How Would "Tempo Policies" Work?

Exploring the Effect of School Reforms on Period Fertility in Europe

Wolfgang Lutz and Vegard Skirbekk[1]

1. Introduction

Governments in many industrialized countries are concerned about the longer term consequences of rapid population ageing on their pension systems, on the health system, as well as on intergenerational equity and global economic competitiveness. The future path of ageing is determined by four forces: The current age structure of the population as well as the future paths of fertility, mortality, and migration. Of these four forces only two, migration and fertility, are candidates for possible government policies intending to counteract the massive ageing trend. The current age structure is a given and as far as mortality is concerned, only policies aimed at increasing life expectancy and hence reinforcing ageing are politically feasible.

Since continued ageing is, to a large degree, pre-programmed in the European age structure, and Europe has already developed a negative momentum toward population shrinking (Lutz, O'Neill, and Scherbov 2003), possible policies aimed at increasing fertility and/or increasing the volume of migration gain cannot be expected to reverse the ageing trend, but they could possibly weaken it and hence soften the expected negative

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consequences of ageing. Calculations for the 15 member countries of the European Union (EU-15) show that even in the case of a strong increase in immigration to 1.2 million net migration gain per year, the old age dependency ratio is likely to almost double by 2050. Similarly, even a strong hypothetical increase in fertility to 2.2 could not stop such significant ageing. Taken together, higher fertility and higher immigration can only moderate the ageing trend. In this context for the EU-15, it turns out that by 2050 100,000 additional immigrants per year have the same demographic effect as a sustainable increase in the total fertility rate (TFR) by 0.1 children per woman (Lutz and Scherbov 2003).

In this paper, we focus on fertility-related policies and particularly on possible policies that are aimed at affecting the tempo of fertility, i.e., the effect that depresses the level of period fertility and hence lowers the number of births in a calendar year as long as the mean age of childbearing increases. In the next section we study the theoretical rationale for such tempo policies by discussing a) the possible demographic effects of a stop in the increase of the mean age of childbearing, and b) the political feasibility of such policies that would not aim at the number of children that couples choose to have (the quantum choice, which is largely seen as a private decision) but rather focus on the timing of these births. There are also important health reasons for trying to end a further increase in the mean age of childbearing, as well as social and economic welfare considerations. We will then look at the length of education as one of these social factors that is – for reasons other than fertility – currently the object of intensive policy considerations in many European countries.

In short, the question is whether current plans to shorten the average duration and timing of education (while still achieving the same degrees) could result in a force exerting downward pressure on the mean age of childbearing that would be significant enough to stop or substantially weaken the current fertility depressing tempo effect. We first look at empirical Swedish data that clearly show that the exact age at high school graduation has a significant effect on the average age at first and second birth. We then go on to present some hypothetical calculations for Norway and Italy, where a shortening of high school education is currently being discussed as well as for Bavaria, where it has recently been decided to shorten that duration from nine to eight years. For both cases we find that such school reforms are likely to weaken the tempo effect and hence contribute to more births and slower ageing in the future. In the discussion section we consider other possible tempo policies that would not just shorten life cycle spans before childbirth, but possibly reorder the currently prevailing sequencing of events in adulthood by, e.g., encouraging student couples to have children.

2. Rationale for Tempo Policies

This paper follows up on two other recent papers and aims at concretizing and operationalizing the policy relevant aspects of those papers. In March 2003, Lutz, O'Neill and Scherbov published an article in *Science* entitled "Europe's Population at a Turning Point." One of the key points made in this paper was that the current fertility depressing effect of an ongoing increase in the mean age at childbearing will have a significant and lasting effect on population dynamics in Europe, presenting a force towards population decline and accelerated population ageing. This so-called tempo effect on fertility has recently received much attention in the demographic literature (see, e.g., Bongaarts and Feeney 1998; Kohler and Philipov 2001). It is based on the analytical insight that fertility is currently low in Europe for two different reasons: 1) Women are delaying births to later ages, resulting in fewer births in the calendar years during which this delay happens; 2) Even after adjusting for this tempo effect, fertility is below replacement level. If women do not forego postponed births altogether, delayed childbearing does not affect the total number of births women have over the course of their lives, but still lowers period birth rates as long as postponement is going on and hence contributes to further population ageing and decline. In real life not all postponed births will be recuperated, and increases in the mean age of childbearing also tend to reduce the quantum of the fertility of the concerned cohorts (tempo-quantum interactions).

In the context of tempo analysis, much of the demographic work so far has focused on estimating fertility rates that adjust for this tempo effect, seeing it as a disturbance that should be eliminated in order to come up with a "purer" fertility measure, the tempo adjusted TFR. Lutz, O'Neill, and Scherbov (2003) turn this approach upside down and focus on the tempo effect not as something that should be ironed out, but rather as something that is the focus of interest and could provide a point of leverage for possible attempts to influence the level of period birth rates, something called tempo policies. Quantitatively they show that at the level of the current 15 member states of the European Union (EU-15) a hypothetical end to postponement would bring the period TFR up from currently 1.5 to 1.8 over the coming 10-40 years and would significantly moderate future population decline and ageing. They also show that about 45 percent of the calculated population decline in their scenarios is due to the tempo effect. In terms of ageing it is shown that a continuation of the tempo effect for the next 10-40 years would imply that an additional 500 to 1,500 million person-years of workers would be needed to support the elderly population over the rest of the century, as compared with a no-delay scenario (hypothetical immediate end to the tempo effect). This clearly demonstrates that the changing age of childbearing represents a very important force of population dynamics in Europe that requires special attention. It is worth noting that tempo policies in the opposite direction, i.e., increasing the mean age at childbearing in order to speed up fertility decline in developing countries, has already been part of the demographic literature (see Bongaarts 1994).

In another recent paper, Goldstein, Lutz, and Scherbov (2003) explicitly address another more methodological point in this context. Stable population theory says that under below replacement fertility conditions, a longer mean age of generation implies a slower shrinking of the population. This is a force in the opposite direction as compared to the tempo effect described above. What is the balance of these two opposing effects? The authors show both through analytical considerations as well as through a set of alternative simulations that the tempo effect by far outweighs the mean length of the generation effect for the coming centuries. The second effect would catch up only about 250-300 years into the future, if it is assumed that all postponed births are later recuperated. If one also includes estimates of tempo-quantum interactions, then the tempo effect becomes so overwhelming that the mean length of the generation effect can safely be disregarded. In other words, the above-mentioned aspect of stable population theory does not put into question the assertion that in actual European populations, a near term end to postponement or even a decrease in the age of childbearing would have significant demographic consequences in the direction of less shrinking and less ageing.

Although Lutz, O'Neill, and Scherbov (2003) are not very specific about how the suggested tempo policies could look, they discuss the political acceptability of policies following this line. Against the background that in contemporary Europe, explicitly pronatalistic policies meet pronounced public resistance, family policies in Europe today are based on an equal opportunity rationale and aim to help women combine childrearing with employment. With the possible exception of France, such policies in the past seem to have had little, if any, effect on period fertility. Family policies aiming at the timing of births rather than family size may be more acceptable. Such policies would also have an important health rationale in addition to a demographic rationale. A continued increase in the mean age of childbearing not only raises the risk of staying involuntarily childless, it also leads to burgeoning numbers of often cumbersome infertility treatments and increases the health risks associated with late pregnancies for both mothers and children. Hence, policies aimed at creating the conditions that allow women to have their children at an earlier age, or at least not being driven into further delays, could turn out to be win-win strategies, combining individual health concerns with public demographic concerns.

What public policies could help to stop the further increase in the mean age of childbearing or even lead to a decrease within the foreseeable future? There seem to be strong social and economic forces that work into the direction of ever increasing mean ages. The dominating view is that women first want to finish their education, then become established in a job and find a reliable long-term partner before they dare to enter the demanding phase of raising children, which also commits them for at least 15-20 years. And the standards of what is considered a satisfactory establishment in the professional career as well as what partnership is reliable enough to have children, seem to be still moving upward. How should such forces toward later childbearing possibly be reversed?

In theory, there are two different ways in which childbearing could come earlier in the female life cycle: One is a reordering of sequences (such as having children prior to finishing education); another is maintaining the usual sequence but shortening the phases that precede the birth of children (such as shortening the period of education). While the first amounts to a major change in social institutions and the widespread thinking of what is the preferred sequence of events, the second seems more realistic in contemporary

Europe. Actually, for reasons entirely unrelated to the timing of births, efforts in many European countries are under way, that aim at lowering the age at which young men and women finish their secondary or tertiary education without lowering the average educational attainment of these cohorts.

In this paper we will focus on education reforms as a possible strategy to introduce a downward force on the mean age of childbearing.

3. Age at Graduation and the Timing of Demographic Events

An increase/decrease in the age at graduation, particularly at the tertiary level, is likely to raise/lower the age of entering parenthood, because women usually postpone having children until they have completed their educational careers (Blossfeld and Huinink 1991). Studies on the timing of events suggest that individuals tend to sequence events in adulthood according to rigid schemes: Leaving school precedes entering the labor market, having a child, and other events in adulthood (Billari, Manfredi, and Valentini 2000; Blossfeld and De Rose 1992; Rindfuss, Bumpass, and St. John 1980). In effect, a change in the timing of one event is likely to affect the timing of subsequent events.

This effective incompatibility between education and childbearing seems to have become stronger over time, at least in the U.S. (Rindfuss, Morgan, and Offutt 1996). This implies that graduating from school is increasingly important for fertility decisions. Furthermore, even in countries where legislation aims at making it easier to combine having children with being a student, such as Norway, being enrolled in education still suppresses the probability of childbearing (Kravdal 2001), indicating that fertility during education is not strongly influenced by public policies.

Over the past decades the increasing lengths of education have had substantial effects on fertility patterns. As educational attainment has increased during the last decades, the mean age at childbirth in most European countries has increased considerably, and total fertility rates have dropped below replacement levels (Council of Europe 2001). For example, in Norway, the mean age at first birth increased from 25.8 (1991) to 27 years (2001), while the TFR dropped from 1.92 to 1.78. In Sweden, the mean age at first birth increased from 26.3 (1990) to 27.9 (2000), while TFR fell from

2.14 to 1.54. When discussing changes in the length of education and in the average age at graduation, it is important to distinguish between the changing age at which a certain level of education is completed and the change in the average level of educational attainment. Both factors have recently moved upwards.

Educational reforms that decrease the age of leaving school are currently under way, or are being planned, in several European countries. School regulations can affect graduation age through two mechanisms: a) Changing the age of entering school, which for a given schooling period would alter the graduation age; and b) Compressing or extending the school duration required for a specific school degree.

Changes in the required school duration are currently underway across Europe, where, for example, Norwegian four-year university degrees are replaced by three-year bachelor degrees (NOU 2000). In Italy, tertiary education is shortened to harmonize with the European standards given in the Bologna Declaration (1999). In autumn 2001, the German *Bundesland* Saarland shortened academic track primary and secondary school duration from 13 years to 12, and several other *Bundesländer* are implementing similar reforms, including Bavaria. The reasons for implementing school shortening reforms are to increase the flow of students through the system, and to increase the supply of labor for the economy as well as increase the cost-effectiveness of the educational system. Possible effects of these reforms on the level of period fertility have so far not been addressed.

The age at entering school also varies, and can be as young as four or as old as eight years according to the country (UNESCO 2003). When German, Italian, and Norwegian children enter school the year they turn six, their counterparts of the same age from Holland, England, Scotland, and Wales are already in their second year of school; in Luxemburg and Northern Ireland they are in their third year, while six year-olds in Denmark and Finland still have one year to go before they start to attend school.

The age at school entrance has in recent years been changed towards younger entrance ages in several countries. Only seven of the American states required enrolment in school below the age of seven in 1965, while in 1992, 25 states did so (U.S. Department of Health, Education and Welfare 1965; Education Commission of the States 1994). In Sweden the school entrance age was lowered in the 1990s, after regulations on the age of school entrance were liberalized. Moreover, a recent, industry-sponsored German proposal (Lenzen 2003) suggested lowering the school entrance age to four years and reducing the typical school duration to 10 years, in order to lower the age of exiting the educational system.

4. Empirical Analysis of the Fertility Effects of School Leaving Age: Case of Sweden

Women with higher school leaving ages have fewer children and have them at a later time, but the non-random educational sorting makes drawing conclusions about the causal nature of this relationship difficult. Women with older/younger age at leaving school tend to have different levels of education as well; therefore, they differ by unobserved characteristics that affect both educational attainment and fertility decisions, such as preferences, abilities, opportunities, and family background. To identify the causal effects of a change in the school leaving age, we present a study based on a natural experiment[2] that produces variation in the explanatory variable (graduation age) that is uncorrelated with other influences on fertility.

Skirbekk, Kohler, and Prskawetz (2003) analyze a dataset of 863,304 non-immigrant Swedish women born between 1946-1962 and utilize the fact that Swedish children are enrolled in school in the calendar year in which they become seven years old. Therefore, children who are born during two consecutive months, December and January, differ by 11 months in the age at graduating from school, although they are born merely one month apart.

This institutional setting of the Swedish school system results in an exogenous variation in the age at completing compulsory or higher education, assuming that parents cannot time the births of their children very accurately to the exact month. Birth months affect age at graduation in the same way as a random sorting of individuals into higher and lower school leaving ages. This setting is, therefore, well suited to investigate the causal link between the timing of fertility and variation in the school leaving age.

Skirbekk, Kohler, and Prskawetz find that variation in the school leaving age has a strong and consistent effect on the timing of demographic events in adulthood. An 11

[2] For a discussion of the use of natural experiments, see Rosenzweig and Wolpin (2000).

month higher school leaving age, that is the difference between women born in December and January the following year, results in a 4.9 month later age at first birth. In Figure 1 this pattern is shown for the four quarters of the year, indicating a very clear downward slope and a difference of 3.1 months between the first and the fourth quarter.

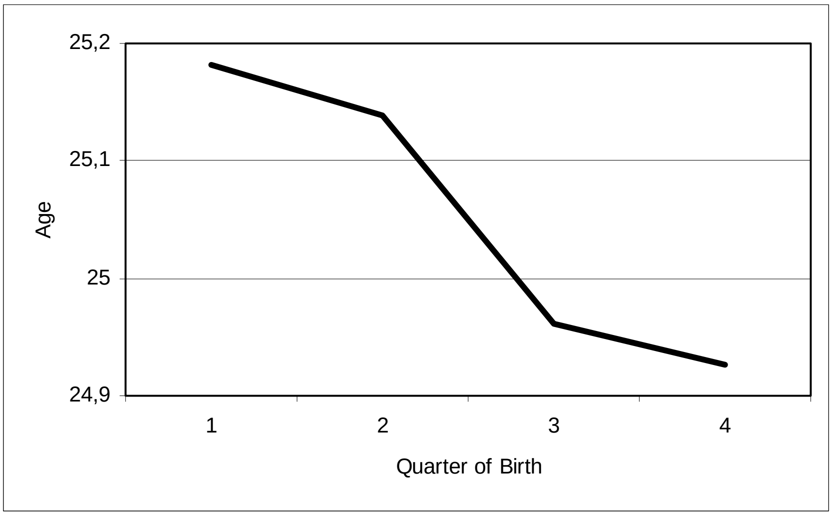

Figure 1. Age of mother at birth of first child for Swedish women born 1946-1962.

The timing of the second birth is also affected by the school leaving age. The birth interval between the first and the second child remains virtually unchanged in response to variation in the age at first birth caused by different years of graduation. Figure 2 shows that there is almost no difference in birth intervals between women born in the four quarters of the year, indicating that there is no conscious compensation for birth-month induced variation in the age at first birth. These findings suggest that important timing aspects of fertility are not so strongly connected to specific age patterns, but rather to the time since leaving school, as well as norms set by the individual’s peer group, in this case the cohort.

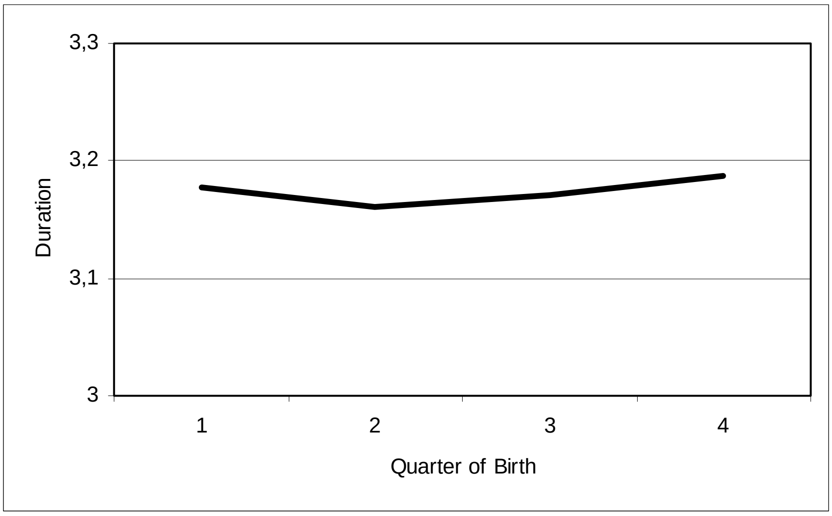

Figure 2. Timing difference between first and second child.

A school reform that would lead to a younger school graduation age would not only affect the individual woman's age at the time of school exit, but would also affect the social age of her peer group. The experiment conducted by Skirbekk, Kohler, and Prskawetz illuminates some fertility effects of a shock to the school leaving age, but not those stemming from an altered social age of the school cohort, the peer group. The social age is determined by peer group influences that are exerted by individuals in the same school cohort. A lower age at graduation would increase the social age of those affected, which would increase the effect of a younger school leaving age on the timing as well as the quantum of childbearing through tempo-quantum interactions: The impact of a more "mature" social influence at a younger biological age would heighten the probability of having children at a younger age and in turn could also increase cohort fertility.

In addition to schooling, several other influences could affect the duration between graduation and fertility decisions. These include social norms, the role of the family in providing financial support (Bentolila and Ichino 2000; Planas 1999) as well as business cycles (OECD 1999). However, neither the level nor the variation in the school leaving age is likely to affect these variables, which are likely to be determined by other factors rather than graduation ages (OECD 2000). One could assume an interaction with the educational system only in the case of the unemployment of young adults.

A change in the school leaving age is likely to have a stronger influence on the timing of fertility than the one identified in the Swedish birth month experiment, since *both* biological *and* social age at the time of graduation matter for fertility decisions. Moreover, there is a trend of increasing ages at birth for younger cohorts, as the average age at first birth increased by 30 months from the 1946 to the 1962 cohort. This suggests that our within-year decreases in the ages at first birth are understated, as the within-year trend is decreasing with age. Taken together, a not implausible assumption would be that a one year change in the school graduation age would be reflected in a unit shift in the age of entering parenthood. But we will also experiment with other assumptions.

5. Hypothetical Forecasts for Bavaria, Italy, and Norway

In order to investigate the possible demographic impacts of a change in the timing of fertility, we project the consequences of fertility changes for the young cohorts concerned for Norway, Italy, and the German state of Bavaria, which with 13 million inhabitants is bigger than many European countries.[3] In the case of Italy and Bavaria, we keep life expectancy constant and assume zero net migration. In Norway, standard assumptions for official population projections are used, with decreasing mortality and an annual net immigration of 13,000 (Note: In the final version of this paper we will have comparable mortality and migration assumptions for all three populations, but this does not significantly change the results when comparing scenarios).

In the following we will discuss five different scenarios that are based on different assumptions with respect to the future course of period TFR. In all cases where the effect of a school reform (resulting in an assumed lower mean age of childbearing) is being simulated, we assume that the reform first affects the female birth cohort of 1995. Hence the effect on the period TFR will only be gradual and increase as more and more of the women born after 1995 move into the main reproductive ages. For the cohorts born before 1995, rates are assumed to stay constant at the level described in the specific scenario assumptions. The assumed TFRs for the three populations are plotted in Figures 3a-3c.

[3] The Norwegian data comes from Statistics Norway, the Italian data from ISTAT, and the Bavarian data from the Bayerisches Landesamt für Statistik und Datenverarbeitung.

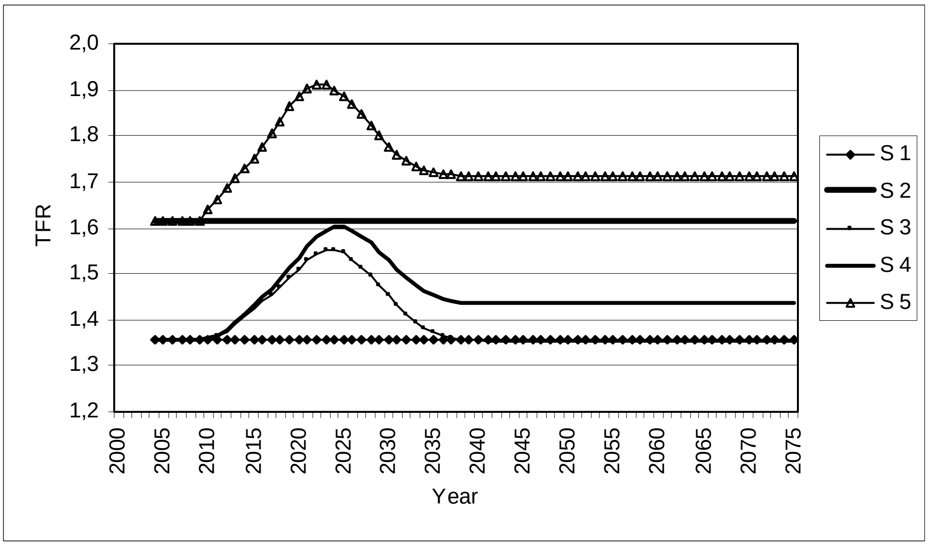

Figure 3a. Total fertility rate, Bavaria.

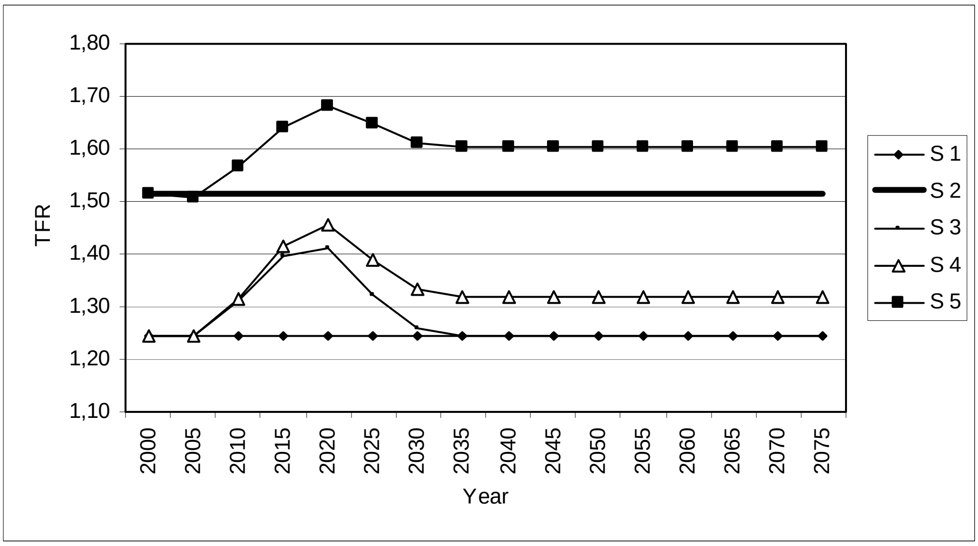

Figure 3b. Total fertility rate, Italy.

Figure 3c. Total fertility rate, Norway. [to be added later]

First, we consider a **constant period TFR scenario (Scenario 1)**. It presents a reference case for comparison, in which period all age-specific period fertility rates remain constant throughout the projection period. Substantively, this scenario assumes that current postponement continues. Since postponement cannot continue forever, it also implies that as the tempo effect gets weaker, this will be compensated by a declining quantum in order to produce a constant period TFR.

The next scenario refers to the hypothetical case of **constant tempo-adjusted period TFR (Scenario 2)** at the current level**.** Here we assume that period fertility immediately jumps to the level of tempo-adjusted fertility, assuming an instant end to further delays in childbearing. Again, these rates are then held constant over time. To estimate the adjusted tempo effect, we apply Lutz, Philipov, and Scherbov (2004) estimate for a general relationship between an increase in the mean age of childbearing and the tempo effect. It shows that on average in contemporary Europe, an increase in the mean ages of childbearing (over all birth orders) of 0.1 years depresses the period TFR levels by 0.19 children. Lutz, Philipov, and Scherbov base this estimate on data from European countries from 1980-2000. Applying this estimate, the Italian tempo-adjusted fertility is 1.51, while the unadjusted TFR in 2000 is 1.24. In Bavaria, tempo-adjusted fertility is 1.65 and the unadjusted TFR is 1.35 for 2002.

Next we consider a scenario reflecting a specific school **reform (Scenario 3).** In this scenario we consider the case of a school reform that has the net effect of reducing the mean age of childbearing by two years for the cohorts born 1995 or later. This is implemented by a simple downward shift in the age-specific fertility profile for the cohorts concerned. This effect is clearly stronger than what one would expect from a shortening of the educational period by one year. It might be seen as close to representing the case in which the average school leaving age drops by two years because of a school reform, which might be the result of a lower school entrance age, or a compressed education, or a combination of both. Since we do not have sufficient evidence for assuming a certain quantitative relationship between a lower age of leaving school and a lower mean age of childbearing (see discussion in Sections 3 and 4), we found it safer to make the assumptions in terms of a certain assumed shift in the age pattern of fertility. The effect of a one year decline in the mean age of childbearing would be half of the effect calculated under this scenario.

The next scenario studies the case of a **reform with quantum effect (Scenario 4)**. Here the likely possibility of a tempo-quantum interaction on fertility is investigated, where the cohorts affected by the school reform are not only younger at the time of childbearing, but also increase cohort fertility levels.[4] We base our estimates on Kohler, Skytthe, and Christensen (2001), who find that a one-year earlier initiation of childbearing increases fertility outcome by 3 percent. Given the school reform that causes a two-year drop in the age at first birth, this would lead to a 6 percent higher fertility in the "reform with quantum effect" scenario.

Finally, we consider a fifth scenario, which looks at the case of **reform with quantum on top of Scenario 2 (Scenario 5).** Here we simply assume that the reform does not affect a society that is otherwise continuing the delay of childbearing (as assumed in Scenario 1), but we look at the hypothetical case that postponement would come to a natural end (Scenario 2) and the effect of the school reform, including the effect of possible associated tempo quantum interactions, would come on top of this. Clearly, this scenario has the highest assumed future fertility rates. Table 1 presents a summary of the five scenarios.

Table 1. Summary of the five scenarios.

Scenario	**Description**
S 1	Constant period fertility
S 2	Constant tempo adjustment
S 3	School reform
S 4	School reform with quantum effect
S 5	School reform with quantum effect on top of the S 2 scenario

Figure 3 (above) shows the trends of period TFR that underlie the five scenarios. In order to allow the study of long-term implications of these assumptions, the time horizon goes until 2075. Figure 3a gives the data for Bavaria and 3b for Italy. (Figure 3c for Norway will be added when the Norwegian scenarios have been redone in a consistent manner).

Figure 4 gives the results in terms of the series of absolute numbers of births. The overall trend is clearly declining for all scenarios in Bavaria and Italy. This is because fertility, even under the highest scenarios, will still be below replacement level and also

[4] This result may be compatible with the results from Skirbekk, Kohler and Prskawetz (2003) who find no impact on fertility outcome of a lower/higher biological age when leaving school. This can be due to the fact that a decrease in the school leaving age would also increase the individual's social age, which could lead to higher cohort fertility levels.

because smaller and smaller cohorts of women will enter the reproductive ages as a consequence of the low fertility in the past (the negative momentum of population growth). In Norway (see Figure 4c) where the TFR is currently around 1.8 and the age distribution is still younger, the calculated scenarios partly result in an increase in the absolute number of births.

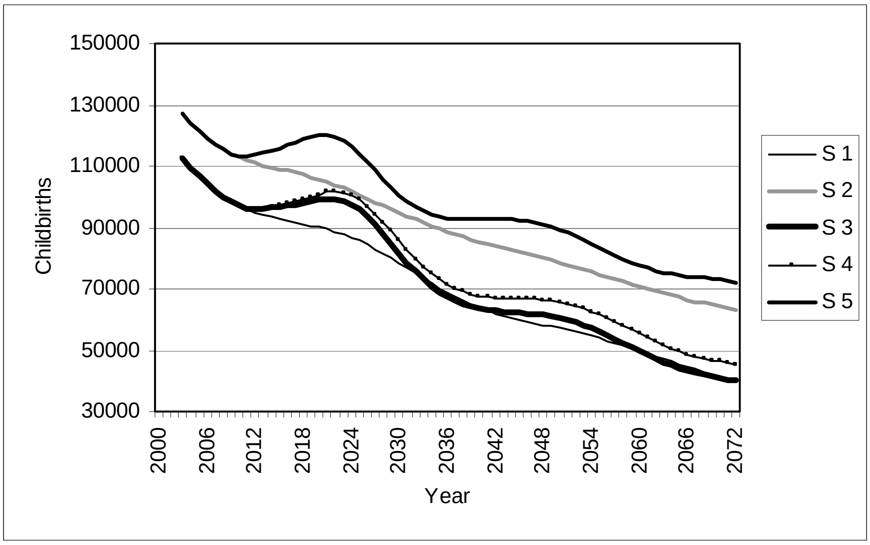

Figure 4a. Number of births, Bavaria.

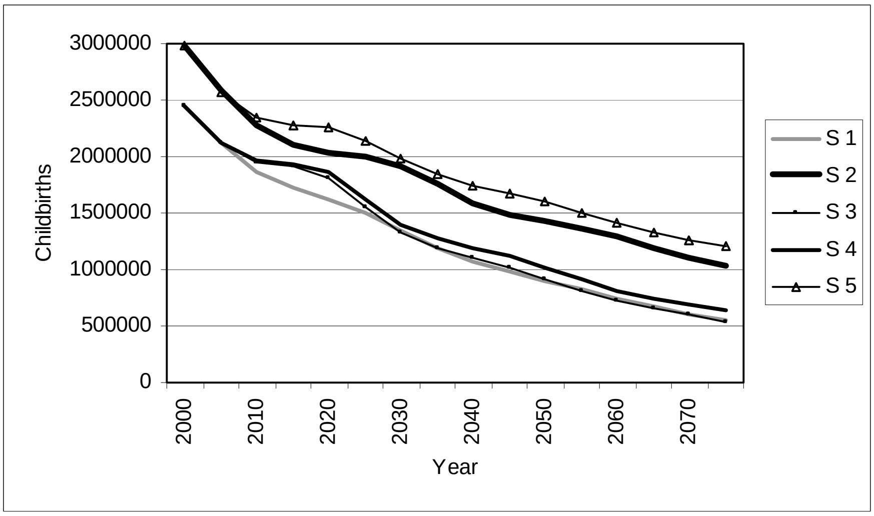

Figure 4b. Number of births, Italy.

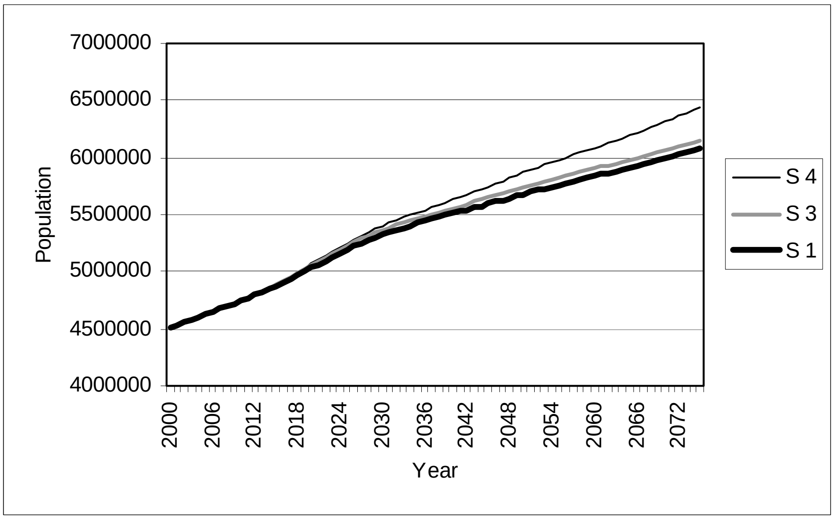

Figure 4c. Number of births, Norway.

Figure 5 gives the old age dependency ratio for the three populations and the different scenarios. Since this ratio is defined as the population above age 65 divided by the population aged 15-64, one would only expect a delayed effect of changes in the births series. And indeed the three Figures (5a – 5c) all show a visible variation among scenarios only beginning around 2030. After that the differences turn out to be quite sizable. In Bavaria and Italy, the lowest fertility scenarios (Scenarios 1 and 3) result in old age dependency ratios that are well above 0.6 during the second half of the century, whereas in the cases of a declining mean age of childbearing, presumably as a consequence of school reform combined with a natural end of the tempo effect, this ratio would fall below 0.5.

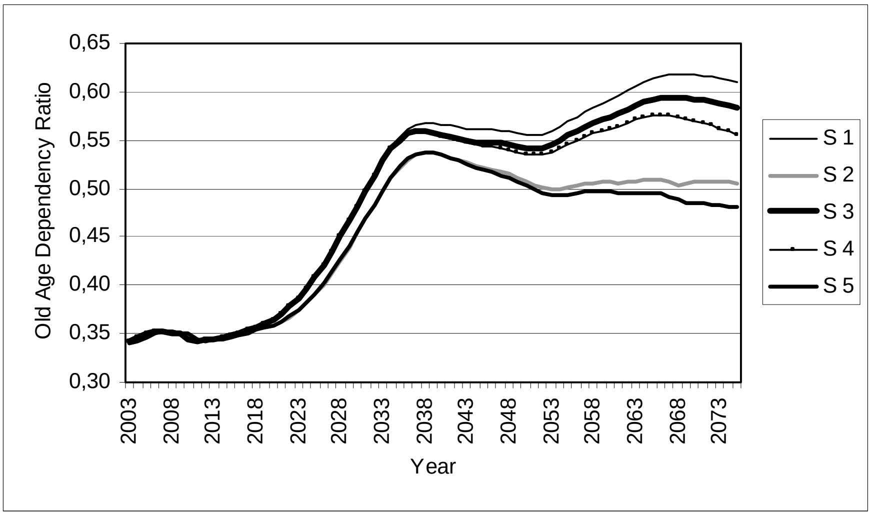

Figure 5a. Old age dependency ratio (65/15-64 year olds), Bavaria.

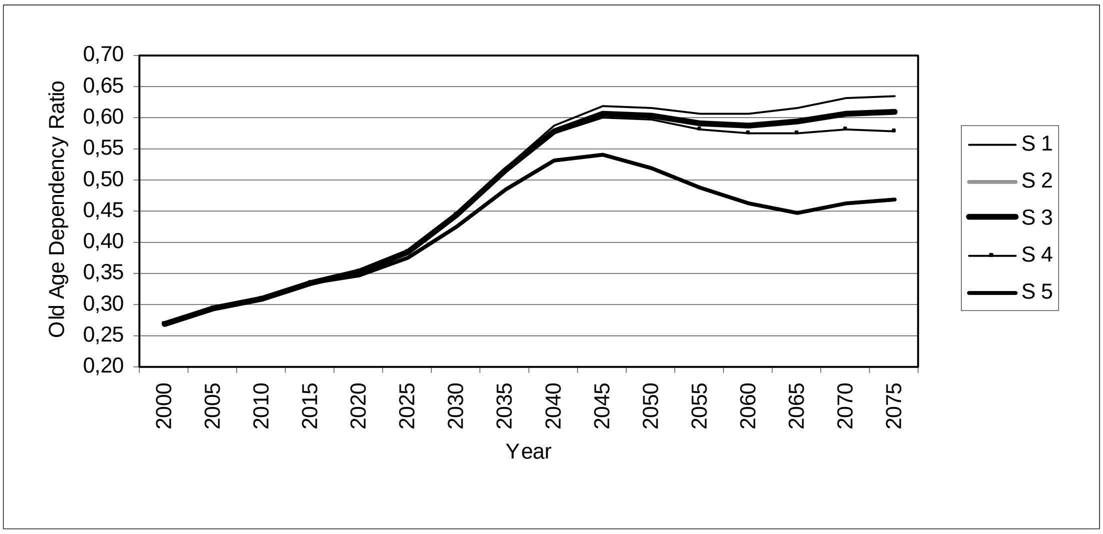

Figure 5b. Old age dependency ratio (65/15-64 year olds), Italy.

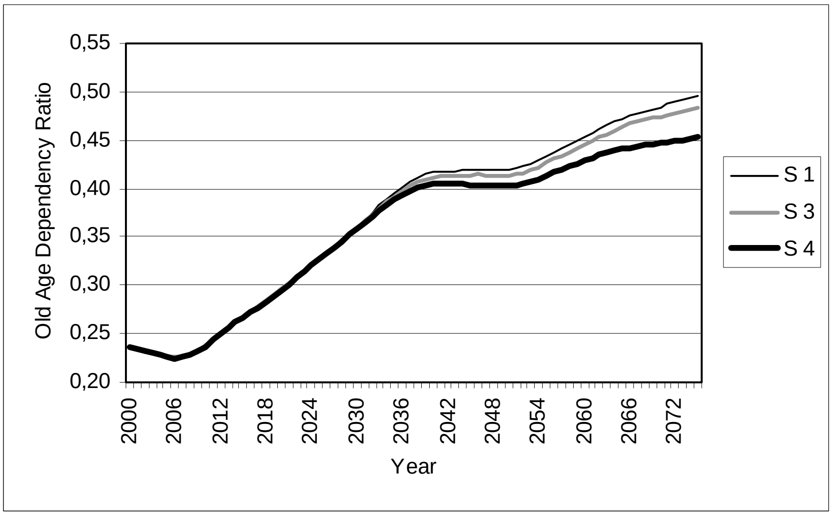

Figure 5c. Old age dependency ratio (65/15-64 year olds), Norway.

Figure 6 gives the implications for changes in total population size due to these fertility changes under otherwise identical mortality and migration assumptions. For Italy and Bavaria, none of the scenarios can stop the significant population decline that is implied by the declining number of births as described above. But the extent of decline is still surprising, even when one considers that this is for a closed population (assuming no migration) and constant mortality. Under all scenarios but one, the population of Bavaria would decline to less than half of its current size, from currently around 13 million to less or around 6.5 million by 2075. Only the combination of a significant school reform with a natural end to the tempo effect will result in 8.1 million, which is short of halving the population size. For Italy, the picture is even a bit more extreme. But the point of this exercise was not to look at absolute changes (for this we need realistic mortality and migration assumptions), but rather to compare the scenarios and study the relative impacts of possible school reform effects. Table 2 presents the results of the five scenarios for Bavaria, Italy, and Norway in numerical form.

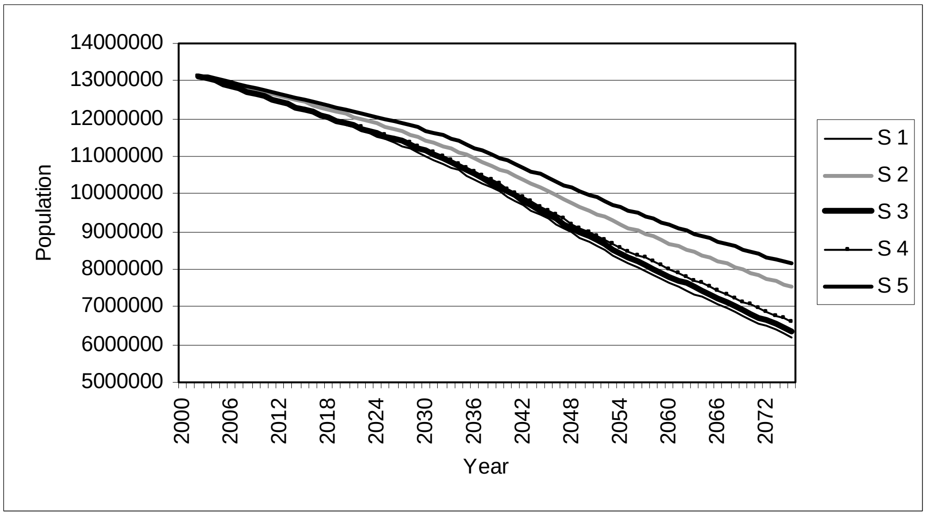

Figure 6a. Population size, Bavaria.

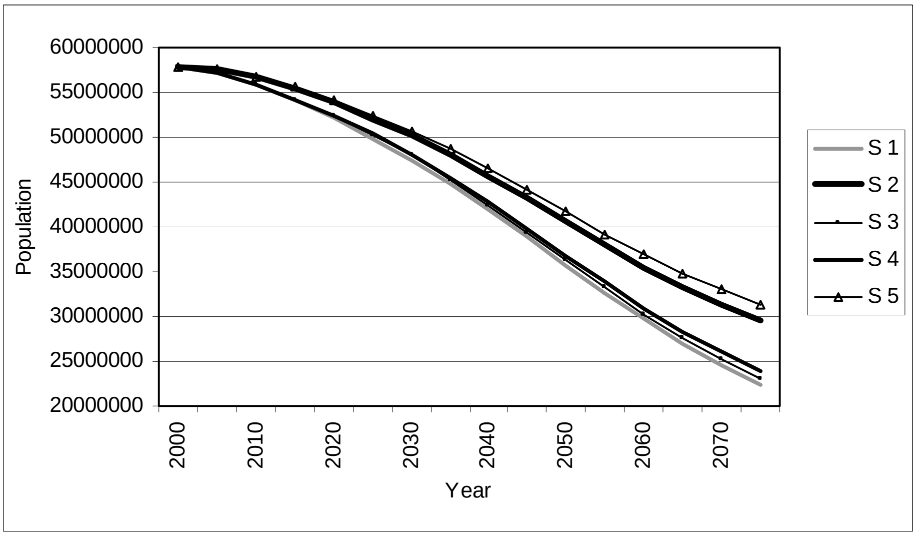

Figure 6b. Population size, Italy.

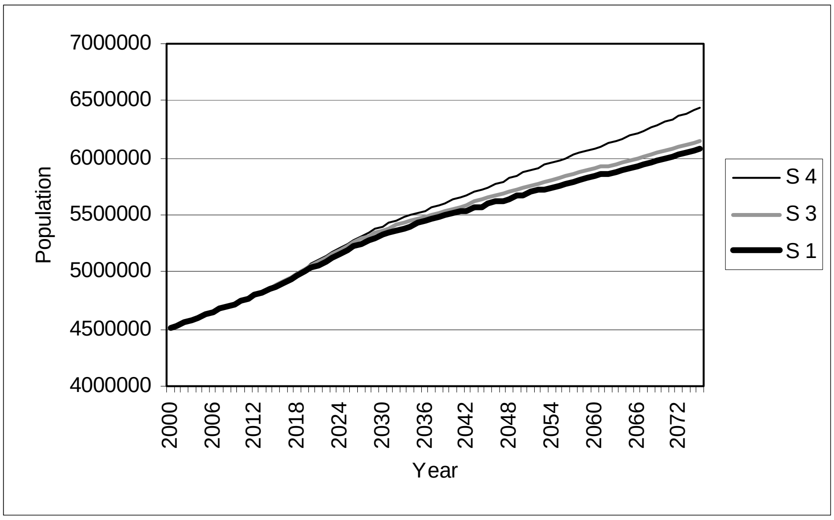

Figure 6c. Population size, Norway.

Table 2. Results of the five scenarios for Bavaria, Italy, and Norway in numerical form.

Total fertility rate	Scenario	Year 2005	2025	2050	2075
Bavaria	S 1	1.36	1.36	1.36	1.36
	S 2	1.62	1.62	1.62	1.62
	S 3	1.36	1.55	1.35	1.35
	S 4	1.36	1.60	1.44	1.44
	S 5	1.36	1.88	1.71	1.71
Italy	S 1	1.24	1.24	1.24	1.24
	S 2	1.51	1.51	1.51	1.51
	S 3	1.24	1.32	1.24	1.24
	S 4	1.24	1.39	1.32	1.32
	S 5	1.51	1.65	1.60	1.60

Births	Scenario	Year 2005	2025	2050	2075
Bavaria	S 1	106,702	85,606	57,073	38,673
	S 2	121,185	100,631	78,501	61,261
	S 3	106,702	95,784	60,508	38,988
	S 4	106,702	99,018	65,664	44,570
	S 5	121,185	113,744	89,323	70,633
Italy	S 1	2,124,805	1,499,916	903,514	550,103
	S 2	2,586,913	1,993,273	1,422,878	1,037,482
	S 3	2,124,805	1,552,293	922,289	542,822
	S 4	2,124,805	1,626,273	1,016,674	631,663
	S 5	2,576,593	2,140,111	1,596,483	1,199,518

Norway	S 1	106,702	85,606	57,073	38,673
	S 3	106,702	106,182	77,701	58,594
	S 4	106,702	95,784	60,508	38,988

Old age dependency ratio	Scenario		Year		
		2005	2025	2050	2075
Bavaria	S 1	0.35	0.41	0.55	0.61
	S 2	0.35	0.39	0.51	0.51
	S 3	0.35	0.41	0.54	0.58
	S 4	0.35	0.41	0.53	0.56
	S 5	0.35	0.39	0.50	0.48
Italy	S 1	0.29	0.39	0.62	0.64
	S 2	0.29	0.39	0.60	0.61
	S 3	0.29	0.39	0.60	0.61
	S 4	0.29	0.39	0.60	0.58
	S 5	0.29	0.37	0.52	0.47
Norway	S 1	0.23	0.33	0.42	0.49
	S 3	0.23	0.33	0.41	0.48
	S 4	0.23	0.33	0.40	0.45

Population	Scenario		Year		
		2005	2025	2050	2075
Bavaria	S 1	12,927,110	11,441,910	8,723,014	6,204,185
	S 2	12,970,033	11,797,074	9,560,948	7,539,145
	S 3	12,927,110	11,540,545	8,869,152	6,351,478
	S 4	12,927,110	11,559,870	8,993,732	6,610,223
	S 5	13,008,622	11,987,925	9,976,049	8,131,172
Italy	S 1	57,071,760	49,863,018	35,756,849	22,427,284
	S 2	57,604,987	52,056,141	40,557,212	29,555,049
	S 3	57,071,760	50,321,100	36,324,883	22,938,042
	S 4	57,071,760	50,409,797	36,816,325	23,878,791
	S 5	57,604,987	52,498,661	41,641,273	31,337,378
Norway	S 1	4,604,600	5,190,100	5,678,800	6,081,900
	S 3	4,604,000	5,229,200	5,744,100	6,155,200
	S 4	4,604,400	5,250,400	5,867,400	6,443,100

In summary, the tentative scenarios presented in this section clearly indicate that changes in the age of childbearing (here operationalized as a two year change) that can be the result of school reforms have significant long-term effects on population dynamics. If we compare the constant period TFR scenario (scenario 1) with the school reform with quantum effect scenarios (scenario 4), then we see that the absolute number of births over the coming decades is likely to be 8-16 percent higher in the case of school reform. In terms of total population size and the old age dependency ratio, the long-term differences due to an assumed education reform (even without a natural end to the tempo effect) are at the order of 5 to 10 percent. Considering what a single percentage point means in terms of expenses for social security, these are indeed very significant long-term impacts that make a closer analysis of the effects of school reform on the mean age of childbearing a worthwhile effort.

6. Discussion

Tempo policies are a new concept, and possibly a powerful and socially acceptable way to increase period fertility rates where they are considered to be too low. As discussed in Lutz, O'Neill, and Scherbov (2003) and Goldstein, Lutz, and Scherbov (2003), this concept is based on a sound demographic rationale, but is far from mature in terms of its possible social operationalization. In this paper we tried to focus on education reforms that lead to a younger mean age at graduation for a given degree as one possible form of tempo policy. Such reforms are currently being discussed in order to improve the supply of skilled young labor and to reduce the social cost of education (which in itself would be a win-win strategy). If these reforms would turn out to help stop the trend toward ever increasing mean ages of childbearing, which is desirable for both individual health and aggregate demographic reasons, this would actually represent a multiple win strategy. But clearly more work is needed to substantiate this claim. The purpose of this paper is to propose the approach and initiate a discussion that hopefully will result in many more contributions.

Low period fertility is not only of concern in Europe. Several Asian countries have TFRs of below 1.5 and are confronted with the prospect of significant population ageing as a consequence. The concern about low fertility has been particularly pronounced in Singapore. Over the last years the government of Singapore has implemented several policy packages, including tax cuts, housing support, and cash benefits, that are explicitly pronatalist in a way that would make them not easily acceptable in Western Europe. With current (2002) TFR at 1.37, that of the Chinese population majority at 1.18, and that of women with tertiary education below 0.8, fertility differentials are also a major concern. Unfortunately we do not have the data to assess the extent to which this very low fertility is due to a tempo effect. But there is evidence that fertility postponement is very strong among the more highly educated women in Singapore and therefore, we expect a strong tempo effect. Because past pronatalist policy packages did not result in fertility increases and period fertility continued to fall, the prime minister of Singapore set up a special task force under his supervision to deal with the issue of low fertility. With the high political priority assigned to the issue and a past record of rather strong government influence on private lifestyle, Singapore may be a candidate for trying to implement policies that not only shorten the periods of education to a given degree, but actually try to reverse the life cycle sequence of parts of the younger cohorts. In Singapore childbearing is (still) universally within wedlock and marriage is typically postponed until the couple can afford an apartment, which means that they must have made some money in the labor market first. In this context providing student couples who are ready to marry and have children with subsidized campus housing and childcare to actually be able to meet their child desires may well result in an increase in student fertility. One would expect that during study time, young parents may have more flexibility for arranging their days and accommodating childcare than in the case of both partners trying to fight their way up in competitive companies.

The reordering of the currently rather rigid life cycle sequencing could, of course, also be considered for the rest of the low fertility world. One may think of a lot of reasons for such reordering: Doctors tell us that from a purely physiological perspective the best age of childbearing is 20-25. So much on the health rationale. What about the stability of partnership and divorce as factors in this rationale? It is often argued that a lower age at marriage means a higher risk for divorce and hence is potentially harmful to the children. While it is true that marriages below age 20 show a higher risk of divorce, this is less clear for marriages in the low and mid-20s (Lutz, Wils, and Nieminen 1991). In any case with increasing rates of non-marital unions and non-marital fertility, this issue becomes less relevant. Also, the divorce rates which are well above 50 percent in many European cities seem to be driven by many other factors for which it is not necessarily advantageous to have children late in life. If a couple has children early on, they will be grown up earlier, giving their parents more independence, and be less affected when men come into their infamous mid-life crisis and decide to abandon their first family. For women, if at age 30 the children are already beyond infancy, they may still invest more into their working career as opposed to this happening at age 40. Of course, there are many pluses and minuses to be considered in both directions, but at least we want to start an interesting discussion about the timing of fertility that has implications beyond the individual life cycle.

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