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The Future of Human Reproduction: Will Birth Rates Recover or Continue to Fall?

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Abstract

Today more than half of the world population has fertility below the replacement level, i.e., less than two surviving children per woman; and there are now several countries where fertility has dropped to levels that are of serious concern to policy-makers. All major population projections currently assume that fertility in the countries with the lowest levels will recover or at least not decline any further. Should birth rates, however, defy these projections and continue to decline, then these populations would shrink and age much more rapidly than currently assumed. The "low fertility trap hypothesis" discussed in this contribution gives plausible reasons why indeed fewer and fewer people may want to have children in the future.

Introduction

Reproduction secures the survival of our species and also assures the continuation of culture through the transmission of skills and norms. As long as the level of fertility was broadly in line with the level of mortality and hence assured relatively stable population size or moderate increases, there seemed to be little concern about the overall level of human fertility. The focus was more on the implications of differential fertility, i.e., some countries or some social groups growing more rapidly than others and hence changing the balance of power. When over the second half of the 20th century the "population explosion" resulted in a more than doubling of world population from 2.5 billion in 1950 to 6.1 billion in 2000, with significant further growth already preprogrammed in the young population age structure, the high level of fertility in developing countries became a major policy concern. It still is so today for Africa and Western Asia, while the rest of the world has seen remarkably rapid fertility declines. Today more than half of the world population has fertility below the replacement level, i.e., less than two surviving children per woman (Wilson, 2004). Based on these recent developments we can expect that with high probability the 21st century will see the end of world population growth and possibly the beginning of a long term decline (Lutz *et al.*, 2001). The degree to which this will happen will largely depend on the long term fertility levels in post-demographic transition societies.

A famous quote attributed to both Winston Churchill and Konrad Adenauer is: "People will always want to have children." This seemed self-evident until very recently and the low fertility rates in some countries were attributed to problems in achieving one's ideal family size rather than lack of want. But new data show that ideal family size seems to be on the decline in many countries (Goldstein *et al.*, 2003). Is there a chance that Churchill and Adenauer were wrong after all? The "low fertility trap hypothesis" gives plausible reasons why indeed fewer and fewer people may want to have children in the future. But not only the wants may change; there may be new obstacles to actually having the children that people still want to have. While much has been said about the problems for women to combine work and family, there are new disturbing findings on declining sperm counts which, e.g., in Denmark make it likely that about 20 percent of the young men today will not be able to father a child naturally. These two recent developments alone suggest that one should have a closer look at the forces that may influence tomorrow's birth rate.

All major population projections currently assume that fertility in the countries with the lowest levels will recover or at least not decline any further. Should birth rates, however, defy these projections and continue to decline, then the populations concerned would shrink and age much more rapidly than currently assumed. In that case we would have to revise the demographic basis for all assessments of the possible consequences of population ageing and decline - ranging from the ruminations of the EU-EcoFin (economics and finance ministers) group to debates about future family care patterns of the elderly and much more.

Since there is no comprehensive theory to guide our thinking about the future level of the birth rate in low fertility countries, this highly relevant issue, which is necessary as a basis for planning, can only be understood through a broad and truly interdisciplinary research program that combines bio-medical factors (both on the female and male side) with evolutionary anthropology as well as sociological, economic and psychological approaches. Demography is well positioned to serve as the interface between the different disciplines by converting different discipline-specific approaches and contributions into one common currency: the future number of births. In the following I will discuss a few considerations that could possibly lead to such a new and ambitious research endeavor.

The Lack of a Theory with Predictive Power in Post-Demographic Transition Populations

Explanations and projections of fertility trends in different parts of the world have been generally guided by the paradigm of demographic transition which assumes that after an initial decline in death rates, birth rates – after a certain lag – start to fall. In this general form, the demographic transition model has received overwhelming empirical support in capturing the remarkable fertility changes that happened during the 20th century.

The demographic transition began in the late 18th and 19th centuries in today's more-developed countries (MDCs) and spread to today's less-developed countries (LDCs) in the latter half of the 20th century (Notestein, 1945; Davis, 1954, 1991; Coale, 1973). The conventional "theory" of demographic transition predicts that as living standards rise and health conditions improve, mortality rates first decline and then, somewhat later, so do fertility rates. Demographic transition "theory" has evolved as a generalization of the typical sequence of events in what are now MDCs, where mortality rates declined comparatively gradually from the late 1700s and then more rapidly in the late 1800s and where, after a gap of up to 100 years, fertility rates also declined. Different societies experienced transition in different ways, and today various regions of the world are following distinctive paths (Tabah, 1989). Nonetheless, the broad result was, and is, a gradual transition from a small, slow-growing population with high mortality and high fertility to a large, slow-growing or even slowly shrinking population with low mortality and low fertility rates. During the transition itself, population growth accelerates because the decline in death rates precedes the decline in birth rates.

Unfortunately, the demographic transition paradigm – although useful for explaining global demographic trends during the 20th century and having strong predictive power in terms of projecting future trends in countries that still have high fertility – essentially has nothing to say about the future of fertility in Europe (Lutz, 1994; 2006). The recently popular notion of a "second demographic transition" is a plausible way of describing a bundle of behavioral and normative changes that took place recently in Europe, but it has little or no predictive power. In fact, the social sciences as a whole have yet to come up with a useful theory to predict the future fertility level of post-demographic transition societies. Forecasters can only try to define a likely range of uncertainty. As the fertility transition is irreversible, we are quite sure that the fertility rate will not go back to pre-transitional high levels, say, to above a value of 3.0. There is no equally convincing argument about a lower bound, although many demographers tend to think that fertility is unlikely to fall below 1.0 for long periods. But, as we will see from the discussion below, there are reasons to think that fertility will fall even lower, and there is a real possibility that future fertility will show the strong fluctuations in terms of booms and busts we have seen over the past decades. Hence, thinking in terms of a long-term stable level – as underlies the population projections of the United Nations and of many statistical agencies – may be the wrong way of thinking about the future.

Six Dimensions Shaping the Future of Fertility

How can we meaningfully talk about the future of fertility when there is no consistent theory? Much research has been carried out over the past decades that tried to identify and study specific determinants of fertility and the individual level covariates of fertility and specific settings. But little has been achieved so far in terms of drawing a comprehensive picture of what will drive the overall birth rates in the future.

It is quite surprising, on the other hand, to see how little the agencies producing population projections make use of the vast – although fragmented – body of existing scientific literature on fertility determinants. While this can be partly blamed on the scientists who fail to present a comprehensive picture of their findings to the forecasters, forecasters themselves often seem to prefer rather mechanistic extrapolation methods or smooth approaches to a set target level rather than going through a painful process of consultations with experts who are reluctant to be nailed down to any specific statements on the future.

As a step toward improving this clearly unsatisfactory situation, a European Union research project, which aims at providing a better basis for population projections in Europe by combining modeling at the micro- and macro-level (acronym MicMac), has recently developed a comprehensive assessment scheme that structures different arguments that would point toward higher or lower fertility in the future around six main forces that shape the level of future cohort fertility.[1] The scheme relies on expert-based assessment of factors influencing the birth rate and has recently been applied for defining the assumptions for the new UK National Population Projections (ONS, 2007). The following independent forces, which will jointly determine the future birth rate, are being considered:

Trend in ideal family size and the strength of individual desires for children. Although answers to ideal or desired family size questions in surveys cannot be seen as direct predictors of fertility at the individual level, their changes over time can give us some indication in what direction the desire for children is moving. Empirical data show that personal ideal family size tends to be higher than actual family size in most European countries. Because of various obstacles as well as competing desires, many couples have less children than they say they consider ideal. With all its problems, this indicator still comes closest to the most fundamental question concerning the future of reproduction, namely, to what degree people still want children in the future, and how strongly they value children in comparison to other things that life has to offer. Unless it is

somehow part of human nature that people want to have at least two children on average, changing social norms can lead to sub-replacement ideal family sizes and possibly in the future to much lower levels than we have seen so far. This is the focus of the low fertility trap hypothesis which will be discussed in detail below.

Trend in the pattern of education and work, including the proportion of time dedicated to the professional side of life. It is widely acknowledged that the expansion of education for both men and women in most European countries has been associated with a significant postponement of childbearing. Entry into the labour market after education has become more difficult, and working life itself has become more competitive as a result of globalization. In many European countries, young employees who in the past used to get more or less permanent positions now have to jump from one short term contract to the next. Under such conditions it becomes more difficult to decide to establish a family and not dedicate all of their time and energy to a professional career. Globalization and the flexibility goals pursued under the Lisbon agenda can be at odds with the desirability of more secure and sheltered conditions during the first years of family formation. How this balance of time and energy allocation between work and private life will develop in the future can be expected to have immediate consequences on the rate of childbearing.

Changing macro-level conditions (government policies, childcare facilities, housing conditions etc.) that influence the cost of children in a broader sense. Economic considerations do play a role when deciding about the number of children to have, even though other factors tend to dominate the decision. Both the economic incentive structures and the costs of children differ greatly among European countries. A look at the French experience shows that a massive redistribution (in the tax system as well as through direct child benefits) from those with no or few children to those with three or more, carried out consistently over many decades, did indeed prevent fertility from showing the same declines that were experienced by most neighboring countries. While the effectiveness of specific policy measures aimed at increasing fertility is difficult to assess due to the complexity of the entire incentive structure (ranging from the social security system to the housing market and cultural factors), there is little doubt that significant changes in this structure influence fertility. And in the case of a high desired family size, this is probably easier to achieve than in cases where desired family size has already declined.

Changing nature and stability of partnership. It still takes two people, a woman and a man, to produce a child. Having a child is a very long term commitment (at least 18 years?). The presence of children makes a big difference to the lifestyle of their parents, and usually, the responsibility is considered a lower burden when it is shared between both parents. But couple relationships, whether marriages or non-marital unions, show a tendency to be less stable over time. In almost all Western societies, divorce and separation rates have been on the rise. Because births are most intimately linked to partnerships, trends in the nature and stability of partnerships must also affect the birth rates, although there can be effects in opposing directions: Women may decide not to have children, if they cannot count on their partners to stay with them and take part in the childrearing; on the other hand, a new partnership after separation may be an incentive to have an additional child with the new partner. The net effect of these opposing forces is culture specific and hard to predict.

Changes in the population composition and differential trends in population subgroups. Some national populations in Europe have become more heterogeneous over the past decades. This is mostly due to immigration. Specific ethnic or religious subgroups of the population have fertility rates that are twice that of the rest of the population. And even in the second generation, the fertility rates of those subgroups remain significantly higher in many of the countries concerned. Over time the share of these high fertility subgroups in the total population has a tendency to increase as a direct consequence of their higher fertility and in many countries also through continued immigration of new members of these subgroups. The future fertility rates at the national level can be significantly influenced by such changes in population composition. The extent of this upward force on the birth rate will depend on the persistence of fertility differentials and on future migration.

Changing bio-medical conditions. Bio-medical considerations have been largely absent from the social science discourse about the determinants of fertility, because it has typically been assumed that the decision by a couple to have a child suffices to bring one into being. This assumption has already been criticized with respect to the prevalence of unplanned pregnancies. Retrospective surveys show that generally some 10–30 percent of all births are classified as unplanned (by the interviewed women themselves) with great variations across countries and by the order of births. Future progress in contraceptive technology could have a substantial impact on further lowering the birth rate, if it eliminated or greatly reduced this still surprisingly high proportion of unplanned pregnancies, e.g., by requiring an active step – such as seeing a doctor – in case one wants to get pregnant. Another highly relevant biomedical factor on the female side is the combination of continued postponement of childbearing to higher and higher ages and the fact that fecundability (the monthly probability of conception) starts to decline around age 30 and is already significantly reduced after age 35. This age pattern of fecundability has been remarkably stable over time due to a finite number of egg cells. As a consequence, one not only observes a dramatic rise in the number of fertility treatments, but also an increase in involuntary childlessness. Future improvements in assisted reproductive technologies or behavioral changes with respect to the age at which women decide to have their children can have important impacts on future birth rates.

On the male side there may be even more significant reproductive health problems ahead. Recent studies on sperm quantities and quality seem to indicate a significant deterioration which is largely attributed to exposure to endocrine disrupters in utero. For Denmark where the problem has been studied most extensively and representative samples are taken from all army recruits, Skakkebaek *et al*. (2001) estimate that about 20 percent of young men today will not be able to father a child naturally. There are only a few other comprehensive studies on this problem, but similar results have been found in studies for Edinburgh, Hamburg and Leipzig. The most worrying aspect of these studies is the trend over time. While studies in the US during the 1940s (using the same method to count sperms) found a sperm concentration of more than 100 Mio/ml for the majority of the men, Figure 1 shows that now, more than 40 percent of Danish men have a concentration below the 40 Mio/ml threshold, which is considered problematic, and 20 percent are below 20 Mio/ml, which implies severe subfecundity. The specific reasons for this trend are not yet well understood, although the causes in utero lie two decades before the measured consequence. But if this trend continues in the future, higher proportions of men may fall into this category. Unless the couples affected can be helped through in vitro fertilization, it would inevitably lead to lower birth rates.

The future of the birth rate will be a function of the interaction of these six dimensions of change. The future trend in each of these dimensions is uncertain and their interaction is even more so. Yet we are not completely ignorant of the likely forces that shape the future of these dimensions. Much research has been conducted over the past decades on the individual factors. What has been lacking most of all is a truly interdisciplinary integration of these different aspects that will jointly result in a certain fertility level in the future. We need to integrate into one model all the social and economic forces that determine the ideal family size and the desired timing of birth for both men and women, their partnership dynamics together with their educational and professional careers, and finally, the biomedical aspects both on the male and female side. Since such analysis cannot be carried out at the aggregate level of averages because there is major individual heterogeneity along all these dimensions, a promising avenue of research is to apply methods of agent-based modeling which have the potential to combine these bio-medical and behavioral aspects under one common framework.

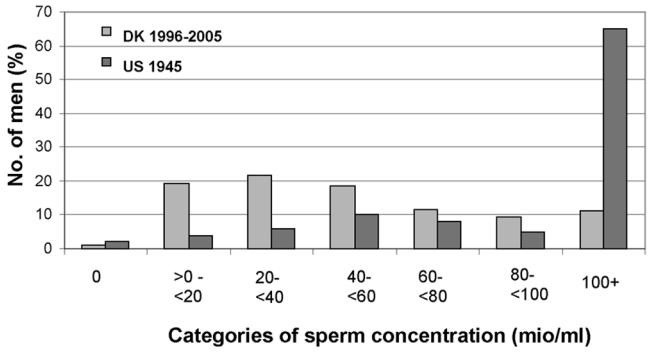

Figure 1: Sperm concentration of young men: United States 1945 vs. Denmark 1996-2005. Source: Skakkebæk (2007).

As a first, modest step in this direction of integrating several of the relevant dimensions in a dynamic and interactive way, I will discuss one specific, testable hypothesis in the second part of this contribution.

The Hypothesis of a "Low Fertility Trap" for Countries that already have the Lowest Fertility

In order to stimulate the scientific and theory oriented discussion about the future of human reproduction, I will discuss here a hypothesis which, if true, implies significant further declines in the birth rates for those countries that already have the lowest levels of fertility with immense consequences for population ageing and shrinking. It assumes self-reinforcing mechanisms leading to a bifurcation in trends among industrialized countries. While countries which are at or are only slightly below replacement level fertility can expect rather stable levels, those that have been well below replacement for longer periods would enter a downward spiral of birth rates due to negative population momentum, declines in ideal family size among younger cohorts as a consequence of being socialized in a low fertility setting, and worsening relative income of young couples as compared to their parents. While some recent data support this hypothesis, more rigorous testing is needed.

Starting Point

Fertility trends in industrialized countries have shown an interesting bifurcation over the past decade. Some countries (including the US, UK, France and Nordic countries) have relatively stable levels of total fertility rates (TFRs) between 1.7 and 2.0, while many (in other parts of Europe and in East Asia) have seen TFRs falling to below 1.5 with no recovery since. Currently 25 of these very low fertility countries have TFRs of 1.3 (two-thirds of replacement level fertility) or below. Belarus, Ukraine, Slovenia, Bosnia-Herzegovina and Singapore have TFRs of 1.2; South Korea and Taiwan 1.1; Hong Kong 1.0; and Macao 0.9 (Population Reference Bureau 2006). In Singapore and South Korea, these very low levels of fertility exist despite explicitly pro-natalist government policies.

Population projections typically assume that these low levels are only a short-term deviation and fertility will soon recover. Of the three multi-lateral agencies publishing independent projections, the United Nations (2005) assumes that the TFRs of all countries converge to 1.85. Eurostat (2007) assumes that future TFRs will be stable around recent cohort fertility levels (implying a mild TFR increase in most countries). The International Institute for Applied Systems Analysis (IIASA) assumes that long-term fertility levels will lie between 1.5 and 2.0 with the specific level being a function of population density (Lutz *et al*., 2001).

No agency assumes continued fertility decline in the main scenario.

In the absence of a good theory about the future trend of fertility in low fertility countries, all of these assumptions are more or less arbitrary. It is surprising, however, that so far no group assumed a simple continuation of the declining trend which in other contexts is considered the most obvious and straightforward assumption. The same groups assume that life expectancy will (with the exception of countries affected by AIDS) continue along the increasing trend generally observed over past decades. One would expect that there must be convincing reasons (such as the effects of AIDS) for assuming a discontinuity in a pervasive trend. But what are the reasons for countries that have experienced strong fertility declines over the past decades?

A recent summary of substantive arguments concerning future fertility trends in Europe (Lutz, 2006) identified only two convincing reasons for supposing that there might be a trend reversal in period fertility rates: (a) effective fertility enhancing policies, and (b) an end of the tempo effect, i.e., the depression of period fertility rates due to the postponement of births. As far as (a) is concerned, the extensive literature on fertility enhancing policies suggests that there is no magic bullet and that pro-natalist policies (France) or social policies indirectly affecting fertility (Nordic countries) had to be in place for decades to be effective. In other countries, the introduction of specific fertility enhancing incentives had little to no effect (Gauthier, 2002; Sobotka *et al.*, 2005). And as for (b), there is one example where the tempo effect has already come to an end: in Spain the recent leveling off of the increase in the mean age of childbearing has only resulted in a very mild increase in TFR to still below 1.4 (VID/IIASA, 2006). This casts some doubts on the potential of these two mechanisms to significantly increase the birth rates in the near future. But there may be powerful forces toward still lower fertility in countries that already have very low fertility.

Three Forces Leading to Fewer Births

The low fertility trap (LFT) hypothesis as discussed here consists of three independent elements that work in the same direction and reinforce each other (Lutz *et al.*, 2006). The absolute number of births in a population is a function of the age pattern of period fertility and the age structure of the population (see Figure 2). Period fertility results from a combination of cohort fertility and shifts in the timing of fertility, which can have different determinants. Finally, we assume that the level of cohort fertility is influenced among other factors (including biological ones) by norms about the personal ideal family size.

LFT-1 operates at the level of population dynamics and reflects the negative momentum of population growth. It refers to the influence of the age structure on the number of births. While in developing countries momentum is a major force toward growth (Bongaarts, 1994), it can turn into a force toward shrinking following extended periods

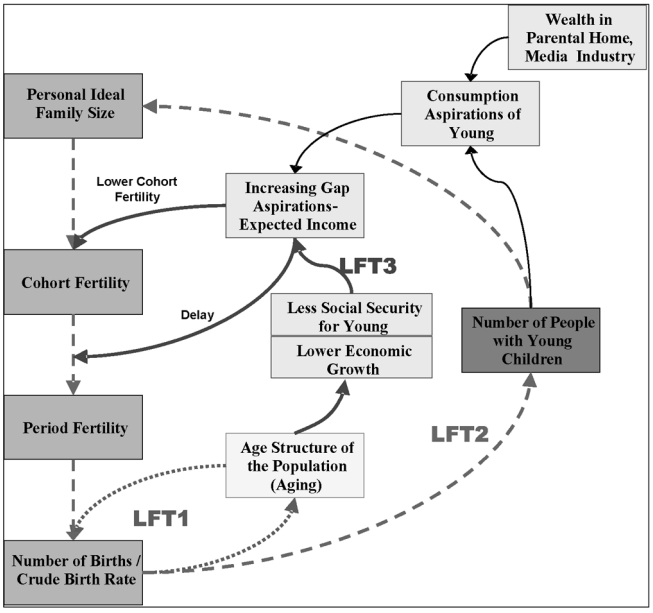

Figure 2: The demographic (LFT-1), sociological (LFT-2) and economic (LFT-3) mechanisms that constitute the low fertility trap hypothesis. Source: Lutz et al. (2006, p.175).

of very low fertility. Fewer and fewer women enter the reproductive age, and, hence the number of births will decline, even if fertility instantly jumps to replacement level. It has been shown that the EU as a whole recently entered negative momentum and in some countries it is far advanced (Lutz *et al.*, 2003). This process in itself causes a downward spiral in the number of births.

LFT-2 operates at the level of social norms and refers to changes in personal ideal family size, which is assumed to be one of the factors determining cohort fertility. Personal ideal family size tends to be markedly higher than actual fertility, but it seems to be on the decline in several European countries (Goldstein *et al.*, 2003). LFT-2 is based on the hypothesis that such a decline in ideals was triggered by declines in actual fertility some time ago. The German-speaking countries, which in the 1970s were the first to see fertility fall to very low levels (TFRs around 1.5 or below), now are the first to show below replacement family size ideals among the younger cohorts. LFT-2 assumes that through the process of socialization and social learning, the norms and in particular the family size ideals of the young generation are influenced by what they experience around them. If their environment includes few or no children, children will figure less prominently in their own image of a desirable life.

LFT-3 is derived from the first part of Easterlin's (1980) relative income hypothesis, which views fertility as a function of the match between personal aspirations for consumption (largely determined by the income level in the family of origin) and expected income of the young (formed by current labor market experiences). If aspirations are higher than expected income, this will result in lower fertility, and *vice versa*. There are several forces that could bring down expected

income in ageing societies. The necessary downward adjustments in social security typically affect younger cohorts more than older ones; and, in contrast to Easterlin's expectation that smaller cohorts have higher incomes, rapid population ageing may also result in lower economic growth and less job creation in the future (Global Entrepreneurship Monitor, 2004). Whatever the economic consequences of rapid ageing may be, many surveys have shown that younger people today have a more pessimistic outlook to the future (Blossfeld *et al.*, 2005). On the other hand, youngsters today tend to have higher aspirations for material consumption as their parents have greatly benefited from the economic boom of the past decades (Stutzer, 2004). There is also a demographic factor: Due to declining fertility, children had to share parental wealth with fewer siblings. A first analysis of OECD data suggests that indeed the income of younger men today is in real terms lower than that of their fathers a decade ago, and that the relative income gap is widening over time for several countries, with Italy showing particularly strong declines (Lutz *et al.*, 2006).

Relevance and Test

It is justified to talk about a trap if a situation is considered undesirable, was entered unintentionally, and is difficult, if not impossible, to escape. All three conditions will be met in very low fertility countries, if the hypothesis is true. The validity of this hypothesis will have most significant implications for government policies. If it is false, there is no reason for specific birth enhancing policies; but if it is true, governments may want to take serious action before it is too late to escape the trap.

LFT-1 need not be tested because it is analytically well established (Keyfitz, 1971). LFT-2 can be tested by observing the evolution of ideal family sizes in the Mediterranean countries that had their precipitous TFR declines about a decade later than the German-speaking countries. The prediction is that younger cohorts in those countries will now start to have lower ideals, while in the higher fertility countries, family size ideals would remain stable at high levels. This is precisely what the newest data from the Eurobarometer 2006 show as depicted in Figure 3 for six selected countries (Testa, 2006). While between 2001 and 2006 the ideals are constant at a high level for Sweden, France and UK, they have a declining trend in Spain and Italy and are further declining at a very low level in Austria. But this first evidence needs to be further substantiated. No comprehensive testing could be done for LFT-3 yet.

Because of its great and urgent importance for policy, the hypothesis should not just be tested by waiting and seeing how the trends will evolve, but rather by collecting more information aimed explicitly at testing this hypothesis for Europe and East Asia. More comparable data are needed on the trends and differentials of ideal family size and its interaction with actual fertility as well as on the changes in relative income. This could be mostly achieved by utilizing existing data collection instruments and include specific additional items. But this will only happen if the relevant institutions become aware of this hypothesis and its significance.

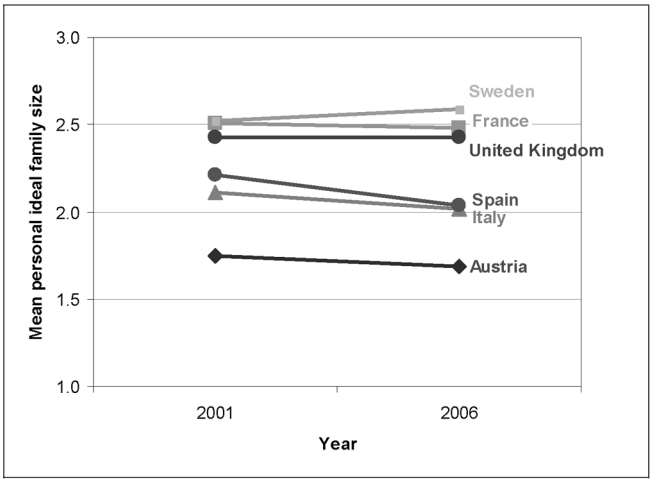

Figure 3: Personal ideal family size in 2001 and 2006 for six selected countries, women aged 25–39. Source of data: Testa (2006).

Conclusions

Policy makers in Europe have not yet decided whether they should make the level of the birth rate an explicit object of government policies. Apart from France which made this decision many decades ago, in most of the very low fertility countries there is considerable opposition to direct government interference with private decisions in the matter of family size, though this is combined with dissatisfaction about the low level of fertility. The recent Communication by the European Commission on "The demographic future of Europe–from challenge to opportunity" is indicative of this uneasy and ambivalent attitude with respect to pronatalistic policies. The section that addresses possible birth enhancing policies has the supposedly euphemistic title "Promoting demographic renewal in Europe."[2] The document suggests that governments focus on policies that enable couples to have the number of children they want to have. It uses the data already discussed on ideal family size to argue that there is a gap between desired and actual family size, and that it could be closed by social policies that are already desirable for other social or gender policy reasons (such as better child care facilities). Whether this is indeed likely to result in an increase in the birth rate and is an efficient use of resources has recently been questioned by several scholars including the economist Gary Becker (2007).

The choice between abstaining from the adoption of birth-enhancing policies and the introduction of targeted and effective fertility programs depends largely on the perceived negative consequences of low fertility. And surely the severity of these consequences will depend on the question of how low fertility will be in the future. Hence, in the end the question boils down to anticipating the future course of the birth rate–with and without explicit policies. Given our ignorance in this field and the overriding importance of the issue, it certainly deserves more systematic research attention.

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Notes

[1] More information about the MicMac Project is available from: http://www.nidi.knaw.nl/en/micmac/.

[2] Unfortunately, in population analysis the term "demographic renewal" refers to the process by which older members of the population die and are replaced by younger ones, but we must assume that the Commission does not want to encourage faster population renewal.

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