CHAPTER 8

Fertility

S. Philip Morgan and Kellie J. Hagewen

SUBSTANTIVE CONCERNS

Human fertility has attracted great attention over the past half-century.[1] In fact, the largest, coordinated social science research efforts in history (the World Fertility Surveys and Demographic Health Surveys) have had fertility as their focus. Motivation for this attention emanates from the important and wide-ranging consequences of fertility and fertility change. Fertility levels are key components of population change and have been, historically, the component most difficult to predict (Bongaarts and Bulatao 2000). Also, fertility levels alter cohort sizes that, in turn, impact a full set of age-graded institutions such as schools, the labor force, marriage, and social security. Finally, human fertility is strongly linked to "parenting" or social replacement, the process of socializing group members. Except perhaps for increasing longevity, no 20th-century change has impacted individual lives more than have fertility changes. Consider, for instance, the cascading consequences of declining fertility and the dramatic declines in the size of families, sibships and households, the number of close relatives, and the years spent as parents of small children.

Given the importance of fertility differences and trends and the effort devoted to their study, one should expect substantial scientific progress in this area of demography. Indeed, no social science subfield is more developed than fertility. Of course, not all

[1] Teachman and colleagues (1993) report in a 1993 article in *Demography*, the official journal of the Population Association of America, that of the 1,232 articles published in the journal between 1964 and 1991, by far the most common subject area was fertility and contraception, comprising 36% of all published articles.

answers are in hand and disputes exist. But highly useful analytic and theoretical frameworks have been developed, widely accepted methodologies for collecting and analyzing information have evolved, and significant knowledge has accumulated. We review this scientific progress in this chapter.

THEORETICAL ISSUES

We begin by distinguishing between analytic frameworks and causal/behavioral theories. Analytic frameworks are useful ways to organize data, and they capture structural aspects of the process. Fertility research has produced widely accepted and very useful analytic frameworks. However, these analytic frameworks are largely silent regarding the more distal social causes of fertility trends and group differences. There is much greater disagreement regarding the relative value of these more distal causal theories. We address analytic frameworks and causal theories in turn.

Analytic Frameworks

Two mutually informing analytic frameworks have been central to much recent fertility research: the *life course* and the *proximate determinants* frameworks. The biological nature of fertility determines the structure of each framework. In fact, both frameworks rest on very straightforward observations. The life course perspective adopts a sequential model because children tend to be born one at a time, not in lots (Namboodiri 1972: 198). Moreover, because women are biologically restricted to having children only between menarche and menopause, fertility may be considered as an irreversible, time-limited sequence.

This sequential structure can be used to decompose overall change into age and birth order (or parity) components (see Morgan 1996). Or it can be adopted to compare the fertility regimes of different groups. For instance, when do two groups behave differently and when do they behave similarly? This structure also makes explicit the fundamental life course principle that events and their circumstances at time t can influence behavior at time $t+1$. Most researchers now view fertility outcomes as resulting from a series of sequential decisions. For instance, permanent childlessness results most often from a series of decisions to postpone childbearing and not from firm decisions made early in life to remain childless (see Rindfuss, Morgan, and Swicegood 1988).

The proximate determinants paradigm provides a second organizing framework. It rests on the observation that the sequential biological process is influenced through only a few mechanisms, specifically, variables that influence sexual activity, the likelihood of conception, and the likelihood that conceptions result in live births (see Davis and Blake 1956). Bongaarts and Potter's (1978) operationalization of the proximate determinants demonstrates that most fertility variability between populations and over time can be accounted for by the following four determinants: (1) marriage and marital disruption (as indicators of the segments of the life cycle when women are sexually active), (2) postpartum infecundability (the period after a birth without ovulation; its length is determined primarily by the duration and intensity of breastfeeding), (3) use and effectiveness of contraception, and (4) induced abortion. Three other determinants are occasionally or potentially important: (5) the onset of permanent sterility, (6) natural fecundability (frequency of intercourse), and (7) spontaneous intrauterine mortality. However, they do not vary as much among populations as the first four.

The life course and proximate determinant frameworks together provide a crucial foundation for understanding the mechanisms that influence individual and aggregate fertility. Descriptive work using these frameworks identifies precisely "what needs to be explained." As an example, the most dynamic fertility component in the U.S. baby boom and bust was the timing of the first birth (Ryder 1980). This observation begs the question: What accounts for this changing timing of family formation? Likewise, if an observed fertility decline can be attributed, within the proximate determinants framework, to changes in marriage, then a very different explanation is required other than that the change is due to increasing contraceptive use. Overall, then, theories of fertility change and variability are incomplete if they do not specify where in the life course and through which proximate determinants the social, economic, and cultural factors operate.

Causal/Behavioral Theories

Fertility transitions are complete in many developed countries and are in progress in much of the rest of the world. The transition model has three stages: relatively high and stable fertility, followed by a period of fertility decline, and then followed by relatively low and stable fertility. This fertility transition is part of the demographic transition model that includes similar changes/stages in mortality (see chapter 10 in this *Handbook*). The demographic transition theory, based heavily on observed, historical changes in the West, linked fertility and mortality changes to social, economic, and family changes caused by industrialization and urbanization (Notestein 1953). Given a very long time frame, all economic transitions (from rural/agrarian to urban/industrial) have been accompanied by fertility declines. But demographic transition theory has not performed as well in accounting for the timing of fertility decline. This poor fit of data to theory has led to a number of revisions, extensions, and elaborations of demographic transition theory.

Specifically, substantive behavioral explanations for fertility transition focus on at least one of three elements: the nature of fertility decisions, the information and knowledge available to decision makers, and the institutional context for decision making. We first consider high fertility in pre industrial settings. Widespread evidence indicates that the high fertility of many populations coincided with a "natural fertility" regime, one in which potential decision makers did not limit their number of births via changed behavior at higher parities (Henry 1961). There are three possible reasons: (1) decision makers were motivated to have as many children as possible, (2) decision makers did not know how to limit fertility, or (3) fertility control was not licit. Important behavioral theories focus on each alternative.

The first alternative is consistent with micro economic models of choice that stressed the economic value of children. Children provide substantial labor in preindustrial settings and have relatively low direct and opportunity costs. One version of the argument for the rationality of high fertility is found in Caldwell's (1982) work. Caldwell argued that preindustrial patriarchal family structure (an institutional context) allowed older individuals and males to appropriate wealth from younger and female family members. This positive "wealth flow" from children toward the senior generation motivated higher fertility. High fertility, in turn, produced greater wealth, power, and prestige for patriarchs. According to this and other arguments stressing the economic value of children, fertility was high in preindustrial contexts because children were net assets.

Empirical evidence regarding the economic value of children in preindustrial contexts is mixed. Children clearly performed substantial work, but their rearing and support also required substantial investment. The current consensus is that children were not universally perceived as net economic assets in preindustrial settings.[2] These mixed results on the economic cost of children shifted attention to children's roles as adults in supporting their parents. In many contexts older persons were dependent upon their children for support in old age. Prior to old age dependency, many relied upon children for support in case of crisis. A large literature has focused on the import of children in providing old age security and risk insurance (e.g., Cain 1983; Nugent 1985).

Finally, the cost-benefit analysis of high fertility focuses on noneconomic values of children. Across a range of institutional contexts, parents give reasons for having children, such as having a child to love and care for, having a sibling for a previously born child, having a son or a daughter, or bringing the family closer together (see Bulatao 1981).

Others have argued against individual cost-benefit calculations in many preindustrial contexts. van de Walle (1992), for instance, has claimed that many persons did not conceptualize family size as a key decision variable because factors determining it seemed beyond their ability or willingness to control. The vagaries of mortality or the social construction of morality pushed effective family size control beyond the reach of most.

Note that this argument does not mean that people had no knowledge of birth control. Rather it implies that they were not willing to use these mechanisms. In some settings knowledge of techniques may have been the limiting factor, while in others, limiting family size was beyond the "calculus of conscious choice." Proponents of these two positions have waged an intellectually engaging debate for over two decades. Evidence for both positions exists, and there is no reason to assume that a single answer is appropriate for all settings. For instance, evidence of infanticide in preindustrial China shows that under given institutional arrangements controlling family size and composition was of extreme importance. In addition, the extended family arranged marriage to control family size. Abstinence and abortion also have a long history in China (Lee and Feng 1999). In contrast, in Western Europe there was little evidence of family size control before the onset of fertility decline. Knodel and van de Walle (1979) have discussed the evidence in detail. For instance, they point out that nonmarital and marital childbearing declined in tandem. While one might argue that the desire to limit marital fertility was absent prior to the onset of decline, the European historical context included strong negative sanctions for nonmarital childbearing. Thus, incentives to avoid nonmarital childbearing clearly existed prior to the onset of fertility decline. Indeed, the nearly simultaneous decline of marital and nonmarital fertility suggests that knowledge of birth control means, not motivation, was the missing ingredient. As

[2] Evolutionary arguments point out that other mechanisms generally guaranteed a substantial supply of children (Potts 1997) and that exploitation of the younger generation is not a viable evolutionary strategy (Kaplan 1994).

further evidence, women in developing countries frequently report having more children than desired. This is prima facie evidence against the claim that families in preindustrial settings desired as many children as they could have (Shorter et al. 1971; Knodel and van de Walle 1979).

The fertility transition's second stage views family size declines as resulting from conscious actions by decision makers, specifically decisions to curtail childbearing at lower parities. Depending on their explanation for the preceding natural fertility regime, theorists point toward institutional change that transforms children from net assets to financial liabilities, or ones that provide new knowledge or changed norms that allow for family size control.

Caldwell (1982), for instance, points to schooling and nonfamilial employment opportunities that undermined the power and control of patriarchs and shifted the net flow of wealth toward children. Others have incorporated the importance of mortality decline. For instance, Easterlin and Crimmins's (1985) framework explicitly includes the possibility that declining infant and child mortality produced an increase in surviving children. For some decision makers, surviving children (the supply of children) now exceeded the desired number (the demand for children), producing a motivation for fertility control. In sum, a large body of work argues that rational decisions in changed contexts tended to lead to a new decision—to stop childbearing after a desired number was achieved.

For those arguments that stressed the lack of contraceptive knowledge or the presence of normative injunctions against using them, key factors in the decline were likely the spread of knowledge or new ideas legitimizing contraceptives or the small family size ideal. These ideas could have included broad, increasingly popular, anti-natalist ideologies of individualism and self-actualization. Such ideologies justified nonfamilial activities and aspirations (Lesthaeghe 1983). But the diffusing knowledge may have also included new information about techniques or the diffusion of the technologies themselves. The evidence suggesting a role for diffusion processes is powerful. For instance, the European Fertility Project (see Coale and Watkins 1986) characterized the geographical pattern of European fertility decline as a "contagion process." Geographical proximity and measures of interaction (e.g., shared language) were strong predictors of the timing of fertility decline. Likewise, reviews of evidence from developing country fertility surveys have shown patterns of change far too rapid to be attributed solely to decision-maker adjustment to changing objective, socioeconomic circumstances (Cleland and Wilson 1987).

Consistent with earlier adjudication between these positions, one need not choose one or the other as a universal answer (see Mason 1997). In an analysis that we believe best captures the contemporary demographic consensus, Bongaarts and Watkins' (1996) review of postwar fertility declines finds evidence that both structural change and diffusion processes are at work.

The third and final stage of the demographic transition is low fertility that approximates very low mortality. Such a balance is logically necessary; over the long run neither positive nor negative growth rates can continue. An emerging issue of both practical and intellectual import is the question of whether economically advanced societies will have fertility levels that even approximate replacement levels.

One position is nicely characterized by Bumpass (1990), who argues that the long-term factors that have reduced fertility "have not run their course." These factors include "structural" changes in the way we live and work that make children costly (in economic terms and in terms of foregone opportunities). Secular forces also include ideologies of self-actualization and individualism that could become even more powerful and pervasive antinatalist ideologies (see Lesthaeghe 1983; van de Kaa 2001).

As an example, many see increasing female labor force participation as a key structural, secular, antinatalist factor. The standard microlevel home economics approach posits that declining gender discrimination and greater access to the labor market increases the cost of having children. This increased cost results from women's exit from the labor force to bear and raise the children and the costs of labor force exit on career trajectories. This argument has led to the very widely held view that increased labor force participation by women would depress fertility rates. In the past, evidence for such an association was common at both the individual and aggregate levels.

More recent arguments, however, stress the importance of institutions in conditioning the effects of secular structural change (Rindfuss 1991, Rindfuss, Guzzo, and Morgan 2003). For instance, if one assumes that female labor force participation increases will continue, the question then becomes what societies using which institutions can make accommodations that allow women to more easily work and have children?

Perhaps the best evidence that societies vary on this dimension is the changing aggregate-level association between female labor force participation rates and the total fertility rate. Traditionally and according to most theories, this association should be negative; higher labor force participation is associated with lower fertility. But in low-fertility contexts, the opposite appears to be true (see Rindfuss and Brewster 1996; Rindfuss, Guzzo, and Morgan 2003). This cross-sectional association occurs because, in the past two decades, the association between labor force participation and fertility has varied dramatically by country. In the U.S., for instance, increases in labor force participation have not been accompanied by decreases in fertility. In Italy over the past two decades, for contrast, the association between labor force participation and fertility has been strongly negative (Rindfuss, Guzzo, and Morgan 2003). What aspects of context weaken the incompatibility of work and family obligations? Many point to available, high-quality day care, flexible work environments (flex time and parental leaves, for example), and more egalitarian gender roles that provide women with a domestic helpmate and a reduced "second shift." In sum, this second view holds that fertility levels are determined by adjustments in the institutions of family, economy, and public policy (for different conceptualizations of these adjustments see Esping-Anderson 1999; McDonald 2000). Thus, the future of fertility depends upon societal adjustments that ease work-family conflicts. Some countries will make or have made such adjustments, while others have not and may not (see Morgan and King 2001).

The above review underemphasizes several important issues. First, our review has largely ignored the larger social context in which the debate about fertility occurred. The politics of the Cold War period, concerns about a global "population explosion," and the feminist movement all provided an urgency and brought resources and attention to the study of fertility transitions. This political context helped define high fertility as a social problem of the highest order and thus motivated action at many levels (see Hodgson 1988; Hodgson and Watkins 1997). Two levels of action were by governments and by nongovernmental organizations, both of which organized and funded family planning programs. These programs clearly sped fertility declines in many countries. A second theme underemphasized here is linked to theories drawn from closely observed local experiences (e.g., Watkins 2000; Kertzer and Fricke 1997). Known as "thick description,'' these theories provide details of change specific to certain locales and resonate more closely with the experiences of the respondents. Such a focus is missed by the broad review just presented.

METHODS AND MEASURES

A mature science has reached agreement on definitions of key concepts, measurement strategies, and appropriate analysis procedures. Fertility research is clearly institutionalized in each of these domains. Fertility's success as a scientific area of study rests on fortuitous features of the phenomenon itself, the broader interest in fertility (for administrative and other reasons) that have encouraged data collections and standardization of measurement strategies, and an immense amount of research attention on a decadal time scale.

Fertility shares with the study of mortality fortuitous features of the study phenomenon. Births and deaths, the core events in demography, focus on observable events that are relatively easily measured, naturally quantifiable, highly structured, and can be easily incorporated into accounting frameworks or represented by descriptive demographic models (Morgan and Lynch 2001). In any science, conceptual clarity and intersubjective agreement across observers are essential for good measurement. Births are biologically based and are thus fixed in a universally accepted truth. Another important characteristic of births is that they are categorical by nature and thus inherently quantifiable, making measurement reliability attainable. The actual occurrence of a birth is universally recognized, although the actual meaning and consequences of a birth may be socially constructed. Therefore, valid cross-national and cross-temporal measurement of fertility is feasible. This is not to say that fertility measurement is easy or error free. But the inherent features of fertility provide a leverage for good measurement that is not found for many other concepts (Morgan and Lynch 2001).

The interest in fertility data for administrative purposes aids fertility measurement, increases data availability, and improves data quality. The importance of fertility data for administrative purposes has led to wide-scale collection. The usefulness of comparable fertility data across administrative units encourages the codification of definitions and standardization of measurement procedures.

While births are the event to be measured, the concept of an event/exposure rate is fundamental to all demographic measurement. The additional key concept needed for rate calculation is the *population at risk* or *person-years* of exposure. The essential measurement task is to estimate the risk of a specific event (e.g., a birth, a first birth, a nonmarital birth). The accepted strategy utilizes a ratio of a count of events (births to a specified group) to an estimate of the *person-years* exposed to the risk of an event in a given time period (Preston, Heuveline, and Guillot 2001). In the year 2000, for instance, a woman who survives the full year contributes a full year at risk of a birth and thus adds one to the denominator of a year 2000 birth rate. There is a range of strategies for estimating years at risk (Preston, Heuveline, and Guillot 2001).

Once rates have been estimated, how does one conceptualize social change? In general, birth rates can be examined by alternative dimensions of time: period or cohort. Period fertility measures look at fertility cross-sectionally, or births/exposure occurring at one period in time (usually across a set of age categories). Cohort analysis, conversely, follows a group longitudinally or over a women's reproductive history, again across age. Data for calculating period measures are more widely available, they have useful and interpretable meanings and, consequently, they are more frequently used (Newell 1988).

The two most commonly used period measures of fertility are age-specific fertility rates (ASFR) and the total fertility rate (TFR). When calculating age-specific fertility rates, the numerator is restricted to births occurring to women of a specified age interval, and the denominator is restricted to the number of person-years lived by women in the age interval (see Preston, Heuveline, and Guillot 2001). The teenage (age 15 to 19) birth rate is an age-specific birth rate, as is the rate for women aged 35 to 39.

The total fertility rate (TFR) is the most frequently used indicator of period fertility; it is the simple sum of the ASFRs across the childbearing years. Thus, the TFR is an age-standardized, single-value, summary measure of fertility. The TFR has a powerful yet easily understood interpretation. Specifically, the TFR is the number of children a woman would bear if she experienced, at each age, the current period age-specific fertility rates (and she survived to the end of her reproductive cycle). In the absence of mortality, a TFR of 2.0 would equal replacement level fertility. This means that the women are having enough births to replace themselves and their male partner. Other measures estimate replacement-level fertility in the presence of mortality (see Preston et al. 2001). Table 8.1 presents estimates of the highest and lowest TFRs for countries in 2002.

The TFR can be calculated from cohort data, that is, age-specific rates for an actual cohort. This measure (sometimes called children ever born) can be interpreted as the mean number of children produced by a birth cohort.

Data for fertility rate estimation come from several sources. Vital registration systems, if birth certificates are filed for all births, can provide an accurate count of births. One can then use various demographic procedures to estimate the denominator of desired rates, usually from census data projected forward or backward to correspond to the year in question. For instance, since birth certificates usually include the age of the mother, one can get a count of births to 20-year-old women. The census estimate of the midyear, 20-year-old, female population provides a commonly used estimate of years at risk, which is the denominator of the rate.

Frequently censuses contain data that can be used to measure fertility. Many censuses include the number of children ever born (a cohort measure of fertility). Also, since censuses generally include a household roster, one can count a woman's number of surviving children in the household. Strategies exist for estimating fertility from this count of *own children*. Specifically, one makes a set of adjustments to the count

Table 8.1. Selected High and Low TFRs from Around the World, 2002.

Country	TFR	Country	TFR
Niger	8.00	Spain	1.16
Somalia	7.25	Italy	1.20
Angola	7.20	Greece	1.30
Uganda	7.10	Germany	1.33
Yemen	7.10	Austria	1.36
Mali	7.00	Portugal	1.46

Source: United Nations Population Division, 2002.

of coresiding children (e.g., one estimates and includes the own children that did not survive to the census date and those not living with their mother at the time of the census (see Rindfuss and Sweet 1977). This clever strategy, known as *own children analysis*, can be used in some but not all settings.

Finally, surveys can ask about *retrospective fertility history*. That is, a respondent is asked to recall all her births and their dates. If her own age is reported correctly and if all birth dates are accurate, then accurate ASFR fertility rates for surviving women can be calculated. Specifically, one can for *x* years prior to the survey count births in year *t-x* and years of exposure in year *t-x* for women in the sample of a given age.

The survey strategy also allows for additional fertility-relevant information to be collected, resulting in estimates of fertility in the absence of high-quality vital registration and censuses. This methodology was used in the World Fertility Surveys and the Demographic Health Surveys carried out in many developing countries over the past three decades.

So far our discussion has been limited to measures of actual fertility, where measurement properties are strong. There are many other variables used in the study of fertility, each of which bring measurement challenges. These variables are fertility intentions or desires, measures of contraceptive use, coital frequency, marriage/union status, and breast-feeding. We only comment here on fertility intentions or desires. (See Chapter 3, "Marriage and Family," for a discussion of the measurement of marital/union status.)

Virtually all contemporary populations, and presumably all future ones, will consist primarily of persons or couples that strategize about family size. Clearly, declining family size preferences constitute a primary cause of fertility transitions and will influence post transition fertility levels. In societies undergoing fertility transitions, observed fertility frequently exceeds stated preferences; in post transition countries of the 1990s the opposite was true (Bongaarts 2001). The study of emerging and changing family size preferences and their relation to behavior provides clues to the nature of fertility decision making and the causes of fertility trends and differentials.

Commonly used prospective questions are the following: Do you *intend* to have a (or another) child? And, if yes, How many more children do you intend to have? These questions raise two fundamental issues. The first is whether fertility intentions or, alternatively, fertility *expectations* or *desires*, should be of paramount, substantive interest. Intentions reflect the respondent's goals (what the respondent plans to do) and, as such, should be strongly linked to subsequent behavior in environments where fertility is controlled. In contrast, expectations invite (sometimes explicitly, but often implicitly) a consideration of impediments that might interfere with one's intentions (such as contraceptive failure or subfecundity) and produce an underestimate or overestimate (respectively) of future fertility. Fertility desires require an even more hypothetical exercise that is linked closely to the concept of *demand for children* (which is the number of children one would intend if there were no subjective or economic costs to fertility control).

Some empirical evidence indicates that many respondents do not detect the differences between these terms *or* are unable/unwilling to perform the implied conceptual tasks that distinguish them (Ryder and Westoff 1971). Further, the demographic literature frequently refers to these questions as family size preferences and ignores the distinctions noted above.

The second issue raised by this pair of questions is whether prospective intentions are best represented as a *fixed target* or as a *set of sequential decisions*. We have stressed earlier the importance of considering the inherent, sequential nature of fertility decisions. But prior to the 1960s, fertility intentions were mainly measured according to an alternative, the fixed-target model. This model posits that individuals or couples "formulate a desired completed family size and pursue this relative constant target throughout their reproductive life" (Lee 1980: 205). The fixed-target model, combined with reports of children already born, allowed the operationalization of *intended parity*. Specifically, intended parity is the sum of births to date and reported intended additional births. Mean intended parity for cohorts was frequently used to anticipate future fertility trends. The accuracy of forecasts based on intended parity depends on the predictive validity of reproductive intentions. This will be discussed in more detail later in this chapter.

Note that the first question above (Do you intend to have a/another child?) is a direct measure of sequential decisions that women or couples actually make and thus should be closely linked to fertility behavior. In fact, this indicator is highly predictive of subsequent fertility, especially if a time referent is included (explicitly asking do you intend to have a child in the next three years, three to five years, longer than five years, or intend no children). This variable is frequently used in analyses of factors influencing fertility decisions.

Respondents can also be asked about their intentions vis-à-vis births that they have had in the past. Demographers have developed a standard procedure and terminology for identifying *wanted* and *unwanted births*. Specifically, respondents are asked to recollect their fertility intention *at the time of each pregnancy*: 'At the time you became pregnant did you: (1) want to become pregnant at that time, (2) want to have children in the future, but not now, or (3) not want any additional children?' The first two responses are coded as *wanted* (although the second is termed a *timing failure*), and the third category as *unwanted*. For women who have completed childbearing, wanted fertility reflects their family size preferences and unwanted fertility a component that could have been avoided by effective birth control. Evidence clearly shows that the unwanted component of fertility declines as effective contraception and abortion become widely available.

EMPIRICAL FINDINGS

The fertility literature is huge. We will introduce it by identifying 10 major "social facts," i.e., empirical regularities from this literature.

1. Fertility in populations not using contraception and abortion varies substantially.
2. The timing of the onset of fertility transition (vis-à-vis objective socioeconomic conditions) is highly variable.
3. Existing institutions influence the fertility transition, thus the process of change varies from place to place and has historical continuity.
4. The fertility transition involves a collective evaluative assessment of social conditions and possible responses.
5. Once the fertility transition begins, it does not stop until fertility reaches levels of approximately two children or lower.

6. Fertility change is a period, not a cohort, phenomenon.
7. Fertility delay is fundamentally antinatalist.
8. Valid and reliable retrospective fertility histories can be collected from women in a broad range of settings. Reliable information on abortion cannot generally be obtained from respondents.
9. Long-range fertility intentions (individual or aggregate) have low predictive validity (at both the individual and aggregate level).
10. The fertility desires/intentions of men and women (and husbands and wives) are similar; and the impacts of their intentions/desires on subsequent fertility are similar.

We now discuss these in greater detail. These statements are not immutable "facts," but rather they reflect current, accepted wisdom.

1. In populations not using contraception and abortion, fertility varies substantially.

As noted earlier, *natural fertility* results if there are no attempts to control family size. In practice, however, natural fertility is frequently operationalized as involving no contraception or abortion (Henry 1961). Fertility is high in natural fertility populations—but how high? Females can have children as early as the midteens and can continue until the late 40s. Theoretically, women could have nearly one birth per year. Thus the theoretical maximum fertility, in the absence of all behavioral constraints, could be as high as 35 births!

In fact, no population has averaged anywhere close to this theoretical maximum level of fertility. Instead the classic example of a high-fertility population, the Hutterites, has fertility one-third this high. From 1880 to 1950, the U.S./–Canadian Hutterite population increased from 443 to 8,542 persons (Eaton and Mayer 1953). This is the world's fastest known natural growth rate (4.21% annually), with families averaging around 10 to 12 children (Ingoldsby 2001).

On the other end of the natural fertility spectrum lie the Dobe !Kung hunter-gathers, residents of the Kalahari Desert in Africa prior to 1975 (Howell 1979, 2000). The reported TFR for this natural fertility population was about 4.5 births per woman. Thus, the question, "How can natural fertility populations be so different from each other, and why are even the highest observed rates much lower than the theoretical maximum?"

The answer to both questions relies heavily on the *proximate determinants framework* described earlier. All known societies have encouraged practices that, through biological mechanisms, reduce fertility well below maximum levels. Key features are norms about union formation and dissolution (specifically, marriage) that impact coital frequency and the risk of pregnancy. Late marriage (indicating the postponement of sexual intercourse) reduces the years available for childbearing and thus the number of births.

The second important determinant of these differences in fertility is breast-feeding and postpartum amenorrhea (Bongaarts and Potter 1983). It is now well established that breast-feeding leads to a substantially longer postpartum period without ovulation than the typical 1.5- to 2-month interval that is experienced by women who do not breast-feed (Léridon 1977). Also, the intensity of breast-feeding affects the likelihood of ovulation. Women who exclusively breast-feed their children have a significantly lower chance of ovulating than do women who supplement breast-feeding with other food.

The !Kung typically breast-feed for three years and Hutterite women, for less than half this period.

In short, the Hutterite–Dobe !Kung natural fertility differential can be traced to greater time spent out of sexual unions (especially due to separation and union dissolution) and especially a much longer and more intense period of breast-feeding among the !Kung. In general, differences in natural fertility can be accounted for by these same two proximate determinants (see Bongaarts and Potter 1978, 1983).

2. *The timing of the onset of the fertility transition (vis-à-vis objective socioeconomic conditions) is highly variable.*

Demographic transition theory attributes fertility (and mortality) change to the process of economic development, especially the transition from a rural agrarian society to an urban industrial one. This leaves unanswered the question of what part of this process was most crucial for fertility decline. Was it changed occupations, urban living, or increased educational attainment that produced fertility decline? Further, what level of change in these aspects of economic development or its correlates was necessary to initiate a fertility decline?

The current consensus is that this view is overly mechanistic. There are no "threshold levels" of these macroeconomic indicators that consistently predict the onset of the transition. Likewise, there are no identifiable macrolevel changes that consistently predict the speed of the transition. Some argue that these findings must be interpreted cautiously, and one should not imply that economic development plays no causal role. Specifically, if multiple causes of decline are acknowledged, and if one views industrialization and urbanization as fundamental but distal causes (that need not produce synchronous change), then the role of economic development would receive greater support (Mason 1997).

3. *Existing institutions influence the fertility transition, thus the process of change varies from place to place and has historical continuity.*

Some of the reasons for the "loose" connections between socioeconomic change and fertility lie in preexisting differences in cultures and social institutions. For example, Greenhalgh (1988) argues that Chinese populations were among the first to experience fertility decline compared to others at similar levels of development. She attributes this to a historical and institutional context that made the number and sex composition of children a focal point of family strategy. In short, the Chinese populations began with a historical legacy that legitimated family size control and linked mobility strategies to number of children. Chinese groups quickly adopted modern contraception as a modern technology consistent with more costly traditional ones (including infanticide). In the Chinese context, the adoption of contraception was for limiting family size (specifically adopted by older women at higher parities).

In contrast, traditional African fertility regimes have been more concerned with a wide spacing of births as opposed to their number (Caldwell, Orubuloye, and Caldwell 1992). The link between limiting the number of children and upward social mobility was less apparent in these contexts. Institutions such as child fosterage may have played a role by spreading the costs of children across families, reducing the immediate impacts of rising child costs. Thus, the adoption of contraception was attractive as a substitute for postpartum abstinence and with the ideas that healthy children were produced by wide spacing (that could be aided by contraceptive use). As a result, the initial adoption of contraception in Africa tended to be simultaneous across ages and parities.

In short, Chinese and African family traditions influenced the speed and nature of their fertility transition. Chinese institutions hastened the transition (by its traditional emphasis on the size and composition of families and its use of postnatal control, explicitly, infanticide). African extended family and lineage institutions retarded change. The nature of the transition was also influenced. In Chinese populations fertility decline fell almost entirely due to contraceptive use after the desired number and composition of children were born. In Africa, fertility fell because of the wider spacing of births and birth limitation.

4. The fertility transition involves a collective evaluative assessment of social conditions and possible responses.

In a recent attempt to explain contemporary fertility transitions, Bongaarts and Watkins (1996) replicated the claim (discussed in 2, above) of a modest relationship between development indicators and changes in fertility. However, they argue that the diffusion of information about birth control techniques and ideas that legitimate small family size are important determinants of the timing of fertility change. This idea was central in the reports from the European Fertility Project (see Coale and Watkins 1986). Once a region of a country began a fertility transition, neighboring regions that shared a common language experienced a fertility decline shortly thereafter, regardless of the region's level of development. In this spirit, Bongaarts and Watkins (1996) conclude that social interaction in the form of exchanging information and ideas, evaluating their meaning in a given context, and social influences that encourage or discourage certain behaviors are significant factors in the transition from high to low fertility. Their measures of societal contact added significant explanatory power to their model of fertility transition. Watkins' work in contemporary African settings (e.g., Watkins 2000) describes at a microlevel how women's conversations helped to construct an understanding that fertility control was safe, appropriate, and advantageous.

5. Once the fertility transition begins, it does not stop until fertility reaches levels of approximately two children.

A well-known finding from the European Fertility Project is that once a 10% decline in fertility occurred (for any province), an irreversible transition was underway (Coale and Watkins 1986). Data in the Bongaats and Watkins study (1986) also show remarkably steady tendencies toward decline once the process is underway. Table 8.2 shows a cross-sectional, global view of the transition as of 2000. Of the 187 countries for which the UN provides data, only 19 have not yet shown evidence of fertility decline. These countries are primarily in Africa and include over 20% of the population of Africa. Thirty-two countries, again primarily in Africa, have recently begun a decline and another 73 are well into the transition. For practically all these countries, the lowest fertility observed is the most recent estimate, clearly indicating a steady march toward replacement level (or lower) fertility. Twenty-three countries, over half of the Asian countries, have TFRs that have fallen below 2.1 in the last decade or so. Coupled with the 39 countries that reached low fertility several decades ago (and experienced a post–World War II increase and then decline), these data indicate that by 2000 over 45% of the world's population lived in a country with replacement level fertility or below. Note that only two countries have experienced the transition to low fertility and have stabilized at levels above replacement (Argentina and Uruguay have levels that have remained close to 3.0 for the 1950 to 1980 period).

6. *Fertility change is a period, not a cohort, phenomenon.*

Earlier we noted that changing fertility rates can be described as occurring by cohort replacement or by pervasive period change. Ryder (1965) developed a paradigm of social change based on the concept of cohort replacement. The cohort perspective posits that trajectories of experience are frequently set by events early in life and are resistant to change subsequently. Cohort explanations stress the unique experience of a specified birth cohort (see Ryder 1965; Cherlin 1992). Change by cohort replacement comes slowly and steadily over time as new cohorts, in an orderly way, replace older ones.

Period explanations, on the other hand, emphasize the idea that shifts in fertility seem to affect all age groups at the same time. For example, shifts and changes in family attitudes and values may broadly impact nearly everyone's lives at once. Thus, the effects of these shifts are not unique to any one age group of people.

Twentieth-century U.S. fertility changes bear the unmistakable impact of period factors, including the Great Depression, wars, and economic cycles. Evidence from other developed countries is similar: changes in fertility are period driven, and cohort factors are weak or nonexistent (Ni Bhrolchain 1992).

7. *Fertility delay is fundamentally antinatalist.*

Although not invariant in magnitude, the timing of fertility is linked consistently to the number (or quantum) of births. This timing-number link can be seen for individual

TABLE 8.2. Stages of the Transition to Low Fertility in the Major Areas of the World by 2000.

Major Area and Region	NO Transition	Declining but TF>5	Declining with 5<TF<2.1	Declined to TF<=2.1	Early Transition 2.1<TF<3	Early Transition with "Baby Boom" TF<2.1	Total
				Number of countries			
Africa	15	21	16	1	0	0	53
Asia	1	10	25	12	0	0	50
Europe	0	0	1	3	0	35	39
Latin America/ Caribbean	0	0	24	7	2	0	33
North America	0	0	0	0	0	2	2
Oceania	0	1	7	0	0	2	10
World	16	32	73	23	2	39	187
		Percentage of People Living in Countries at Selected Stages of Transition					
Africa	20.7	43.2	36.0	0.1	0.0	0.0	100
Asia	0.5	6.3	49.6	39.9	0.0	3.6	100
Europe	0.0	0.0	0.4	0.9	0.0	98.7	100
Latin America/ Caribbean	0.0	0.0	88.8	3.4	7.8	0.0	100
North America	0.0	0.0	0.0	0.0	0.0	100.0	100
Oceania	0.0	1.5	21.9	0.0	0.0	76.5	100
World	3.0	9.5	39.0	24.6	0.7	19.6	100

Source: United Nations Population Division, 2002 (Table 1.1 World population Prospects: The 2000 Revision, Volume III) http://www.un.org/esa/population/ publications/wup2001/WUP2001report.htm.

women and cumulates in completed cohort fertility. A different dynamic operates between timing and quantum in period rates. We discuss each in turn.

Women who bear children early have larger numbers of children ever born (Morgan and Rindfuss 1999; Kohler, Billari, and Ortega 2002). There are several reasons for this association, and if all are operative in a particular setting, their cumulative effect can be substantial. To explain, as noted earlier, fertility is a nonreversible and time-bounded process. Given a relatively fixed mean age at menopause, a later start leaves less room for subsequent birth intervals (regardless of their mean length). This fact explains the powerful influence of marriage/union formation as a proximate determinant of natural fertility. But this mechanism can remain active in controlled settings because of the chance of contraceptive failure. Given a fixed number of children and fixed birth intervals, an earlier birth implies longer periods of exposure to an unintended pregnancy following the last intended birth. In addition, fecundity declines with age so that postponement can lead to couples being unable to have all of the children they intend. Finally, there are two potentially powerful social mechanisms. The first is a selective mechanism: those who desire more children and place a high priority on children may be less likely to postpone childbearing and thus start having them earlier. The second is more substantively interesting and follows from the sequential decision-making approach outlined earlier. Postponement can bring experience that competes with childbearing and increases the chance of additional postponement. Additional postponement can, in time, become a decision to have no (or no more) children.

Within a period framework, fertility postponement (in year t) is also associated with lower fertility (in year t). This is true even if the cohorts contributing to period fertility rates eventually have equivalent levels of completed fertility. For simplicity, assume a constant cohort level of childbearing. Fertility delay, a later age pattern of childbearing, can be viewed as postponing births into the subsequent year. This postponement lowers the number of births in year t by delaying them into year $t+1$. Bongaarts and Feeney (1998) describe this process and show that the effects on period rates, including the widely used TFR, can be substantial and can operate for several decades. In fact, a major factor producing the very low contemporary TFR rates is a dramatic and continuing postponement of fertility.

8. *Valid and reliable retrospective fertility histories can be collected from women in a broad range of settings. Reliable information on abortion cannot generally be obtained from women.*

Women's fertility is revealed across a 30- to 35-year period of the life cycle. To collect information, one could collect data through an ongoing surveillance system. However, demographers have learned that in many settings retrospective fertility reports are of high quality and that trends constructed from these retrospective reports mirror those produced by vital registration systems or other data sources (e.g., Sirken and Sabagh 1968; Swicegood, Morgan, and Rindfuss 1984; Rindfuss, Morgan, and Offutt 1996: Figure 2). These retrospective histories have allowed for a wealth of cross-national data on fertility levels, trends, and differentials.

Fertility has many characteristics that make it an ideal event to be reported retrospectively: it is a discrete event that occurs at a clear point in time, births are usually positively sanctioned (increasing the respondent's willingness to report the event), recalling the exact date is often aided by celebrations (i.e., birthdays), and the event is recorded on administrative records (allowing verification).

Pregnancy histories, as opposed to birth histories, are much more problematic. First, in the case of an early-term spontaneous miscarriage, respondents may not recognize that they were pregnant. More problematic, in many contexts, pregnancies that end in abortions are underreported because of the stigma attached to abortions. In the U.S., for instance, only about one-half of abortions are reported in retrospective pregnancy histories (see Fu et al. 1998). In the U.S., more reliable data come from vital registration forms that doctors are required to fill out when performing an abortion and by surveys of abortion providers (see Henshaw 1998).

9. *Fertility intentions (individual or aggregate) are not reliable or valid indicators of future (individual or aggregate) fertility.*

As noted in an earlier discussion, a common question in fertility surveys asks women how many children they have now and how many more they intend to have. The sum of these is referred to as their *intended parity*. With longitudinal data one can ask how well these intentions predict subsequent fertility. Note that this question assumes a one-time decision model, instead of the sequential model favored in earlier discussions. Nevertheless, let us evaluate this model vis-à-vis accumulated evidence. One reason for such an exercise is to evaluate the one-time and sequential decision models.

Suppose that more distal social, economic, and psychological variables are linked to fertility only through fertility intentions. In other words, all relevant factors affect intentions directly, and intentions mediate these more distal effects. Indeed, numerous studies show that fertility intentions predict the subsequent behavior of individuals far better than do demographic and social indicators. However, evidence also clearly indicates a more complex process that produces a patterned inconsistency between intentions and behavior. Specifically, some groups (married women) are better than others (unmarried women) at predicting their future behavior. In other words, the link between intent and behavior can vary across groups (e.g., O'Connell and Rogers 1983; van de Giessen 1992). In addition, some subgroups and periods have higher fertility than others, net of intentions. That is to say, there is a direct effect of group membership and period that bypasses the proximate intention variable (Thomson 1997; Schoen et al. 1999). The fact that fertility differences or changes are not always foreshadowed by different or changed intentions challenges the usefulness of intention data for fertility forecasts (Campbell 1981). In explaining the failure of 1970 intended parity data to anticipate the fertility decline between 1970 and 1975, Westoff and Ryder (1977: 449) reasoned that "respondents failed to anticipate the extent to which the times would be unpropitious for childbearing, the same kind of forecasting error that demographers have often made." Thus, intentions and other preference measures can provide clues to future trends and differences, but they should not be expected to perform consistently as reliable and precise indicators of future individual or aggregate behavior. People can and do change their minds, as a sequential decision model suggests.

10. *The fertility desires/intentions of men and women (and husbands and wives) are similar; the impacts of their intentions/desires on subsequent fertility are similar.*

Social scientists have frequently speculated that the motivations for having children differed between men and women and that these differences made women (or men) more pronatalist. Mason and Taj (1987) have discussed these reasons, including the greater burden that women bear in pregnancy, birth, and childrearing (that might make women more willing to limit births than men) or the greater wealth and prestige that men might accrue through children (that might make men less willing to limit births than women). Mason and Taj's evidence shows, across a range of developing countries, that intended parity or desired family size varies little by gender. These results emphasize the social context that strongly and similarly influences the desires/intentions of both men and women. Results for couples show similar results in a number of Asian countries (see Mason and Smith 2000).

Results in developed countries are similar. Again the similarity could reflect the common conditions faced by husbands and wives. However, in the U.S. there is direct evidence that spouses know the fertility intentions and desires of their spouses and take them into account when stating their future intentions (Morgan 1985). Of course, not all spouses agree. Some evidence, again for U.S. couples, suggests that when spouses disagree, the wife's desire has somewhat greater predictive power than the husband's (Thomson, McDonald, and Bumpass 1990). But again, the primary findings are small gender differences in fertility intentions/desires and similar predictive validity of these intentions/desires.

RESEARCH DIRECTION

The scientific study of fertility is well advanced. We define an advanced science as one with agreed upon strategies of measurement and analysis, widely accepted frameworks for organization and interpretation of data, and widely accepted characterizations of phenomena that are "explained." In this chapter we have discussed each of these elements.

A logical way to conclude this discussion is to identify some important unanswered questions and to identify the ones most important to address in the next few decades.

For countries beginning or in the midst of the fertility transition, one is unsure whether to expect a more rapid or a slowed transition to low fertility. Studies of these transitions are key for refining our theories of fertility decline and because new phenomena could fundamentally alter the process. One argument holds that countries with currently high fertility are selected for their resistance to fertility decline. Perhaps they have pronatalist institutions that are especially resistant to change. Alternatively, reduced concern about population increase could reduce international aid, such as support for family planning programs, directed toward population concerns. This reduced aid could arrest ongoing fertility declines. Finally, new factors could alter the decision context making fertility control less acceptable (HIV/AIDS for instance). Or demographic differences could be politicized and linked to group identity and political disadvantage and thus perpetuated or exaggerated. Such a dynamic may account for Muslim–non-Muslim fertility differences in Asian countries with Muslim minority populations (see Morgan et al. 2002: 534). Such intergroup processes could emerge and operate at the international level, fueled by international events that foster pan-Islamic identity.

Other evidence suggests that recent declines have been more rapid than those begun in earlier decades, leading to the prediction that the pace of current and future declines will be the most rapid of all (Bongaarts and Bulatao 2000: 76–77). This expectation is linked to the importance of the diffusion of ideas and technology conducive to low fertility. The current globalization of trade, communication, and travel promotes these diffusion processes (Bongaarts and Watkins 1996).

Among low-fertility countries the key issue, as discussed earlier, is How low will fertility go? This question begs another (addressed by Morgan and King 2001): Why do couples have children in the 21st Century? Evidence that parenting is a powerful, life-defining event is widespread; most persons, men and women, desire and expect to have children. But substantial variation exists in intended family size, and we need to know more about the intensity of preference (Do persons strongly desire two or does a response of "two children intended" imply relative indifference in the one to three range?). The same question holds at the international level, where evidence suggests widespread mean desired family sizes of approximately two (Bongaarts 2001; 2002). More intensive study could reveal a general willingness in some countries to have fewer than this number. Such a finding may portend lower future fertility.

Nevertheless, the key contemporary question is: Can countries and will countries create environments where men and women can have the children they intend and also pursue careers and valued leisure activities? Or will competition among these valued life domains lead to decisions to postpone and forego childbearing? Covariation of institutional contexts with fertility levels shows that very low fertility is not inevitable (Morgan 2003). However, this claim leaves us a long way from precise answers to the question: What mix of societal institutions produces an environment conducive to replacement-level fertility? Answering this question tops the low fertility research agenda. The richness of future analyses will be aided by more (and more non-Western) societies to study as low fertility spreads (Morgan 2003).

Finally, future technology may alter the characteristics and experiences of pregnancy, childbirth, and parenting and thus contribute to making the future trends and differentials uncertain. For instance, postponed childbearing increases the risk of sub- or infecundity. But these risks can be partly offset by assisted reproductive technologies. Will new innovations and discoveries make this technology less intrusive, more effective, and more acceptable and thus virtually eliminate infecundity as an antinatalist factor? Also, genetic engineering, techniques that allow parents to choose the genetic makeup of their children, could have far reaching effects on reproduction, the family, and society (e.g., Silver 1998). But it remains unclear whether such technology will become available and whether it will be widely used. The debates over these new technologies will be among the most interesting and important of the coming decades.

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