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Europe's population at a turning point — Source link

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Europe's Population at a Turning Point

Wolfgang Lutz,* Brian C. O'Neill, Sergei Scherbov

Europe has just entered a critical phase of its demographic evolution. Around the year 2000, the population began to generate "negative momentum": a tendency to decline owing to shrinking cohorts of young people that was brought on by low fertility (birthrate) over the past three decades. Currently, the effect of negative momentum on future population is small. However, each additional decade that fertility remains at its present low level will imply a further decline in the European Union (EU) of 25 to 40 million people, in the absence of offsetting effects from immigration or rising life expectancy. Governments in Europe are beginning to consider a range of policy options to address the negative implications of population decline and rapid aging (*1*, *2*). Social policies and labor laws aimed at halting the further increase in the mean age of childbearing—which contributes to low fertility—have substantial scope for affecting future demographic trends. They also have an additional health rationale because of the increasing health risks associated with childbearing in older women.

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Negative Momentum and Low Fertility

Population momentum measures the effect of the current age structure on future population growth (*3*, *4*). A young population has positive momentum (a built-in tendency to grow). An older population can have negative momentum when low fertility leads to smaller numbers of children than of parents, locking in future decreases in the number of parents and a tendency toward population decline. Momentum can be calculated by performing a hypothetical projection in which all forces for change in population size except age structure are removed (*5*).

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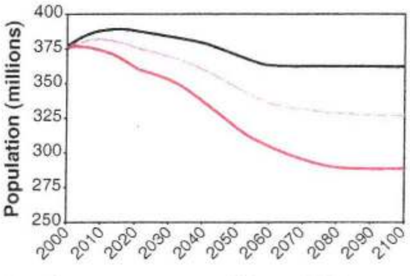


Negative momentum: effect of 20 more years of low fertility on population size in the EU. Population of the 15 member countries of the EU if one assumes that fertility immediately increases to replacement level and remains constant thereafter (black line) or that fertility remains at 1.5 (red line) or 1.8 (pink line) until 2020, when it rises to replacement level.

We find that for the 15 member countries of the EU, low fertility brought the population to the turning point from positive to negative momentum around the year 2000. Currently, negative momentum is small (see figure, above); population even grows for 15 years in our momentum projection before declining, because of the large numbers of people born during the baby boom of the 1960s. However, if the current fertility rate of around 1.5 births per woman persists until 2020, negative momentum will result in 88 million fewer people in 2100, if one assumes constant mortality and no net migration.

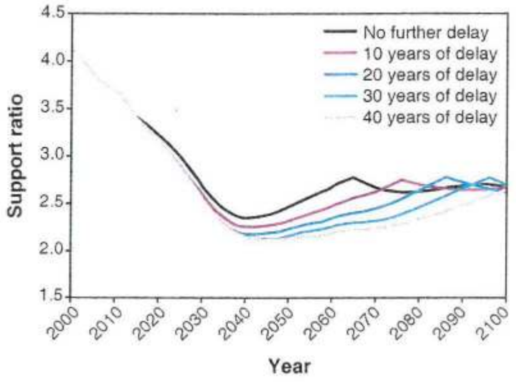
EFFECTS OF LOW FERTILITY ON POPULATION IN EUROPE

	Population decline by 2100		Contribution of delay	
Period of low fertility (years)	Continued delay (TFR 1.5) (millions)	No further delay (TFR 1.8) (millions)	(mllions)	(%)
0	15	15	0	0
10	55	34	22	39
20	88	49	39	45
30	118	63	55	46
40	144	77	67	46

Negative momentum: effect of periods of low fertility on population decline in Europe. The scenarios assume fertility (birthrate) remains constant at 1.5 (continued delay case) or at 1.8 (no further delay case) for the number of years noted in the first column before instantly rising to replacement level. TFR, total fertility rate.

Fertility is currently low in Europe for two reasons: first, women are delaying births to later ages [the tempo effect (*6*, *7*)], and second, even after adjusting for this delay, fertility is below the level necessary for each generation to replace itself fully (low adjusted fertility). Delayed childbearing does not affect the total number of children women have over the course of their lives, provided they do not forgo postponed births altogether. However, it reduces the number of children born during the period in which delay is occurring, which lowers birth rates in that period and contributes to the aging of the population.

The population decline of 88 million resulting from 20 years of low fertility can be separated (Fig. 1) into contributions from the tempo effect and from low adjusted fertility. The tempo effect is assumed to be 0.3 children per woman, roughly consistent with recent experience in 10 EU countries for which data are available (*8*). Postponement of births may continue, because many social and economic factors still favor later childbearing (*9*). Adjusted fertility is assumed to remain constant at 1.8. Given these assumptions, if increases in the mean age of childbearing were halted, the period fertility would rise from 1.5 to 1.8. Our simulations show that, under these conditions, substantially less negative momentum is generated, and ultimate population size is only 49 million lower than today's. Thus, 45% of the population decline caused by a birthrate of 1.5 over 20 more years can be attributed to the effect of the increasing age of childbearing women on birth rates. In general, we find that each decade of fertility at current levels leads to declines in ultimate population size of 25 to 40 million, with the contribution of timing remaining around 40% or more in all cases (see table). We arrive at the same conclusion when we assume that, instead of remaining constant, adjusted fertility continues to fall [(*10*), see supporting online material]. The effect caused by increasing age of childbearing clearly deserves attention not just in adjustments to fertility rates (*6*, *11*), but also



Effect of further delays in childbearing on aging in the EU member states.

when considering determinants of the future size and age structure of Europe's population.

Aging and Delayed Childbearing

Continued increases in the mean age of childbearing will also have significant effects on the age distribution within the population. In the scenario simulating an immediate halt to the delay in childbearing, the "support ratio" declines from about four working-age persons (ages 15 to 64) per elderly person (age 65+) to considerably less than three for most of the remainder of the century (see figure, above), if we assume 0 net migration and no changes in mortality. If the delay in childbearing continued with no change in adjusted fertility, the support ratio would further decline to almost 2, nearly doubling the demographic dependence burden as compared with the present. Twenty years of continued increases in the mean age of childbearing imply an additional decline in the support ratio of about 0.5 workers per elderly person by 2065, the year when the difference is most pronounced. The cumulative effects are substantial. Looked at from the perspective of the working-age population, continued delay of 10 to 40 years will imply that an additional 500 to 1500 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.

Policy Implications

Over the coming decades, the decisive shift to an older age structure in Europe (*12*) will challenge social security and health systems, may hinder productivity gains, and could affect global competitiveness and economic growth. It could also strain relations among generations, particularly between those who are on the contributing and receiving ends of public transfer programs. It may also diminish social cohesion, particularly if increasing labor demand leads to substantial immigration from other cultures. Although population aging is the main focus of population-related social, economic, and political concerns in Europe, there is also a deeply rooted fear of population decline (*13*) associated with a possible weakening of national identity and loss of international political and economic standing.

Policy discussions have primarily focused on adjusting to given demographic trends, by making structural adjustments to pension systems, labor markets, and health and fiscal systems. With already very high tax rates, however, there is a limit to how much governments can squeeze out of a shrinking labor force. Hence, discussions are beginning to turn to policies that could influence demographic trends themselves. Because substantial increases in immigration remain politically unpopular, fertility may increasingly be considered as a policy variable (*14*). Childbearing could come to be considered a "social act" (*15*) rather than a purely private decision.

In 1976, a set of policies was enacted in East Germany that included much improved child-care facilities, financial benefits, and government-supported housing if a woman became pregnant. As a consequence, period fertility in East Germany, which had declined almost in parallel with West Germany, increased from 1.5 to 1.9 (*16*). The mean age of childbearing stayed below 25 years, while it increased to more than 28 years in the West. In contemporary Western Europe, however, there is pronounced public resistance to explicitly pronatalist policies. This is partly because of infamous birth promotion programs in past fascist regimes and partly because births are often viewed as an obstacle for women pursuing careers and therefore not something the government should promote as an end in itself. Family policies in Europe today are based instead on an equal-opportunities rationale and aim to help women combine child rearing with employment. Such policies seem to have had a small, if any, effect on period fertility (*17*).

Policies that aim to affect the timing of births rather than family size may be more acceptable. Such policies would have to address some of the prime reasons for continued childbearing delay, including inflexible higher education systems, youth unemployment, housing markets, and especially career patterns built around traditional male life-course models. Revamping the conventional sequence of life course transitions can also help solve conflicts between work and family (*18*). Health benefits may provide an additional rationale. A continued delay in childbearing has not only led to burgeoning numbers of infertility treatments but also to increasing medical concerns about health risks for mother and child associated with late pregnancies.

Halting the trend toward higher mean ages of childbearing would significantly moderate population aging and decline in Europe. Changes in the timing of births have been pointed out as a possible avenue for slowing population growth in developing countries, in that case by encouraging delays in childbearing (*19*). Here, we are suggesting the reverse: that discouraging further delays in childbearing could help confront the population-related challenge faced by Europe.

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20. The authors acknowledge helpful comments from J. Bongaarts, G. Y. Cao, T. Frejka, J. Goldstein, A. Goujon, N. Keilman, H. P. Kohler, R. Lee, P. McDonald, D. Philipov, C. Wilson, and anonymous reviewers.

Supporting Online Material

www.sciencemag.org/cgi/content/full/299/5615/1991/DC1

Supporting Online Material, W. Lutz et al., 1080316
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Methodology and Data Sources
Description of data sources. This analysis is carried out at the level of the European Union with its current 15 member states. The starting population for the year 2000 by sex and single year of age has been derived from the database of the European Demographic Observatory (ODE) through personal communication with Alain Confesson. These data also include fertility rates by single year of age and mortality rates by sex and single year of age. The ODE database is derived from basic data provided by European statistical offices as part of an international framework for data collection.

Projection methods and assumptions. The alternative population projections were carried out using standard cohort component population projection methods using software developed by the authors. Since this analysis aims at isolating the impacts of alternative fertility assumptions, in all scenarios only the fertility component was modified as described in Table 1, while we assumed that mortality stayed constant at life expectancies of 81.5 years for women and 75.5 years for men. We also assumed a closed population without migration.

Sensitivity to Assumptions on Future Quantum of Period Fertility
Simulations presented in the main text are based on a hypothetical reference scenario in which it is assumed that the adjusted fertility – also called the quantum of period fertility – remains constant in the future at its current level of about 1.8. This simple scenario facilitates analysis of the implications of continued delays in childbearing for future population size and structure. However there are two aspects of our simulations to which results may be sensitive: the assumed magnitude of the tempo effect, and the possibility that the quantum of fertility may decline in the future.

Declines in cohort fertility in recent decades suggest that the quantum of fertility could decline over the next few decades. To investigate the robustness of our conclusions regarding the importance of tempo effects to alternative assumptions about the quantum of fertility, we repeated our calculations for a reference scenario in which the quantum is assumed to decline from 1.8 in 2000 to 1.5 in 2020, a decline of 0.15 per decade which is in the upper range of recent experience in many European countries.

Results show that our main conclusions remain unchanged under this alternative scenario. Because period fertility is lower in these simulations than in the analogous scenarios presented in the main text, future population size is smaller and age structure is older. Figure 1 demonstrates that continued delays in childbearing, if one assumes declining quantum, contribute substantially to the generation of negative momentum by continued low fertility. For example, 20 years of further delay in childbearing is responsible for 37% of the population decline between 2000 and 2100 (the analogous result for the constant quantum reference scenario in the main text is 45%). This result assumes, as in the calculations in the main text, that the tempo effect is constant at 0.3 children per woman. Figure 2 shows that childbearing delays also contribute substantially to changes in the support ratio. Twenty years of postponement of childbearing implies an additional decline in the support ratio of about 0.3 in 2065, the year when the difference is most pronounced. If delay continues for 40 years, the additional decline in the support ratio is 0.5.

We also tested the robustness of our conclusions to the assumed magnitude of the tempo effect. We repeated our calculations assuming that the tempo effect remains constant at 0.2 births per woman, rather than 0.3 births per woman as assumed in the simulations reported in the main text. As reported in footnote 8 of the main text, the population-weighted average tempo effect based on 10 individual country calculations reported in Bongaarts (8, main text) is 0.33, for the period 1990-1997. Data are insufficient to estimate the tempo effect for the additional 5 EU countries. It is plausible that the inclusion of these countries, and of extending the period over more recent years, could produce a somewhat lower estimate of the average tempo effect in the EU over the past decade, since the increase in the mean age of childbearing is generally smaller over the past few years and in the countries which lack detailed fertility data. Since a precise estimate of the tempo effect is not possible, we use 0.2 as a hypothetical scenario to test sensitivity. Our results show that outcomes change roughly in proportion to the change in the assumed tempo effect. That is, reducing the tempo effect by a third (from 0.3 to 0.2) reduces the contribution of delay to population decline, as reported in Table 1 of the main text, by about a third (e.g., from 45% to 30% in the case of 20 years of further delay). Likewise, the implications of delay for the dependency burden is reduced by a third as well.

Other scenarios, outside the scope of our analysis, are possible as well. Childbearing delays could be reversed rather than simply halting, causing the mean age of childbearing to decline. In addition, changes in the tempo of fertility could interact with the quantum. For example, it has been suggested that postponement of births can induce declines in quantum. We suggest that the reverse may be true as well: if births begin to shift to younger rather than older ages, this may induce an increase in the quantum. In this way the effect of policies influencing the tempo of fertility may be magnified through their indirect effects on the quantum.

Table S1. Period fertility assumptions for all scenarios in main text and supplementary material. Fertility is interpolated linearly between values shown in the table, and remains constant beyond 2050. Scenarios 1, 9, and 13 appear in Fig. 1; scenarios 1 and 8-15 are used to construct Table 1; scenarios 2 and 4-7 appear in Fig. 2; scenarios 1, 9, 13, 20 and 21 appear in Fig. S1; scenarios 2, 16, 17, and 19 appear in Fig. S2.

Scenario Nr.	*Name*	**2000**	**2001**	**2010**	**2011**	**2020**	**2021**	**2030**	**2031**	**2040**	**2041**	**2050**
1	Instant replacement level	2.06	2.06	2.06	2.06	2.06	2.06	2.06	2.06	2.06	2.06	2.06
2	Constant quantum, no further delay	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
3	Constant quantum, continued delay	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
4	Constant quantum, 10 years further delay	1.5	1.5	1.5	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
5	Constant quantum, 20 years further delay	1.5	1.5	1.5	1.5	1.5	1.8	1.8	1.8	1.8	1.8	1.8
6	Constant quantum, 30 years further delay	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.8	1.8	1.8	1.8
7	Constant quantum, 40 years further delay	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.8	1.8
8	Scenario 3 + replacement level in 2011	1.5	1.5	1.5	2.06	2.06	2.06	2.06	2.06	2.06	2.06	2.06
9	Scenario 3 + replacement level in 2021	1.5	1.5	1.5	1.5	1.5	2.06	2.06	2.06	2.06	2.06	2.06
10	Scenario 3 + replacement level in 2031	1.5	1.5	1.5	1.5	1.5	1.5	1.5	2.06	2.06	2.06	2.06
11	Scenario 3 + replacement level in 2041	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	2.06	2.06
12	Scenario 2 + replacement level in 2011	1.8	1.8	1.8	2.06	2.06	2.06	2.06	2.06	2.06	2.06	2.06
13	Scenario 2 + replacement level in 2021	1.8	1.8	1.8	1.8	1.8	2.06	2.06	2.06	2.06	2.06	2.06
14	Scenario 2 + replacement level in 2031	1.8	1.8	1.8	1.8	1.8	1.8	1.8	2.06	2.06	2.06	2.06
15	Scenario 2 + replacement level in 2041	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	2.06	2.06
16	Declining quantum, no further delay	1.8				1.5	1.5	1.5	1.5	1.5	1.5	1.5
17	Declining quantum, 20 years further delay	1.5				1.2	1.5	1.5	1.5	1.5	1.5	1.5
18	Declining quantum, 30 years further delay	1.5	**Interpolated**			1.2	1.2	1.2	1.5	1.5	1.5	1.5
19	Declining quantum, 40 years further delay	1.5				1.2	1.2	1.2	1.2	1.2	1.5	1.5
20	Scenario 17 + replacement level in 2021	1.5				1.2	2.06	2.06	2.06	2.06	2.06	2.06
21	Scenario 16 + replacement level in 2021	1.8				1.5	2.06	2.06	2.06	2.06	2.06	2.06

Fig. S1. Effect of 20 more years of low fertility on population size, if one assumes declining quantum of period fertility. Population of the EU-15 if one assumes fertility immediately increases to replacement level and remains constant thereafter (black line), and if one assumes fertility declines linearly from 1.5 to 1.2 (dark green line) or 1.8 to 1.5 (bright green line) in 2020 when it rises to replacement level. For comparison, dotted pink and red lines show results from Fig. 1 in the main text, if one assumes constant quantum of period fertility [fertility remains at 1.5 (red line) or 1.8 (pink line) until 2020 when it rises to replacement level]. Mortality is held constant and migration is set to zero in all cases.

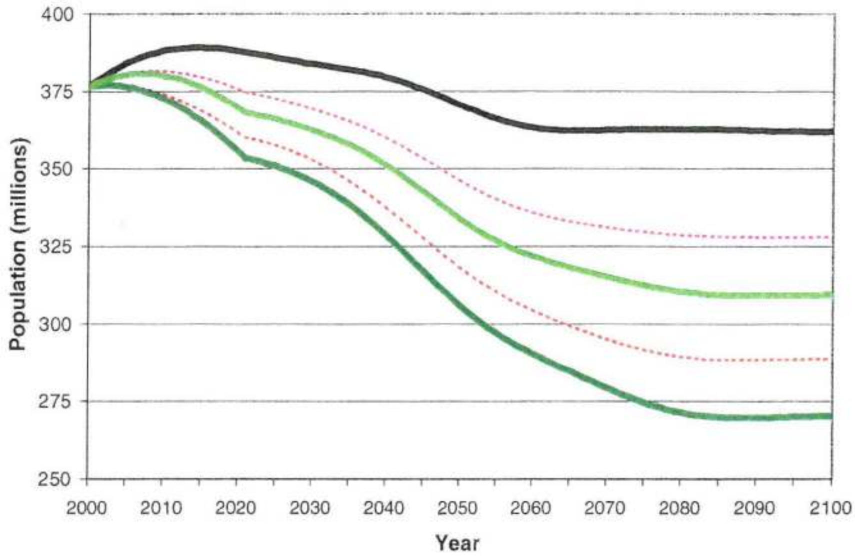

Fig. S2. Effect of further delays in childbearing on aging, if one assumes declining quantum of period fertility. Support ratio in the EU-15, if one assumes zero to four decades of further delay, with mortality held constant and no migration. For comparison, the dotted black line shows results from Fig. 2 in the main text and is based on the assumptions of constant quantum of period fertility and no further delay in childbearing.