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

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September 19, 2002

**Abstract**

Lowest-low fertility, defined as a period total fertility rate below 1.3, has rapidly spread in Europe during the 1990s and is likely to expand further. In this paper we argue that the emergence and persistence of this new phenomenon is due to the combination and interaction of five factors. First, tempo- and compositional distortions that reduce the *TFR* below the associated level of cohort fertility. Second, socioeconomic changes—including increased returns to human capital and high economic uncertainty in early adulthood—that have made late childbearing a rational response for individuals/couples. Third, social interaction effects that reinforce this behavioral adjustment and cause postponement transitions with large and persistent changes in the mean age at birth. Fourth, institutional settings that favor an overall low quantum of fertility. Fifth, postponement-quantum interactions that amplify the consequences of this institutional setting when it is combined with a rapid delay of childbearing. We conclude the paper with some speculations about future trends in lowest-low fertility countries and candidates.

**Forthcoming in *Population and Development Review***

## 1 Introduction

The majority of the world's population is expected to live in regions with near-replacement or below-replacement fertility in less than 10 years, and the earlier distinct fertility regimes,

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'developed' and 'developing', are increasingly disappearing in global comparisons of fertility levels (Bongaarts and Bulatao 2000; Lutz et al. 2001; Wilson 2001). Several aspects of this convergence towards low fertility are particularly striking. First, the spread of below-replacement fertility to formerly high fertility countries has occurred at a remarkably rapid pace and implied 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 shattered.[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 paper as total fertility rate (*TFR*) levels below 1.3, and at the end of the 1990s there were 13 lowest-low fertility countries in Southern, Central and Eastern Europe with a total population of over 370 million persons. Third, recent fertility trends in Europe and other developed countries have been accompanied by a remarkable divergence in the fertility levels, ranging in the late 1990s from lowest-low fertility to *TFR* levels above 1.7 in France or Denmark and to *TFR* levels close to 2.1 in the United States.

In this paper we investigate the emergence and persistence 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 the emergence of lowest-low fertility in Europe is due to 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 indicators 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 towards low and lowest-low fertility. Fourth, *institutional settings* in Southern, Central and Eastern European countries have favored an overall low quantum of fertility. Fifth, and finally, *postponement-quantum interactions* have amplified the consequences of these institutional settings, and they have caused particularly large reductions in completed fertility in lowest-low fertility countries due to the delay of childbearing. Moreover, a differential relevance of postponement-quantum interactions is an important factor contributing to the divergence of European countries into those that have accommodated late childbearing without substantial declines in cohort and period fertility and those that experienced large declines of fertility during the postponement transition. We conclude our paper with a discussion of future scenarios for fertility trends in lowest-low fertility countries and lowest-low 'candidates'.

## 2 Characterizing lowest-low fertility

### 2.1 Defining and measuring lowest-low fertility

We define lowest-low fertility as a total fertility rate below 1.3. *TFR* levels below 1.3 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% in a stable population with an overall mean age at birth of 30 years. A *TFR* of 1.3 also implies a reduction of the birth cohort by 50% and a halving of the stable population size every 45 years.[2] If the *TFR* further declines and persists at a level of one, the annual rate of decline in the stable population rises to 2.4% and the halving-times of population size and birth cohorts are merely 30 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 appear and persist on a country level only in the last decade. National *TFR* levels below 1.3 never prevailed for extended periods in the Northern and Western European countries that were forerunners in the trend towards sustained below-replacement fertility. In particular, the only incidences of lowest-low fertility on a national level in Northern and Western Europe were temporary and occurred in France during World War I, West Germany in 1984–85, and the unified Germany in 1993–95.[3]

The emergence of sustained lowest-low fertility first occurs in Southern, Central and Eastern European countries.[4] Based on Council of Europe (2001), thirteen 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, 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 then joined by Bulgaria, the Czech Republic, Latvia and Slovenia in 1995, and by the remaining lowest-low fertility countries between 1996 and 1999. There have been further changes in more recent years, and this evolution of the group of countries with $TFR \leq 1.3$ is expected given the definition of lowest-low fertility based on a threshold. In fact, there were three entries to and four exits from the group of lowest-low fertility countries in the year 2000 (entries with *TFR* in 2000: Lithuania 1.27, the Slovak Republic 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). It is possible that some of these *TFR* reversal above 1.3 are short-lived and that the latter countries return to lowest-low fertility. In addition, several other countries in Central and Eastern Europe and the Balkans have also very low *TFR* levels, and Poland (1.34), Georgia (1.35) or Croatia (1.39) will possibly join the group of lowest-low fertility countries soon. Moreover, other European countries with traditionally low fertility, such as Austria (1.34) and Germany (1.36), are also likely to join the group.

The above emergence of lowest-low fertility in Southern, Central and Eastern Europe has also been associated with a renewed divergence of European countries between those stabilizing at moderately below-replacement fertility and those with *TFR* declines below 1.3. For instance, several countries that were among the first to experience sustained below-replacement fertility in the late 1960s and early 1970s, including Denmark and the Netherlands, exhibit relatively high fertility in the late 1990s. Moreover, the Dutch and Danish *TFR*s 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 exhibit even higher *TFR*s. These trends are in sharp contrast to the recent and pervasive *TFR* declines to levels below 1.3 in lowest-low fertility countries. In addition to this divergence, the recent trends have also been accompanied by a disruption or reversal of many well-known associations between aggregate indicators of fertility and fertility-related behaviors (Billari and Kohler 2002). For instance, the cross-sectional correlations in European or OECD countries between the total fertility level on the one side, and the total first marriage rate, the proportion of extramarital births and the female labor force participation rate on the other side have reversed during the period from 1975 to 1999 (see also Brewster and Rindfuss 2000), and the analyses in Billari and Kohler (2002) provide a clear indication that a high prevalence of marriage and institutionalized long-term partnership commitments 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 anticipated. These distortions have been much emphasized in recent discussions due to the widespread delay of childbearing (e.g., Bongaarts and Feeney 1998; Kohler and Ortega 2002a; Kohler and Philipov 2001). For instance, the 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 very intense with annual increases in the mean age exceeding 0.2 per year. Combined with a relatively high initial mean age, this postponement has lead to some of the highest mean ages at first birth worldwide. In the Central and Eastern European (CEE) countries, the patterns are not so uniform. Extremely fast postponement has occurred in Slovenia, the Czech Republic and Hungary. Other countries, like 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 very young mean age. Similar patterns also prevail in other countries of the former Soviet Union like Russia, Belarus and Armenia.

A second demographic factor that influences the period total fertility rate is the composition of the population by parity. If a recent decline of fertility is concentrated on higher birth orders, the observed parity composition of the population in the short- and medium term is tilted towards 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—and not present—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. This is due to the fact that 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. In order to assess this contribution of changes in the parity composition to the trends in period fertility levels, it is therefore 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. Unfortunately, the data requirements for these calculations are more intense (see

Section 2.3). Therefore the only measure of tempo which is available for almost all the lowest-low countries is the traditional mean age at first birth, calculated from order- and age-specific fertility rates (Table 1).

## 2.2 Fertility postponement and completed fertility

One final methodological question in the context of recent fertility declines is the relevance of studying period fertility. Lowest-low fertility may not lead to particularly low cohort fertility if it is just a temporary phenomenon. In this case, fertility 'recuperates' 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 somewhat different in the CEE countries, where cumulated fertility for currently young mothers is among the highest in Europe due to the relatively young pattern of childbearing. For instance, women in the 1965 female cohort are expected to have less 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 more than 1.8 children (Council of Europe 2001; Frejka and Calot 2001a,b). The contrast is even more drastic for younger cohorts. For instance, the fertility level at age 27 in the 1970-71 cohort is always above one child in all CEE 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, since 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. Lowest-low fertility in Italy, however, is not associated with particularly low levels of first-birth childbearing in recent cohorts (at least when compared to the Netherlands).

Evidence on the scope for recuperation can also be obtained from micro-data. If there is a 'pure' postponement of fertility with perfect recuperation at later ages, and if we ignore for the moment 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—the completed fertility is approximately similar between early and late starters. Unfortunately, the empirical evidence is in contrast to this hypothesis of a 'pure' postponement. In particular, there exists 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 et al. (2001) show in a study using Danish monozygotic (MZ) 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. However, in some countries, including Denmark and the U.S., the relevance of this negative postponement effects has weakened over time (Kohler et al. 2001; Morgan and Rindfuss 1999). For instance, the estimates for Denmark show that an additional year of delay in childbearing causes a reduction of completed fertility by 3.8–4.9% for cohorts 1945–52, while it causes a reduction of only 1.7–1.85% for cohorts 1953–60. This reduction in the negative effect of postponement on completed fertility is an important aspect of 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), the completed cohort fertility declined only slightly from 2.06 to 1.89 (Eurostat 2001).

Some lowest-low fertility countries may provide important exceptions in this declining relevance of the onset of childbearing for completed fertility. Since the more sophisticated analyses performed on the basis of Danish MZ twins are not feasible in lowest-low 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 experience their first birth prior to age 32. These estimates provide individual-level evidence about the importance of the onset of childbearing on completed fertility, and the regression coefficient—denoted as *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 2.9–5.1% for each one-year delay in the onset of parenthood. For the youngest cohorts in the table, the postponement effects equal 2.9% for Italy and 3.8% for Spain. Despite its decline in the most recent cohorts, the postponement effect is still substantially above the levels in Denmark and Sweden, which represent countries with very successful recuperation. The Central and Eastern European cases differ from the Italian and Spanish situation in terms of a relatively 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 that 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 there does *not* seem to be a 'pure' postponement of fertility. Moreover, the lowest-low fertility countries in Southern Europe seem to exhibit a relatively strong negative association between the onset of childbearing and the level of fertility, and this postponement effect has not weakened substantially in more recent cohorts.

### 2.3 Demographic Analysis of Lowest Low Fertility

In this section we implement the methodological approach of Kohler and Ortega (2002a), which is a refinement of the Bongaarts and Feeney (1998) and Kohler and Philipov (2001) tempo adjustment of period fertility measures, in order to obtain estimates of the completed cohort fertility that is associated with currently observed *TFR* levels in lowest-low fertility countries.[5] The basic idea of the Kohler-Ortega (KO) approach is to use 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 due to shifts in the parity distribution of the population over time (see Section 2.1), and KO show that the tempo-adjustment of period fertility measures can be extended to childbearing intensities. The KO-approach then uses tempo-adjusted childbearing intensities to calculate a variety of fertility measures for synthetic cohorts, including ($a$) the lifetime birth probability of at least one child, ($b$) the level of childlessness (equal to one minus the life-time birth probability of at least one child), and ($c$) 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.

The above calculations are useful because they provide proper cohort fertility measures that reflect the level of childlessness and level of completed fertility that are 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 distortions due to past fertility trends that affect the parity distribution of the population (for additional discussions and applications, see Kohler and Ortega 2002a,b; Ortega and Kohler 2002). Nevertheless, it is important to keep in mind that the index of period fertility is not necessarily a projection of fertility in *real* cohorts. In particular, this index is a measure of period fertility or fertility quantum, while 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 Section 2.2—because the additional delays in childbearing shift first and second births towards older ages at which the probability of progressing to another child is declining.

The data requirements for the KO calculations are more severe than those for the calculation of the Bongaarts and Feeney adjusted *TFR* since 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 not available from published statistics. We have obtained these data for Italy, Spain, Bulgaria, the Czech Republic and Hungary from the Observatoire Démographique Européen and own cohort fertility reconstruction, and we are able to apply the KO approach to several important lowest-low fertility countries with different socioeconomic backgrounds (Table 3).[6] We also report the total fertility rate in addition to the results of the KO approach, and for comparison we include in Table 3 also two non-lowest-low countries, the Netherlands and Sweden (these estimates are taken from Kohler and Ortega 2002b). The *TFR*s and KO-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 *TFR*s for first births in the lowest-low fertility countries in Table 3 declined substantially during the fifteen years of observation, and the observed *TFR*s suggest large reductions in first-birth fertility that range from 17% (Italy) to 42% (Czech Republic). The corresponding changes in Sweden and the Netherlands are -6% and +19% respectively. The *TFR* for first birth, however, is not a good indicator of the quantum of first birth fertility in a calendar year. A preferable indicator is the KO 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 about the trends in first birth fertility in the lowest-low fertility countries. In particular, the life-time birth probabilities in the mid/late 1990s exceed the *TFR* for first births by 32%–45% in Italy and Spain and by 37% to 51% in Bulgaria, Czech Republic and Hungary. Moreover, they have also declined substantially less than the *TFR* for first births during the 15 years from the early/mid 1980s to the mid/late 1990s. For instance, the life-time birth probability declined by only 1–7% in Italy and Spain and by 4–8% in Bulgaria, the Czech Republic and Hungary.

In column three of Table 3 we calculate the levels of childlessness in synthetic cohorts that are associated with the period fertility patterns in the early/mid 1980s and the mid/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 or 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/late 1990s attains a childlessness of 16–19% in Italy and Spain and of 13–19% in Bulgaria, Czech Republic and Hungary. These levels of childlessness are below or comparable to the corresponding estimates for Sweden and the Netherlands in the late 1990s (Table 3). These levels are also quite modest when compared to the childlessness observed in some other countries, as for instance Germany, where more than one third of the women in the 1965 cohort are expected to remain childless (Dorbritz and Gärtner 1999).

Despite the only moderate declines in the level of first-birth childbearing, it is undisputed that there have been important declines in the level of childbearing in lowest-low fertility countries. These declines, however, are concentrated on higher parities. In columns three and four of Table 3 we therefore 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 based on 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 23–43%. This decline in the *TFR*, however, is likely to exaggerate the reduction in the quantum of fertility due to tempo and compositional distortions. The comparison of the *TFR* with the index of period fertility 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 a synthetic cohort fertility between 1.43–1.67 in Italy and Spain and 1.36–1.53 in Bulgaria, Czech Republic and Hungary. The index of period fertility is between .24 to .52 children higher than the level of the period *TFR*, and it declined during the period from the early/mid 1980s to the mid/late 1990s by only 16–17% in Italy and Spain, 16–23% in Hungary and the Czech Republic and 30% in Bulgaria. Moreover, while the index of period fertility in the lowest-low fertility countries in Table 3 is below that of Sweden and the Netherlands, the differences between the countries in Table 3 are substantially smaller if fertility is measured by the period fertility index instead of the *TFR*.

In summary, our results in Table 3 suggest that the decline in the quantum of first birth has *not* been a primary driving force in the emergence of lowest-low fertility in the Southern, Central and Eastern European countries that are included in Table 3.[7] This suggests that even in lowest-low fertility contexts, the biological, social and economic incentives for children are sufficiently strong that most women (or couples) desire to have at least one child (e.g., Foster 2000; Morgan and King 2001; see also Kohler et al. 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 somewhat lower due to the postponement-quantum interactions resulting from a continued delay of childbearing, unless this effect is compensated by an increase in the quantum of fertility.

# 3 Explaining the emergence of lowest-low fertility: Incentives, social interactions and institutional factors

In this section we explore the socioeconomic conditions and individual-level determinants that underlie the demographic patterns identified in the previous section. We focus on the delay of childbearing and the progression after the first child that we have emphasized in our earlier analyses as the central demographic aspects in understanding lowest-low fertility. The basic starting point of our discussion 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. Specifically, due to 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 different reasons why individuals may not have an extra child for the moment: one may plan to have a child at a later time, or one may plan not to have a child at all, or one might not have a clear idea about these future plans. It is important that this decision to postpone childbearing can be revised afterwards. 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 generally 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 of having children. A 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 partnerships 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 one hand, decisions about the number of children in lowest-low fertility countries are increasingly concentrated on the choice between childlessness as compared to one or two children. On the other hand, the timing of fertility is relatively flexible. The desired onset of childbearing can range over almost two decades in the life-span from the late teenage years to the mid and late thirties (potentially also later). The timing of fertility in lowest-low fertility countries is therefore likely to be sensitive to changes in the socioeconomic conditions, especially at low parities.

## 3.1 The socioeconomic background of delayed childbearing in lowest-low fertility countries

The socioeconomic context of decisions about timing of parenthood varies substantially across lowest-low fertility countries, and there is a striking difference between Southern and CEE countries. 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, the entry into the labor market for young adults is extremely difficult (Table 5). The three lowest-low fertility countries in Southern Europe have the highest youth unemployment rates in the European Union in 1999, and this situation has been essentially unchanged since 1989. Unemployment rates are also higher for females than for males, 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, with considerably lower unemployment rates than its Mediterranean counterparts.

The chronic high unemployment situation in Southern Europe has discouraged young adults from entering the labor market and made higher education more attractive, and it has deteriorated working conditions to sometimes precarious situations with mostly low-paid temporary jobs. In addition, there is a crowding-out process in which more educated young people are displacing less educated people from their traditional positions (e.g., Dolado et al. 2000). The labor market uncertainty and poor economic prospects in early adulthood also facilitate the commonly observed behavior of prolonging the stay 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 among Eastern Europe countries and former Soviet Republics. While all of these countries share the common experience of the transition from a planned to a market economy, the success of this transition and the economic hardship during the transformation have varied considerably. Some of these tremendous differences in income levels and economic outcome during the transition period are documented in Table 4. Most of the CEE countries with lowest-low fertility, and in particular those in the former Soviet Union, have experienced a decline in output over the transition period. Many countries have also experienced a substantial surge in inflationary pressures during the economic crisis. This is especially the case in the former Soviet Union, and countries such as Bulgaria or Romania. In addition, income levels have been very volatile in all transition countries in Table 4, and the median income fluctuated from year to year by as much as 25 per cent (Forster and Toth 1997; Lokshin and Ravallion 2000). Similarly, labor turnover has been very frequent and lead to common spells of unemployment. For instance, 57 per cent of Russian women during 1994–1998 were very concerned about the possibility of not being able to provide themselves with the bare essentials in the following year (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 transition countries. The returns to human capital have considerably increased as compared to the pre-transition 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 et al. 1999; Newell and Reilly 2000; Orazem and Vodopivec 1995; Rutkowski 1996). In contrast, there has been a decline in the returns to experience for low educated people. As a result, poverty is particularly common among the low educated and those having more than two children (Grootaert and Braithwaite 1998; Milanovic 1998).

### 3.2 Postponement as a rational response to socioeconomic incentives

Based on the above sketch of the socioeconomic background, we can investigate the individual-level determinants of delayed childbearing in lowest-low fertility countries. In particular, an important commonality of the socioeconomic context in lowest-low fertility 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 human capital.

In the 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 due to the increased employment opportunities. Higher education has thus 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 the CEE countries, the uncertainty is due to the overall economic insecurity and hardship caused by the transition. Moreover, the economic 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 enable access to more stable employment with relatively high salaries. The main problem in attaining education faced by individuals in Eastern Europe is that the opportunity costs may be too high in some of the poorest countries. Parents may have problems financing higher education of their children since they are also affected by the transition, and credit constraints may preclude access to loans in order to cover tuition and consumption during studies.

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

The comparison of the evolution of university enrollment with the mean age at childbearing is very illuminating. The countries with marked increases in higher education tend to be identical to the countries with the most pronounced delays in the mean age at first birth.[9] This association between delays in childbearing and increases in individuals' human capital investments is consistent with our hypothesis: increasing returns to education induce young adults—and particularly young women—to study for a longer time in the expectation that this improves their ability to cope with the economic uncertainty and to take advantage of the new opportunities created during the transition period. Exceptions to this general pattern seem to be concentrated among countries where the economic situation is worst, and where the coping strategy of higher education and human capital investments is not accessible for important fractions of the population. In addition to the human capital motive for delaying childbirth, the very unstable standards of living in Eastern Europe also lead to a strategic postponement in which children—and similar decisions implying long-term commitments—are deferred in the expectation that the uncertainty about future prospects is reduced over time.[10]

Changes in social policy are an important 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 via 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 have ended, or eroded due to inflation, or were modified, and this fact has also contributed to the postponement of motherhood in the last decade.

A further determinant of the 'postponement–low-fertility nexus' is the delay of childbearing in association with investments in housing and durables. This is especially relevant in Italy and Spain, where the interference of childbearing with educational investments has been much reduced due to the delay of parenthood to very late ages. In these countries, the preponderance of own property in the housing market and the restricted rental market induces young people to stay at home with their parents until their financial resources are adequate for paying the mortgage (Duce Tello 1995).[11] Since this can take several years after entry in the labor market, this process can lead to delays of childbearing substantially beyond the completion of higher education.

### 3.3 Social feedback effects on the timing of fertility

The previous section has primarily focused on individuals' incentives that render delayed childbearing more advantageous. The discussion of these individual-level determinants of timing decisions, however, is not sufficient to understand the *dynamics* of fertility postponement in lowest-low fertility populations (and more generally, also in other low fertility populations). In particular, we believe that the analysis of individual's responses to socioeconomic incentives and socioeconomic changes needs to be integrated with a consideration of social interaction and its effect of the dynamics of fertility change.

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

The presence of social interaction exerts important influences on the dynamics of the fertility postponement for at least three reasons (Kohler et al. 2000; Montgomery and Casterline 1996): (*a*) *social multiplier effects* tend to increase the overall 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 equilibria*—or *multiple demographic regimes*—with early and late childbearing, and transitions between these equilibria can lead to rapid and irreversible changes in the timing of fertility; (*c*) *status-quo enforcement* can lead to persistent norms and path-dependent fertility developments in situations with strong familial and social ties, and this implication can help to explain the only gradual emergence of 'new' demographic behaviors—such as out-of-wedlock childbearing—in countries like Italy. Before we turn in more detail to these dynamic implications of social interactions, we briefly review the arguments of 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 is a highly complicated problem for women or couples, especially in the context of uncertainty and changing socioeconomic environments.[12] Social learning provides a possibility to simplify and augment decision-making in this context. Childbearing and career experiences of friends are therefore likely to influence women's and couples' decisions about the timing of fertility. For instance, the interaction with others can provide information about questions like "How did classmates, who had their first child relatively early, fare in terms of career and partnership?" and "What is the divergence in social and economic attainment between those who had their children early as compared to those who had them later?" In addition to this possibility to learn from others, social learning also implies an aggregate-level feedback mechanism. In particular, in a population that delays childbearing, social learning from others implies that the experience of friends having children is revealed at an increasingly later age. A woman at some given age, say age 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 an identical 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 important mechanism of how social interactions affect fertility decisions. The importance 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] Similar to our discussion of social learning, we are interested in these social influences not only because of their direct effect on individual's behavior, but also because of the associated social multiplier effect. This multiplier effect occurs, for instance, because changes in innovative subpopulations in response to new socioeconomic conditions imply an erosion and transformation of the prevailing social norms that affect such behavior. The behavioral change of the innovators has thus 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 many lowest-low fertility countries, partnership formation and marriage are inherently connected with the transition into parenthood. This is particularly the case in Italy and Spain, where out-of-wedlock childbearing is still relatively rare, pre-marital cohabitation is not wide-spread, and the trend towards late childbearing is associated with late home-leaving and late union-formation (De Sandre 2000; Delgado and Castro Martín 1998).

An important demographic implication of this trend towards 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 et al. 1984; Grossbard-Shechtman 1985), similar implications are caused by changes in the age-distribution of union formation. In particular, a general delay of partnership formation in the population 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, and second, it increases the expected 'quality' of marriageable partners at older ages because the marriage market will be 'thicker' and contain more potential mates at any given age. Socioeconomic changes that provide incentives for delayed childbearing, for instance higher returns to female education or technological innovations facilitating fertility control, therefore affect the timing of marriage in a twofold manner: on the one hand, via a direct effect on individual's incentives to delay, and on the other hand, via an indirect effect through the reduction in the costs of delaying marriage/cohabitation for individuals. The latter aspect gives again rise to a social multiplier effect (for a formal analysis and application to the U.S., see Goldin and Katz 2000).

*Social feedbacks through competition in the labor market*: A further potentially relevant mechanism of social interaction is competition in the labor market that is caused by the presence of high unemployment. In this situation, the labor market can give rise to a social multiplier effect, quite similar to the mechanism operating through the marriage market above (for a related formal model, see Kohler 2001, Chapter 6). In particular, social interaction reinforces the effect of unemployment and economic uncertainty towards delayed childbearing. This social multiplier effect arises because women with children tend to have lower labor supply 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 at the primary ages of entering the labor market. This increased childlessness leads to an increased female labor supply, which in turn increases the competition and unemployment risks during early adulthood. The postponement of fertility caused by unemployment during early adulthood is therefore exacerbated through a feedback process that increases the overall female labor supply in the age groups that are most affected by economic stress.

### 3.4 The dynamics of delayed childbearing: postponement transitions

The arguments in the previous section suggest that the consideration of social interaction mechanisms can improve our understanding of the dynamics of fertility postponement. In particular, we will argue in this section 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). This 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 group of three years during which the mean age at first birth increases by more than .3 years. Within lowest-low fertility countries, this year of onset ranges from 1978 (Italy) to 1994 (Russia, Armenia) and 1997 (Belarus) (Table 1). The horizontal axis in Figure 1 plots the years since the onset of the postponement transition, and the vertical axis depicts the change in the mean age at first birth since this onset. In order to avoid a cluttering of the graph, we display some CEE countries with a very recent onset in a sub-graph. 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 substantial increases in the mean age at first birth in lowest-low fertility countries that we have emphasized throughout this paper. More importantly, the standardization of the time-scale in this figure reveals several key 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 that is characterized by a relative stability in first-birth timing; ($b$) once initiated, the postponement transitions in all lowest-low fertility countries is persistent and irreversible, leading to large changes 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 very different socioeconomic conditions in Europe, including also very different patterns of post-1990 economic crises in Eastern Europe and very different levels in the mean age at first birth prior to the postponement transition. For countries with an onset of the transition after 1993 it is still very early to make inferences about the path of the postponement transitions, but it seems very likely that they will follow the other lowest-low fertility countries.

The empirical characteristics of postponement transitions in low and lowest-low fertility countries in Figure 1 are not only similar to the characteristics of the fertility decline during the demographic transition in Europe, but can also be explained by a similar set of mechanisms. In particular, we argue in this paper that the empirical patterns of the postponement transition in Figure 1 can be consistently explained by the *combination* of individual-level incentives for delaying childbearing and the aggregate-level implications of social interactions. Moreover, neither aspect alone is likely to be sufficient.

In order 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 above postponement dynamics. For simplicity we focus on the timing of the first child, which is the most pivotal parity in lowest-low fertility countries, and we utilize a micro-macro interaction model that in similar fashion has been used to explain other rapid behavioral changes in demography and the social sciences more general (e.g., see Arthur 1994; Kohler 2001; Schelling 1978). In particular, Figure 2 depicts a stylized population in which social interactions influence the desired age at first birth. The horizontal axis denotes $\bar{A}$, which is the average age at first birth, and it represents the overall age-pattern of childbearing in the population. The vertical axis denotes $EA_i^*$, which denotes 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 $EA_i^*$ then 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 these figures is that social interaction—through the different mechanisms outlined above—implies a dependence of the individually desired timing of childbearing on the prevailing mean age at first birth in the population. In particular, all of the above mechanisms imply that delays in the average birth timing in the population lead to a later individual desired age at first birth. Since all members of the population are affected by these social interaction effects, the individual changes in birth timing lead to a similar shift in the expectation $EA_i^*$. The average desired age at first birth 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° line at three points $\bar{A}_e^{\text{early}}$, $\bar{A}^{\text{crit}}$ and $\bar{A}_e^{\text{late}}$. Two of these intersections, $\bar{A}_e^{\text{early}}$ and $\bar{A}_e^{\text{late}}$, represent equilibria to which the birth timing in the population will converge based on the prevailing socioeconomic conditions (like 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 $\bar{A}_e^{\text{early}}$, 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 towards the equilibrium level $\bar{A}_e^{\text{early}}$. The same reasoning holds for the case when the population is slightly to the right of the equilibrium level, and it also applies to the late fertility equilibrium at $\bar{A}_e^{\text{late}}$. 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 a relatively old age.

In order to understand the implications of this multiple-equilibria model for changes in the timing of fertility over time, consider for instance a population that is in the early fertility equilibrium and is characterized by a mean age at first birth of $\bar{A}_e^{\text{early}}$. What happens if there is an increase in the returns to female education, or a higher uncertainty in early adulthood, that leads to a delay in the individually desired age at first birth? The direct effect of these new socioeconomic conditions shifts the full 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 $\bar{A}_e^{\text{early}}$, is no longer an equilibrium. As a consequence, the age-pattern of childbearing will change after the increase in the returns to education or uncertainty in early adulthood, and the mean age at first birth will adjust towards a new stable situation.

Two scenarios can be distinguished in this adjustment process. In the first scenario, we assume that the increase in the returns to education or the uncertainty in early adulthood is only modest, and the resulting upward shift of the full line in Figure 2 is relatively small. As a consequence, there remain three intersections with the 45°, and the new socioeconomic conditions merely imply that the early fertility equilibrium is shifted towards a later age located at the right of the initial equilibrium $\bar{A}_e^{\text{early}}$. The adjustment process towards this new equilibrium level implies that the population will experience a postponement of fertility towards 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 individualistic 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 full line in Figure 2 upward, and $(b)$ an indirect effect—or *social multiplier effect*—due to the adjustment process towards the new equilibrium level that lies at the new intersection of the full line with the diagonal. These social multiplier effects can be quite 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 process in Figure 2 pertains to the case where the upward shift of the full line in Figure 2 in response to the increased returns to education or higher uncertainty is assumed to be large. This case is depicted by the broken line in Figure 2. Most importantly, the upward shift implies that the initial early fertility equilibrium $\bar{A}_e^{\text{early}}$ vanishes, and the late fertility regime at $\bar{A}_e^{\text{late}}$ remains as the only stable equilibrium. As a consequence, the change in socioeconomic conditions initiates an adjustment process from the initially prevailing early timing of fertility, $\bar{A}_e^{\text{early}}$, towards the late pattern of childbearing at $\bar{A}_e^{\text{late}}$. Because this transition is a shift between two distinct timing regimes, this process leads to substantial, rapid and persistent increases in the mean age at first birth within relatively short periods of time.

In a multiple equilibria situation as in Figure 2, therefore, changes in socioeconomic conditions can lead to a *postponement transition* similar to the country paths depicted in Figure 1. Once this transition is initiated through socioeconomic changes eroding the initial early fertility equilibrium, the population will experience a rapid and persistent delay in the timing of childbearing. Moreover, because the feedback effects resulting from social interactions is the primary driving force of this adjustment process, these shifts in the timing of childbearing may be associated with relatively modest socioeconomic transformations once the postponement of fertility is initiated. Hence, the transition appears to observers as if it is driven by its own momentum. This pattern is for instance 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 the occurrence of uncertainty in early adulthood, are quite pervasive and will gradually affect most developed countries and induce a tendency towards later childbearing. Based on the characteristics of the postponement transition that is initiated by these socioeconomic changes, we also expect a convergence of countries towards a relatively late timing of fertility in the long term. Moreover, our multiple-equilibria model in Figure 2 suggests that the transitions towards this late-fertility regime continues even if the socioeconomic conditions that prompted the transition are reversed. 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 equilibrium—as soon as some initial socioeconomic changes have resulted in a delay of childbearing beyond the critical level $\bar{A}^{crit}$ in Figure 2. For instance, the transition to postponed childbearing is likely to continue even if the economic uncertainty due to unemployment in early adulthood, which is an important determinant of the onset of the transition, disappears and the economic situation of young adults improves (e.g., this has been the case in Spain where the extent of youth unemployment has declined during the 1990s; see Table 5). The postponement of childbearing is therefore likely to be persistent, despite the fact that socioeconomic situations that initiate the onset of this transition are only temporary and transient.[16]

The above postponement transition towards 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, the above discussion suggests that the long-term trend towards low and lowest-low fertility in Europe is related to three distinct transition processes: the (first) demographic transition leading to parity-specific stopping behavior within marriage, the second demographic transition resulting in ideational changes and in the rise of non-marital family forms, and most recently, the postponement transition that shifts the timing of fertility towards a late childbearing regime. The postponement transition is therefore a third step that follows the control of marital fertility and the transformation of partnership behaviors, and it implies a delay of parenthood towards later age as the combined result of individual incentives for late childbearing and social interaction effects that reinforce this trend.

### 3.5 Determinants of the quantum 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. In this section we therefore consider the interdependence between 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 quite widespread agreement in the literature that lowest-low fertility countries share an institutional setting that implicitly favors a relatively low quantum of fertility (see Section 2.3 for estimates of the cohort fertility associated with currently observed lowest-low *TFR* levels). For instance, the lowest-low fertility countries in Southern Europe, Italy and Spain, provide highly insufficient child-care support (Esping-Andersen 1999).[17] The labor market is also relatively inflexible in terms of possibilities for part-time work or re-entering the labor force after an absence due to child-birth (Del Boca 2002; González et al. 2000; Stier et al. 2001). This hinders the combination of female labor force participation and childbearing. In comparison with other Western European countries, Italy and Spain also have among the lowest levels of state support for families with children in terms of 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), this substitution of family support for public support is likely to be insufficient in contemporary industrialized countries. Moreover, the high integration of young adults in their parents' home and extended family may even discourage union formation and fertility (Dalla Zuanna 2001).

Family roles in the Southern European lowest-low fertility countries have also been slow in adapting to the new role of women (Chesnais 1996). Italy and Spain have a highly asymmetric labor divisions within households, which becomes even more asymmetric after the birth of the first child (Palomba and Sabbadini 1993). The countries therefore conform with McDonald's (2000) argument about gender equity: fertility falls to very low levels when gender equity rises in individual-oriented institutions, like the labor market, while it remains low in family-oriented institutions.

The moderate and very low quantum in Eastern Europe is in part determined by similar institutional factors hindering high parity progression probabilities. In addition, many of the pronatalist—or at least family friendly—policies in CEE countries have discontinued after 1990 (Macura 2000), and the economic crisis has deteriorated particularly the high integration of women in the labor market. Furthermore, Eastern Europe is characterized by a persistence of economic insecurity throughout the life-course. This is in contrast to Southern Europe, where unemployment and economic stress are concentrated during early adulthood years. In Eastern Europe, the uncertain long-term outlook regarding unemployment, the housing situation and economic recovery implies that uncertainty affects not only the timing of the first birth but also the transition to the second child and higher-parity children.

While the above institutional context—at least in Southern Europe—has been relatively constant in recent decades, its effect on the quantum of fertility has not. In particular, the effect of this institutional context needs to be investigated with an explicit attention to 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 prior to marriage and parenthood are 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 an increase in the opportunity costs of childbearing in terms of foregone wages.

This relation between the timing of fertility and the wage-level (measured around first childbirth) is depicted by the broken line in Figure 3(a). The wage-level has been standardized so that it equals one for women with an early onset of parenthood. It increases with a later age at first birth because the delay in childbearing is generally associated with higher levels of human capital and labor-market experience that are rewarded in the labor market. This rise in wages increases the opportunity costs of time spent outside the labor-market, and it increases the costs of time-intensive 'goods' such as children. The opportunity cost, however, is not as high as the wage level since there can be some labor force participation. In particular, women with late childbearing can substitute away from 'own' child-care and into 'purchased' child-care (kindergarten, household help, etc.). This implies that the opportunity costs of children increase less steeply with delayed childbearing than the index of wages (for the moment we ignore other costs of children that may potentially depend on the age at first birth, such as for instance health costs during pregnancy).[18]

The extent of this difference between wages and opportunity costs of children, however, depends on the compatibility of childbearing with female labor force participation. In a country with a low compatibility, the ability to arrange a 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 above substitution from time-at-home to time-in-the-labor-market is restricted. The postponement-induced increase in wages therefore translates into substantial increases in the opportunity costs of children, including also the opportunity costs of additional children after the first child (see line AB in Figure 3a). These higher child-costs will tend to reduce the quantum of fertility and the parity progression probabilities after the first birth.[19]

If there is a high compatibility of childbearing and female labor force participation, wage increases associated with late childbearing lead to more modest increases in the opportunity costs of children (see line AC in Figure 3a). In particular, women will be able to shift relatively flexibly 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, with high levels of female labor force participation there can also be a positive income effect on the demand for children.

These differences between countries with high and low compatibility of work and children have important implications for the causal effects of delayed childbearing on the quantum of fertility. In particular, the higher human-capital associated with delayed childbearing translates directly into increased opportunity costs of children. This effect is especially relevant when it is combined with the large delays in childbearing that occur during the postponement transition. In this case, the postponement-induced increases in child-costs are likely to imply substantial declines in individual's demand for children of birth-order two and higher.

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 due to an additional year of delay in parenthood, are particularly strong in Southern Europe (see Section 2.1 and 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 combined late childbearing without important reductions in cohort and period fertility (see Section 2.2).

In summary, the above discussion suggests that the postponement of fertility is not neutral with respect to the quantum of fertility. Quite to the contrary, there is a negative association, and the magnitude of this postponement-quantum interaction depends mainly on the compatibility of work and children (Figure 3b). On the one hand, countries with low compatibility between female labor force participation and childbearing, such as Italy and Spain, are subject to large postponement effects. These countries therefore experience substantial reductions in completed fertility that are causally related to delayed childbearing. On the other hand, in countries with a high compatibility of work and children, as for instance Denmark or Sweden, the increased costs of time-at-home associated with delayed parenthood can be partially accommodated by increasing the labor force participation. These countries are therefore likely to have a smaller postponement effect, and late childbearing in itself does not imply strong reductions in the quantum of fertility. The above analyses also suggest that differential postponement effects—as depicted in Figure 3b—constitute an important determinant of the differential reductions in second and higher order fertility in European countries as a result of delayed childbearing. Differences in these postponement-quantum interactions are therefore likely to be an important factor underlying the divergence of fertility levels between low and lowest-low fertility countries in Europe that we have emphasized in our introductory section.

## 4 Summary: the determinants of lowest-low fertility

We have argued in the previous sections that lowest-low fertility, defined as a period *TFR* below 1.3, is caused by a combination of the following demographic and socioeconomic factors:

a) *Tempo- and distributional distortions of period fertility measures* that result in an underestimation of the quantum of fertility using the total fertility rate.

b) *Socioeconomic incentives to delay childbearing* that make postponed fertility a rational response to high economic uncertainty in early adulthood, increased returns to education, shortages in the labor market and similar factors.

c) *Social interaction effects on the timing of fertility* that reinforce the adjustment of individual's desired fertility to socioeconomic changes. In particular, social multiplier effects and multiple equilibria can give rise to *postponement transitions* that lead to rapid, persistent and generally irreversible delays in childbearing across a wide range of socioeconomic conditions.

d) *Institutional settings in lowest-low fertility countries* that favor an overall low quantum of fertility.

e) *Postponement-quantum interactions* that lead to reductions in completed fertility which are causally related to the delay in childbearing. The postponement of fertility therefore does not only lead to a delayed pattern of childbearing. It also implies important negative effects on the quantum of fertility and on completed fertility, and this effect is particularly strong in the institutional context that is characteristic of lowest-low fertility countries.

The above five factors are not necessarily unique to lowest-low fertility countries. However, we believe that lowest-low fertility countries are characterized by a combination of all five factors in a particularly pronounced fashion. Lowest-low fertility is therefore the outcome of an interaction of demographic and behavioral factors that each in itself would lead to lower fertility. In combination and interaction, however, these factors reinforce each other and lead to lowest-low fertility. It is also noteworthy that substantial childlessness has not been a driving force leading to reduced fertility in the group of countries currently classified as lowest-low fertility countries.[20]

## 5 The future of lowest-low fertility: some speculations

Four questions seem to be of central importance in assessing the future of lowest-low fertility. First, is lowest-low fertility a permanent, long-term phenomenon or is it merely a transient phenomenon that will disappear from the demographic landscape in the near future? Second, has lowest-low fertility already reached its lowest levels, or are future declines in fertility likely? Third, is the emergence of lowest-low fertility likely to be a wide-spread phenomenon, or will it remain restricted to regions such as Southern, Central and Eastern Europe, where this pattern is currently concentrated? Fourth, has the postponement of childbearing in lowest-low fertility countries reached its limits and is this trend coming to a halt in the near future?

It is obvious that conclusive answers to these questions are far beyond the scope of this paper, and we believe the issues related to the above questions will importantly shape demographic research in future years. Despite the daunting task of speculating about the future of lowest-low fertility, we will nevertheless embark on an attempt to map some future developments with respect to the above questions (related discussions, for instance, include Bongaarts and Bulatao 2000; Coleman 1996; Lesthaeghe and Willems 1999).

We begin our speculations with indications about the 'physiological limits' to a postponement of fertility and the medical evidence about the feasibility of wide-spread childbearing above the ages of 30–35. Following Menken's (1985) PAA presidential address asking "How late can you wait?", several studies have weighted 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 et al. 1998). In particular, in the peri-menopausal years, which are of key interest when looking at the possibilities of postponing childbearing, declining fecundity is a function of both 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 and independent risk factor for fetal death, independently of reproductive history, and they conclude that the general chances of successful pregnancies in women aged 40 and over are poor.[21] In general, our reading of the medical literature suggests a significant skepticism and controversy about the feasibility of widespread and sufficiently reliable childbearing above age 35, especially for first births. Moreover, as far as we can assess, there is 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 the currently observed trends toward delayed childbearing. In vitro fertilization, intra uterine insemination and oocyte donation, may partially overcome some of these age-related problems. However, comprehensive evidence about the extent to which these developments can facilitate wide-spread very late fertility on the population level does not yet exist. In addition to this skepticism about the possibilities of reliably realizing fertility intentions at late ages, Beets et al. (1994) also 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. This potential lack of information about the feasibility of childbearing at advanced ages was even the theme of a Newsweek cover story 'The truth about fertility: Don't believe the hype—even fertility specialists say younger is better' (Newsweek, August 27, 2001). The cover story also refers to a new generation of celebrities who seem to be new 'trend-setters' by having their first babies in their 20s.[22]

In lieu of conclusive evidence in the medical literature about the limits of postponed childbearing, we may also turn to aggregate country-level evidence about the potential endpoints of the postponement. It is clear that many CEE countries with still relatively early childbearing can continue the postponement of birth, even at relatively rapid annual rates such as an annual increase in the mean age at first birth by .2, for at least two to three decades until they reach the late age-patterns of fertility currently observed among Northern and Southern European countries. During this period there may also be little reason to expect that the period fertility will rise because tempo distortions caused by the postponement of fertility diminish.

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 leading countries in fertility postponement. These countries have experienced substantial increases in the mean age at birth, and in some cases there has been a recent slow-down 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 the late-fertility equilibrium or the endpoint of fertility postponement. In summary, the analyses of country-level data about the mean age at birth and parity-specific birth rates or childbearing intensities do not necessarily suggest that the postponement will come to a halt in the near future.

It is clear that the 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 longevity, one may foresee a rectangularization of fertility patterns. This rectangularization, which needs not be only a feature of lowest-low countries but of all below-replacement fertility countries, is characterized by a concentration of childbearing in an increasingly narrow age-interval. In this scenario, few women will have children prior to, say, age 28 or 29, and childbearing at parity one and two will be concentrated when women are in their thirties. There will be very few higher parity births, especially among women with a late onset of childbearing. A first indication of such a potential rectangularization of fertility in Spain, the Netherlands and Sweden is found by Kohler and Ortega (2002b), 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%) during 1980–98, while the mean increased from 26.7 to 30.8 (+16%). This trend towards a rectangularization is also revealed by the interquartile range in the age at first birth (for a related application to mortality, see Wilmoth and Horiuchi 1999). This interquartile range is the difference between the ages when 25% and 75% of women, who ultimately experience a first birth, have entered parenthood. In a synthetic cohort experiencing the 1980 (tempo-adjusted) childbearing intensities in Spain, for instance, this interquartile range is equal to 7.0 years, and it is reduced to 5.2 years in a cohort that experiences the 1998 childbearing intensities.[23] These declines in the standard deviation and the interquartile range suggest a beginning concentration of fertility into a more narrow age interval, and it indicates that pure increases in the mean age may start to reach their limits.

The future development of the quantum of fertility is of course an additional major determinant of long-term period and cohort fertility levels. Extensive and comprehensive discussions of this aspect are for instance included in Bongaarts and Bulatao (2000), Lesthaeghe and Willems (1999), Morgan and King (2001) or Golini (1998). In the present discussion, we therefore focus on the question of whether lowest-low fertility is likely to decline further due to an ongoing delay of childbearing. We address this question first for the Southern-European lowest-low fertility countries that were the first to fall persistently below a *TFR* of 1.3. 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 of the mean age at first birth may start to decline in the next years. 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 discussion of postponement-quantum interactions in Section 3.5 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* is 1.23 in 2000 after a trough of 1.19 in 1996) and Spain (*TFR* is 1.24 in 2000 after a trough of 1.17 in 1996) may be due to this decline of tempo effects and diminishing relevance of compositional distortions (see Section 2.1). Nevertheless, despite this potential reversal of period fertility, many cohorts in Southern Europe will remain considerably below replacement fertility almost irrespective of the future fertility developments in the next decades. This is due to the already late childbearing in these countries that leaves little scope for a future recuperation of fertility.

The situation is somewhat different in Central and Eastern European countries that still exhibit a relatively young mean age at birth. Due to the potential for considerable future delays in childbearing, we do not foresee that tempo-distortions lose their relevance in CEE countries. Unless there are changes in the quantum, for instance due to improved economic conditions and reductions in uncertainty, we expect that these countries will remain at or close to lowest-low fertility levels for a considerable time, say 20–30 years. Moreover, a potential further decline in period fertility due to tempo-distortions seems likely in countries like Bulgaria, Russia or 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 1.1–1.3.

A final issue in the context of lowest-low fertility pertains to the mechanisms that could potentially lead to a reversal of this pattern. In addition to a diminishing role of tempo-distortions, fertility levels could stabilize or recover due to a wide range of factors that affect the quantum and desired level of fertility. On one hand, increases in the quantum of fertility can occur due to improvements in the economic situation, especially for young adults or in transition countries. Some empirical evidence suggests that better economic conditions for young adults lead to earlier transitions to adulthood, marriage, and fertility (Aassve et al. 2002; Ahn and Mira 2001). On the other hand, more generous 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 transfers to families with children. Due to the relatively low levels of childlessness, these policies in lowest-low fertility countries should be targeted in particular towards 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 discussion of postponement-quantum interactions in Section 3.5, interventions that increase the compatibility of work and children are particularly important, especially in lowest-low fertility countries with already very late patterns of childbearing. However, none of the current lowest-low 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 2002). This lack of policy response may also be due to some skepticism about the extent to which policy measures can substantially influence demographic behavior and raise fertility levels (e.g., see a recent review paper by Gauthier 2001).

We conclude our speculations with a demographic mechanism that implies homeostatic forces and could potentially lead to increased quantum of fertility in the future. In particular, persistent 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 it also leads to substantially reduced relative cohort sizes. For instance, the first lowest-low fertility cohorts born early in the 1990s in Italy and Spain are about 41% smaller than the cohorts born 25 years earlier.[24] In the next 10–20 years, when these small cohorts begin higher education, or begin to enter the labor and housing markets, they are likely to face substantially more favorable conditions than their 25-year older predecessors, who have contributed importantly to the emergence of lowest-low fertility in the 1990s. This positive effect of cohort size, first proposed by Easterlin in the context of the U.S. baby boom (for a summary of these arguments, see Easterlin 1980), 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.[25] Despite its speculative character, this effect may nevertheless be important since it is likely to be one of the few demographic factors with homeostatic implications that can lead to a reversal of lowest-low fertility.

The outlook on the future of lowest-low fertility in this section clearly indicates that this pattern is unlikely to be a short-term phenomenon that will quickly disappear from the demographic landscape. In our opinion, lowest-low fertility is likely to be a persistent pattern. We expect that it prevails for a considerable period in the CEE countries with a *TFR* below 1.3. In addition, we believe that lowest-low fertility is likely to spread in the near future to several other countries that currently experience a *TFR* between 1.3 and 1.5. These 'lowest-low fertility candidates' include Austria, Germany, several Central and Eastern European countries like Poland, Lithuania, Slovakia, Croatia, and Asian countries like Korea and Japan. Moreover, other South-East Asian countries might possibly cross the lowest-low barrier. The regions of Hong-Kong and Macao already have lowest-low fertility levels, and countries like Japan (1.4) and the Republic of Korea (1.5) potentially follow this trend in the near future. Moreover, a recent study on low fertility in urban China (Zhao 2001) has shown that the one-child policy reduced the total fertility rate of urban China to a level of 1.15 starting in 1980, and the Chinese urban population may already constitute one of the largest lowest-low fertility populations worldwide.

# Notes

[1]For instance, in the seventies Bourgeois-Pichat (1976) proposed a *TFR* of 1.5 as the minimal 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 nevertheless permeated 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 towards replacement fertility in all the 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 $r = log(NRR)/\mu$, where $\mu$ is the overall mean age at birth and the $NRR$ is calculated as $NRR = .4886 * TFR$. We use $\mu = 30$, 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% 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 post-war years (1996–98) and the data quality is questionable due to 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, i.e. the region of the former GDR, has experienced lowest-low fertility since 1991 with rates below one between 1991 and 1996, while West Germany has experienced a *TFR* close to 1.4 throughout the 1990s. For a discussion of the specific East German situation, see for instance Witte and Wagner (1995).

[4]On a regional or subnational levels, patterns of lowest-low fertility have occurred already much earlier. For instance, patterns of lowest-low fertility emerged in cities such as Vienna, Stockholm or Berlin already around 1930. According to the Princeton Fertility Study, there were a total of nine lowest-low fertility districts in Europe in 1930, including Vienna, Sussex, Hampshire, Northamptonshire, Berlin, Oslo, Stockholm, Basel, Geneva. These regions were mostly urban areas, and some of them attained *TFR* levels that were substantially below one (e.g., a *TFR* of 0.63 in Vienna).

[5]In particular, the Kohler and Ortega (2002a) (KO) approach overcomes two potential problems in the Bongaarts and Feeney (1998) adjustment (e.g., see 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 parity 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 KO approach avoids these two problems by using childbearing intensities (or occurrence-exposure rate), 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 Kohler and Ortega (2002a) approach, therefore, is to obtain a pure measure of period fertility that is free of compositional effects and invariant with respect to past fertility changes that occurred prior to the period of interest.

[6]The data were provided by the Observatoire Démographique Européen and include age- and parity specific childbearing intensities (rates of the first kind) and fertility rates (rates of the second kind) 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 basic conclusion is similar to results obtained from 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 due to the postponement of parenthood are less important than suggested by the *TFR* for first births and its adjustment, and shifts in the parity composition of the population—that are not included in *TFR*-based investigations—have importantly contributed in addition to the delay in childbearing.

[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 is 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 et al. 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 foreseeable 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. If there is a bad economic performance, on the other hand, fertility might continue to be 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 the parents contribute to both earlier home-leaving from their siblings and more expensive housing. There are also sizeable 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 quite 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, among women aged 23-25, 58% of them said that there is a lower acceptable age limit for entering a union, and 81% said so for the birth of a child (Billari and Micheli 1999). There is also evidence from quantitative studies that sequencing norms discourage individuals (in particular women) not to become 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 micro-foundation for this dependence beyond our intuitive arguments in Section 3.3, 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 et al. 2000).

[15]Our discussion in this paper focuses on the multiple equilibria situation depicted in Figure 2. Social multiplier effect, however, do not require the presence of multiple equilibria and the same effect persists also in social interaction models with a single equilibrium. See Kohler et al. (2000) for a further discussion.

[16]In principle it is conceivable that there is a reversal in the age-pattern of fertility. In a multiple-equilibria 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, due to 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 et al. 2000). The various policy measures implemented in the GDR 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, for instance, the share of children below age 3 with day-care coverage in Southern Europe was 4.7%, with respect to 9.2% in Continental Europe (Austria, Belgium, France, Germany and the Netherlands) and 31.0% in the Nordic countries (Denmark, Finland, Norway and Sweden) (Esping-Andersen 1999).

[18]For a discussion of economic models of fertility, and specifically also 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 et al. (2001). Recent analyses of mother's or parents' time spent with children in the U.S. include Bianchi (2000) and Sandberg and Hofferth (2001).

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

[20]This pattern may change when some of the current lowest-low candidates, such as Germany or Austria, reach a total fertility of 1.3 or below. In West Germany, for instance, about 26% of women in the 1959 cohort are childless (Eurostat 2001) and childlessness is expected to be above 1/3 in younger cohorts (Dorbritz and Gärtner 1999). Some additional aspects, not emphasized in the present paper, are likely to become important once countries with such high childlessness reach lowest-low fertility. In particular, a central question in these countries is the polarization of fertility behavior and the determinants that lead to this divergence in fertility-related behaviors between those who have at least one child (frequently associated with marriage or long-term cohabitation) and those who will remain childless (and frequently also single).

[21]Long-term trends in the age limits to conceive 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 et al. 1998; van Zonneveld et al. 2001). The age at menopause is on average about 50–51 years in Western countries, and it shows a remarkable variation between women from 40 to 60 years that partially depends on a woman's contraceptive use and parity (Kaufert et al. 1987; van Noord et al. 1997).

[22]The examples mentioned in the article include Belgium's Princess Mathilde, Jade Jagger, French model Laetitia Casta and acress Kate Winslet.

[23]The calculations first compute the probability $P(x)$ of having a first birth prior to age $x$ for women in a synthetic cohort who experiences 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 $\omega$ is the oldest age at childbearing. We then use linear interpolation to calculate the ages where $\tilde{P}(x)$ equals .25 and .75. The interquartile range is the difference between these ages.

[24]We compare the cohort born in the first year in which the *TFR* fell below 1.3, i.e., 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).

[25]In particular, 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 particularly lead to faster transitions into marriage and parenthood. Quantum changes primarily occur because the tempo-quantum discussed in Section 3.5 are reversed.

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**Table 1:** Total fertility rate (TFR), mean age at first birth (MAFB) and onset of postpopnement transition in lowest-low fertility countries and 'candidates'

| | TFR | | | Year TFR most recently fell | | MAFB | | Difference | Year of |
|---|---|---|---|---|---|---|---|---|---|
| **Country** | **1985** | **1990** | **1999** | **$\leq 2$** | **$\leq 1.3$** | **1990** | **1999** | **1990–99** | **Onset** |
| 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† | 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 R | 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† | 0.4 | 1994 |
| Ukraine | 2.02 | 1.89 | 1.19‡ | 1989 | 1997 | | | | |

*Notes:* MAFB = mean age at first birth; when indicated, data refer to (†) 1997. Sources: Council of Europe (2001).

**Table 2:** Estimates of the postponement effect for various cohorts in Italy, Spain, Bulgaria, the Czech Republic, Hungary and Sweden. This postponement effect reflects the relative decrease in individual's completed fertility that is associated with a one year delay in the age at first birth

| **Country** | **Cohorts** | | | |
|---|---|---|---|---|
| **Italy** | *1923-1935* | *1935-1945* | *1946-1951* | *1952-1958* |
| Postponement effect | 0.0373** | 0.0420** | 0.0480** | 0.0294** |
| | (0.002) | (0.0018) | (0.0046) | (0.0037) |
| **Spain** | | | *1945-1951* | *1952-1958* |
| Postponement effect | | | 0.0511** | 0.0382** |
| | | | (0.0061) | (0.0041) |
| **Bulgaria** | | | *1949-1955* | *1956-1960* |
| Postponement effect | | | 0.0278** | 0.0266** |
| | | | (0.006) | (0.00515) |
| **Czech R.** | | | *1952-1955* | *1956-1959* |
| Postponement effect | | | 0.0351** | 0.0346** |
| | | | (0.0081) | (0.0070) |
| **Hungary** | | | *1952-1954* | |
| Postponement effect | | | 0.0289** | |
| | | | (0.0049) | |
| **Sweden** | | | *1949* | *1954* |
| Postponement effect | | | 0.0215** | 0.0160** |
| | | | (0.0042) | (0.0042) |

*Notes:* All estimates are based on women who experience their first birth prior to age 32. Analyses include cohort dummies that capture trends in cohort fertility. Standard errors are in parentheses. *p-values:* $^{+}$ $p \leq 0.10$; * $p \leq 0.05$; ** $p \leq 0.01$. Sources: *Italy*: ISTAT Survey 1983 (Women, only up to 9 births up to age 38) for Cohorts 1923-1945; FFS 1995-96 (Women, weighted, only up to 9 births up to age 38), Cohorts after 1946. *Spain*: FFS 1995-96 (Women, weighted, only up to 9 births up to age 38). *Bulgaria*: FFS 1997-98 (Women, weighted, only up to 6 births up to age 38). *Czech Republic*: FFS 1997 (Women, weighted, 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)

**Table 3:** Demographic analysis of lowest-low fertility for Italy, Spain, Bulgaria, the Czech Republic and Hungary (inlcuding also Sweden and the Netherlands for comparison)

| | First births | | | All birth orders | |
|---|---|---|---|---|---|
| | $TFR^a$ | lifetime birth probability | Childlessness | $TFR^a$ | period fertility index |
| **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 R.** | | | | | |
| 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**[b] | | | | | |
| 1982–84 | 0.66 | 0.83 | 0.17 | 1.59 | 1.71 |
| 1997–99 | 0.62 | 0.84 | 0.16 | 1.43 | 1.70 |
| **The 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 |

*Notes:* (*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*) For Sweden, the data only include the Swedish born population and the calculations exclude the foreign born population.

**Table 4:** Economic indicators and gross university enrollment ratios for lowest-low fertility countries

| Country | Economic Indicators | | | | Gross University Enrollment$^c$ | | | |
|---|---|---|---|---|---|---|---|---|
| | GNI per capita$^a$ 1999 | GDP average growth$^b$ 1990–99 | GDP growth$^b$ 1999 | Average inflation 1990–99 | Women 1989 | Women 1999–2000 | Men 1989 | Men 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 R. | 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‡ |

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

**Table 5:** Youth unemployment rates (under 25) in Southern Europe

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

*Source:* OECD, Employment Statistics (available at http://www.oecd.org)

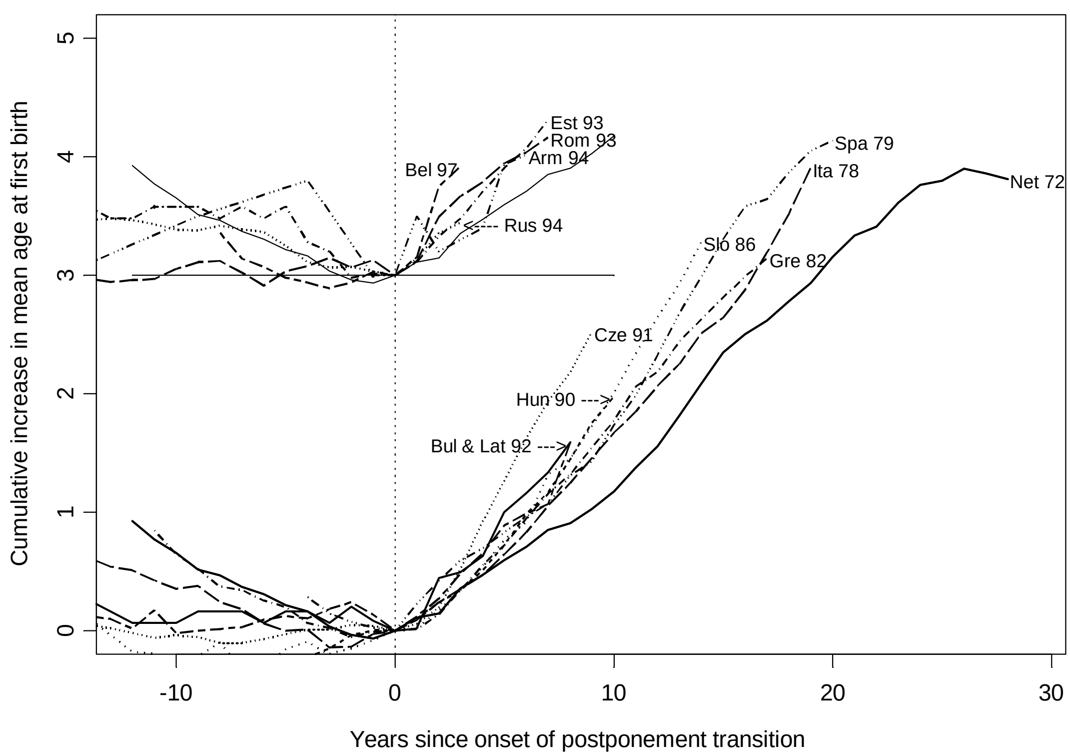


**Figure 1:** Onset and pace of the postponement transition in lowest-low fertility countries and the Netherlands

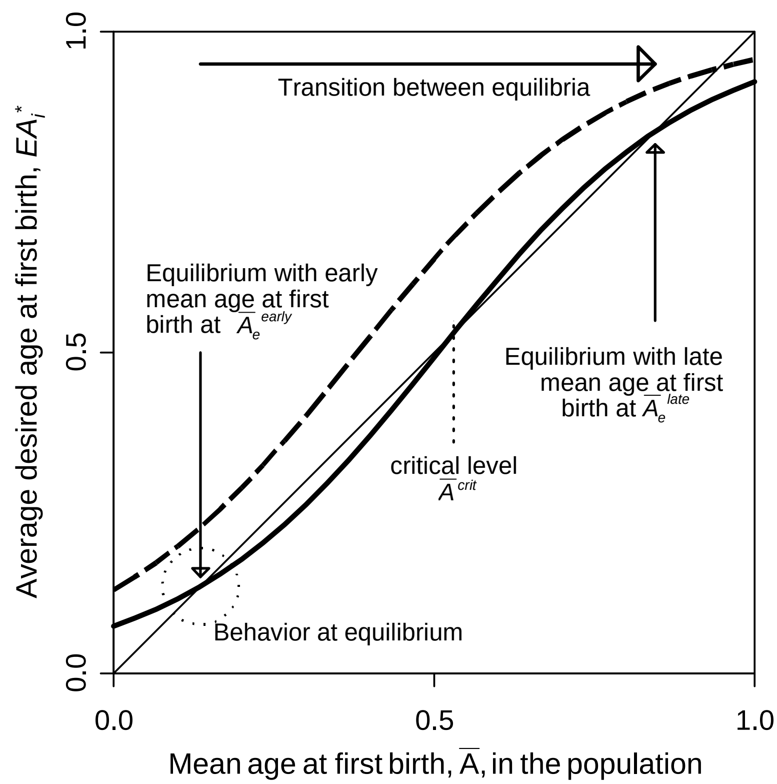


**Figure 2:** Fertility postponement social interactions and multiple equilibria

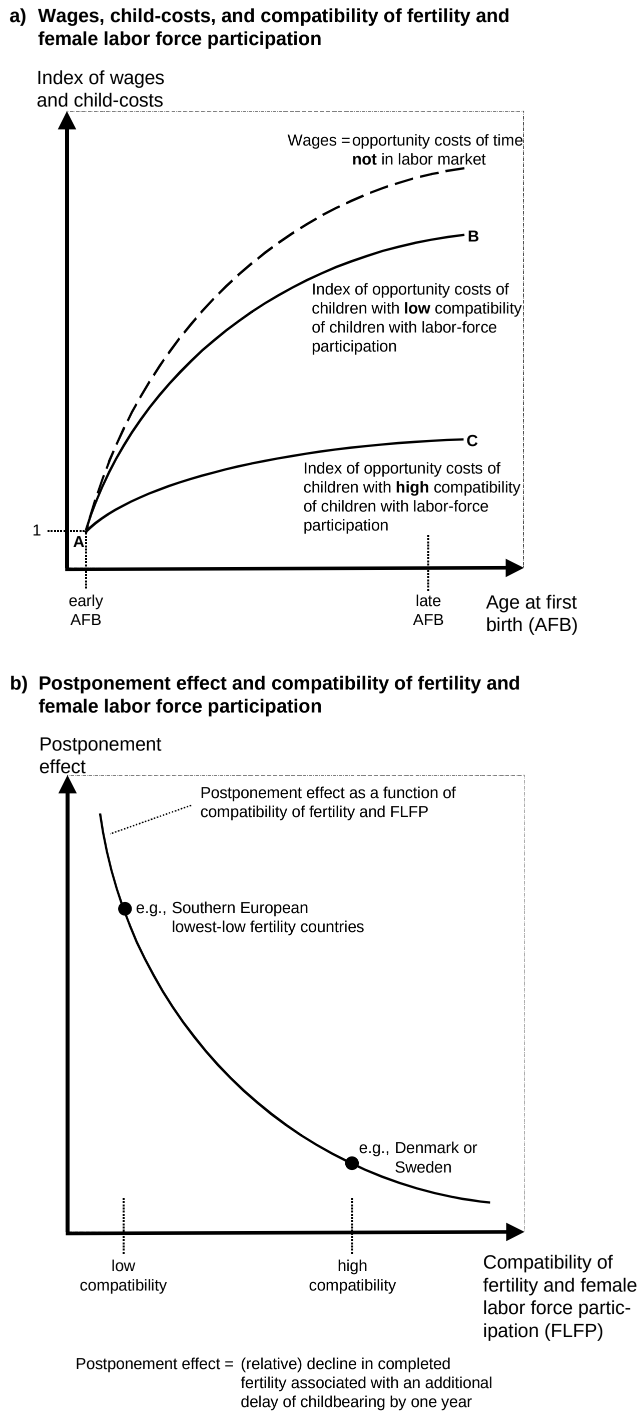


**Figure 3:** Postponement of fertility, wages and child costs