants, and address the factors that underlie the divergence of fertility levels in Europe and developed countries more generally. The central thrust of our argument is that lowest-low fertility in Europe has emerged from the combination of five distinct demographic and behavioral factors. First, *demographic*

distortions of period fertility measures, caused by the postponement of fertility and changes in the parity composition of the population, have reduced the level of period fertility below the associated level of cohort fertility. Second, *economic and social changes* have made the postponement of fertility a rational response for individuals. Third, *social interaction processes* affecting the timing of fertility have rendered the population response to these new socioeconomic conditions substantially larger than the direct individual responses. As a consequence, modest socioeconomic changes can explain the rapid and persistent postponement transitions from early to late age patterns of fertility that have been associated with recent trends toward low and lowest-low fertility. Fourth, *institutional settings* in Southern, Central, and Eastern European countries have favored an overall low quantum of fertility. Fifth, *postponement–quantum interactions* have amplified the consequences of these institutional settings and have caused particularly large reductions in completed fertility in lowest-low-fertility countries in which childbearing is delayed. Moreover, the differential relevance of postponement–quantum interactions in various countries contributes to the divergence of European countries into those that have accommodated late childbearing without substantial declines in cohort and period fertility and those that have experienced large declines in fertility during the postponement transition. We conclude with a discussion of future scenarios for fertility trends in current and prospective lowest-low-fertility countries.

Characterizing lowest-low fertility

TFR levels at or below 1.3—lowest-low fertility—are clearly not a demographic equilibrium, and sustained lowest-low fertility implies far-reaching demographic, economic, and social consequences. For instance, a TFR of 1.3 implies an annual decline of the population size by 1.5 percent in a stable population with an overall mean age of women at childbirth of 30 years (assuming very low female mortality between age 0 and age 50). A TFR of 1.3 also implies a reduction of the birth cohort by 50 percent and a halving of the stable population size every 45 years.[2] If the TFR declines further and persists at a level of 1.0, the annual rate of decline in the stable population rises to 2.4 percent and the halving times of population size and birth cohorts are merely 29 years. This substantially faster decline of the population also reveals that the precision of demographic measures becomes increasingly important in lowest-low-fertility contexts: a difference in the TFR between 1.0 and 1.3 is equivalent to the difference between 3.2 and 4.2 in terms of stable population growth rates.

The choice of a threshold to define lowest-low fertility is to a certain extent arbitrary. Our choice of 1.3 serves to differentiate the extremely low levels of fertility that started to prevail on a country level only in the last

decade from the category of below-replacement fertility, which characterizes many more countries. National TFR levels at or below 1.3 have never prevailed for extended periods in the Northern and Western European countries that were forerunners in the trend toward sustained below-replacement fertility. The only examples of lowest-low fertility on a national level in Northern and Western Europe were temporary and occurred in France during World War I, in West Germany in 1984–85, and in unified Germany in 1993–95.[3]

Lowest-low fertility is currently concentrated in Southern, Central, and Eastern Europe.[4] According to the Council of Europe (2001), 14 countries attained lowest-low fertility levels during the 1990s (Table 1): three in Southern Europe (Greece, Italy, and Spain), five in Central and Eastern Europe (Bulgaria, Czech Republic, Hungary, Romania, and Slovenia), and six in the former Soviet Union (Armenia, Belarus, Estonia, Latvia, Russia, and Ukraine). The first countries to reach lowest-low fertility levels were Spain and Italy in 1993. They were joined by Bulgaria, the Czech Republic, Latvia, and Slovenia in 1995, and by the remaining lowest-low-fertility countries between 1996 and 1999. The group of countries with TFR at or below 1.3 has further evolved in more recent years, as would be expected given that the definition of lowest-low fertility is based on a threshold. In particular, there were three entrants to and four exits from the group of lowest-low-fertility countries in 2000 (entrants with TFR in 2000: Lithuania 1.27, Slovakia 1.29, and Moldova 1.30; exits with TFR in 2000: Belarus 1.31, Estonia 1.39, Hungary 1.32, and Romania 1.31 [Council of Europe 2001]). Some of these TFR reversals above 1.3 may be short lived. In addition, several other countries in Central and Eastern Europe and the Balkans have very low TFR levels, and Poland (1.34), Georgia (1.35), and Croatia (1.39) may join the group of lowest-low-fertility countries soon. Other European countries with traditionally low fertility, such as Austria (1.34) and Germany (1.36), are also likely to join the group.

The emergence of lowest-low fertility in Southern, Central, and Eastern Europe has been associated with a renewed divergence of European countries between those stabilizing at moderately below-replacement fertility and those with TFRs at or below 1.3. For instance, several of the first countries to experience sustained below-replacement fertility in the late 1960s and early 1970s, including Denmark and the Netherlands, exhibited relatively high fertility in the late 1990s. Moreover, the Dutch and Danish TFRs have increased during the 1990s—to levels of 1.65 in the Netherlands and 1.73 in Denmark (Council of Europe 2001), and several other European countries have even higher TFRs. These trends are in sharp contrast to the declines to levels below 1.3 in lowest-low-fertility countries. In addition, this divergence has been accompanied by a disruption or reversal of many well-known associations between aggregate indicators of fertility and fertility-related be-

haviors (Billari and Kohler 2002). For instance, the cross-sectional correlations in European or OECD countries between the total fertility level on the one hand, and the total first marriage rate, the proportion of extramarital births, and the female labor force participation rate on the other hand have reversed during the period from 1975 to 1999 (see also Brewster and Rindfuss 2000); and the analyses in Billari and Kohler (2002) provide clear indication that a high prevalence of marriage and institutionalized long-term cohabitation is no longer associated with higher fertility in cross-sectional comparisons among European countries.

While the focus on the period TFR provides an easy classification of lowest-low fertility, it can also be misleading because of important measurement issues. In particular, the TFR is subject to tempo and compositional influences. Tempo distortions occur during periods when fertility is either postponed or advanced. These distortions have been much emphasized in recent discussions because of the widespread delay of childbearing (e.g., Bongaarts and Feeney 1998; Kohler and Ortega 2002a; Kohler and Philipov 2001). For instance, women's mean age at first birth in all lowest-low-fertility countries is higher in 1999 than in 1990 (Table 1). In the Southern European countries, postponement has been pronounced, with annual increases in the mean age at first birth exceeding 0.2 per year. Combined with a relatively high initial mean age, this postponement has led to some of the highest mean ages at first birth anywhere in the world. In the Central and Eastern European countries, the patterns are less uniform. Very fast postponement has occurred in Slovenia, the Czech Republic, and Hungary. Other countries, such as Bulgaria, Estonia, Latvia, and Romania, have experienced moderate postponement with increases in the mean age at first birth around 0.1 per year, and these countries continue to have a fairly young mean age at first birth. Similar patterns prevail in other countries of the former Soviet Union such as Russia, Belarus, and Armenia.

A second demographic factor that influences the period total fertility rate is the composition of the female population by parity. If a recent decline of fertility is concentrated on higher birth orders, for instance, the observed parity composition of the population in the short and medium term is tilted toward high parities as compared to the equilibrium distribution that would prevail in the long term after fertility rates have stabilized at their current level. This difference in the observed versus the equilibrium distribution occurs because the observed parity distribution in the population reflects past fertility behaviors and trends (see also Lee 1980). The same disequilibrium in the parity distribution occurs after a substantial postponement of fertility. Unfortunately, the commonly used TFR is affected by such fluctuations in the parity distribution of the population. In particular, if one holds the age-specific parity progression probabilities constant, the TFR is lower when fertility has recently declined or has recently been postponed.

TABLE 1 Total fertility rate (TFR), mean age at first birth, and year of onset of postponement transition in lowest-low-fertility countries, 1985–99

Country	TFR			Most recent year TFR fell		Mean age at first birth			
	1985	1990	1999	≤2	≤1.3	1990	1999	Difference 1990–99	Year of onset[a]
Greece	1.67	1.39	1.28	1983	1998	25.5	27.3	1.7	1982
Italy	1.42	1.33	1.23	1977	1993	26.9	28.7[b]	1.5	1978
Spain	1.64	1.36	1.20	1982	1993	26.8	29.0	2.1	1979
Bulgaria	1.98	1.82	1.23	1987	1995	22.2	23.0	0.8	1992
Czech Rep.	1.96	1.90	1.13	1983	1995	22.5	24.6	2.1	1991
Estonia	2.12	2.04	1.24	1991	1996	22.9	23.8	0.9	1993
Hungary	1.85	1.87	1.29	1980	1999	23.1	24.8	1.7	1990
Latvia	2.09	2.01	1.18	1991	1995	23.0	24.2	1.2	1992
Romania	2.32	1.84	1.30	1990	1999	22.6	23.5	0.9	1993
Slovenia	1.71	1.46	1.21	1981	1995	23.7	26.1	2.4	1986
Armenia	2.56	2.63	1.20	1993	1999	22.8	22.9	0	1994
Belarus	2.08	1.90	1.29	1990	1997	22.6	23.2	0.1	1997
Russia	2.05	1.90	1.17	1990	1996	22.6	23.0[b]	0.4	1994
Ukraine	2.02	1.89	1.19[b]	1989	1997	NA	NA	NA	

NOTE: NA = not available.
[a]Year of onset of the postponement transition is the first in a group of three years during which the mean age at first birth increases by more than 0.3 years.
[b]Data refer to 1997.
SOURCE: Council of Europe (2001).

This is because women who are exposed to lower-parity births are underrepresented in the population. If fertility stabilizes, these compositional distortions diminish and the observed TFR converges to the equilibrium level. To assess the contribution of changes in the parity composition to trends in period fertility levels, it is useful to compare the observed TFR with the level that would have been observed in equilibrium. The latter can be computed from calculations based on period parity progression rates (e.g., Feeney and Yu 1987), and Kohler and Ortega (2002a) show how these calculations can be combined with tempo adjustment. The data requirements for these calculations are substantial. Therefore the only measure of tempo that is available for most lowest-low-fertility countries is the mean age at first birth, calculated from order- and age-specific fertility rates (Table 1).

Fertility postponement and completed fertility

One final methodological question in the context of recent fertility declines is the relevance of studying period fertility. If it is just a temporary phenomenon, lowest-low fertility may not lead to particularly low cohort fertility. Fertility may recuperate at older ages (Frejka and Calot 2001a,b; Lesthaeghe 2001; Lesthaeghe and Willems 1999). However, recuperation is

difficult once the onset of fertility is postponed to very late ages, as is the case in Southern Europe, because it leaves little time for catching up. The situation is different in the Central and Eastern European countries, where cumulated fertility for young mothers is among the highest in Europe because of the relatively young pattern of childbearing. For instance, women in the 1965 cohort are expected to have fewer than 1.6 children in Italy and Spain at age 35, whereas women in the same cohort in most of the lowest-low-fertility countries in Central and Eastern Europe have already borne more than 1.8 children (Council of Europe 2001; Frejka and Calot 2001a,b). The contrast is even sharper for younger cohorts. For instance, the cumulated cohort fertility level at age 27 in the 1970–71 cohort is above 1.0 in all Central and Eastern European countries and former Soviet Republics, whereas it is below 0.4 in Italy and Spain (Frejka and Calot 2001b). At the same time, Billari and Kohler (2002) show that the cohorts born 1950, 1955,… , 1975 in Italy have *more* first children at any age—up to the latest age observed in 1996—than the corresponding Dutch cohorts. This is surprising since the Netherlands represents a country with relatively high period and cohort fertility in Europe. Moreover, because the Italian cohorts exhibit a lower level of cumulated fertility (all birth orders combined) after age 30 than their Dutch counterparts, the analyses provide a first indication—to be further substantiated below—that lowest-low fertility in Italy is associated with a low progression probability after the first child and a "falling behind" in cohort fertility at relatively late ages.

Evidence on the scope for recuperation can also be obtained from micro-data. If there is a "pure" postponement of fertility (i.e., one with perfect recuperation at later ages), and if we ignore issues of unobserved heterogeneity and selectivity, then the age at first birth should be only a weak predictor of an individual's completed fertility in simple regressions of fertility on the age at first birth. Independently of when women would start their reproductive careers, a pure postponement of fertility would imply that—on average—completed fertility is approximately the same for early and late starters. But the empirical evidence contradicts this hypothesis of a pure postponement. In particular, there is a well-known negative association between the age at first birth and completed fertility (e.g., Bumpass and Mburugu 1977; Marini and Hodsdon 1981; Morgan and Rindfuss 1999). Kohler, Skytthe, and Christensen (2001) show in a study using Danish monozygotic twins that this effect persists even after controlling for potentially important unobserved characteristics that determine both the age at first birth and completed fertility. Hence, there seems to be a negative postponement effect that causally links a later onset of childbearing to lower completed fertility. In some countries, however, including Denmark and the United States, the relevance of this negative postponement effect has weakened over time (Kohler, Skytthe, and Christensen 2001; Morgan and

Rindfuss 1999). For instance, the individual-level estimates for Denmark show that an additional year of delay in childbearing causes a reduction in women's completed fertility of 3.8 to 4.9 percent for cohorts 1945–52, while it causes a reduction of only 1.7 to 1.9 percent for cohorts 1953–60. This decline in the negative effect of postponement on completed fertility is an important reason why Denmark has achieved a high recuperation of delayed births: although the mean age at first birth increased by 2.8 years across merely 16 birth cohorts (from 23.5 in the 1945 cohort to 26.3 in the 1960 cohort), completed cohort fertility declined only slightly from 2.06 to 1.89 (Eurostat 2001).

Some lowest-low-fertility countries may represent exceptions to this declining relevance of the timing of the onset of childbearing for completed fertility. Because the more sophisticated analyses performed using data on Danish twins are not feasible in lowest-low-fertility countries, we perform simple regressions of the logarithm of fertility at age 38, which can be considered as almost completed fertility, on the age at first birth for women who experienced their first birth before age 32. These estimates provide individual-level evidence about the effect of the timing of the onset of childbearing on completed fertility, and the regression coefficient—denoted as the postponement effect—measures the relative decline in completed fertility associated with a one-year delay in the age at first birth. Table 2 shows the estimates of this postponement effect for some key lowest-low-fertility countries and for Sweden as a reference. In Italy and Spain the postponement effect is relatively high, and it implies a relative reduction of completed fertility between 2.9 and 5.1 percent for each one-year delay in the onset of motherhood. For the youngest cohorts in the table, the postponement effects equal 2.9 percent for Italy and 3.8 percent for Spain. Despite its decline in the most recent cohorts, the postponement effect in these countries is still substantially above the levels found in Denmark and Sweden, two countries with very successful recuperation. The Central and Eastern European cases differ from the Italian and Spanish situation by having a small or moderate postponement effect that has been quite stable over time. This relatively small effect may be due to the young age pattern of fertility in these cohorts, which provides more opportunities for women to recuperate after delaying their first birth.

The results in Table 2 therefore suggest important postponement–quantum interactions that are consistent with many related studies: late starters in childbearing tend to have lower fertility than early starters, and a pure postponement of fertility seems to be absent. Moreover, the lowest-low-fertility countries in Southern Europe seem to exhibit a strong negative association between the onset of childbearing and the level of fertility, and this postponement effect, despite some weakening in more recent cohorts, remains substantial.

TABLE 2 Estimates of the postponement effect for various cohorts in selected lowest-low-fertility countries (including Sweden for comparison), showing the relative decrease in completed fertility associated with a one-year delay in the age at first birth

Country	Cohorts			
Italy	**1923–35**	**1935–45**	**1946–51**	**1952–58**
	0.0373**	0.0420**	0.0480**	0.0294**
	(0.002)	(0.0018)	(0.0046)	(0.0037)
Spain			**1945–51**	**1952–58**
			0.0511**	0.0382**
			(0.0061)	(0.0041)
Bulgaria			**1949–55**	**1956–60**
			0.0278**	0.0266**
			(0.006)	(0.00515)
Czech Republic			**1952–55**	**1956–59**
			0.0351**	0.0346**
			(0.0081)	(0.0070)
Hungary			**1952–54**	
			0.0289**	
			(0.0049)	
Sweden			**1949**	**1954**
			0.0215**	0.0160**
			(0.0042)	(0.0042)

NOTES: All estimates are based on women who experienced their first birth prior to age 32. Analyses include cohort dummies that capture trends in cohort fertility. Standard errors are in parentheses.
p-values: ** $p \leq 0.01$.
SOURCES: Italy: ISTAT Survey 1983 (women, only up to 9 births up to age 38) for cohorts 1923–45; Fertility and Family Surveys (FFS) 1995–96 (women, only up to 9 births up to age 38), cohorts after 1946. Spain: FFS 1995–96 (women, only up to 9 births up to age 38). Bulgaria: FFS 1997–98 (women, only up to 6 births up to age 38). Czech Republic: FFS 1997 (women, only up to 5 births up to age 38). Hungary: FFS 1992–93 (women, only up to 9 births up to age 38). Sweden: FFS 1992–93 (women, only up to 7 births up to age 38).

Demographic analysis of lowest-low fertility

In this section we implement the methodological approach of Kohler and Ortega (2002a) to obtain estimates of completed cohort fertility associated with currently observed TFR levels in lowest-low-fertility countries.[5] The Kohler–Ortega approach is a refinement of the Bongaarts and Feeney (1998) and Kohler and Philipov (2001) tempo adjustment of period fertility measures. It uses age- and parity-specific childbearing intensities, or occurrence-exposure rates, that are calculated by relating births of order $i + 1$ to women at parity i (e.g., the number of first births is divided by the number of childless women at each age group). These childbearing intensities are not subject to compositional distortions that arise from shifts in the parity distribution of the population over time, and Kohler and Ortega show that the tempo

adjustment of period fertility measures can be extended to childbearing intensities. The Kohler–Ortega approach then uses tempo-adjusted childbearing intensities to calculate a variety of fertility measures for synthetic cohorts, including the lifetime birth probability of at least one child, the level of childlessness (equal to one minus the lifetime birth probability of at least one child), and the period fertility index that is equal to the completed fertility of a synthetic cohort experiencing the tempo-adjusted period childbearing intensities of a calendar year. This index differs from the adjusted TFR because it is based on tempo-adjusted childbearing intensities, or occurrence-exposure rates, instead of order- and age-specific fertility rates.

The above calculations provide cohort fertility measures that reflect the level of childlessness and the level of completed fertility associated with the tempo-adjusted childbearing intensities observed in a calendar year. These measures are free of tempo distortions, and they are not subject to compositional distortions resulting from past fertility trends (for additional discussions and applications, see Kohler and Ortega 2002a,b; Ortega and Kohler 2002). Nevertheless, the period fertility index is not necessarily a projection of fertility in real cohorts. This index is a measure of period fertility or fertility quantum, whereas the completed fertility of real cohorts depends on the future trends of both period quantum and fertility postponement. For instance, Kohler and Ortega (2002a,b) show that an ongoing delay of childbearing is associated with postponement–quantum interactions that often lead to a reduction in completed fertility—consistent with our micro-analyses in the preceding section—because the additional delays in childbearing shift first and second births toward older ages at which the probability of progressing to another child is declining.

The data requirements for the Kohler–Ortega calculations are more demanding than those for the calculation of the Bongaarts and Feeney adjusted TFR since both births and the female population in each calendar year need to be disaggregated by parity and age. The population parity composition by age, however, is often unavailable from published statistics. We have obtained these data for Italy, Spain, Bulgaria, the Czech Republic, and Hungary from the Observatoire Démographique Européen and our own cohort fertility reconstruction, and we are able to apply the approach to several lowest-low-fertility countries with different socioeconomic characteristics (Table 3).[6] We also report the total fertility rate in Table 3, and for comparison we include two countries with somewhat higher fertility, the Netherlands and Sweden (these estimates are taken from Kohler and Ortega 2002b). The TFRs and other results in Table 3 are averaged across two three-year periods in the early to mid 1980s and mid to late 1990s, and they cover the most recent 15-year time span for which data are available.

The observed TFRs for first births in the lowest-low-fertility countries in Table 3 declined substantially during the 15 years of observation, and the

TABLE 3 Demographic analysis of selected lowest-low-fertility countries (including Sweden and the Netherlands for comparison)

	First births			All birth orders	
	TFR[a]	Lifetime birth probability	Child-lessness	TFR[a]	Period fertility index[b]
Italy					
1980–82	0.73	0.86	0.14	1.55	1.70
1994–96	0.61	0.81	0.19	1.19	1.43
Spain					
1981–83	0.79	0.85	0.15	1.91	2.02
1996–98	0.58	0.84	0.16	1.15	1.67
Bulgaria					
1982–84	0.96	0.97	0.03	1.96	1.96
1997–99	0.65	0.90	0.10	1.11	1.36
Czech Republic					
1982–84	0.90	0.92	0.08	1.98	1.96
1997–99	0.53	0.88	0.12	1.13	1.52
Hungary					
1982–84	0.85	0.91	0.09	1.72	1.83
1997–99	0.57	0.87	0.13	1.27	1.53
Sweden[c]					
1982–84	0.66	0.83	0.17	1.59	1.71
1997–99	0.62	0.84	0.16	1.43	1.70
Netherlands					
1982–84	0.64	0.81	0.19	1.48	1.70
1997–99	0.76	0.82	0.18	1.59	1.70

[a]The total fertility rates are calculated from the same cohort data that are used for the Kohler–Ortega analyses; the TFR levels therefore differ slightly from published statistics.
[b]The period fertility index is equal to the completed fertility of a synthetic cohort experiencing the tempo-adjusted period childbearing intensities of a calendar year.
[c]For Sweden, the data include only the Swedish-born population.

observed TFRs suggest large reductions in first-birth fertility that range from 16 percent in Italy to 41 percent in the Czech Republic. The corresponding changes in Sweden and the Netherlands are –6 percent and +19 percent. The TFR for first births, however, is not a good indicator of the quantum of first-birth fertility in a calendar year. A preferable indicator is the Kohler–Ortega lifetime birth probability of at least one child, which is reported in the second column of Table 3, because it removes both tempo and compositional distortions from the observed TFR. These calculations yield a quite different picture of the trends in first-birth fertility in the lowest-low-fertility countries. In particular, the lifetime birth probabilities in the mid to late 1990s exceed the TFR for first births by 33 to 45 percent in Italy and Spain and by 38 to 66 percent in Bulgaria, the Czech Republic, and Hungary. Moreover, they have

declined substantially less than the TFR for first births during the 15 years from the early to mid 1980s to the mid to late 1990s. For instance, the lifetime birth probability declined by only 1 to 6 percent in Italy and Spain and by 4 to 7 percent in Bulgaria, the Czech Republic, and Hungary.

In column 3 of Table 3 we calculate the levels of childlessness in synthetic cohorts that are associated with the period fertility patterns in the early to mid 1980s and the mid to late 1990s. Most importantly, these calculations suggest that the lowest-low-fertility patterns observed during the late 1990s in Italy, Spain, Bulgaria, the Czech Republic, and Hungary do not imply particularly high levels of childlessness. Once tempo distortions are removed, our calculations suggest that a synthetic cohort experiencing the tempo-adjusted fertility pattern observed during the mid to late 1990s attains a level of childlessness of 16 to 19 percent in Spain and Italy and of 10 to 13 percent in Bulgaria, the Czech Republic, and Hungary. These levels of childlessness are well below or comparable to the corresponding estimates for Sweden and the Netherlands in the late 1990s (Table 3). These levels are also modest when compared to the childlessness observed in some other countries, for instance Germany, where more than one-third of women in the 1965 cohort are expected to remain childless (Dorbritz and Gärtner 1999).

Despite only moderate declines in the level of first-birth childbearing, it is undisputed that noteworthy declines in the overall level of childbearing have occurred in lowest-low-fertility countries. These declines, however, are concentrated on higher parities. In columns 4 and 5 of Table 3 we combine births at all parities and report the observed TFR and the period fertility index that is equal to the completed cohort fertility obtained from the tempo-adjusted childbearing intensities. As we expect from our earlier discussions, the observed total fertility rate in the lowest-low-fertility countries in Table 3 has declined substantially during the period of investigation, with declines ranging from 23 to 43 percent. Because of tempo and compositional distortions, however, this decline in the TFR is likely to exaggerate the reduction in the quantum of fertility. The comparison of the TFR with the period fertility index can reveal the extent of these distortions. In particular, this index suggests that the tempo-adjusted childbearing intensities prevailing during the mid to late 1990s are associated with synthetic cohort fertility between 1.43 and 1.67 in Italy and Spain and between 1.36 and 1.53 in Bulgaria, the Czech Republic, and Hungary. The period fertility index is between .24 and .52 children higher than the level of the TFR, and during the period from the early to mid 1980s to the mid to late 1990s it declined by only 16 to 17 percent in Italy and Spain, 16 to 22 percent in Hungary and the Czech Republic, and 31 percent in Bulgaria. Moreover, while the period fertility index in the lowest-low-fertility countries in Table 3 is below that of Sweden and the Netherlands, the differences between countries are substantially smaller if fertility is measured by the period fertility index instead of the TFR.

In summary, our results suggest that the decline in the quantum of first births has not been a primary driving force in the emergence of lowest-low fertility in the Southern, Central, and Eastern European countries included in Table 3.[7] This suggests that even in lowest-low-fertility contexts, the biological, social, and economic incentives for childbearing are sufficiently strong that most women (or couples) desire to have at least one child (for related discussions, see, e.g., Foster 2000; Morgan and King 2001; Kohler, Rodgers, and Christensen 1999). In addition, our analyses of lowest-low-fertility countries in Table 3 show that the tempo-adjusted childbearing intensities prevailing during the mid to late 1990s imply a completed fertility in synthetic cohorts between 1.36 and 1.67 children. The completed fertility in real cohorts is likely to be lower because of the postponement–quantum interactions resulting from a continued delay of childbearing, unless this effect is compensated by an increase in the quantum of fertility.

Explaining the emergence of lowest-low fertility

In this section we explore the socioeconomic characteristics and individual-level determinants that underlie the demographic patterns identified previously. We focus on the delay of childbearing and the progression after the first child that we have emphasized as the central demographic aspects in understanding lowest-low fertility. Our starting point is the observation that fertility is a dynamic process over the life course. Children are generally born one at a time, and individuals have considerable control over the timing of fertility. Given the widespread availability of reliable contraception in most lowest-low-fertility countries, we can assume that births are looked for, or at least not intentionally avoided. In such a context, there are several reasons why individuals may not have a child at the moment: one may plan to have a child later, one may plan not to have a child at all, or one might not have a clear idea about such plans. There is no irreversible commitment associated with plans to delay fertility, at least within the biological and medical limits that determine the ages of childbearing. This flexibility is in sharp contrast to the transition into parenthood, which is irreversible once a child is born.

This asymmetry between the irreversibility of childbirth and the reversibility of future plans about the timing of fertility provides an incentive to postpone the decision to have children. Postponement can reduce the uncertainty about the costs and benefits of children, and also the uncertainty associated with the economic situation and the stability of unions in early adulthood. The potential of young adults to adjust the timing of their fertility is facilitated by the diverging plasticity of quantum and timing decisions. On the one hand, decisions about the number of children in lowest-low-fertility countries are increasingly concentrated on the choice be-

tween childlessness and having one or two children. On the other hand, the timing of fertility is relatively flexible. The desired onset of childbearing can range over two decades in the life span from the late teenage years to the mid and late 30s (potentially also later). The timing of fertility in lowest-low-fertility countries is therefore likely to be sensitive to changes in socioeconomic conditions, especially at low parities.

The socioeconomic background of delayed childbearing

The socioeconomic context of decisions about timing of parenthood varies substantially across lowest-low-fertility countries, and the difference between Southern European and Central and Eastern European countries is striking. In Southern European countries, per capita income levels are at medium to high levels with steady growth, and these countries have also experienced low inflation (Table 4). At the same time, entry into the labor market for

TABLE 4 Economic indicators and gross university enrollment ratios for lowest-low-fertility countries

	Economic indicators				Gross university enrollment[c] (percent)			
					Women		Men	
Country	GNI per capita[a] 1999	GDP average annual growth[b] 1990–99 (percent)	GDP growth[b] 1999 (percent)	Average annual inflation 1990–99 (percent)	1989	1999–2000	1989	1999–2000
Greece	12.1	2.2	3.4	6.2	25.3	56.2	24.4	53.2
Italy	20.2	1.4	1.4	3.4	29.1	52.8	30.3	40.7
Spain	14.8	2.2	3.7	3.1	33.8	62.3	36.3	53.0
Bulgaria	1.4	–2.7	2.4	116.5	28.2	50.1	24.4	35.7
Czech Republic	5.0	0.8	–0.2	7.7	13.9	29.1	17.7	28.2
Estonia	3.4	–1.3	–1.1	15.5	26.5	62.6	25.7	43.3
Hungary	4.6	1.0	4.5	17.4	14.9	40.5	13.7	33.1
Latvia	2.4	–4.8	0.1	9.2	29.0	62.4‡	20.4	37.9‡
Romania	1.5	–0.8	–3.2	61.4	8.4	24.3†	8.6	20.8†
Slovenia	10.0	2.4	4.9	9.9	27.8	61.3‡	22.3	45.7‡
Armenia	0.5	–3.2	3.3	32.5	23.8[d]	14.0†	23.8[d]	10.5†
Belarus	2.6	–3.0	3.4	169.6	50.3	56.2	45.5	43.7
Russia	2.3	–6.1	3.2	52.0	58.9	73.0	48.4	57.4
Ukraine	0.8	–10.7	–0.4	69.8	45.8[d]	46.0‡	45.8[d]	40.4‡

[a]GNI per capita = gross national income per capita in thousand US$.
[b]GDP = gross domestic product.
[c]Gross university enrollment ratio is the total enrollment in university education, regardless of age, divided by the population of the age group that officially corresponds to university education.
[d]Enrollment ratio pertains to males and females combined.
Calendar year: †1996; ‡1998–99.
SOURCES: World Bank (available at http://www. worldbank.org); UNESCO, Institute for Statistics (available at http://www.unesco.org).

young adults is often very difficult, as is reflected in high youth unemployment rates (Table 5). The three lowest-low-fertility countries in Southern Europe had the highest youth unemployment rates in the European Union in 1999, a situation essentially unchanged since 1989. Unemployment rates are also higher for women than for men, in contrast to Northern European countries. The link between unemployment and low fertility is also supported by the observation that the only Southern European country with relatively high fertility is Portugal, which has considerably lower unemployment rates than its Mediterranean counterparts.

The chronic high youth unemployment in Southern Europe has discouraged young adults from entering the labor market, has made higher education more attractive, and has caused working conditions to deteriorate toward a high fraction of low-paid temporary jobs. In addition, there is a crowding-out process in which better-educated young people are displacing less-educated people from their traditional positions (e.g., Dolado, Felgueroso, and Jimeno 2000). Labor market uncertainty and poor economic prospects in early adulthood also tend to perpetuate the commonly observed behavior of staying in the parents' household until relatively late ages. In both Italy and Spain, for instance, the successful entry into the labor force tends to accelerate household and union formation (Billari et al. 2002).[8]

There is also considerable heterogeneity in the determinants of low fertility and postponement within Eastern European countries and former Soviet republics. While all of these countries share the experience of the transition from a planned to a market economy, the success of this transition and economic hardships during the transformation have varied considerably. Some of these differences in income levels and economic outcome during the transition period are documented in Table 4. Most of the Central and Eastern European countries with lowest-low fertility, in particular those in the former Soviet Union, have experienced a decline in output over the transition. Many countries have also experienced substantial inflation during the economic crisis. This is especially the case in the former

TABLE 5 Youth unemployment rates (under age 25 years) in Southern Europe

	Women		Men	
Country	**1989**	**1999**	**1989**	**1999**
Italy	38.5	38.3	25.9	28.6
Greece	34.0	39.3	17.0	21.4
Spain	42.6	37.3	24.4	21.7
Portugal	15.8	11.1	8.3	7.5
EU (15)	19.6	19.2	14.4	16.7

SOURCE: OECD, employment statistics (available at http://www.oecd.org).

Soviet Union and in countries such as Bulgaria and Romania. In addition, income levels have been volatile in all transition countries listed in Table 4, with the median income fluctuating from year to year by as much as 25 percent (Forster and Toth 1997; Lokshin and Ravallion 2000). Labor turnover has been frequent, leading to common experiences and fears of unemployment (Kohlmann and Zuev 2001; see also Kohler and Kohler 2002).

The structure of wages and employment has also been transformed in Central and Eastern European countries experiencing transitions to market economies. The returns to human capital have increased considerably as compared to the pretransition period, and young cohorts can expect reward levels for skills that approach—or are comparable to—the returns in Western European countries (e.g., Munich, Svejnar, and Terrell 1999; Newell and Reilly 2000; Orazem and Vodopivec 1995; Rutkowski 1996). In contrast, there has been a decline in the returns to experience for people with lower educational levels. As a result, poverty is particularly common among the poorly educated and those having more than two children (Grootaert and Braithwaite 1998; Milanovic 1998).

Postponement as a rational response to socioeconomic incentives

On the basis of this sketch of the socioeconomic background, we investigate the individual-level determinants of delayed childbearing in lowest-low-fertility countries. An important commonality of the socioeconomic context in these countries is a high level of economic uncertainty in early adulthood. This uncertainty provides an incentive to delay decisions that imply long-term commitments, such as the decision to have children, and it provides an incentive to invest in education and other forms of human capital.

In Southern European countries, the uncertainty is basically due to youth unemployment and/or job instability: high unemployment risks simultaneously lower the opportunity costs of pursuing higher education and create incentives for education related to the increased employment opportunities. Higher education has therefore become the primary pathway for individuals to increase their chances of finding a stable job with a sufficient wage (Lassibille et al. 2001; Sá and Portela 1999). In Central and Eastern European countries, the uncertainty is the result of insecurity and hardship caused by the economic transition. Moreover, the transition has increased the returns to education. The combination of these factors has rendered human capital investments very attractive since these investments provide insurance against poverty and provide access to more stable employment with relatively high salaries. The main problem individuals in Eastern Europe face in attaining education is that the costs may be too high and credit constraints may preclude access to loans to cover tuition and consumption during studies.

The university enrollment ratios in Table 4 reflect the remarkable increase in higher education in Southern European countries, where half of the women pursued university studies by the late 1990s. Central and Eastern European countries share this general trend toward increased enrollment ratios, particularly for women. Bulgaria, Estonia, Latvia, and Slovenia have greatly increased their enrollment ratios to levels comparable to Western countries. Levels in the Czech Republic, Hungary, and Romania have also increased, but since these countries started at much lower levels they still lag behind. The only deviations from the trend toward increased higher education are among the former Soviet republics.

Comparison of the evolution of university enrollment with the mean age at childbearing is illuminating. The countries with marked increases in higher education tend to be those with the most pronounced delays in the mean age at first birth.[9] This association between delays in childbearing and increases in human capital investment is consistent with our hypothesis that increasing returns to education induce young adults—particularly young women—to study longer in the expectation of improving their ability to cope with economic uncertainty and to take advantage of the new opportunities created during the economic transition. Exceptions to this general pattern seem to be found in countries where the economic situation is most severe and where the strategy of higher education and human capital investments is inaccessible to large fractions of the population. In addition to the human capital motive for delaying childbirth, the unstable standards of living in Eastern Europe also lead to a strategic postponement in which decisions about children—and similar decisions implying long-term commitments—are deferred in the expectation that the uncertainty about future prospects will be reduced over time.[10]

Changes in social policy are an additional factor in the former socialist countries. In the socialist period many countries had developed a system of incentives that rewarded early childbearing, for instance by granting easier access to housing and paid maternity leave. These incentives resulted in a reduced age at motherhood, especially during the 1980s (Frejka 1980; Zakharov and Ivanova 1996). During the 1990s many of these benefit structures ended or eroded owing to inflation, or were modified, contributing to the postponement of motherhood in the last decade.

A further determinant of the connection between fertility postponement and low fertility is the availability of housing. This is especially relevant in Italy and Spain, where the interference of childbearing with educational investments has been much reduced owing to the delay of parenthood to very late ages. In these countries, the preponderance of property ownership in the housing market and the restricted rental market induce young people to stay at home with their parents until their financial resources are adequate for paying a mortgage (Duce Tello 1995).[11]

Because this process can take several years after entry in the labor market, it can lead to delays of childbearing substantially beyond the completion of higher education.

Social feedback effects on the timing of fertility

Our discussion of individual-level determinants of timing decisions is not yet sufficient to understand the dynamics of fertility postponement in lowest-low-fertility populations and, more generally, in other low-fertility populations. In particular, we believe that the analysis of individual responses to socioeconomic incentives and socioeconomic changes must be integrated with a consideration of social interaction and its effect on the dynamics of fertility change.

Social interaction effects are firmly established in recent theories of fertility decline in developing countries and during the European demographic transition (e.g., Behrman, Kohler, and Watkins 2002; Bongaarts and Watkins 1996; Kohler 2001; Montgomery and Casterline 1996; Watkins 1990). Despite increased attention to this issue by demographers, social interaction is not yet routinely integrated in research and theoretical frameworks for the determinants of fertility in developed countries.

Social interaction influences the dynamics of fertility postponement for at least three reasons (Kohler, Behrman, and Watkins 2000; Montgomery and Casterline 1996): (*a*) *social multiplier effects* tend to increase the level of behavioral adjustment resulting from socioeconomic changes, and they can increase the pace and extent of fertility delays in response to socioeconomic changes; (*b*) social interaction can give rise to *multiple equilibriums*—or *multiple demographic regimes*—with early and late childbearing, and transitions between these equilibriums can lead to rapid and persistent changes in the timing of fertility; (*c*) *status quo enforcement* can lead to inertia in normative changes and path-dependent fertility developments in situations with strong familial and social ties, and this can help to explain the slow emergence of newer demographic behaviors—such as out-of-wedlock childbearing—in countries like Italy. Before we examine these dynamic implications of social interactions, we briefly review the arguments for why social interaction is likely to be an important determinant of fertility change even in developed countries.

Social learning about the optimal timing of fertility. The optimal timing of fertility may be a complicated decision for women or couples, especially in the context of uncertain and changing socioeconomic environments.[12] Social learning provides a way to simplify and augment decisionmaking in this context. Childbearing and career experiences of friends are therefore likely to influence women's and couples' decisions about the timing of fertility. Interaction with others can provide information about such questions as "How

did classmates who had their first child relatively early fare in their careers and relationships?" and "What is the difference in social and economic attainment between those who had their children early and those who had them later?" Social learning also implies aggregate-level feedback. In a population that delays childbearing, social learning implies that the experience of friends who have children is revealed at an increasingly later age. A woman at some given age, say 25, therefore faces more uncertainty about the advantages and disadvantages of childbearing in a population that exhibits a late pattern of childbearing as compared to a 25-year-old woman in a population with early childbearing. Higher uncertainty in turn implies a further incentive to delay childbearing. Social learning therefore implies a multiplier effect that reinforces the impact of socioeconomic changes that lead to delayed patterns of childbearing.

Social influences on the desired timing of fertility. Normative influences of the social environment on various aspects of entering parenthood and childbearing are a second means by which social interactions affect fertility decisions. The effect of such norms on the timing of demographic events has been a central issue in the life-course approach, and there is cumulating empirical evidence about the relevance of norms for the timing of life-course transitions in early adulthood (e.g., Billari and Liefbroer 2001; Billari and Micheli 1999; Heckhausen 1999; Settersten and Hägestad 1996; White 1998).[13] We are interested in these social influences not only because of their direct effect on individual behavior, but also because of the associated social multiplier effect. This effect occurs, for instance, because changes in innovative subpopulations in response to new socioeconomic conditions imply an erosion and transformation of prevailing social norms that influence such behavior. The behavioral change of the innovators thus has an indirect effect on the incentives and normative context of fertility decisions in the population in general, and this indirect effect makes it more likely that others will adopt the new behavior as well.

Social feedbacks mediated through the marriage market. In some lowest-low-fertility countries, union formation and marriage are inherently connected with the transition to parenthood. This is particularly the case in Italy and Spain, where out-of-wedlock childbearing is relatively rare, premarital cohabitation is not widespread, and the trend toward late childbearing is associated with late home-leaving and late union formation (De Sandre 2000; Delgado and Castro Martín 1998).

One demographic implication of this trend toward late union formation is the induced shift in the composition of potential mates in the marriage market. While the traditional literature on marriage squeezes emphasizes the effect of differential cohort sizes (e.g., Goldman, Westoff, and Hammerslough 1984; Grossbard-Shechtman 1985), changes in the age distribution of union formation have similar implications. In particular, a delay of union formation

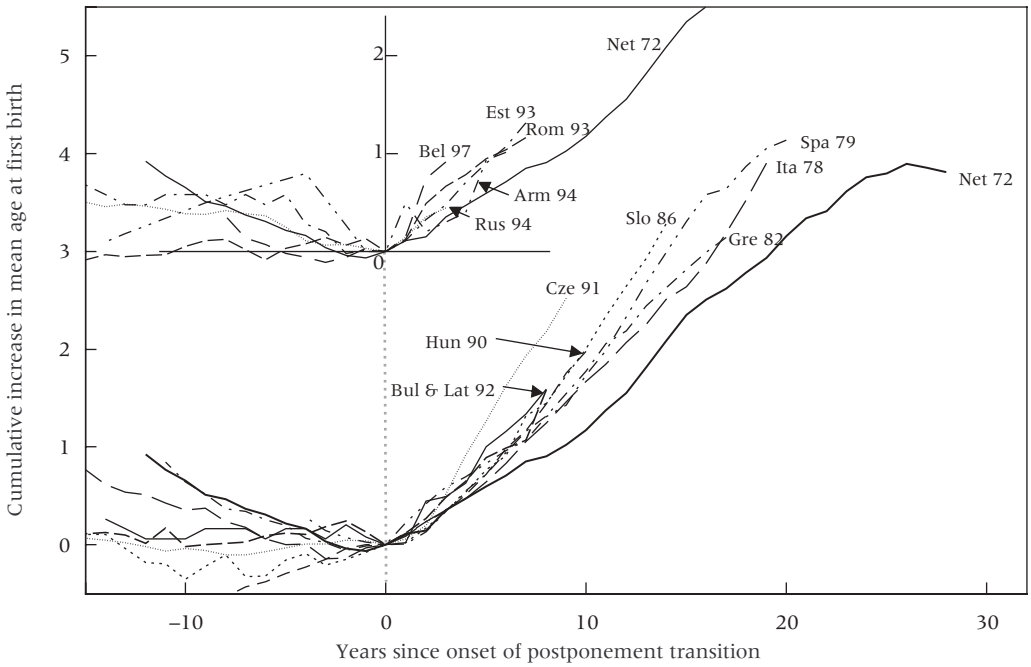
reduces the marriage market costs encountered by individuals who delay marriage/cohabitation. First, it increases the probability of finding a partner at later ages, for instance after finishing more extended education; second, it increases the expected "quality" of marriageable partners at older ages because the marriage market will contain more potential mates at any given age. Socioeconomic changes that provide incentives for delayed childbearing, for instance higher returns to women's education or technological innovations facilitating fertility control, therefore affect the timing of marriage in two ways: on the one hand, through a direct effect on individual incentives to delay, and on the other hand, through an indirect effect by reducing the costs of delaying marriage/cohabitation. The latter aspect gives rise again to a social multiplier effect (for a formal analysis and application to the United States, see Goldin and Katz 2002).

Social feedbacks through competition in the labor market. Another aspect of social interaction is competition in the labor market caused by the presence of high unemployment. In this situation, the labor market can give rise to a social multiplier effect, quite similar to that operating through the marriage market noted above (for a related formal model, see Kohler 2001: Chapter 6). In particular, social interaction reinforces the effect of unemployment and economic uncertainty in delaying childbearing. This social multiplier effect arises because women with children tend to have lower rates of labor force participation than women without children, especially in those low- and lowest-low-fertility countries with inflexible labor markets and insufficient supply of day care. In this situation, a delay of childbearing in the population increases the level of childlessness among women in the primary ages of labor market entry. This increased childlessness leads to an increased female labor supply, which in turn increases competition and unemployment risks during early adulthood. The postponement of fertility caused by unemployment during early adulthood is therefore further supported through a feedback process that increases the overall female labor supply in the age groups that are most affected by economic stress.

The dynamics of delayed childbearing: Postponement transitions

Our arguments in the previous section suggest that consideration of social interaction can improve our understanding of the dynamics of fertility postponement. In particular, we argue here that the delay of childbearing follows a postponement transition that shares many characteristics of the fertility transition in Europe or contemporary developing countries (e.g., see Bongaarts and Watkins 1996). The notion of a postponement transition is substantiated in Figure 1. In this figure we define the year of onset of the postponement transition as the first in a span of three years during which

FIGURE 1 Onset and pace of the postponement transition in lowest-low-fertility countries and the Netherlands



NOTE: For definition of onset see text.

the mean age at first birth increases by more than 0.3 years. Within lowest-low-fertility countries, this year of onset ranges from 1978 (Italy) to 1994 (Russia, Armenia) and 1997 (Belarus) (see also Table 1). The horizontal axis in Figure 1 plots the number of years since the onset of the postponement transition, and the vertical axis indicates the change in the mean age at first birth since this onset. To avoid cluttering the figure, we display some Eastern European countries with a very recent onset in the upper-left corner. In addition we include the Netherlands as a representative Western European country with an early onset of the postponement transition (1972) and a moderately high total fertility rate (1.65 in 1999).

The figure reflects the previously documented substantial increases in the mean age at first birth in lowest-low-fertility countries. More importantly, standardization of the time scale in the figure reveals several characteristics that seem to be inherent to the postponement of fertility: (a) the onset of delayed childbearing in lowest-low-fertility countries is a break with an earlier regime characterized by relative stability in first-birth timing; (b) once initiated, the postponement transition in all lowest-low-fertility countries is persistent and leads to large rises in the mean age at first birth; (c)

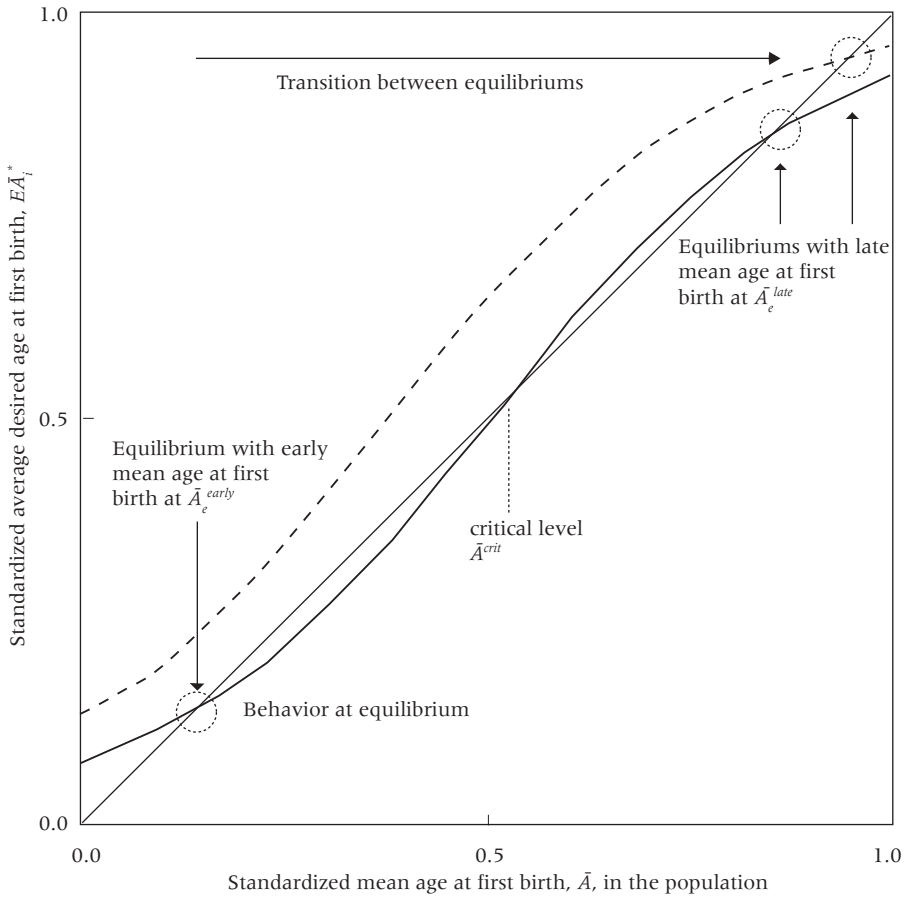
the broad characteristics of the postponement transition are similar across a wide range of socioeconomic conditions: for instance, the paths for the Netherlands, Italy, Spain, Greece, Slovenia, Hungary, the Czech Republic, Bulgaria, and Latvia—that is, all countries with an onset of the transition up to 1992—trace each other closely. This similarity occurs despite the fact that these countries represent diverse socioeconomic conditions in Europe, including different patterns of post-1990 economic crises in Eastern Europe and different levels in the mean age at first birth before the postponement transition. For countries with an onset of the postponement transition after 1992 it is premature to make inferences about their path, but it seems very likely that they will follow those of the other lowest-low-fertility countries.

The empirical characteristics of postponement transitions in low- and lowest-low-fertility countries in Figure 1 are similar to the characteristics of the fertility decline during the demographic transition in Europe and can be explained by a similar set of mechanisms. In particular, we argue that the empirical patterns of the postponement transition in Figure 1 can be consistently explained by the combination of individual-level incentives for delayed childbearing and the aggregate-level implications of social interactions. Moreover, neither aspect alone is likely to be sufficient.

To illustrate how this interaction of individual incentives and feedback mechanisms can give rise to a postponement transition, we develop a simple theoretical model of fertility timing with social interaction that can predict the postponement dynamics outlined above. For simplicity we focus on the timing of the first child, which is the most pivotal parity in lowest-low-fertility countries, and we use a micro–macro interaction model similar to ones that have been used to explain other rapid behavioral changes in demography and the social sciences (e.g., Arthur 1994; Kohler 2001; Schelling 1978). Figure 2 depicts a stylized population in which social interactions influence the desired age at first birth. The horizontal axis denotes $\bar{A}$, the mean age at first birth standardized as ranging from 0 to 1, and it represents the overall age pattern of childbearing in a population. The vertical axis denotes EA_i^*, the expected value (or average) of the desired timing A_i^* of the first birth of all women, indexed by i, in the population. On the individual level, this desired timing depends on individual characteristics (e.g., education, familial background, or preferences) and on aggregate socioeconomic determinants (e.g., wages, prices of child care, state support for children). The expectation EA_i^* thus represents the average desired age at first birth that emerges from the aggregation of these—potentially quite heterogeneous—individual desires about the age at first birth.

A novelty in this approach is that social interaction, through the various mechanisms outlined above, implies a dependence of the individually desired timing of childbearing on the prevailing mean age at first birth in the population. All of the above mechanisms imply that delays in the aver-

FIGURE 2 Fertility postponement as influenced jointly by social interactions and multiple equilibriums



NOTE: See discussion in text.

age birth timing in the population lead to a later individual desired age at first birth, A_i^*, for all women in the population. The average desired age at first birth, EA_i^*, is therefore a function of the age pattern of fertility in the population, and we write this dependence as $EA_i^*(\bar{A})$.[14]

The most important implication of the model in Figure 2 is that the solid line intersects the 45-degree line at three points: $\bar{A}_e^{early}$, $\bar{A}^{crit}$, and $\bar{A}_e^{late}$. Two of these intersections, $\bar{A}_e^{early}$ and $\bar{A}_e^{late}$, represent stable equilibriums to which the birth timing in the population will converge depending on the prevailing socioeconomic conditions (such as prices, wages, child care institutions, etc.). For instance, if the observed mean age at first birth is slightly to the left of the equilibrium level $\bar{A}_e^{early}$, the average individually desired age at first birth is above the prevailing population mean age at first birth.

As individuals pursue their desired timing of fertility, therefore, the population moves toward the equilibrium level $\bar{A}_e^{early}$. The same reasoning holds when the population is slightly to the right of the equilibrium level, and it also applies to the late fertility equilibrium at $\bar{A}_e^{late}$. Figure 2 therefore represents a situation with two distinct and self-sustaining demographic regimes with different birth timing: an "early-fertility equilibrium" characterized by a relatively young age of entering parenthood, and a "late-fertility equilibrium" where childbearing is initiated at relatively older ages.

To see the implications of this multiple-equilibriums model for changes in the timing of fertility over time, consider a population that is in the early-fertility equilibrium, characterized by a mean age at first birth of $\bar{A}_e^{early}$. What would happen if an increase in the returns to women's education or a greater uncertainty in early adulthood leads to a delay in the individually desired age at first birth? The direct effect of these new socioeconomic conditions shifts the solid line in Figure 2 upward so that it reflects the later childbearing desires of individuals. However, the initial timing of fertility in the population, given by the level $\bar{A}_e^{early}$, is no longer an equilibrium. As a consequence, the age pattern of childbearing will change after the increase in the returns to education or greater uncertainty in early adulthood, and the mean age at first birth will adjust itself toward a new stable situation.

Two scenarios can be distinguished in this adjustment. In the first scenario, we assume that the increase in the returns to education or the greater uncertainty in early adulthood is only modest, and the resulting upward shift of the solid line in Figure 2 is relatively small. As a consequence, there remain three intersections with the 45-degree line, and the new socioeconomic conditions merely imply that the early-fertility equilibrium is shifted toward a later age located at the right of the initial equilibrium $\bar{A}_e^{early}$. The adjustment toward this new equilibrium level implies that the population will experience a postponement of fertility toward later ages. The total change in the timing of childbearing is the difference between the new and old location of the early-fertility equilibrium. In contrast to purely individual-level behavior without social interactions, the model in Figure 2 implies that this total change in the age at first birth is the sum of two parts: (a) a direct effect caused by socioeconomic changes shifting the solid line upward, and (b) an indirect effect—or social multiplier effect—resulting in the adjustment toward the new equilibrium level that lies at the new intersection with the diagonal. These social multiplier effects can be substantial even if social interaction is only of modest relevance. Relatively small changes in the returns to education or small increases in uncertainty, which in the absence of social interaction would lead to only slightly delayed childbearing, can therefore result in relatively large shifts in the timing of fertility.[15]

The second scenario for the adjustment in Figure 2 pertains to the case where the upward shift of the solid line in response to the increased returns to education or higher uncertainty is assumed to be large. This case is

depicted by the broken line. Most importantly, the upward shift implies that the initial early-fertility equilibrium $\bar{A}_e^{early}$ vanishes, and the late-fertility regime at $\bar{A}_e^{late}$ remains as the only stable equilibrium. As a consequence, the change in socioeconomic conditions initiates an adjustment from the initial early timing of fertility, $\bar{A}_e^{early}$, toward the late pattern of childbearing, $\bar{A}_e^{late}$. Because this transition is a shift between two distinct timing regimes, it leads to substantial, rapid, and persistent increases in the mean age at first birth within a relatively short time. In the stylized multiple-equilibriums situation indicated in Figure 2, therefore, changes in socioeconomic conditions can lead to a postponement transition similar to the country paths depicted in Figure 1. Moreover, owing to the feedback mechanism implied by social interaction, the transition appears to observers as if it were driven by its own momentum. This pattern, for instance, is consistent with Livi-Bacci's (2001) characterization of the Italian situation as a "postponement syndrome" in which past delays in childbearing provide the primary impetus for an ongoing postponement of fertility.

We believe that many of the socioeconomic changes that erode the early-fertility equilibrium, such as increased returns to human capital investments or increasing economic uncertainty in early adulthood, are in fact pervasive and will gradually induce later childbearing in many developed countries. Given the characteristics of the *postponement transition* initiated by these socioeconomic changes, we also expect a convergence of countries in the long term toward late timing of fertility. Moreover, our multiple-equilibriums model in Figure 2 suggests that the transitions toward this late-fertility regime continue even if the socioeconomic conditions that prompted the transition are altered. This is the case because the late-fertility regime represents a stable equilibrium, and a population will be attracted to this regime—even in the presence of a viable early-fertility alternative—as soon as some initial socioeconomic changes have resulted in a delay of childbearing beyond the critical level $\bar{A}^{crit}$ in Figure 2. The postponement of childbearing is therefore likely to be persistent, despite the fact that socioeconomic situations that initiate the onset of this transition are temporary.[16] This has been the case in Spain, for example, where the extent of youth unemployment has declined during the 1990s, as can be seen in Table 5.

The above postponement transition toward late-childbearing regimes, which is in our opinion likely to occur in many European and other developed countries, can therefore be been seen as a further step in a long-term transformation of fertility and related behaviors. In particular, our preceding discussion suggests that the long-term trend toward low and lowest-low fertility in Europe is related to three distinct transitions: the demographic transition leading to parity-specific stopping behavior within marriage; the "second demographic transition" resulting in ideational changes and in the rise of nonmarital family forms; and, most recently, the postponement transition that shifts the timing of fertility toward a late-childbearing regime.

The postponement transition implies a delay of parenthood toward later age as a combined result of individual incentives for late childbearing and social interaction effects that reinforce this trend.

Determinants of the quantum of fertility in lowest-low-fertility countries

The occurrence of a postponement transition in many low- and lowest-low-fertility countries also implies that the extent to which specific socioeconomic and institutional contexts accommodate late childbearing emerges as an essential determinant of cross-country variation in cohort and period fertility levels. We now consider the interdependence between the quantum of fertility and the postponement of childbearing as a further determinant of lowest-low fertility, and we investigate whether the institutional context of childbearing is an important determinant of these postponement–quantum interactions.

There is widespread agreement that countries with lowest-low fertility share an institutional setting that implicitly favors a relatively low quantum of fertility. For instance, the lowest-low-fertility countries in Southern Europe—Italy and Spain—provide insufficient child care support (Esping-Andersen 1999).[17] The labor market is also relatively inflexible in providing possibilities for part-time work or reentering the labor force after an absence due to childbirth (Del Boca 2002; González, Jurado, and Naldini 2000; Stier, Lewin-Epstein, and Braun 2001). In comparison with other Western European countries, Italy and Spain also have some of the lowest levels of state support for families with children through tax allowances or direct transfers (Esping-Andersen 1999). While this deficit is partially compensated through strong family networks, as for instance through the provision of child care or economic resources by grandparents (Reher 1997), the substitution of family for public support is likely to be insufficient in contemporary industrialized countries. Moreover, the frequent residence of young adults in the home of their parents or extended family may even discourage union formation and fertility (Dalla Zuanna 2001).

Families in Italy and Spain have also been slow in adapting to the new roles of women (Chesnais 1996). The two countries have a highly unbalanced division of labor within households, which becomes even more pronounced after the birth of the first child (Palomba and Sabbadini 1993). The countries therefore conform to McDonald's (2000) observation about gender equity: very low fertility occurs in countries characterized by high levels of gender equity in individual-oriented institutions, such as the labor market, in combination with low levels of gender equity within the family and in family-oriented institutions.

The moderate to very low quantum of fertility in Eastern Europe is in part determined by similar institutional factors hindering high-parity pro-

gression probabilities. In addition, many of the pronatalist—or at least family-friendly—policies in Central and Eastern European countries were discontinued after 1990 (Macura 2000), and the economic crisis has particularly retarded women's participation in the labor market. Furthermore, Eastern Europe is characterized by persistent economic insecurity throughout the life course. This stands in contrast to Southern Europe, where unemployment and economic stress are concentrated in early adulthood. In Eastern Europe, the uncertain long-term outlook for employment, the housing market, and economic recovery affects not only the timing of the first birth but also the transition to the second child and higher-parity children.

While the aforementioned institutional setting as it applies to Southern Europe has been relatively constant in recent decades, its effect on the quantum of fertility has not. The effect of this institutional setting needs to be investigated in the context of the rapid postponement that has transformed the age pattern of entering parenthood in lowest-low-fertility countries. Specifically, the delay of childbearing has been associated with substantially increased investments in higher education for females (Table 4). Similarly, labor market experience preceding marriage and parenthood is likely to be higher for women with late childbearing than for women with early fertility. A direct consequence of these increased levels of female human capital and labor market experience at the time of childbirth is a rise in the opportunity costs of childbearing in terms of forgone wages.

This rise in wages increases the opportunity costs of time spent outside the labor market, and it increases the opportunity costs of time-intensive "goods" such as children. The increase in opportunity costs, however, is not as high as the rise in the wage level since there can be some labor force participation. In particular, women with late childbearing can substitute "purchased" child care (kindergarten, household help, etc.) in place of "own" child care. This implies that the opportunity costs of children increase less steeply with delayed childbearing than do potential wages.[18]

The extent of this difference between women's wages and the opportunity costs of children, however, depends on the compatibility of childbearing with female labor force participation. In a country with low compatibility, the ability to arrange flexible part-time work or the ability to find a position that can be combined with institutional day care is limited. Hence, the scope for the substitution from time at home to time in the labor market is restricted. The postponement-induced increase in wages thus translates into substantial increases in the opportunity costs of children, including also the opportunity costs of additional children after the first child. These higher child costs will tend to reduce the quantum of fertility and the parity progression probabilities after the first birth.[19]

Alternatively, if there is a high compatibility of childbearing and female labor force participation, wage increases associated with late child-

bearing lead to more modest increases in the opportunity costs of children. In particular, women will encounter relative flexibility in shifting their time allocation from time at home to time in the labor market, and this substitution diminishes the effects of increased wages on child costs. In addition, high levels of female labor force participation can also exert a positive income effect on the demand for children.

These differences between countries with high and low compatibility of work and children have implications for the causal effects of delayed childbearing on the quantum of fertility. The higher human capital associated with delayed childbearing translates directly into increased opportunity costs of children. Socioeconomic conditions that provide incentives for individuals to delay childbearing, such as uncertainty in early adulthood, therefore indirectly increase the costs of children and have an indirect negative impact on the desired number of children. This effect is particularly strong in the context of inflexible labor markets and insufficient availability of day care that characterizes Southern European lowest-low-fertility countries. Moreover, this effect is likely to constitute one of the key reasons why postponement effects, which measure the reduction in completed fertility resulting from an additional year of delay in parenthood, are particularly strong in Southern Europe (see Table 2), and it explains the "falling behind" of cumulated cohort fertility at higher ages in Italy and Spain as compared to countries such as the Netherlands or Denmark that have experienced late childbearing in the absence of substantial reductions in cohort and period fertility.

In short, the postponement of fertility is negatively associated with the ultimate quantum of fertility, and the magnitude of this postponement–quantum interaction depends mainly on the compatibility between formal labor force participation and children. On the one hand, countries with low compatibility, such as Italy and Spain, are subject to large postponement effects. These countries experience substantial reductions in completed fertility that are causally related to delayed childbearing. On the other hand, in countries with a high compatibility of labor force participation and children, as for instance Denmark and Sweden, the increased costs of time at home associated with delayed parenthood can be partially accommodated by increasing women's labor force participation. Differences in these postponement–quantum interactions are likely to be a key factor underlying the divergence of fertility levels between low- and lowest-low-fertility countries in Europe.

Some speculations on the future of lowest-low fertility

Four questions seem to us to be of central importance in assessing the future of lowest-low fertility (related discussions include Bongaarts and Bulatao

2000; Coleman 1996; Lesthaeghe and Willems 1999). First, is lowest-low fertility a permanent phenomenon or is it merely a transient one that will retreat from the demographic landscape in the near future? Second, has lowest-low fertility already reached its nadir, or are further declines likely? Third, is lowest-low fertility likely to become a more widespread phenomenon, or will it remain restricted to Southern, Central, and Eastern Europe, regions in which this pattern is currently concentrated? And fourth, has the postponement of childbearing in lowest-low-fertility countries reached its limits, and will this trend come to a halt in the near future?

We begin our speculations with indications about the physiological limits to a postponement of fertility and the medical evidence for the feasibility of widespread childbearing above the ages of 30 to 35 years. Responding to Menken's (1985) question asking "How late can you wait?," several studies have weighed the medical pros and cons of late childbearing. Findings of a study on natural-fertility populations, for instance, show that declining fecundity with maternal age is primarily a result of aging at the level of the ovaries (O'Connor, Holman, and Wood 1998). In the peri-menopausal years, declining fecundity is a consequence of declining fecundability and increasing risk of fetal loss (Wilcox et al. 1988), much of which is due to chromosomal abnormalities. In addition, Andersen et al. (2000) found in a longitudinal population-based register study in Denmark that maternal age at conception is a strong risk factor for fetal death, independent of reproductive history, and they conclude that in general the chances of successful pregnancies in women aged 40 and older are poor.[20] Our reading of the medical literature suggests a significant skepticism about the feasibility of reliable childbearing above age 35, especially for first births. Moreover, we can find no convincing evidence that opportunities for successful and reliable childbearing at older ages are improving at a rate that is compatible in the medium and long term with observed trends toward delayed childbearing. In vitro fertilization, intrauterine insemination, and oocyte donation may partially overcome some of these age-related constraints. However, comprehensive evidence about the extent to which these developments can facilitate widespread very-late fertility on the population level is lacking. In addition to this skepticism about the possibilities of realizing fertility intentions at late ages, Beets et al. (1994) argue that information currently available to women may not be sufficient to make them aware of the uncertainties associated with plans for childbearing after age 35.[21]

In lieu of conclusive evidence about the limits of postponed childbearing, we may turn to aggregate country-level evidence about the potential endpoints of the postponement. It is clear that many Central and Eastern European countries with relatively early childbearing can continue the postponement of births, even at rapid rates such as an annual increase in the mean age at first birth by 0.2 years, for at least two to three decades until

these countries reach the late-age patterns of fertility currently observed in Northern and Southern Europe. During this time there is also little reason to expect that period fertility will rise, owing to diminished tempo distortions caused by the postponement of fertility.

The short- and medium-term limits to postponement are equally ambiguous for other lowest-low-fertility countries characterized by late childbearing, and the same pertains more generally to the countries in which fertility postponement is most pronounced. Some of the countries that have experienced substantial increases in the mean age at birth have seen a recent slowdown in the annual increases in the mean age at first birth. Yet, there is not a single lowest-low-fertility country in which the mean age at first birth has stabilized for several consecutive years at a level that could be perceived as a late-fertility equilibrium or the endpoint of fertility postponement. In summary, analyses of country-level data on the mean age at birth and parity-specific birth rates or childbearing intensities do not necessarily suggest that postponement will cease in the near future.

It is clear that in countries where the mean age at first birth is already fairly high the physiological upper age limit to childbearing prevents substantial future postponement without changing the age pattern of parity-specific fertility rates or childbearing intensities. However, a differential postponement of fertility across age groups can continue for a considerable time, even in those countries that already exhibit very late childbearing patterns. For instance, borrowing a popular idea on human life span, one may foresee a rectangularization of fertility patterns. This rectangularization, which may become a feature not only of lowest-low-fertility countries but of all countries with below-replacement fertility, is characterized by a concentration of childbearing within an increasingly narrow age interval. In this scenario, few women will have children before, say, age 28 or 29, and childbearing at parity one and two will be concentrated among women in their 30s. There will be very few third or higher-parity births, especially among women with a late onset of childbearing. Kohler and Ortega (2002b) have found a first indication of a rectangularization of fertility in Spain, the Netherlands, and Sweden, where the most recent increases in the mean age of the childbearing intensity schedules for first births have been associated with a decreasing standard deviation. In Spain, for instance, the standard deviation declined from 5.4 to 4.7 (–11 percent) during 1980–98, while the mean increased from age 26.7 to age 30.8 (+16 percent). The trend toward rectangularization is also revealed by the interquartile range in the age at first birth (for an analogous application to mortality, see Wilmoth and Horiuchi 1999). This interquartile range is the difference between the ages at which 25 percent and 75 percent of women who ultimately experience a first birth enter parenthood. In a synthetic cohort experiencing the 1980 (tempo-adjusted) childbearing intensities in Spain, for instance, this

interquartile range is 7.0 years, and it is reduced to 5.2 years in a cohort that experiences the 1998 childbearing intensities.[22] These declines in the standard deviation and the interquartile range suggest the beginning of a concentration of fertility into a more narrow age interval, and they indicate that increases in the mean age at first birth may have started to reach their limits.

The future quantum of fertility is of course an additional major element in setting the levels of long-term period and cohort fertility. Extensive discussion of this aspect is found in Bongaarts and Bulatao (2000), Lesthaeghe and Willems (1999), Morgan and King (2001), and Golini (1998). In the present discussion, we focus on whether lowest-low fertility is likely to decline further owing to an ongoing delay of childbearing. We address this question first with reference to Italy and Spain, which have experienced TFR levels below 1.3 since 1993. Our analyses suggest that for these countries the periods with the most rapid pace of postponement may have already passed. Tempo distortions in the total fertility rate are therefore unlikely to rise, and the annual increases in the mean age at first birth may soon start to decline. In combination with a constant quantum of fertility, this suggests that lowest-low fertility in Italy and Spain may have reached its trough and will probably slowly reverse. However, our earlier discussion of postponement–quantum interactions suggests that further delays in childbearing are likely to reduce the quantum of fertility, and this can partially compensate for the positive effect resulting from reduced tempo distortions. The most recent modest reversals of TFR trends in Italy (TFR of 1.23 in 2000 after a trough of 1.19 in 1996) and Spain (TFR of 1.24 in 2000 after a trough of 1.17 in 1996) may be due to this decline of tempo effects and to the diminishing relevance of compositional distortions. Nevertheless, despite this potential reversal of period fertility, many cohorts in Southern Europe will remain considerably below replacement fertility almost irrespective of developments in the next few decades. This is because the already late childbearing in these countries leaves little scope for a recuperation of fertility.

The situation is different in Central and Eastern European countries that still exhibit a relatively young mean age at birth. Given the potential for considerable future delays in childbearing, we do not foresee that tempo distortions will lose their relevance in these countries. Unless these countries experience changes in the quantum of fertility, for instance as a result of improved economic conditions, we expect they will remain at or close to lowest-low-fertility levels for a considerable time. Moreover, a potential further decline in period fertility due to tempo distortions seems likely in countries such as Bulgaria, Russia, and Ukraine, which have attained lowest-low fertility without exhibiting a strong postponement of childbearing. If the transition to late childbearing in these countries gains the pace observed in the Czech Republic or Hungary, then additional tempo distortions can

suppress the period total fertility rate substantially below the current levels of 1.1 to 1.3.

A final issue in the context of lowest-low fertility pertains to the factors that could lead to a reversal of this pattern. In addition to a diminishing role of tempo distortions, fertility levels could stabilize or recover in response to a wide range of factors that affect the desired level of fertility and hence its quantum. On the one hand, increases in the quantum of fertility can occur because of improvements in economic circumstances, especially for young adults or in transition countries. Empirical evidence suggests that better economic conditions for young adults lead to earlier transitions to independent adulthood, marriage, and fertility (Aassve et al. 2002; Ahn and Mira 2001). On the other hand, more fertility-friendly social policies could create a socioeconomic environment that provides increased incentives for having children, including for instance child care provision, better access to labor markets for women with children, and monetary transfers to families with children. Given the relatively low levels of childlessness, these policies in lowest-low-fertility countries would have to be targeted in particular toward the realization of delayed first births at higher ages and the progression from the first to the second child. Potentially effective interventions have been extensively discussed elsewhere (Demeny 1999; McDonald 2000; Teitelbaum 1999). In light of our earlier discussion of postponement–quantum interactions, interventions that increase the compatibility of work and children would seem to be particularly important, especially in countries with already very late patterns of childbearing. However, none of the current lowest-low-fertility countries has implemented significant policy changes with the goal of increasing fertility, despite the considerable public debate about declining birth rates (e.g., see Stark and Kohler, forthcoming). This lack of policy response may also be due to skepticism about the extent to which policy measures can substantially influence demographic behavior and raise fertility levels (e.g., see a recent review by Gauthier 2001).

We conclude our speculations with reference to a demographic phenomenon that implies homeostatic forces and could potentially lead to increased quantum of fertility. In particular, long-lasting lowest-low fertility leads not only to a rapid aging of the population with its well-known problems for social security and related transfer programs, but also to substantially reduced relative cohort sizes. For instance, the first lowest-low-fertility cohorts born in the early 1990s in Italy and Spain are about 41 percent smaller than the cohorts born 25 years earlier.[23] In the next 10 to 20 years, when these small cohorts begin higher education and begin to enter the labor and housing markets, they are likely to face substantially more favorable conditions than their predecessors born 25 years earlier, who have contributed significantly to the emergence of lowest-low fertility in the 1990s. This positive effect of smaller cohort size, first proposed by Easterlin (1980)

in the context of the US baby boom, seems particularly likely given the limited international migration into lowest-low-fertility countries. These positive experiences in the labor and housing market during early adulthood may contribute to an increase in both period and cohort total fertility rates.[24] This effect is likely to be one of the few demographic factors with homeostatic implications that can lead to a reversal of lowest-low fertility.

Notes

This research was conducted while Kohler was head of the research group on Social Dynamics and Fertility, Billari was head of the research group on the Demography of Early Adulthood, and Ortega was visiting scholar at the Max Planck Institute for Demographic Research (MPIDR) in Rostock, Germany. The authors are most grateful for the support they received for this research from the Max Planck Institute. In addition, the authors gratefully acknowledge many useful comments by Tomas Frejka, Jan Hoem, Charlotte Höhn, Iliana Kohler, Ron Lesthaeghe, Peter McDonald, Geoffrey McNicoll, David Reher, and Chris Wilson, as well as many other researchers at the MPIDR. The authors also thank the Advisory Group of the FFS programme on comparative research for its permission, granted under identification number 75, to use FFS data.

1 For instance, in the 1970s Bourgeois-Pichat (1976) proposed a TFR of 1.5 as the level at which fertility reaches its low point and subsequently stabilizes or even reverses. While the specific level of 1.5 may not have been universally agreed upon as the ultimate trough in fertility declines, similar perceptions of a stabilization at—or just below—replacement level have influenced many areas of demographic applications and discussions. Well-known examples of this perception are the common idea of the demographic transition as a movement between regimes with approximate demographic stability, and the fact that the UN population projections during the 1990s assumed a convergence toward replacement fertility in all countries by 2050 (United Nations 1996, 1999).

2 The calculations are obtained using the approximation that the growth rate r in the stable population is approximately given by $r = \log(\text{NRR})/m$, where m is the mean age at birth and the NRR is calculated as NRR = .4886 * TFR. We use $m = 30$, which is a roughly representative mean age for contemporary Western European countries, and TFR = 1.3 for the calculations in the text. In terms of the stable-population implications, a total fertility rate of 1.3 is the mirror image of a TFR of approximately 3.2, which implies an annual growth rate of 1.5 percent and a doubling of the birth cohort and population size every 45 years.

3 In our analyses and comparisons of European lowest-low-fertility countries, we did not include two potentially eligible countries with recent TFR levels below 1.3: (a) the city-state of San Marino (TFR below 1.3 since 1984) because of its very small and predominantly urban population that is highly integrated into Italy; and (b) Bosnia-Herzegovina because the TFR data after 1991 are only reported for three postwar years (1996–98) and the data quality is questionable because of high levels of war-related migration in the 1990s. In addition, it is worth emphasizing that there have been large regional differences within Germany since 1990. East Germany, the region of the former GDR, has experienced lowest-low fertility since 1991 with rates below 1.0 between 1991 and 1996, while West Germany has experienced a TFR close to 1.4 throughout the 1990s. For a discussion of the East German situation, see for instance Witte and Wagner (1995).

4 On a regional or subnational level, patterns of lowest-low fertility occurred much earlier. For instance, patterns of lowest-low fertility emerged in such cities as Vienna, Stockholm, and Berlin around 1930. According to the Princeton Fertility Study, there were nine lowest-low-fertility districts in Europe in 1930, namely Vienna, Sussex, Hampshire, Northamptonshire, Berlin, Oslo, Stockholm, Basel, and Geneva. These regions were mostly

urban areas, and some of them attained TFR levels that were substantially below 1.0 (e.g., a TFR of 0.63 in Vienna in 1930).

5 In particular, the Kohler and Ortega (2002a) approach overcomes two potential problems in the Bongaarts and Feeney (1998) adjustment (e.g., see also Kim and Schoen 2000; van Imhoff 2001; van Imhoff and Keilman 2000). First, the adjustment of the total fertility rate assumes that all women postpone order-*i* births by the same amount within a calendar year. Empirically this is not necessarily the case. Kohler and Philipov (2001) show that the formula can be generalized to virtually any kind of period–age interactions, and they develop the appropriate formulas to include variance effects in the adjustment of the TFR. Second, the adjustment of the total fertility rate is based on order- and age-specific fertility rates. These rates are obtained by dividing the number of births of a given order to women of age *a* by the number of all women of age *a* irrespective of parity. It is easily seen that these rates are affected by the parity composition of the population of women. This is not desirable since the parity composition of the population reflects past fertility behavior. The Kohler–Ortega approach avoids these two problems by using childbearing intensities (or occurrence-exposure rates), which are not affected by changes in the parity distribution over time, and adjusting these childbearing intensities using the Kohler–Philipov approach that includes variance effects. The goal in the Kohler–Ortega (2002a) approach is to obtain a pure measure of period fertility that is free of tempo and compositional distortions and is invariant with respect to fertility changes that occurred prior to the period of interest.

6 The data include age- and parity-specific childbearing intensities (occurrence-exposure rates) and age- and order-specific fertility rates for cohorts born from approximately the 1930s onward. For Spain, comparable data for childbearing intensities have been computed from census, registration, and survey data by the authors. See Kohler and Ortega (2002b) for a detailed discussion of these data.

7 This conclusion is similar to results obtained by the adjusted TFR for first births in the Bongaarts and Feeney (1998) framework. Our analyses, however, suggest a different relevance of demographic determinants: tempo distortions resulting from the postponement of parenthood are less important than suggested by the observed and adjusted TFR for first births; and shifts in the parity composition of the population, which are not included in TFR-based investigations, contribute importantly to the reduction in observed fertility levels.

8 In addition, see Aassve et al. (2002) for a comparative investigation of home-leaving in Italy and other European countries, and Giannelli and Monfardini (2000) and Martikainen and Valkonen (1998) for an analysis of the relationship between unemployment, additional education, and later home-leaving. See Cantó-Sánchez and Mercader-Prats (2000) for a study of poverty reduction connected with these strategies.

9 A notable exception is Bulgaria, where female university enrollment has substantially increased despite a precarious economic situation. This result is in part explained by changes in the enrollment procedure and the classification of universities (personal communication with Iliana Kohler).

10 Even in the absence of uncertainty, models of optimal age at childbearing would predict delayed parenthood in response to increased returns to education (Gustafsson 2001; Happel, Hill, and Low 1984). The specific situation in countries with considerable labor-market or income uncertainty is likely to make this response even stronger due to strategic postponement. For instance, Ranjan (1999) shows a simple two-period model where it is optimal to postpone childbearing in times of increased income uncertainty. This strategy reduces the probability that a child is born in the first period and parents are subject to falling income levels in the second period. This strategic postponement leads to some distinct and observable consequences. In particular, in order that individuals have children at all, the scenarios must include situations where they desire children. This desire, however, is linked to welfare in the future. On the one hand, a good economic performance in the future would increase fertility and it would be associated with a higher age at childbearing. With a bad economic performance, on the other hand, fertility might remain low with the mean age at childbearing determined by the non-postponers. This explanation may underlie the relative stability of the mean age at childbearing in the

countries facing more hardship during the transition, such as Belarus, Russia, or Ukraine.

11 Guiso and Jappelli (2002) document that economic transfers from parents contribute to both earlier home-leaving and more expensive housing. There are also sizable effects of local housing prices on the timing of home-leaving (Giannelli and Monfardini 2000; Martikainen and Valkonen 1998), and in combination with the substantially increased housing prices in recent decades this may constitute an important determinant of the large delays in leaving the parental home.

12 An indication of this complexity is the fact that many economic models of inter-temporal fertility choice are analytically solvable only with highly simplistic assumptions, such as the absence of uncertainty about future socioeconomic conditions or very simple functional assumptions about the utility function (for a recent review of the optimal timing literature, see Gustafsson 2001). With more realistic assumptions, the optimal birth timing can often be obtained only numerically via computer-intensive dynamic algorithms.

13 For instance, there is evidence about age norms for first marriage or first birth that "prescribe" a socially appropriate behavior with respect to the timing of fertility or marriage. In a sociodemographic survey in Friuli-Venezia Giulia, one of the areas with the lowest fertility levels in Italy, 58 percent of women aged 23–25 said that there is a minimum acceptable age limit for entering a union, and 81 percent said so for the birth of a child (Billari and Micheli 1999). Quantitative studies provide evidence that sequencing norms discourage individuals (in particular women) from becoming parents while they are students (Blossfeld and Huinink 1991). These two aspects are also reflected in Bernardi's (2002) qualitative interviews in the Lombardy area in Italy, where one woman (36 years old, one child) reported: "Actually I wanted to follow [university studies in] medicine, but my parents did not allow me because they said that it was too long a career for a woman.... Yes, the condition my parents gave me was this one: 'first you get your degree and then you marry.' And I kept the promise."

14 We do not provide a specific microfoundation for this dependence beyond our intuitive arguments, but ample formal models that reflect the different mechanisms have been developed in the literature and can be transferred analogously to our context of birth timing (for a discussion of this literature, see for instance Kohler 2001; Kohler, Behrman, and Watkins 2000).

15 Our discussion in this article focuses on the multiple equilibriums situation depicted in Figure 2. The social multiplier effect, however, does not require the presence of multiple equilibriums, and the same effect persists in social interaction models with a single equilibrium. See Kohler, Behrman, and Watkins (2000) for further discussion.

16 In principle it is conceivable for there to be a reversal in the age pattern of fertility. In a multiple-equilibriums situation, however, such reversals of significant increases in the mean age at parenthood are unlikely in the absence of policy interventions or substantial socioeconomic changes that favor earlier childbearing. Moreover, because of the stability of the late-fertility equilibrium, only large policy interventions could induce such a shift, whereas small interventions are likely to have only marginal effects (for related discussions, see Kohler 2000; Kohler, Behrman, and Watkins 2000). The various policy measures implemented in East Germany to induce relatively early childbearing may be one example of such a successful policy intervention (for a discussion of these policies, see for instance Cornelius 1990).

17 In the 1980s, the share of children below age 3 with day care coverage in Southern Europe was 4.7 percent, as compared to 9.2 percent in Continental Europe (Austria, Belgium, France, Germany, and the Netherlands) and 31.0 percent in the Nordic countries (Denmark, Finland, Norway, and Sweden) (Esping-Andersen 1999).

18 For a discussion of economic models of fertility, and the value-of-time model on which this example is based, see Willis (1973) and Becker (1981). A detailed economic model of the postponement effect and its relation to the age at first birth is discussed in Kohler, Skytthe, and Christensen (2001). Recent analyses of mother's or parents' time spent with children in the United States include Bianchi (2000) and Sandberg and Hofferth (2001).

19 In addition to the "price effect" caused by increases in female wages there is an "income effect" in the opposite direction; empirically—although not necessarily theoretically—the negative price effect strongly dominates the positive income effect.

20 Long-term trends in the age limits to conceiving are also of crucial importance for assessing the limits of a potential postponement. Bongaarts (1983) reports that in natural fertility populations in different historical settings, the median age of women at last birth is around 40–41 years. With respect to the age limits of conception, the age at menopause is considered to be an almost perfect marker of the reproductive life span for women (te Velde, Dorland, and Broekmans 1998; van Zonneveld et al. 2001). The age at menopause is on average 50–51 years in Western countries, and it shows a wide variation between women from 40 to 60 years that partially depends on a woman's contraceptive use and parity (Kaufert, Gilbert, and Tate 1987; van Noord et al. 1997).

21 This lack of information about the feasibility of childbearing at advanced ages was the theme of a *Newsweek* cover story, "The truth about fertility: Don't believe the hype—even fertility specialists say younger is better" (*Newsweek*, 27 August 2001). The cover story also refers to a new generation of celebrities who seem to be "trend-setters" by having their first babies in their 20s. The examples mentioned in the article include Belgium's Princess Mathilde, Jade Jagger, French model Laetitia Casta, and actress Kate Winslet.

22 The calculations first compute the probability $P(x)$ of having a first birth prior to age x for women in a synthetic cohort who experience the adjusted period childbearing intensities in a calendar year. We then condition on giving birth to at least one child and compute $\tilde{P}(x) = P(x)/P(\omega)$, where ω is the oldest age at childbearing. We use linear interpolation to calculate the ages where $\tilde{P}(x)$ equals .25 and .75. The interquartile range is the difference between these ages.

23 We compare the cohort born in the first year in which the TFR fell below 1.3, that is, the year of onset of lowest-low fertility, and the cohort born 25 years earlier. The respective cohort sizes are 549,484 (1993) and 930,172 (1968) in Italy, and 385,786 (1993) and 659,677 (1968) in Spain (Council of Europe 2001).

24 Macunovich (1998) discusses the possibility that these effects operate mainly through tempo change and only secondarily through quantum. If smaller cohorts benefit from an easier entry into the labor and housing market, this may lead to earlier marriage and parenthood. Quantum changes primarily occur because the tempo–quantum interactions operate in the reverse direction.

References

Aassve, A., F. C. Billari, S. Mazzuco, and F. Ongaro. 2002. "Leaving home: A comparative analysis of ECHP data," *Journal of European Social Policy* 12(4): 289–305.

Ahn, N. and P. Mira. 2001. "Job bust, baby bust: Evidence from Spanish data," *Journal of Population Economics* 14(3): 505–522.

Andersen, A.-M. N., J. Wohlfahrt, P. Christens, J. Olsen, and M. Melbye. 2000. "Maternal age and fetal loss: A population based linkage study," *British Medical Journal* 320: 1708–1712.

Arthur, W. B. 1994. *Increasing Returns and Path Dependence in the Economy*. Ann Arbor: University of Michigan Press.

Becker, G. S. 1981. *A Treatise on the Family*. Cambridge, MA: Harvard University Press.

Beets, G., E. te Velde, P. Verloove-Vanhorick, H. Merkus, and H. Bruinse. 1994. "Medical complications of aging fertility," in G. Beets, H. van den Brekel, R. Cliquet, G. Dooghe, and J. de Jong Gierveld (eds.), *Population and Family in the Low Countries 1993: Late Fertility and Other Current Issues*. Amsterdam: Swets and Zeitlinger, pp. 1–23.

Behrman, J. R., H.-P. Kohler, and S. C. Watkins. 2002. "Social networks and changes in contraceptive use over time: Evidence from a longitudinal study in rural Kenya," *Demography* 39: 713–736.

Bernardi, L. 2002. "Personal network and reproductive choices: Evidence from a low fertility context," unpublished doctoral dissertation, University of Rome "La Sapienza."

Bianchi, S. M. 2000. "Maternal employment and time with children: Drastic change or surprising continuity?," *Demography* 37(4): 401–414.

Billari, F. C., M. Castiglioni, T. Castro Martín, F. Michielin, and F. Ongaro. 2002. "Household and union formation in a Mediterranean fashion: Italy and Spain," in E. Klijzing and M. Corijn (eds.), *Fertility and Partnership in Europe: Findings and Lessons from Comparative Research*, Volume 2. Geneva and New York: United Nations.

Billari, F. C. and H.-P. Kohler. 2002. "Patterns of lowest-low fertility in Europe," Max Planck Institute for Demographic Research, Rostock, Germany, Working Paper #2002-040 (available at http://www.demogr.mpg.de).

Billari, F. C. and A. C. Liefbroer. 2001. "Should I stay or should I go? The impact of age norms on leaving home," paper presented at the Annual Meeting of the Population Association of America, 29–31 March, Washington, DC.

Billari, F. C. and G. A. Micheli. 1999. "Le scelte demografiche. La percezione dei costi e delle norme sociali," in L. Mauri and F. C. Billari (eds.), *Generazioni di donne a confronto. Indagine sociodemografica*. Milan: Franco Angeli, pp. 163–190.

Blossfeld, H.-P. and J. Huinink. 1991. "Human capital investments or norms of role transition? How women's schooling and career affect the process of family formation," *American Journal of Sociology* 97(1): 143–168.

Bongaarts, J. 1983. "The proximate determinants of natural marital fertility," in R. A. Bulatao and R. D. Lee (eds.), *Determinants of Fertility in Developing Countries*. New York: Academic Press, pp. 103–138.

Bongaarts, J. and R. A. Bulatao (eds.). 2000. *Beyond Six Billion: Forecasting the World's Population*. Washington, DC: National Academy Press.

Bongaarts, J. and G. Feeney. 1998. "On the quantum and tempo of fertility," *Population and Development Review* 24(2): 271–291.

Bongaarts, J. and S. C. Watkins. 1996. "Social interactions and contemporary fertility transitions," *Population and Development Review* 22(4): 639–682.

Bourgeois-Pichat, J. 1976. "Baisse de la fécondité et descendance finale," *Population* 31(6): 1045–1097.

Brewster, K. L. and R. R. Rindfuss. 2000. "Fertility and women's employment in industrialized nations," *Annual Review of Sociology* 26: 271–296.

Bumpass, L. L. and E. K. Mburugu. 1977. "Age at marriage and completed family size," *Social Biology* 24(1): 31–37.

Cantó-Sánchez, O. and M. Mercader-Prats. 2000. "Poverty among children and youth in Spain: The role of parents and youth employment status," Estudios sobre la Economía Española, EEE-14, FEDEA (available at http://www.fedea.es).

Chesnais, J.-C. 1996. "Fertility, family, and social policy in contemporary Western Europe," *Population and Development Review* 22(4): 729–739.

Coleman, D. (ed.). 1996. *Europe's Population in the 1990s*. Oxford: Oxford University Press.

Cornelius, I. 1990. "Familien und Bevölkerungspolitik in der DDR," *Arbeit und Sozialpolitik* 8/9: 308–316.

Council of Europe. 2001. *Recent Demographic Developments in Europe*. Strasbourg: Council of Europe Publishing (country-specific data available at http://www.coe.int/T/e/social_cohesion/population).

Dalla Zuanna, G. 2001. "The Banquet of Aeolus: A familistic interpretation of Italy's lowest low fertility," *Demographic Research* 4(5): 133–162 (available at http://www.demographic-research.org).

De Sandre, P. 2000. "Patterns of fertility in Italy and factors of its decline," *Genus* 56(1-2): 19–54.

Del Boca, D. 2002. "The effect of child care and part time opportunities on participation and fertility decisions in Italy," *Journal of Population Economics* 15(3): 549–573.

Delgado, M. and T. Castro Martín. 1998. *Fertility and Family Surveys in Countries of the ECE Region, Standard Country Report, Spain*. Geneva: United Nations.

Demeny, P. 1999. "Policy interventions in response to below-replacement fertility," *Population Bulletin of the United Nations* 40/41: 183–211.

Dolado, J. J., F. Felgueroso, and J. F. Jimeno. 2000. "Youth labour markets in Spain: Education, training and crowding-out," *European Economic Review* 44: 943–956.

Dorbritz, J. and K. Gärtner. 1999. "Berechnungen zur Kinderlosigkeit am Bundesinstitut für Bevölkerungsforschung," *BIB-Mitteilungen* 20(22): 13–15.

Duce Tello, R. M. 1995. "Un modelo de elección de tenencia de vivienda para España," *Moneda y Crédito* 201: 127–152.

Easterlin, R. A. 1980. *Birth and Fortune: The Impact of Numbers on Personal Welfare*. Chicago: University of Chicago Press.

Esping-Andersen, G. 1999. *Social Foundations of Postindustrial Economies*. Oxford: Oxford University Press.

Eurostat. 2001. *New Cronos Database: Population and Social Conditions*. Brussels: Eurostat.

Feeney, G. and J. Yu. 1987. "Period parity progression measures of fertility in China," *Population Studies* 41(1): 77–102.

Forster, M. F. and I. G. Toth. 1997. "Poverty, inequalities and social policies in the Visegrad countries," *Economics of Transition* 5(2): 505–510.

Foster, C. 2000. "The limits to low fertility: A biosocial approach," *Population and Development Review* 26(2): 209–234.

Frejka, T. 1980. "Fertility trends and policies: Czechoslovakia in the 1970s," *Population and Development Review* 6(1): 65–93.

Frejka, T. and G. Calot. 2001a. "Cohort reproductive patterns in low-fertility countries," *Population and Development Review* 27(1): 103–132.

———. 2001b. "L'évolution du calendrier des naissances par génération dans les pays à basse fécondité à la fin du XXe siècle," *Population* 56(3): 397–420.

Gauthier, A. H. 2001. "The impact of public policies on families and demographic behaviour," paper presented at the EURESCO Conference on the Second Demographic Transition, Bad Herrenhalb, Germany, 23–28 June (available at http://www.demogr.mpg.de/Papers/workshops).

Giannelli, G. C. and C. Monfardini. 2000. "Joint decisions on household membership and human capital accumulation of youths," IZA Discussion Paper No. 191, Bonn, Germany (available at http://www.iza.org).

Goldin, C. and L. F. Katz. 2002. "The power of the pill: Oral contraceptives and women's career and marriage decisions," *Journal of Political Economy* 110(4): 730–770.

Goldman, N., C. F. Westoff, and C. Hammerslough. 1984. "Demography of the marriage market in the United States," *Population Index* 50(1): 5–25.

Golini, A. 1998. "How low can fertility be? An empirical exploration," *Population and Development Review* 24(1): 59–73.

González, M. J., T. Jurado, and M. Naldini. 2000. "Introduction: Interpreting the transformation of gender inequalities in Southern Europe," in M. J. González, T. Jurado, and M. Naldini (eds.), *Gender Inequalities in Southern Europe: Women, Work and Welfare in the 1990s*. London: Frank Cass.

Grootaert, C. and J. Braithwaite. 1998. "Poverty correlates and indicator-based targeting in Eastern Europe and the former Soviet Union," World Bank, Policy Research Working Paper No. 1942 (available at http://www.worldbank.org).

Grossbard-Shechtman, A. 1985. "Marriage squeezes and the marriage market," in K. Davis (ed.), *Contemporary Marriage: Comparative Perspective on a Changing Institution*. New York: Russell Sage Foundation, pp. 375–395.

Guiso, L. and T. Jappelli. 2002. "Private transfers, borrowing constraints and the timing of homeownership," *Journal of Money, Credit and Banking* 32(2): 315–339.

Gustafsson, S. S. 2001. "Optimal age at motherhood. Theoretical and empirical considerations

on postponement of maternity in Europe," *Journal of Population Economics* 14(2): 225–247.

Happel, S. K., J. K. Hill, and S. A. Low. 1984. "An economic analysis of the timing of childbirth," *Population Studies* 38: 299–311.

Heckhausen, J. 1999. *Developmental Regulation in Adulthood: Age-Normative and Sociostructural Constraints as Adaptive Challenges*. Cambridge: Cambridge University Press.

Kaufert, P. A., P. Gilbert, and R. Tate. 1987. "Defining menopausal status: The impact of longitudinal data," *Maturitas* 9: 217–226.

Kim, Y. J. and R. Schoen. 2000. "On the quantum and tempo of fertility: Limits to the Bongaarts–Feeney adjustment," *Population and Development Review* 26(3): 554–559.

Kohler, H.-P. 2000. "Social interaction and fluctuations in birth rates," *Population Studies* 54(2): 223–238.

———. 2001. *Fertility and Social Interactions: An Economic Perspective*. Oxford: Oxford University Press.

Kohler, H.-P., J. R. Behrman, and S. C. Watkins. 2000. "Empirical assessments of social networks, fertility and family planning programs: Nonlinearities and their implications," *Demographic Research* 3(7): 79–126 (available at http://www.demographic-research.org).

Kohler, H.-P. and I. Kohler. 2002. "Fertility decline in Russia: Social versus economic factors," *European Journal of Population* 18(3): 233–262.

Kohler, H.-P. and J. A. Ortega. 2002a. "Tempo-adjusted period parity progression measures, fertility postponement and completed cohort fertility," *Demographic Research* 6(6): 91–144 (available at http://www.demographic-research.org).

———. 2002b. "Tempo-adjusted period parity progression measures: Assessing the implications of delayed childbearing for fertility in Sweden, the Netherlands and Spain," *Demographic Research* 6(7): 145–190 (available at http://www.demographic-research.org).

Kohler, H.-P. and D. Philipov. 2001. "Variance effects in the Bongaarts-Feeney formula," *Demography* 38(1): 1–16.

Kohler, H.-P., J. L. Rodgers, and K. Christensen. 1999. "Is fertility behavior in our genes: Findings from a Danish twin study," *Population and Development Review* 25(2): 253–288.

Kohler, H.-P., A. Skytthe, and K. Christensen. 2001. "The age at first birth and completed fertility reconsidered: Findings from a sample of identical twins," Max Planck Institute for Demographic Research, Rostock, Germany, Working Paper #2001-006 (available at http://www.demogr.mpg.de).

Kohlmann, A. and S. Zuev. 2001. "Patterns of childbearing in Russia 1994–1998," Max Planck Institute for Demographic Research, Rostock, Germany, Working Paper #2001-018 (available at http://www.demogr.mpg.de).

Lassibille, G., L. N. Gómez, I. A. Ramos, and C. D. Sánchez. 2001. "Youth transition from school to work in Spain," *Economics of Education Review* 20(2): 139–149.

Lee, R. D. 1980. "Aiming at a moving target: Period fertility and changing reproductive goals," *Population Studies* 34(2): 205–226.

Lesthaeghe, R. 2001. "Postponement and recuperation: Recent fertility trends and forecasts in six Western European countries," paper presented at the IUSSP Seminar on International Perspectives on Low Fertility: Trends, Theories and Policies, Tokyo, Japan, 21–23 March (also available as IPD Working paper 2001-01 at http://www.vub.ac.be/soco/index.htm).

Lesthaeghe, R. and P. Willems. 1999. "Is low fertility a temporary phenomenon in the European Union?," *Population and Development Review* 25(2): 211–228.

Livi-Bacci, M. 2001. "Too few children and too much family," *Daedalus* 130(3): 139–156.

Lokshin, M. and M. Ravallion. 2000. "Short-lived shocks with long-lived impacts? Household income dynamics in a transition economy," World Bank, Policy Research Working Paper No. 2459 (available at http://www.worldbank.org).

Lutz, W., W. Sanderson, and S. Scherbov. 2001. "The end of world population growth," *Nature* 412: 543–545.

Macunovich, D. J. 1998. "Fertility and the Easterlin hypothesis: An assessment of the literature," *Journal of Population Economics* 11: 53–111.

Macura, M. 2000. "Fertility decline in the transition economies, 1989–1998: Economic and social factors revisited," in *Economic Survey in Europe, 2000/1*. Geneva: United Nations, Economic Commission for Europe, pp. 189–207.

Marini, M. M. and P. J. Hodsdon. 1981. "Effects of the timing of marriage and first birth on the spacing of subsequent births," *Demography* 18(4): 529–548.

Martikainen, P. T. and T. Valkonen. 1998. "The effects of differential unemployment rate increases of occupation groups on changes in mortality," *American Journal of Public Health* 88(12): 1859–1861.

McDonald, P. 2000. "Gender equity in theories of fertility transition," *Population and Development Review* 26(3): 427–440.

Menken, J. 1985. "Age and fertility: How late can you wait?," *Demography* 22(4): 469–483.

Milanovic, B. 1998. *Income, Inequality, and Poverty during the Transition from Planned to Market Economy*. Washington, DC: The World Bank.

Montgomery, M. R. and J. B. Casterline. 1996. "Social learning, social influence, and new models of fertility," *Population and Development Review* 22(Supplement): 151–175.

Morgan, S. P. and R. B. King. 2001. "Why have children in the 21st century? Biological predisposition, social coercion, rational choice," *European Journal of Population* 17(1): 3–20.

Morgan, S. P. and R. R. Rindfuss. 1999. "Reexamining the link of early childbearing to marriage and to subsequent fertility," *Demography* 36(1): 59–75.

Munich, D., J. Svejnar, and K. Terrell. 1999. "Return to human capital under the communist wage grid and during the transition to a market economy," *Journal of Comparative Economics* 27: 33–60.

Newell, A. and B. Reilly. 2000. "Rates of return to educational qualifications in the transitional economies," *Education Economics* 7(1): 67–83.

O'Connor, K. A., D. J. Holman, and J. M. Wood. 1998. "Declining fecundity and ovarian ageing in natural fertility populations," *Maturitas* 30: 127–136.

Orazem, P. F. and M. Vodopivec. 1995. "Winners and losers in transition: Returns to education, experience and gender in Slovenia," *World Bank Economic Review* 9(2): 201–230.

Ortega, J. A. and H.-P. Kohler. 2002. "Measuring low fertility: Rethinking demographic methods," Max Planck Institute for Demographic Research, Rostock, Germany, Working Paper #2002-001 (available at http://www.demogr.mpg.de).

Palomba, R. and L. L. Sabbadini. 1993. "Female life strategies: The way of compromise," *Proceedings of the XXIII IUSSP General Conference, Montreal*, Vol. 2, pp. 219–231. Liège: IUSSP.

Ranjan, P. 1999. "Fertility behaviour under income uncertainty," *European Journal of Population* 15(1): 25–43.

Reher, D. 1997. *Perspectives on the Family in Spain, Past and Present.* Oxford: Oxford University Press.

Rutkowski, J. 1996. "High skill pay off: The changing wage structure during economic transition in Poland," *Economics of Transition* 4(1): 89–111.

Sá, C. and M. Portela. 1999. "Working and studying: What explains youngsters' decisions," Luxembourg Income Study (LIS), Working Paper No. 15 (available at http://lisproject.org).

Sandberg, J. F. and S. L. Hofferth. 2001. "Changes in children's time with parents: United States, 1981–1997," *Demography* 38(3): 423–436.

Schelling, T. C. 1978. *Micromotives and Macrobehavior*. New York: W. W. Norton.

Settersten, R. A. and G. O. Hägestad. 1996. "What's the latest? Cultural age deadlines for family transitions," *The Gerontologist* 36(2): 178–188.

Stark, L. and H.-P. Kohler. Forthcoming. "The debate over low fertility in the popular press: A cross-national comparison, 1998–1999," *Population Research and Policy Review.*

Stier, H., N. Lewin-Epstein, and M. Braun. 2001. "Welfare regimes, family-supportive poli-

cies, and women's employment along the life-course," *American Journal of Sociology* 106(6): 1731–1760.

te Velde, E., M. Dorland, and F. Broekmans. 1998. "Age at menopause as a marker of reproductive ageing," *Maturitas* 30: 119–125.

Teitelbaum, M. 1999. "Sustained below-replacement fertility in Europe," *Population Bulletin of the United Nations* 40/41: 161–183.

United Nations. 1996. *World Population Prospects: The 1996 Revision*. New York: United Nations, Department of Economic and Social Affairs, Population Division.

———. 1999. "Future expectations for below-replacement fertility," *Population Bulletin of the United Nations* 40/41: 137–160.

van Imhoff, E. 2001. "On the impossibility of inferring cohort fertility measures from period fertility measures," *Demographic Research* 5(2): 23–64 (available at http://www.demographic-research.org).

van Imhoff, E. and N. Keilman. 2000. "On the quantum and tempo of fertility: Comment," *Population and Development Review* 26(3): 549–553.

van Noord, P. A. H., J. Dubas, M. Dorland, H. Boersma, and E. R. te Velde. 1997. "Age at natural menopause in a population-based screening cohort: The role of menarche, fecundity, and lifestyle factors," *Fertility and Sterility* 68: 95–102.

van Zonneveld, P., G. J. Scheffer, F. J. M. Broekmans, and E. te Velde. 2001. "Hormones and reproductive aging," *Maturitas* 38(1): 83–91.

Watkins, S. C. 1990. "From local to national communities: The transformation of demographic regimes in Western Europe, 1870–1960," *Population and Development Review* 16(2): 241–272.

White, J. M. 1998. "The normative interpretation of life course event histories," *Marriage and Family Review* 27(3/4): 211–235.

Wilcox, A. J. et al. 1988. "Incidence of early loss in pregnancy," *New England Journal of Medicine* 319: 189–194.

Willis, R. J. 1973. "A new approach to the economic theory of fertility behaviour," *Journal of Political Economy* 81(2, pt. 2): 14–64.

Wilmoth, J. R. and S. Horiuchi. 1999. "Rectangularization revisited: Variability of age at death within human populations," *Demography* 36(4): 475–495.

Wilson, C. 2001. "On the scale of global demographic convergence 1950–2000," *Population and Development Review* 27(1): 155–172.

Witte, J. C. and G. G. Wagner. 1995. "Declining fertility in East Germany after unification: A demographic response to socioeconomic change," *Population and Development Review* 21(2): 387–397.

Zakharov, S. V. and E. I. Ivanova. 1996. "Fertility decline and recent changes in Russia: On the threshold of the second demographic transition," in J. Da Vanzo and G. Farnsworth (eds.), *Russia's Demographic Crisis*. Santa Monica: RAND Conference Proceedings, pp. 36–83.