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Low Fertility at the Turn of the Twenty-First Century

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Abstract

In the past few decades, demographic concerns have shifted from rapid population growth fueled by high fertility to concerns of population decline produced by very low, sub-replacement fertility levels. Once considered a problem unique to Europe or developed nations, concerns now center on the global spread of low fertility. Nearly half of the world's population now lives in countries with fertility at or below replacement levels. Further, by the mid-twenty-first century three of four countries now described as developing are projected to reach or slip below replacement fertility. We review the research on low fertility through the predominant frameworks and theories used to explain it. These explanations range from decomposition and proximate determinant frameworks to grand theories on the fundamental causes underlying the pervasiveness and spread of low fertility. We focus on the ability of theory to situate previous and future findings and conclude with directions for furthur research.

Keywords

fertility decline; population replacement; childbearing; population equilibrium; demographic theory

Introduction

Sub-replacement fertility and concerns about its consequences are not new phenomena. In fact, one could argue that such poor reproductive fitness is the oldest and most general threat to a population or species. Many births, 5 or 6 per woman, do not guarantee population replacement if mortality is very high. Throughout much of human history, population growth was slow and erratic, with an approximate balance of high birth and death rates. In contrast, the past few centuries have witnessed fertility rates well above mortality rates owing to the rapid decrease in mortality vis-à-vis fertility. This rate discrepancy produced rapidly growing populations, especially in the post-1950 period.

In most contemporary developed countries, mortality below age 50 is now very low, and thus the replacement level of fertility is slightly above 2 births per woman (i.e., usually taken as 2.1) (see Espenshade et al. 2003). Contemporary concerns about low fertility have resulted from period fertility rates well below this level. Such low fertility is not unprecedented. In the 1930s, demographers noted fertility levels in Europe well below 2 births per woman (Keyfitz & Flieger 1968; also see Kohler et al. 2002), along with the inevitable consequences. Specifically, persistent sub-replacement fertility produces rapidly aging populations, declining workforce size and smaller overall population size. These changes may have cascading negative consequences (see Teitelbaum & Winter 1985, Wilson 2001).

These previously observed low fertility rates were not sustained. Instead, birth rates increased during the baby boom of the 1940s, 1950s, and 1960s and assuaged previous fears of population decline (Teitelbaum & Winter 1985). In fact, coupled with high fertility in the developing world, the baby boom pushed concerns of a population explosion to the forefront of public attention in the 1960s, 1970s, and 1980s (e.g., Ehrlich 1974). But this situation has again reversed. By the late 1980s and early 1990s, countries such as Germany, Spain, and Italy reported fertility rates well below replacement level (<1.5), refueling concerns about very low levels of fertility.

Figure 1 shows fertility levels for selected world regions over the past 50 years. Our measure of fertility, the total fertility rate (TFR), is the most commonly used measure of fertility; it is an age-standardized period measure that can be interpreted as the number of births a woman would have if she experienced current age-specific rates throughout her lifetime (and she did not die prior to the end of reproduction). In the 1950–1955 period, Figure 1 shows that fertility ranged from 2.3 in Northern Europe to 5.7 in East Asia. Over the next two decades, the TFR dipped below 2.1 in all these regions. The pace of decline in East Asia is especially striking and signals that low fertility is not a uniquely Western phenomenon.

Less immediately striking than the pace of declines is the variation in fertility levels across low fertility countries. Table 1 illustrates this variation, showing recent TFRs for selected low fertility countries. TFR estimates range from 1.25 (Greece) to 2.04 (United States). To illustrate the population dynamics of such low fertility, we calculate and present estimated negative growth rates implied by these TFRs and existing mortality conditions.[1] Again the range is set by Greece and the United States, −1.7% to −0.1% per year, respectively. Table 1 also shows the number of years required for these 2000–2005 rates to produce a population one half the current size: 41 years to over 1000 years. Clearly, the observed variation in TFRs is important. The implications of a TFR of 1.25 are vastly different than those of a TFR of 1.75, as are the potential policy responses to ameliorate the consequences (Caldwell et al. 2002,Demeny 2003). Thus, the concerns facing Greece, Italy, and Spain are very different from those facing France and Australia. For the latter two countries, moderate levels of immigration could offset sub-replacement fertility, producing population stability. For Greece, Italy, and Spain, only massive immigration could offset their very low fertility.

Finally, Table 1 presents the approximate duration in years of below-replacement fertility for these selected countries. No country has transitioned back to replacement-level fertility (for any five-year period) once falling below it. Also note that although much of the low fertility literature has focused on countries such as Italy and Spain, the Russian Federation and Japan have actually sustained sub-replacement TFRs for longer periods.

Thus, at the turn of the twenty-first century, fertility decline and sub-replacement fertility have become widespread. Both the current prevalence of low fertility and its persistence are unprecedented (see Frejka & Ross 2001, Population Reference Bureau 2004, Stark & Kohler 2002). Note that Wilson (2004) has estimated that more than half of the world's population now lives in countries with sub-replacement fertility. Further, note that only 3% of the

[1]The net reproduction rate (NRR; see Preston et al. 2001) uses age-specific fertility and mortality rates to estimate the number of surviving daughters a woman would have, given specific and constant fertility/mortality. NRRs used here (see Table 1, footnote c) are estimated by the UN Population Division (2005). These NRRs indicate the relative size of succeeding generations once the population is stabilized. Here, we assume a mean age of childbearing of 30 years, allowing the calculation of the implied annual growth rate in a stable population.

world's population now lives in countries that have not begun fertility decline (Morgan 2003), and that past research suggests that once a fertility transition has begun, it does not stop until birth rates of 2 or below have been achieved (Bongaarts & Bulatao 2000, Bongaarts & Watkins 1996). Consistent with this claim, UN projections suggest that by the mid-twenty-first century, three of four countries now described as developing will have fertility rates at or below 2.1 births per woman (UN Popul. Div. 2003). These developments portend an end to global population increase shortly after the mid-twenty-first century (Bongaarts & Bulatao 2000, UN Popul. Div. 2004a). This forecast is remarkable, removed by only a decade or two from serious concerns about a global population explosion. Widespread fertility at or below 2 births per woman is an important and remarkable development whether one sees it as a necessary transition to a sustainable human population or as an ominous movement toward a continual crisis of low fertility.

Decomposition, Proximate Determinants, and What we Know about Low Fertility

In exploring the spread and variation of low fertility, some demographers have returned to “bread-and-butter” decomposition approaches as a way to describe low fertility regimes and their variations, approaches highly useful in explaining variation in, and declines from, high levels of fertility. Although these approaches have been described as nothing more than “elaborate description” (Hobcraft 2002, p. 131), they have provided valuable information about the proximate determinants of fertility variation that need to be addressed in building, evaluating, and revising theories. Specifically, these approaches have yielded much of the information that is agreed upon (i.e., “what we know”) and thus must be accommodated in plausible explanations of low fertility.

Decomposition approaches are important in revealing the behavioral components that require explanation. Useful decompositions rest on straightforward observations linked to the biological structure of reproduction: Fertility is a sequential, time-limited, nonreversible process. That is, women usually have babies one at a time (sequentially), between menarche and menopause (biologically time-limited) with experiences prior to and during each birth affecting subsequent decisions or actions (the process is path-dependent and not reversible). Especially important to low fertility is the fact that timing of births (i.e., the ages at which women have their babies) can vary dramatically. With intentions for only two children, women could reasonably expect to bear two children if they began at age 20, 30, or 35. Thus, a key question is whether aggregate fertility change (in a given period) reflects fertility postponement (timing) or a change in the number of births women will have (quantum).

Timing and Quantum

As exemplars of decomposition, consider Ryder's (1980) important explanation of the American baby boom and Bongaarts & Feeney's (1998) more recent and general examination of fertility timing. Both classic articles decompose fertility along two dimensions: parity (e.g., the number of prior births of the woman) and timing (the woman's age at giving birth). Our discussion here focuses on the TFR defined above.

If one decomposes fertility by parity, then one can see whether aggregate, current trends are produced by changes in the birth propensity of childless women, of those with one child, or of those at higher parities. For example, the transition from high to low fertility (the first demographic transition) has resulted primarily from the declining incidence of higher parity births (i.e., births to women who already have two or more children). Large families (or high parity births) are generally seen as diluting the parental resources that are available to each child and thus threatening children's full potential. This pressure to reduce family size is heightened by claims (probably of a more recent origin) that each child deserves individualized treatment and focused parental attention. Some researchers argue that informal sanctions against large families now accompany the high monetary and opportunity costs of higher parity births (i.e., large families) in many developed countries (see Morgan 2003).

In contrast, fertility trends in low fertility populations hinge primarily on the behavior of women with no or few births. For instance, Ryder (1980) shows that the fertility behavior of childless women and those with one child accounts for substantial parts of the American baby boom and bust (the 1945–1980 period). Bongaarts & Feeney's (1998, also see Sobotka 2004) work illustrates the crucial importance of first births for understanding cross-national fertility trends and differentials.

But the age of childbearing at each parity is also important. Shifts across birth cohorts are common and can be quite dramatic. To understand better the influence of timing shifts on the TFR, let us consider the TFR for first births only. Let us assume that 80% of women in each birth cohort will always have at least one child (i.e., quantum is fixed). If we allow for increases in the ages of first birth and assume that this trend toward later childbearing continues, the period TFR measure will dip below 0.8. In effect, births that would have occurred in the current year (under the existing timing regime) are postponed into subsequent years under the later timing regime, thus depressing the birth rate in the current year. Bongaarts & Feeney (1998) show that a rough estimate of this effect is indexed by the change in the mean age at childbearing.[2] For example, if the mean age of first births increases by 0.15 years each year, then the first-birth TFR is reduced by a factor of 0.85 (1.0 − .15 = .85). Thus, it follows that given an underlying quantum of fertility (say 0.80 having a first birth), postponement of fertility depresses TFR relative to underlying quantum (in this example to .68 = .80 * .85). Declines in mean age at childbearing have the opposite effect on the TFR.

These timing dynamics are important because fertility timing does change and can have prolonged and substantial effects on period fertility rates. Part of the reason for low rates observed during the 1980s and 1990s was a pervasive shift upwards in the ages at childbearing (especially controlling on the woman's parity). Bongaarts & Feeney show that timing shifts can reduce period rates by 10%–20% (i.e., by factors of .9 to .8) for up to two to three decades. Thus, a country with a TFR of 1.7 may not have any birth cohort of women that actually averages less than 2.0 births (2.0/.85 = 1.7). For many cases of “lowest-low” fertility (i.e., TFRs less than 1.5), up to one third of the fertility deficit relative to replacement levels can be attributed to timing shifts (see Sobotka 2004). Other countries, such as the United States, can attribute all years with below-replacement fertility to postponement (see Billari & Kohler 2004, Bongaarts & Feeney 1998).

The Transition to Parenthood

Consistent with above decompositions, many researchers have focused on the key transition in the fertility process, the transition to parenthood. This work is key for two reasons. First, it posits a framework, the life course perspective, for conceptualizing the effects of cultural, structural, and other factors on first-birth timing. First-birth timing is highly responsive to temporal and structural factors and thus is a major part of the story of timing changes discussed above. Second, although timing is important, the end of postponement would still

[2]Although some improvements have been made to the simple Bongaarts & Feeney (1998) adjustment (see Kohler & Philipov 2001, Yi & Land 2002), it remains a good rule of thumb and a widely accepted template for capturing the effects of timing shifts.

leave many countries with fertility well below replacement (see Frejka & Sardon 2004, Lesthaeghe & Willems 1999). Low fertility explanations thus must account for both fertility postponements and for fewer births (lower quantum). Work focusing on the timing of parenthood shows the many ways that timing and quantum are interrelated. Specifically, in the aggregate, fertility postponed implies some fertility foregone (see Kohler et al. 2002, Morgan & Rindfuss 1999, Quesnel-Vallée & Morgan 2003). Three mechanisms are at work: (*a*) Later childbearing leaves fewer years at risk of an unintended pregnancy/birth; (*b*) later childbearing increases the risk of sub/infecundity; and (*c*) postponement allows women/couples to revise intentions, and these revisions tend to be disproportionately reductions (owing to the development of competing interests). The strength of the link between timing and quantum both at present and in the future is in dispute.[3] At stake is the important question of the "degree of recuperation" or how much delayed fertility can be made up at older ages (see Frejka & Sardon 2004, Lesthaeghe & Willems 1999).

Hobcraft & Kiernan's (1995) "Becoming a Parent in Europe" has been cited by a number of authors in the recent debate about low fertility (e.g., the recent, provocative debate on low fertility in the journal *Population Studies*; see Caldwell & Schindlmayr 2003, 2004; Billari et al. 2004). The Hobcraft & Kiernan framework has many similarities with one proposed a decade earlier by Rindfuss et al. (1988) to explain "first births in America" and with one proposed a decade later by Sobotka (2004) to account for postponement of childbearing and low fertility in Europe. The comparable features of these frameworks can be taken as some long-standing and accepted features of a model of parenthood.

Specifically, all three frameworks propose the life course as an analytic frame, with the focus being a set of sequential decisions to continue to postpone or to have children now. The fertility decision is reached by balancing pro- and antinatalist forces that are rooted in the intersection of the unfolding life course and the social context in which the individual is embedded. Each of the frameworks acknowledges norms and attitudes held by relevant reference groups. Each also discusses constraints to responding to these macrolevel social pressures, but the factors stressed vary across authors.

Kohler and colleagues (see Kohler 2001, Kohler et al. 2002; also see Montgomery & Casterline 1996) offer an appealing model that builds on those discussed above. Consistent with these models, Kohler et al. (2002) conceptualize first-birth postponement as a rational response to socioeconomic incentives, insecurity, etc. Kohler et al. point out that these responses are insufficient and that one must consider the dynamics of social interaction. Specifically, Kohler and colleagues stress the importance of social multiplier effects: social interactions that can give rise to multiple equilibriums and status quo enforcement. For example, Kohler et al. (2002) suggest that increased female human capital and work opportunities encourage marriage and fertility postponement (a rational response to increasing opportunity costs of childbearing). But because these effects are pervasive (i.e., also influence the behavior of many others), they also lower the costs of postponement by making the pool of eligible partners at older ages both larger and of higher quality; this second indirect or multiplier effect results from the behavior of/interaction with others.

Status quo enforcement, in contrast, impedes change by maintaining positive sanctions for normative behavior and negative sanctions for new behavior. But norms weaken with pervasive violation because the imposition of sanctions becomes unfeasible. Thus, social

[3]The link between timing and quantum may be weakening. Effective contraception and sterilization reduce the impact of mechanism *a*. Assisted reproductive technology, improved health, and small desired family size reduce the impact of mechanism *b*. Mechanism *c* varies dramatically by context (i.e., by time period or country).

interaction and collective movements can provide an incentive not just for delay but for shifts from one fertility equilibrium to another with much lower mean fertility.[4]

A Proximate Determinant Model of Low Fertility

Reminiscent of the very important conceptual and analytic contribution of the Bongaarts & Potter's (1983) proximate determinants framework, Bongaarts (2001, 2002) suggests an overarching aggregate framework for low fertility that integrates the work discussed above on the decomposition of timing/tempo and the life course theories focused on first-birth timing. Specifically, this approach decomposes the TFR into a set of multiplicative factors that represents a current (period) fertility regime. We develop the model a bit differently than does Bongaarts. Specifically,

$$TFR = F_t \times (IP) \times (F_u \times F_g) \times (F_i \times F_c).$$

The level of current fertility (i.e., the TFR) is first adjusted by the factor F_t for the accounting effects of shifting births toward younger or older ages at childbearing (i.e., tempo), as suggested by Bongaarts & Feeney (1998) and discussed above. In recent decades, pervasive postponement implies F_t values well below 1.0 (i.e., $F_t < 1.0$). Thus, TFR/F_t equals the quantum of period fertility (i.e., period fertility corrected for the effects of shifts in fertility timing).

Key to explaining TFR/F_t (quantum) is intended parity (*IP*, the number of births intended) of young women (e.g., those aged 21–25) increased or decreased by a set of model parameters that reflects forces not incorporated into their reports of childbearing intentions. These factors are not incorporated into stated intentions because they cannot be well anticipated. Illustrative of factors that increase fertility relative to earlier stated intentions are:

- F_u: *Unwanted fertility*. Unwanted births measured through women's reports (at the time they become pregnant) that they had intended not to have any more children. Thus, these pregnancies (and births) would not have occurred in a "perfect contraceptive" society. Unwanted fertility increases TFR relative to *IP* (and $F_u > 1.0$).
- F_g: *Gender preferences*. Some couples who intend, say, two children, will have strong preferences for at least one son and one daughter (see Pollard & Morgan 2002). But given that sex of children is not easily controlled or anticipated, roughly half of such couples will reach the two-child goal but not have an acceptable gender composition. These couples are likely to revise their *IP* upwards. Such preferences and behavior would increase TFR relative to *IP* (and $F_g > 1.0$).[5]

Illustrative of factors that attenuate the impact of intended parity on observed fertility are:

- F_i: *Impaired fecundity*. In general, women (and their partners) will not know if they are, or when they will become, sub- or infecund. Thus, women cannot factor impaired fecundity into their *IP* reports. A few women are infecund at young ages (1% or 2% at ages 15–19; see Bongaarts & Potter 1983), but the proportion increases with age (especially after age 35; see Bongaarts & Potter 1983, Menken

[4]This provides a good example of asymmetric causality (see Lieberson 1985)—socioeconomic changes can cause a transition from young to old age at first birth equilibrium (but their reversal would not reverse the behavioral change).

[5]Likewise, some couples will have additional children because one of their children dies. Given the rarity of child death in rich countries, we do not include a parameter for it here. Like gender preferences, this unanticipated situation would tend to increase fertility relative to intentions (i.e., the parameter would be >1.0).

1985) and with the prevalence of some diseases/infections. Male fecundity declines with age also, but its onset is much later than for females and its pattern of decline less certain. Clearly, impaired couple fecundity decreases TFR relative to *IP* (and $F_i < 1.0$).

- F_c: *Competition.* Women/couples can also revise their *IP* upwards or downwards depending on their experiences, opportunities, and constraints (that encourage or compete with childbearing). Following Bongaarts, we refer to this broad class of constraints and competing opportunities as competition. Some of this competition may be anticipated and incorporated into *IP*. What is not, e.g., the unanticipated difficulty of combining career and family responsibilities, of finding a suitable partner, etc., is reflected in this parameter. In contemporary settings, F_c is expected to be < 1.0.

In this framework, observed fertility reflects the balance of these forces. Morgan and colleagues (Hagewen & Morgan 2005, Morgan 2003, Morgan & Hagewen 2005, Quesnel-Vallée & Morgan 2003) have applied this framework in several different contexts as a conceptual and as an analytic model.

What We Know

The elaborate description captured in the decompositions and frameworks above outlines what we know. We extract from these frameworks a set of low fertility axioms.[6]

1. Fertility postponement lowers current period measures of fertility relative to cohort measures or to period measures not adjusted for these timing shifts. Thus, timing shifts, which are time-limited phenomena,[7] are a significant part of contemporary low fertility.
2. Fertility timing (the age at which women have children) may have consequences for the number of children that individual women will bear. Specifically, in the aggregate, fertility postponed implies some fertility foregone.
3. Women's (men's and couple's) fertility histories unfold in tandem and in interaction with human capital formation, mental and physical health trajectories, and other key aspects of their life course and that of their partners. The life course perspective is the unquestioned, appropriate analytic frame for contextualizing fertility intentions and behavior.
4. Parents incur high direct and indirect costs in having and rearing children in most contemporary contexts. Indirect costs are substantial and reflect primarily the mother's foregone earnings due to pregnancy, childbirth, and childrearing (see DiPrete et al. 2003). Direct costs are also substantial and are more easily and regularly calculated (see Lino 2004).
5. Dominant norms and cultural schemas legitimate active birth control (i.e., it is widely accepted that the quantum and timing of children impact individual and family well-being and that strategizing and acting on this belief is legitimate).
6. Low parity births (especially the first and having a sibling for the first child) remain strongly normative and fulfill women's/couples' desire to be parents and have a family. Ideal and intended family sizes of young women are usually two, with three

[6]We use axiom in its standard usage, i.e., accepted on its intrinsic merit or widely accepted as a self-evident truth.

[7]We say shifts in fertility timing are time limited because the influence on period rates persists only as long as timing continues to change. Any scenario of continued increases is not feasible if projected sufficiently long, e.g., increases of .15 for 100 years implies mean increase in first-birth timing of 15 years and for 200 years an increase of 30 years!

being the second most popular choice. Childlessness and one-child families are not seen as ideal and are not commonly intended (see Bongaarts 2001, Hagewen & Morgan 2005).[8]

7. High parity births are increasingly rare and non-normative; given the other axioms discussed and especially the high costs of children (see axiom 4 above), high parity births may be viewed as disadvantageous for parents, siblings, and society more generally.

Fundamental Causes of Low Fertility and Its Variations

Low fertility frameworks must also allow for more fundamental (or distal) causes; the axioms above are proximate and beg more fundamental questions such as, for example, why are monetary and opportunity costs of children very high? At this level of abstraction, explanations for low fertility are varied, and the number of theoretical contributions is large. Moreover, explanations for low fertility are not fully divorced from the empirical and theoretical work on fertility declines from high levels or "fertility transitions" (see Bumpass 1990, Hirschman 1994, Mason 1997). To situate these varied contributions, we offer a two-dimensional conceptual space created by theoretical dimensions of scope and content. Scope refers to the geographical and temporal applicability of the theory, and content refers to the primary putative causal factors. Table 2 displays these dimensions and locates various contributions in this space.

The Conceptual Range of Theories

Before discussing particular contributions, let us justify the importance of these two orienting dimensions. First, the horizontal dimension—scope—captures a theory's reach across time and space (see Table 2). At one extreme we have global theory, presumably relevant to all contemporary countries/groups and one useful for anticipating future change. As one moves from left to right, one shifts from grand global theories to interactive ones, and finally to idiosyncratic ones. The distinction between interactive and idiosyncratic is important. Consistent with its meanings in quantitative statistical frameworks, an interactive model implies that the effect of a specific change is dependent on the level of a second (third, and/or fourth) variable. Interactive explanations can still be highly structured with broad scope. But some scope conditions are incorporated, by definition, as part of these models. Idiosyncratic explanations are historical in nature and stress the uniqueness or path dependence of each case. As one moves from left to right, the models lose parsimony but typically gain substantive plausibility and improved fit to key observations.

The vertical dimension—content—does not represent a continuum but rather a set of categories of putative causes of fertility change. The last category, synthetic/path-dependent explanations, represents contributions that stress the importance of multiple factors. The importance of multiple factors does not necessarily imply an interactive model because the multiple factors can have additive effects. Because no contribution we discuss denies the existence of multiple causes, row entries in Table 2 represent the primary putative causal factor lying at the heart of the scholar's argument.

Contributions Stressing Economic Change

The classic work on demographic transition theory and its antecedents falls in the upper left (NW) of this conceptual space (see Notestein 1945, 1953). This theory has grand scope and views economic development as the driving causal force. Specifically, demographic

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[8]Some evidence toward increasing willingness to see one child as ideal is reported by Goldstein et al. (2003). See Hagewen & Morgan (2005) for some limited, recent evidence of declining intentions.

transition theory posits that economic development will lower mortality; in turn, both of these factors will lead to a subsequent fertility decline. Eventually, fertility levels will match low mortality, but the homeostatic mechanisms underlying this balance are not specified.

We position the classic work of Davis (1937, 1997) in this area of Table 2. As in demographic transition theory, Davis argues that economic development (i.e., industrialization) drove a process of social change that undermined incentives for childbearing (see also Thompson 1929). Correlated institutional changes served as proximate causes, but Davis further argues that "the declining birth rate has resulted from a ripening incongruity between our reproductive system (the family) and the rest of modern social organization." This incongruity was not transitional (or the result of a time lag) but was fundamental to modern societies. The modern urban-industrial-mobile society was essentially at odds with the social organization characterized by a kin-based, familistic society. The new fertility regime was one of small families (also see Livi-Bacci 1999). The discrepancy was at least partially the result of the changing roles, expectations, and opportunities of women as economic development occurred (Davis & van den Oever 1982). This theory is grand in scope; it predicts global fertility decline with continued economic globalization and low fertility as a looming crisis for all economically advanced countries.

In addition, the rationales to have higher parity births were increasingly and specifically undermined by economic development. Value-of-children studies suggest that key rationales for childbearing (becoming a parent, having a child to love, carrying on the family name, etc.) were satisfied by a first and second child. Higher parity births had rationales (e.g., help around the house or with chores, look after younger children, etc.) that were quickly undermined by economic development (see Bulatao 1981). In some contexts the direct costs of education were salient, but indirect costs were likely more consequential (see Becker 1981, Becker & Lewis 1973, Caldwell 1982). The increase in these costs does not seem to be a fact in dispute and must be an antinatalist force (see Blau & Robins 1989, Mason & Kuhlthau 1992).

Caldwell & Schindlmayr's (2003) recent, provocative review shares this conceptual space; they cite Davis approvingly at several points. Caldwell's earlier work (1982) notes a set of achievement ladders constructed by industrial society, placing demands specifically on women and extending education for both sexes and for children. Caldwell & Schindlmayr (2003) are impressed with the global spread of low fertility, e.g., its emergence in a broad range of cultural contexts. They argue for a theory with a grand scope to account for the emerging global pattern of low fertility. Economic development and globalization, and accompanying greater wealth and consumerism, fit their search requirements for a fundamental, powerful, and pervasive causal force.

Adjacent to this space and to the right, we place a Caldwell (2001) elaboration. Specifically, in attempting to understand the nearly simultaneous decline of fertility in both developed and developing countries in the 1960s and 1970s, Caldwell (2001) continues to stress economic development and increasing incomes as the ultimate cause of low fertility. But a more compelling explanation of the simultaneous timing required acknowledgment of new birth control technologies (e.g., the contraceptive pill) and new rationales for controlling fertility (e.g., concern about rapid population growth). These new technologies and new rationales provided an environment that accentuated and hastened fertility decline.

Next, further right (NE corner) are idiosyncratic explanations that focus on markets/economic change as a driving force for fertility declines in specific nations/regions. Notable among these idiosyncratic explanations is the contrast of East and West Germany postunification (Kreyenfeld 2003) and whether fertility decline in East Germany was fueled mainly by the economic crisis or whether it was more of an adaptation in evolving toward West Germany (Conrad et al. 1996, Eberstadt 1994, Witte & Wagner 1995). According to the crisis argument, the upheavals caused by the fall of communism had social consequences (Caldwell 2004), including an insecurity about the future or personal disorientation in addition to economic hardship (Philipov 2002). Thus, the fundamental causes are overarching, but nations sharing these experiences (e.g., nations in Eastern Europe) may fare uniquely on fertility outcomes after such upheavals owing to their unique political and social histories (see Sobotka et al. 2003). Although the crisis explanation is used for many countries undergoing the shift from communism, it has not been substantiated at the microlevel in Russia (Kohler & Kohler 2002). In addition, the argument that upheaval and uncertainty promote fertility has also been forwarded (see Friedman et al. 1994).

Contributions Stressing the Import of Ideological Change

In the next row of Table 2, we place the arguments of scholars who stress ideological changes, as opposed to objective, economic ones. As Mason (1997, p. 450) argues, “theories of fertility change must recognize that changing perceptions ultimately drive fertility change, and that perceptions may change more slowly or more quickly than the reality with which they are concerned.” A useful way to conceptualize changing perceptions or ideological change is as a package, an integrated set of ideas that provides an orienting and motivating schema for life. Behavioral change, including fertility change, results from the adoption of new cultural schema that interpret contemporary contexts in ways that produce low fertility. One can conceive of rational decisions once this interpretative schema has been set (see Hammel 1990).

The work of van de Kaa and Lesthaeghe is illustrative. Their causal interpretation of low fertility (Lesthaeghe & van de Kaa 1986, van de Kaa 1987) hinges on a cultural shift in the dominant mental/cultural schema (see also Lesthaeghe & Willems 1999). Specifically, following Ariès (1962, 1980), van de Kaa and Lesthaeghe (see van de Kaa 2003, p. 78) argue that there are two successive motivations for declining fertility. The first, associated with the (first) demographic transition and especially with declining family size, assumes that all who could have children would bear them, and that parents' dominant orienting goals were to provide substantial resources to their children. Van de Kaa (2003, p. 78) says that altruism toward children defines this schema, one that Ariès claimed produced an enormous sentimental and financial investment in children. In contrast, low fertility and associated demographic change (i.e., the second demographic transition, including the emergence of sustained low fertility and associated demographic change such as increased rates of divorce and cohabitation) are motivated by new ideas that place the individual and individual choice at the core of the unfolding life course; the contemporary challenge, they argue, is for individuals to construct a meaningful life in the absence of a clear normative life course (one not necessarily including parenthood).

This new schema is consistent with Giddens's (1991) description of the deinstitutionalized modern life course. The choices to have children and when become ones that women/couples make as they construct stimulating and meaningful lives. Caring for children remains important but in a context in which the decision to have children is optional and parenthood should contribute to individual self-actualization. Note that this reflexive or postmodern cultural schema is consistent with the behavioral components of the second demographic transition: fertility delay, decisions to forego childbearing, cohabitation, union instability, etc. This emphasis on changed cultural schema does not deny structural changes, including economic globalization. But the fundamental change, according to van de Kaa and Lesthaeghe, was a shift in the dominant interpretative frame through which these changes were viewed.

Van de Kaa's and Lesthaeghe's argument was developed to account for pervasive changes that occurred in the West, so the initial implied scope of their argument is limited. However, low fertility is not just a Western phenomenon, as we have noted. Thornton (2005) argues that a powerful cultural frame or schema, developmental idealism, conflates Western wealth and power with Western family forms and Western cultural forms. Thus, these ideas have power by association, and Western conceptions of the family follow or precede economic globalization. These sets of ideas can have powerful effects on individuals. Combining the arguments of van de Kaa, Lesthaeghe, and Thornton, one can imagine shifts in cultural schema that could help explain patterns of low fertility on a global scale.

Contributions Stressing Institutional Change/Differences

Moving downward again we reach a category, institutional influences, that emphasizes structural aspects of society that can constrain and channel behavior. This conceptual contrast with cultural frames/schema (discussed above) is, of course, only an abstraction. Culture and structure continually interact; in fact, one might define institutions as embodied culture. Nevertheless what we discuss here is frequently called structure and includes gender, family structure, child care provision, consumer markets, government policies, etc.

Gender has attracted much attention in the low fertility literature. McDonald (2000) explains how gender equity can be antinatalist in high fertility contexts but pronatalist in low fertility settings. This question arises because of the anomalous positive association appearing in the 1990s between aggregate fertility levels and levels of female labor force participation. This reversal of an assumed, structural antinatal relation between women's work and fertility elicited great interest (Ahn & Mira 2002, Billari & Kohler 2004, Brewster & Rindfuss 2000, Rindfuss et al. 2003). McDonald (2000) argues that the transition from high fertility to fertility around replacement level is accompanied by, and encouraged by, increasing gender equity within the family. Gender equity promotes lower fertility by increasing the likelihood that women's fertility intentions will be consequential and by increasing alternative avenues to satisfaction, status, and prestige. Thus, McDonald's arguments are consistent with those of social demographers (Calhoun & Espenshade 1988, DiPrete et al. 2003, Kravdal 1992, Rindfuss&Brewster 1996) and economists (see Easterlin 1980, 1987; Engelhardt & Prskawetz 2002; Willis 1973) that gender change increases the opportunity costs of mothers' foregone labor market opportunities. Empirical evidence on this point is substantial and supportive (Mincer 1985, Weller 1977, Adsera 2004).

Once fertility is low, gender equity may rise further in individual-oriented institutions (e.g., education, the economy, politics) while remaining relatively low in family-oriented institutions. As a result, fertility can fall to very low levels, e.g., among societies usually characterized as more patriarchal (e.g., Italy, Spain, and Japan) but remain closer to replacement levels in more egalitarian contexts (e.g., Scandinavia and the United States) (see Gauthier & Hatzius 1997, Rindfuss et al. 2003). Fertility closer to replacement level (with pervasive gender equity) occurs because women bear fewer of the time, energy, and financial costs of rearing children (greater equity has spread these costs more broadly than in settings with stronger familial patriarchy). Note that McDonald's theory of gender and fertility change is clearly interactive: Very high gender equity in nonfamilial institutions produces low fertility only when gender equity in familial institutions lag behind.

Esping-Anderson (1999) offers another important institutional and interactive theory focused on Western welfare state regimes. Esping-Anderson identifies institutional clusters that combine different types of labor markets, the state, and the family. Thus, the fertility rate under a social democratic regime (e.g., Norway) may vary from a conservative regime (e.g., Italy) owing to the balance of the family, state, and market in managing social risks.

The relationship between defamilialization (or a state's willingness to absorb the responsibilities traditionally relegated to the family) and fertility is increasingly positive and supported by the now positive relationship between female employment and fertility (see Brewster & Rindfuss 2000). Low fertility could become a "low fertility equilibrium trap that springs from the incapacity of women to harmonize careers and family obligations" (Esping-Anderson 1999, p. 5). However, other regimes constitute contexts in which near-replacement fertility remain (e.g., a liberal regime such as the United States)

The McDonald and Esping-Anderson genre of explanation has been commonly used; that is, the origin of fertility variation and change is often sought in institutional variation and change (see Ryder 1980). For instance, Rindfuss et al. (2003; also see Morgan 2003) stress institutional variation that impacts (*a*) availability, acceptability, accessibility, quality, and cost of childcare; (*b*) market substitutes for goods/services formerly produced in the home; (*c*) labor market accommodations (e.g., flex time); (*d*) public policy interventions (e.g., family leave); and (*e*) gender role flexibility and men's contributions to housework and childcare.

Contributions Stressing Technological Change

New technologies are not exogenous. They emerge within contexts that allow or encourage their development and use, or they diffuse or are imported from other settings. But their precise use, their meaning, and the extent of their diffusion depend on cultural understandings and existing social institutions of the receiving population. Thus, although we acknowledge the fuzziness of this conceptual category (technology that is separate from culture and institutions), it identifies a class of arguments in which technology plays a key role (see Table 2). More specifically, fertility and technological change are intertwined on several levels: contraception/assisted reproduction, household technologies, labor market and production technologies that make work more women-friendly, and increased "child quality" owing to health and education inputs increasingly coming from nonfamily institutions (Becker 1981, chapter 11).

A key area of technological change involves contraceptive technology and infertility treatments. These technologies play a secondary role in many explanations of fertility change. But they can be seen as playing a fundamental role. An extreme example is Potts's (1997, p. 5) sweeping evolutionary argument: He claims that humans have a set of biological predispositions that, in our hunting and gathering past, would have jointly produced high reproductive fitness (i.e., above replacement-level fertility). He claims that humans are genetically predisposed to seek sexual relations, to love and support our own children once they are born, and to be socially and sexually competitive. In the absence of contraception and abortion, these predispositions assure that babies are born, that they are cared for after birth, and that the most able (in terms of accumulating wealth and status) will have the most surviving offspring. In contrast, in contemporary contexts the link between sex and reproduction can be severed by contraception and abortion, which are key technological/social innovations. Potts argues that evolution has provided us with no gene for a certain number of children. Once the link between sex and reproduction is broken, what will provide the motivation for children? From this perspective, effective contraception plays a key role in fertility decline and sub-replacement fertility.

Goldin & Katz (2000) make a very different argument about contraception and, specifically, the oral contraceptive, or the pill. Theirs is an idiosyncratic argument focusing on the United States; they present time series data consistent with claims that the pill altered women's career decisions through both direct and indirect routes. The direct route was the pill's increased reliability and ease of use compared with other methods. Thus, the pill allowed a larger group of women to invest in expensive, long-duration training without paying as high a price in terms of abstinence or postponement of unions as women did before the pill. The indirect effect is the one mentioned above, termed by Kohler social multiplier effects (see Kohler 2001, Kohler et al. 2002). Goldin & Katz conclude that the pill had a large effect on career and marriage (and by inference fertility timing), even though isolating this effect with great certainty is not possible. (A weakness of this argument is the low fertility in some countries where the pill is far less important, e.g., Japan, Italy.)

On technological change more generally, a number of arguments stress the role of technology in interaction with economic development and increased productivity (e.g., Galor & Weil 1996, 2000). Specifically Galor & Weil (1996) argue that technology (increased capital per worker) raised women's wages relative to men's. These higher wages reduced fertility owing to the higher opportunity costs of childbearing. This lower fertility, in turn, led to greater investments in technology (i.e., increases in level of capital per worker).

Theories Stressing Multiple Domains and/or Their Interactions

Another important conceptual space is the bottom left (SW corner) (see Table 2). This space reflects global and synthetic explanations of social change, including low fertility. It differs from those above in that the putative causal forces are not derivative solely of economic, ideological, institutional, or technological change. Rather, it is the combination of these factors. Goode's (1963) classic, *World Revolution and Family Patterns*, defines this conceptual space. Goode argues that industrialization, family change, and ideological change are sets of mutually reinforcing factors that were sweeping the globe because of their joint attractiveness: industrialization because of the greater wealth and standard of living it brought; Western ideology because of the widespread desire for greater freedom and choice in life decisions; and the Western family because of its free mate choice, companionate marriage, and low fertility. Bumpass (1990) supported this approach to theorizing about family change in his presidential address to the Population Association of America, as did Mason (1997) in her presidential address focusing on the demographic transition.

Path Dependence and Idiosyncratic Explanations

At the bottom right (SE corner) of Table 2, we place explanations that stress the unique details of particular contexts and their unique intertwining. For instance, the historian Ginsborg (2003, p. 74) explains the very low Italian fertility as the distinctive “intertwining of the old and the new in family strategies.” More specifically, Ginsborg does not dispute some transnational influences. “[T]here were strong forces pushing toward a European model of modernity, among which were the cultural revolution of the 1960s and 1970s, leading to greater individual choice, the spread of contraception and legalized abortion, the partial emancipation of women and their entry in to the labor market.” But Ginsborg also stressed Italian-specific factors that combined with these transnational ones in a distinctive intertwining. He writes, “tradition weighed heavily in both the public and the private spheres; the felt obligation to have children within marriage, the power of the family as an intergenerational collective, the state's disinterest, after the unfortunate Fascist experience, in reproduction politics” (Ginsborg 2003, p. 74). Although we have used the work of the historian Ginsborg as an illustration, many demographers and sociologists are receptive to these kinds of arguments. Hobcraft (see Billari et al. 2004, p. 81), in responding to Caldwell & Schindlmayr (2003), writes, “I have no difficulty with accepting differing explanations for different regions and time periods, though these explanations need to be drawn from a common overarching framework.” Consistent with Hobcraft's view, Morgan (2003) argues that the exceptionalism of American replacement-level fertility is best accounted for by a host of distinguishing factors; he illustrates this point by contrasting Italy and the United

States, where a set of modest differences (some idiosyncratic) adds up to a substantial overall difference.

Recent study of East and Southeast Asia highlights the path-dependent nature of fertility transitions within the regions and their differing causes (Caldwell & Caldwell 2003, Gubhaju & Moriki-Durand 2003). The experience of low fertility in Japan and its causes (Atoh 2001) are distinctly different from those in China (Yi 1996). Countries such as Thailand (Prachuabmoh & Mithranon 2003), Singapore (Yap 2003), and Korea (see Cho 2000) are currently discussed in terms of their specific contexts more often than situated in a broader global theory (see Atoh et al. 2004).

Conclusion: Where do we go from here?

Reviewers often conclude by stating that we need to know much more and that huge gaps exist in our understanding. We begin by stressing the opposite point: We know a great deal! We agree with Mason (1997, p. 452) that fertility researchers are inhibited more by “erroneous thinking than by any fundamental lack of knowledge.” We challenge claims that fertility researchers “really don't know why fertility fell from high levels (6–8 children per woman) to two children” or that we “really don't understand the postwar baby boom and bust” or that “we don't really know why very low fertility exists in some societies and why fertility levels approximate replacement elsewhere.” In fact, at certain levels of abstraction (at the level of decomposition and the proximate determinants), we have frameworks to answer all these questions, and we can provide the specific details that make the explanations compelling (e.g., see Hobcraft & Kiernan 1995, pp. 23–27; Cherlin 1992, pp. 31–65). Much of what critics mean when they say we don't understand is probably unknowable—both now and in the future—because the answers they seek imply a level of determinism that does not exist.

To explain, we know a great deal about fertility change and variation. Consider the axiomatic claims listed above. These claims are embodied in at least one of the frameworks discussed in the section on Decomposition, Proximate Determinants, and What We Know About Low Fertility. These statements and models reflect one level at which we can know things. The models provide general frameworks within which we can construct social histories of particular cases. These frameworks can accommodate the more distal causes stressed by various authors and shown in Table 2. Note that interactive effects and case-specific idiosyncrasies do not render general claims useless or false. Rather, they illustrate that our models are simpler than reality itself and that our models capture what is systematic and known about/across cases. As Lieberson & Lynn (2002, p. 4) note “*incomplete* is not the same as *erroneous*.” Models are useful to the extent that they capture key aspects of the cross-case variation we seek to explain.

If these proximate/descriptive frameworks had been available in 1945, they would not have predicted the baby boom or bust. Further, these models will not predict well future fertility levels (on a decadal timescale). Critics will say the poor predictive capacity of these frameworks is due to their omission of true, fundamental, or distal causes of social change or that the more proximate variables discussed above are not linked in consistent ways to these fundamental and distal causes. Both criticisms are true. But we argue that such precise, mechanistic theories of social change should not be sought (see Lieberson & Lynn 2002, p. 10). Such attempts assume powerful, persistent, and pervasive drivers of social change, forces that make irrelevant existing cultures and institutions, a level of determinism that does not exist.

Thus, our final question is, What do we need to know or do? Each of the frameworks discussed previously imply important basic science research agendas. Decomposition analyses must update our understanding of current trends and differences so that our social histories focus on the dynamic demographic components of change. To understand the transition to parenthood in particular times and places, the general perspectives outlined above need to be applied with a thorough understanding of the particular case. We need more sophisticated modeling and detailed longitudinal data to understand how life course development occurs for particular individuals in different contexts. We need to map the ever-changing cultural and structural landscape and how persons understand it if we are to craft compelling social histories of changing family and fertility behavior.

We especially recommend the conceptual framework of Bongaarts (2001, 2002) as a frame for organizing subsequent low fertility work; it suggests a set of important unfinished research agendas. At the heart of the model is the intended parity of young women, i.e., how many children do women/couples want? All other parameters reflect factors that impinge on translating these intentions into behavior. A first step is to further explore fertility intentions and the individual experience and normative and structural constraints that they reflect. Are these intentions general normative statements, or do they reflect more concrete plans for the individual? How are fertility intentions weighed vis-à-vis other goals as the life course unfolds? Are fertility intentions primarily about the timing of parenthood and subsequent births? Or, are number-of-children concerns paramount?

The next question implicit in the Bongaarts framework is: Why don't women/couples realize intentions? This is key because all current data suggest that below-replacement fertility reflects a shortfall of births relative to intentions, i.e., fertility intentions are significantly higher than are current TFRs (see Hagewen & Morgan 2005). Rather than reflecting any inherent problem with stated intentions, this intent-behavior disjuncture may reflect the agency, constraints, and happenstance that define the individual life course. So a second agenda item is to understand better how, for instance, individuals' family trajectories are interrelated with human capital formation, health trajectories, or other key life cycle domains across contexts.

Third, the Bongaarts framework decomposes the intent-behavior disjuncture into that due to unwanted fertility, timing shifts, infecundity, competition with other goals, etc. The import of these constraints will vary across contexts, providing important questions for cultural and structural analysis. Why, for instance, is unwanted fertility much higher in the United States than in most other low fertility contexts? The residual competition parameter will vary in magnitude across populations: Does this variability reflect availability of partners/spouses or variation in work-family conflict traceable to various institutional structures and interactions?

For the more distal causes (featured in Table 2), new integrative work is needed. We need models of change that are conciliant with what we know from other disciplines—from cognitive and brain sciences, social anthropology, history, economics, psychology, and political science. We want a model that corresponds to the (biological, psychological, social, and cultural) processes at work in the world. These models will highlight the range of possible outcomes and stress the unpredictability of social change. In this regard, linking biology, genetics, life course development, and social context stands as a major challenge to a fuller understanding of fertility change and variation, and more generally, family change and variation. On this score, our knowledge is rudimentary; the most promising sign is the increasing willingness of some scientists to take up the agenda. Cross-species, cross-cultural, and historical observations provide some relevant data (e.g., Hrdy 1999). Measurement of genetic markers and heritability studies provide additional clues (see

National Research Council 2003) for the needed theoretical development. But the greatest need is for a fuller understanding of the dynamics of cultural and institutional change, an effort requiring tools and concepts often associated with cultural anthropology and history. We must move beyond debates of economic change versus ideology or structure versus culture to new formulations that do justice to the dynamics of social change (e.g., Sewell 1992,2005).[9]

In addition, the role of policy requires further attention. Although noted as a substantial factor in the work of Esping-Anderson and others (see McDonald 2002), the role of policy as a fundamental cause of fertility variation remains uncertain while variation in the policy histories of low fertility regimes is great (see UN Popul. Div. 2004b). If low fertility persists and spreads, the interest in effective pronatalist policies will intensify and proliferate. Thus, an increased knowledge base on effective policies and attention to the ethical and practical implications of policy action/inaction are needed.

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Literature Cited

Adsera A. Changing fertility rates in developing countries: the impact of labor market institutions. J Popul Econ 2004;17:17–43.

Ahn N, Mira P. A note on the changing relationship between fertility and female employment rates in developed countries. J Popul Econ 2002;15:667–82.

Ariès, P. Centuries of Childhood. New York: Vintage Books; 1962.

Ariès P. Two successive motivations for the declining birth rate in the west. Popul Dev Rev 1980;6:645–50.

Atoh M. Very low fertility in Japan and value change hypotheses. Rev Popul Soc Policy 2001;10:1–21.

Atoh M, Kandiah V, Ivanov S. The second demographic transition in Asia? Comparative analysis of the low fertility situation in east and southeast Asian countries. Jpn J Popul 2004;2:42–75.

Becker, GS. A Treatise on the Family. Cambridge, MA: Harvard Univ. Press; 1981.

Becker GS, Lewis HG. On the interaction between the quantity and quality of children. J Polit Econ 1973;81:S279–88.

Billari FC, Frejka T, Hobcraft J, Macura M, van de Kaa DJ. Discussion of paper 'Explanations of the fertility crisis in modern societies: A search for commonalities'. Population Studies 2004;57(3): 241–263.Caldwell, John; Schindlmayr, Thomas. Popul Stud 58:77–92.

Billari FC, Kohler HP. Patterns of low and lowest low fertility in Europe. Popul Stud 2004;58:161–76.

Blau DM, Robins PK. Fertility, employment, and child-care costs. Demography 1989;26:287–99. [PubMed: 2731623]

Bongaarts J. Fertility and reproductive preferences in post-transitional societies. Popul Dev Rev 2001;27:260–81.

Bongaarts J. The end of fertility transition in the developed world. Popul Dev Rev 2002;28:419–44.

Bongaarts, J.; Bulatao, RA., editors. Beyond Six Billion: Forecasting the World's Population. Washington, DC: Natl. Acad. Sci. Press; 2000.

Bongaarts J, Feeney G. On the quantum and tempo of fertility. Popul Dev Rev 1998;24:271–91.

[9]Work by Sewell (1992, 2005) takes on such an agenda but is not oriented toward fertility or demography. Johnson-Hanks et al. (2005) have begun to adapt Sewell's approach to demographic phenomena.

Bongaarts, J.; Potter, RG. Fertility, Biology and Behavior. New York: Academic; 1983.

Bongaarts J, Watkins SC. Social interactions and contemporary fertility transitions. Popul Dev Rev 1996;22:639–82.

Brewster KL, Rindfuss RR. Fertility and women's employment in industrialized countries. Annu Rev Sociol 2000;26:271–96.

Bulatao RA. Values and disvalues of children in successive childbearing decisions. Demography 1981;18:1–25. [PubMed: 7202782]

Bumpass LL. What's happening to the family? Interactions between demographic and institutional change. Demography 1990;27:483–98. [PubMed: 2249741]

Caldwell BK, Caldwell JC. Below-replacement fertility: determinants and prospects in south Asia. J Popul Res 2003;20:19–34.

Caldwell, JC. The Theory of Fertility Decline. New York: Academic; 1982.

Caldwell JC. The globalization of fertility decline. Popul Dev Rev 2001;27(Suppl):93–115.

Caldwell JC. Social upheaval and fertility decline. J Fam Hist 2004;29:382–406.

Caldwell JC, Caldwell P, McDonald P. Policy responses to low fertility and its consequences: a global survey. J Popul Res 2002;19:1–24.

Caldwell JC, Schindlmayr T. Explanations of the fertility crisis in modern societies: a search for commonalities. Popul Stud 2003;57:241–63.

Caldwell JC, Schindlmayr T. Reply to the discussion of our paper ‘Explanations of the fertility crisis in modern societies: a search for commonalities’. Popul Stud 2004;58:93–94.

Calhoun CA, Espenshade TJ. Childbearing and wives' foregone earnings. Popul Stud 1988;42:5–37.

Cherlin, AJ. Marriage, Divorce, Remarriage. Cambridge, MA: Harvard Univ. Press; 1992.

Cho, N. UN Expert Meet Policy Responses Popul Ageing Popul Decline. New York: 2000 Oct.. Policy Responses to Population Ageing and Population Decline in Korea; p. 11-13.

Conrad C, Lechner W, Werner W. East German fertility after unification: crisis or adaptation? Popul Dev Rev 1996;22:331–58.

Davis K. Reproductive institutions and the pressure for population. Sociol Rev 1937;29:289–306.

Davis K. Kingsley Davis on reproductive institutions and the pressure for population. Popul Dev Rev 1997;23:611–24.

Davis K, van den Oever P. Demographic foundations of new sex roles. Popul Dev Rev 1982;8:495–511.

Demeny P. Population policy dilemmas in Europe at the dawn of the twenty-first century. Popul Dev Rev 2003;29:1–28.

DiPrete TA, Morgan SP, Engelhardt H, Pacalova H. Do cross-national differences in the costs of children generate cross-national differences in fertility rates? Popul Res Policy Rev 2003;22:439–77.

Easterlin, RA. Birth and Fortune: The Impact of Numbers on Personal Welfare. New York: Basic Books; 1980.

Easterlin, RA. Easterlin hypothesis. In: Eatwell, J.; Milgate, M.; Newman, P., editors. The New Palgrave: A Dictionary to Economics. Vol. 2. New York: Stockton Press; 1987. p. 1-4.

Eberstadt N. Demographic shocks after communism: Eastern Germany, 1989–93. Popul Dev Rev 1994;20:137–52.

Ehrlich, PR. The Population Bomb. New York: Ballentine; 1974.

Engelhardt, HK.; Prskawetz, A. On the changing correlation between fertility and female employment over space and time. Work. Pa 2002-52. Max Planck Inst Demogr Res; Rostock, Germany: 2002. http://www.demogr.mpg.de/papers/working/wp-2002-052.pdf

Espenshade TJ, Guzman JC, Westoff CF. The surprising global variation in replacement fertility. Popul Res Policy Rev 2003;22:575–83.

Esping-Anderson, G. Social Foundations of Post-Industrial Economies. New York: Oxford Univ. Press; 1999.

Frejka T, Ross J. Paths to subreplacement fertility: the empirical evidence. Popul Dev Rev 2001;27:213–54.

Frejka, T.; Sardon, JP. Childbearing Trends and Prospects in Low-Fertility Countries: A Cohort Analysis. Dordrecht, Neth.: Kluwer Acad.; 2004.

Friedman D, Hechter M, Kanazawa S. A theory of the value of children. Demography 1994;31:375–401. [PubMed: 7828763]

Galor O, Weil DN. The gender gap, fertility and growth. Am Econ Rev 1996;86:374–87.

Galor O, Weil DN. Population, technology, and growth: from Malthusian stagnation to the demographic transition and beyond. Am Econ Rev 2000;90:806–28.

Gauthier AH, Hatzius J. Family benefits and fertility: an econometric analysis. Popul Stud 1997;51:295–306.

Giddens, A. Modernity and Self-Identity. Stanford, CA: Stanford Univ. Press; 1991.

Ginsborg, P. Italy and Its Discontents: Family, Civil Society, State. New York: Palgrave Macmillan; 2003.

Goldin C, Katz LF. Career and marriage in the age of the pill. Am Econ Rev 2000;90:461–65.

Goldstein J, Lutz W, Testa MR. The emergence of subreplacement family size ideals in Europe. Popul Res Policy Rev 2003;22:479–96.

Goode, WJ. World Revolution and Family Patterns. New York: Free Press Glencoe; 1963.

Gubhaju BB, Moriki-Durand Y. Below-replacement fertility in East and Southeast Asia: consequences and policy responses. J Popul Res 2003;20:1–18.

Hagewen KJ, Morgan SP. Intended and ideal family size in the United States, 1970–2002. Popul Dev Rev 2005;31(3):507–27. [PubMed: 20376334]

Hammel EA. A theory of culture for demography. Popul Dev Rev 1990;16:455–85.

Hirschman C. Why fertility changes. Annu Rev Sociol 1994;20:203–33. [PubMed: 12318868]

Hobcraft, J. Moving beyond elaborate description: towards understanding choices about parenthood. In: Macura, M.; Beets, G., editors. Dynamics of Fertility and Partnership in Europe: Insights and Lessons from Comparative Research. New York: UN; 2002. p. 13-16.

Hobcraft, J.; Kiernan, K. EAPS/IUSSP Proc Eur Popul Conf. Milan: Franco Agnelli; 1995. Becoming a parent in Europe; p. 27-65.

Hrdy, SB. Mother Nature: A History of Mothers, Infants and Natural Selection. New York: Pantheon; 1999.

Johnson-Hanks, J.; Bachrach, C.; Kohler, HP.; Morgan, SP. Structure, Events, and the American Family. Mimeo. 2005. http://www.soc.duke.edu/~efc/publications.php

Keyfitz, N.; Flieger, W. World Population: An Analysis of Vital Data. Chicago: Univ. Chicago Press; 1968.

Kohler, HP. Fertility and Social Interaction: An Economic Perspective. Oxford: Oxford Univ. Press; 2001.

Kohler HP, Billari FC, Ortega JA. The emergence of lowest-low fertility in Europe during the 1990s. Popul Dev Rev 2002;28:641–80.

Kohler HP, Kohler I. Fertility decline in Russia in the early and mid-1990s: the role of economic uncertainty and labor market crises. Eur J Popul 2002;18:233–62.

Kohler HP, Philipov D. Variance effects in the Bongaarts-Feeney formula. Demography 2001;38:1–16. [PubMed: 11227839]

Kravdal O. The emergence of a positive relation between education and third birth rates in Norway with supportive evidence from the United States. Popul Stud 1992;46:459–75.

Kreyenfeld M. Crisis or adaptation—reconsidered: a comparison of East and West German fertility patterns in the first six years after the 'Wende'. Eur J Popul 2003;19:303–29.

Lesthaeghe, R.; van de Kaa, DJ. Twee demografische transities? (Two Demographic Transitions?). In: van de Kaa, DJ.; Lesthaeghe, R., editors. Bevolking: groei en krimp (Population: Growth and Decline). Deventer: Van Loghum Slaterus; 1986. p. 9-24.

Lesthaeghe R, Willems P. Is low fertility a temporary phenomenon in the European Union? Popul Dev Rev 1999;25:211–28.

Lieberson, S. Making It Count. Berkeley: Univ. Calif. Press; 1985.

Lieberson S, Lynn F. Barking up the wrong branch: scientific alternatives to the current model of sociological science. Annu Rev Sociol 2002;28:1–19.

Lino, M. Misc. Publ. No. 1528-2003. USDA, Cent Nutr Policy Promot; Alexandria, VA: 2004. Expenditures on children by families, 2003. http://www.cnpp.usda.gov/Crc/crc2003.pdf

Livi-Bacci, M. The Population of Europe (The Making of Europe). London: Blackwell; 1999.

Mason KO. Explaining fertility transitions. Demography 1997;34:443–54. [PubMed: 9545624]

Mason KO, Kuhlthau K. The perceived impact of child care costs on women's labor supply and fertility. Demography 1992;29:523–43. [PubMed: 1483540]

McDonald P. Gender equity in theories of fertility transition. Popul Dev Rev 2000;26:427–39.

McDonald P. Sustaining fertility through public policy: the range of options. Population 2002;57:417–46.

Menken J. Age and fertility: How late can you wait? Demography 1985;22:469–83. [PubMed: 4076479]

Mincer J. Inter-country comparisons of labor force trends and of related developments: an overview. J Labor Econ 1985;3:S1–32. [PubMed: 12267645]

Montgomery M, Casterline J. Social influence, social learning and new models of fertility. Popul Dev Rev 1996;22(Suppl):151–75.

Morgan SP. Is low fertility a twenty-first-century demographic crisis? Demography 2003;40:589–603. [PubMed: 14686132]

Morgan, SP.; Hagewen, K. Is very low fertility inevitable in America? Insights and forecasts from an integrative model of fertility. In: Booth, A.; Crouter, AC., editors. Creating the Next Generation. Mahwah, NJ: Erlbaum; 2005. p. 3-28.

Morgan SP, Rindfuss RR. Reexamining the link of early childbearing to marriage and to subsequent fertility. Demography 1999;36:59–75. [PubMed: 10036593]

Natl. Res. Counc.. Offspring: Human Fertility Behavior in Biodemographic Perspective. Washington, DC: Natl Acad. Press; 2003.

Notestein, F. Population—the long view. In: Schultz, TW., editor. In Food for the World. Chicago: Univ. Chicago Press; 1945. p. 36-57.

Notestein, F. Proc 8th Int Conf Agric Econ. London: Oxford Univ. Press; 1953. Economic problems of population change; p. 13-31.

Philipov, D. Fertility in times of discontinuous societal change: the case of Central and Eastern Europe. Work. Pap. WP 2002-024. Max Planck Inst. Demogr. Res.; Rostock, Germany: 2002. http://www.demogr.mpg.de/papers/working/wp-2002-024.pdf

Pollard MS, Morgan SP. Emerging gender indifference: sex composition of children and the third birth. Am Sociol Rev 2002;67:600–13.

Popul. Ref. Bur. Transitions in world population. Popul Bull 2004;59:3–40.

Potts M. Sex and the birth rate: human biology, demographic change, and access to fertility-regulation methods. Popul Dev Rev 1997;23:1–39.

Prachuabmoh V, Mithranon P. Below-replacement fertility in Thailand and its policy implications. J Popul Res 2003;20:35–50.

Preston, SH.; Heuveline, P.; Guillot, M. Demography: Measuring and Modeling Population Processes. Malden, MA: Blackwell; 2001.

Quesnel-Vallée A, Morgan SP. Missing the target? Correspondence of fertility intentions and behavior in the U.S. Popul Res Policy Rev 2003;22:497–525.

Rindfuss RR, Brewster KL. Childrearing and fertility. Popul Dev Rev 1996;22(Suppl):258–89.

Rindfuss RR, Guzzo KB, Morgan SP. The changing institutional context of low fertility. Popul Res Policy Rev 2003;22:411–38.

Rindfuss, RR.; Morgan, SP.; Swicegood, CG. First Births in America. Berkeley: Univ. Calif. Press; 1988.

Ryder, NB. Components of temporal variations in American fertility. In: Hiorns, RW., editor. Demographic Patterns in Developed Societies. London: Taylor & Francis; 1980. p. 15-54.

Sewell WH. A theory of structure: duality, agency, and transformation. Am J Sociol 1992;98:1–29.

Sewell, WH. Logics of History. Chicago: Univ. Chicago Press; 2005.

Sobotka T. Is lowest-low fertility in Europe explained by the postponement of childbearing? Popul Dev Rev 2004;30:195–220.

Sobotka T, Zeman K, Kantorova K. Demographic shifts in the Czech Republic after 1989: a second demographic transition view. Eur J Popul 2003;19:249–77.

Stark L, Kohler HP. The debate over low fertility in the popular press: a cross-national comparison, 1998–1999. Popul Res Policy Rev 2002;21:535–74.

Teitelbaum, MS.; Winter, JM. The Fear of Population Decline. Orlando, FL: Academic; 1985.

Thompson WS. Population. Am J Sociol 1929;34:959–75.

Thornton, A. Reading History Sideways. Chicago: Univ. Chicago Press; 2005.

UN Popul. Div.. Below-Replacement Fertility Expected in 75 Percent of Developing Countries. New York: UN; 2003. http://www.un.org/News/Press/docs/2003/pop850.doc.htm

UN Popul. Div.. World Fertility Report: 2003. New York: UN; 2004a. http://www.un.org/esa/population/publications/worldfertility/World_Fertility_Report.htm

UN Popul. Div.. World Population Policies 2003. New York: UN; 2004b.

UN Popul. Div.. World Population Prospects: The 2004 Revision. New York: UN; 2005. http://esa.un.org/unpp

van de Kaa DJ. Europe's second demographic transition. Popul Bull 1987;42:1–57. [PubMed: 12268395]

van de Kaa, DJ. Second demographic transition. In: Demeny, P.; McNicoll, G., editors. Encyclopedia of Population. New York: Macmillan; 2003. p. 872-75.

Ventura SJ, Hamilton BE, Sutton PD. Revised birth and fertility rates for the United States, 2000 and 2001. Natl Vital Stat Rep 2003;51(4):1–18.

Weller RH. Wife's employment and cumulative family size in the United States, 1970 and 1960. Demography 1977;14:43–65. [PubMed: 836442]

Willis RJ. A new approach to the economic theory of fertility behavior. J Polit Econ 1973;81:S14–64.

Wilson, C. Implications of global demographic convergence for fertility theory. Presented at IUSSP Work. Group Low Fertil. Conf. Int. Perspect. Low Fertil.; Tokyo, Japan. March 21-23; 2001.

Wilson C. Fertility below replacement level. Science 2004;304:207–8. [PubMed: 15073356]

Witte JC, Wagner GG. Declining fertility in East Germany after unification: a demographic response to socioeconomic change. Popul Dev Rev 1995;21:387–97.

Yap MT. Fertility and population policy: the Singapore experience. J Popul Soc Secur 2003;1(Suppl): 643–58.

Yi Z. Is fertility in China in 1991–92 far below replacement level? Popul Stud 1996;50:27–34.

Yi Z, Land KC. Adjusting period tempo changes with an extension of Ryder's basic translation equation. Demography 2002;39:269–85. [PubMed: 12048952]

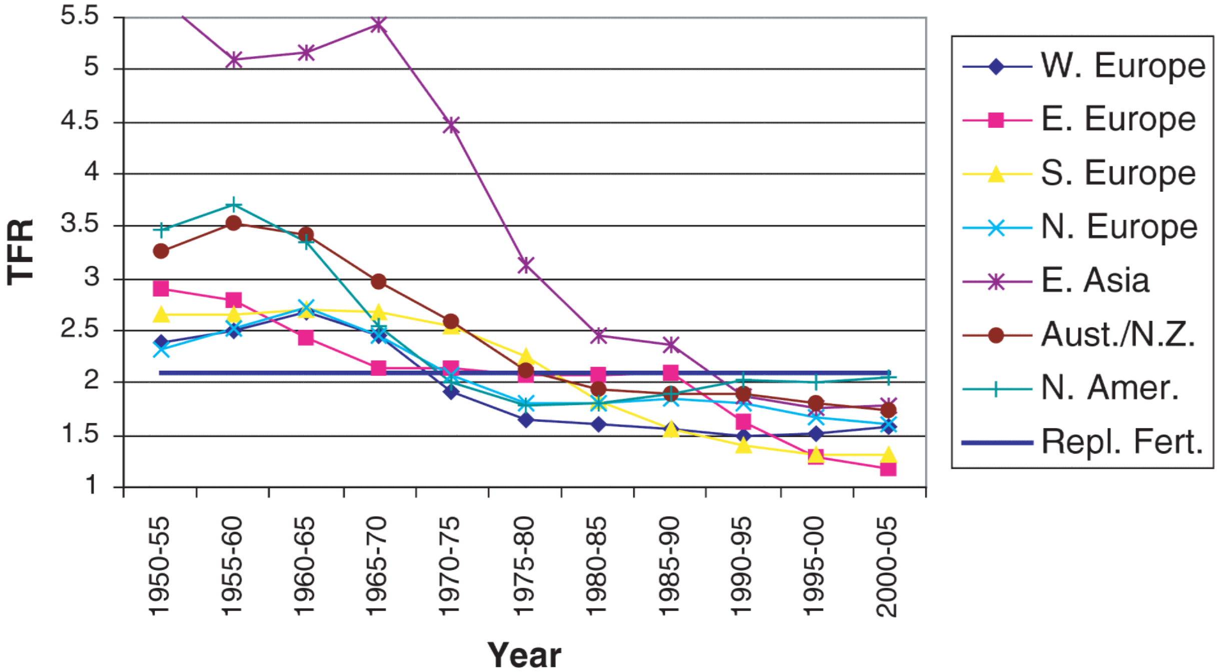

Figure 1.
Regional fertility (TFR), 1950–2005.

TABLE 1

Variation in low total fertility rates

Country	TFR 2000–2005[a]	Implied growth rate[c]	Implied years to halve[d]	Period when TFR fell below 2.1[a]	Years TRF<2.1[e]
Europe					
Germany	1.32	−1.5%	46	1970–1975	30
France	1.87	−0.4	196	1975–1980	25
Russian Federation	1.33	−1.6	43	1965–1970	35
Spain	1.27	−1.6	42	1980–1985	20
Italy	1.28	−1.6	42	1975–1908	25
Greece	1.25	−1.7	41	1980–1985	20
Sweden	1.64	−0.8	88	1970–1975	30
Asia					
China	1.70	−0.9	75	1990–1995	10
Japan	1.33	−1.5	46	1955–1960	45
Australia/New Zealand					
Australia	1.75	−0.6	119	1975–1980	25
North America					
United States	2.04	−0.1	1025	1970–1975	25
United States: white non-Hispanic	1.84[b]	−0.4	196	N/A	N/A

[a]Source: UN Population Division (2005).

[b]U.S. data for 2001 from Ventura et al. (2003).

[c]Source: UN Population Division (2005). Calculated from net reproduction rate (NRR). Mean age at childbearing set at 30 for all countries.

[d]Time to halve = ln(2)/growth rate.

[e]Calculated from beginning of period TFR fell below 2.1 to 2000.

TABLE 2

Typology of low fertility theories/schemas with illustrative examples

	Scope		
	Global	**Interactive**	**Idiosyncratic**
Content			
Economic change	Notestein 1945, 1953 Davis 1937 Caldwell & Schindlmayr 2003	Caldwell 2001	Sobotka et al. 2003 Kreyenfeld 2003 Witte & Wagner 1995
Ideological change	Lesthaeghe & van de Kaa 1986 Thornton 2005		
Institutional		Esping-Andersen 1999 McDonald 2000 Rindfuss et al. 2003	Morgan 2003
Technological change	Potts 1997	Galor & Weil 1996, 2000	Goldin & Katz 2000
Synthetic/path dependent	Goode 1963 Bumpass 1990 Mason 1997		Ginsborg 2003 Atoh 2001 Prachuabmoh & Mithranon 2003