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THE PHOENIX POPULATION: DEMOGRAPHIC CRISIS AND REBOUND IN CAMBODIA*

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Abstract

The study of mortality crises provides an unusual and valuable perspective on the relationship between mortality and fertility changes, a relationship that has puzzled demographers for decades. In this article, we combine nationally representative survey and demographic-surveillance system data to study fertility trends around the time of the Khmer Rouge (KR) regime, under which 25% of the Cambodian population died. We present the first quantitative evidence to date that attests to a one-third decline of fertility during this regime, followed by a substantial "baby boom" after the fall of the KR. Further analyses reveal that the fertility rebound was produced not only by a two-year marriage bubble but also by a surge in marital fertility that remained for nearly a decade above its precrisis level. Our results illustrate the potential influence of mortality on fertility, which may be more difficult to identify for more gradual mortality declines. To the extent that until recently, Cambodian fertility appears to fit natural fertility patterns, our findings also reinforce meaning of this core paradigm of demographic analysis.

> In July 1978, a youth named Korb, bound hand and foot, arrived at a Pol Pot regime extermination camp. The local security chief, "Comrade Uncle An," was handed the following note:
>
> Formerly this person was normal in character. Then, over about ten days, he went crazy. […] If many people come in, first he begins to whistle, and then he sings the following rhyme out loud:
>
> O! Khmers with black blood
>
> Now the eight-year Buddhist prophecy is being fulfilled.
>
> Vietnam is the elder brother

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Kampuchea is the younger.

If we do not follow the Vietnamese as our elder brothers

There will be nothing left of the Khmer this time but ashes.

(Kiernan and Boua 1982:363)

On January 7, 1979, the Vietnamese army entered Phnom Penh, the capital city of Cambodia, and ended three years, eight months, and twenty days of ruling by Pol Pot's Khmer Rouge (KR). Cambodia had then lost an estimated 1.5 to 2.0 million people to excess mortality (Heuveline 1998; Kiernan 1996; Sliwinski 1995)—one-quarter of its population at the time of the KR takeover. In the late 1990s, the first post-KR nationally representative surveys showed Cambodia's population growing steadily again, with fertility among the highest in Southeast Asia albeit lower than at the time of the last pre-KR census (1962).[1] The smaller size of the cohorts born during the KR regime, clearly visible in census data, suggests a birth dearth in addition to excess deaths. However, with their focus on the fertility and contraceptive use of women younger than age 50, extant fertility surveys alone do not allow for a retrospective study of fertility during or just after the KR regime (Rindfuss, Palmore, and Bumpass 1982).

The study of demographic trends during and after mortality crises provides an unusual and valuable perspective on the relationship between mortality and fertility—a relationship that has puzzled demographers for decades. Although several recent reviews on the state of the fertility transition emphasized the role of mortality decline in fertility change (e.g., Cleland 2001; Hirschman 1994; Mason 1997), the empirical record is rather disappointing. The second National Academy of Sciences (NAS) review of the issue (Montgomery and Cohen 1998) provided little more evidence than the first, which took place two decades earlier and was largely skeptical (Preston 1978). Montgomery (1998) reasoned that mortality declines, which do not generate observable events, may not be immediately recognized and thus fail to generate behavior change. Other reviewers point to several thorny analytical difficulties introduced by the prolonged and gradual pattern of mortality decline enjoyed by most populations, such as a long list of potential confounding factors, feedback mechanisms, and an uncertain lag structure (LeGrand and Sandberg 2006).

Rapid mortality swings that are well defined in time and space are less vulnerable to these conceptual and analytical challenges, but researchers must often make ingenious use of data collected for purposes other than the specific study of the mortality and fertility links. Because the events that lead to and end a mortality crisis should be highly salient, mortality trends, at least their direction, should be accurately perceived. Although the crisis will likely induce both a mortality increase and a contemporaneous fertility decline, the return to normal mortality conditions might result in an increase in fertility. Historical time series provide evidence of crisis-induced fertility declines and postcrisis fertility rebounds, but those are not necessarily indicative of any change in reproductive *behavior* (Lee 1997; Palloni, Hill, and Pinto Aguirre 1996). The record from more recent mortality crises in China (Ashton et al. 1984), Ethiopia (Lindstrom and Berhanu 1999), Angola (Agadjanian and Prata 2002), and Rwanda (Hill 2004) is also inconclusive in terms of changes in reproductive behavior, partly because of the limitations of data often collected for other purposes than the study of demographic changes (Hill 2004).

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[1] Before nationally representative surveys were available, data from Cambodian refugees in Thailand already suggested very high fertility in the 1980s. One of the first studies (Holck and Cates 1982) also suggested a very low conception rate upon arrival, but only among some refugee groups.

In this article, we analyze what we believe are the first data collected to document fertility trends before, during, and after a mortality crisis. These data include close to 3,000 birth histories of Cambodian women aged 15 to 74, collected in 2001–2002, as part of an ongoing, demographic-surveillance system. Fertility levels appear lower in this population than in the country for the periods and age groups available in the most recent nationally representative fertility survey, but fertility changes appear remarkably consistent with national trends in the past 20 years. The sample's high upper-age limit allows us to provide a quantitative assessment of this population's fertility reduction, which was induced by the extreme hardships endured under the KR, and subsequent rebound. We find evidence of a sustained fertility increase subsequent to the mortality crisis, which we interpret as the reproductive response of threatened families and communities. In particular, we see evidence of an increase in marital fertility, occurring within a "natural fertility" regime at the time, which also leads us to revisit the meaning of this core concept of demographic theory (Henry 1961).

BACKGROUND

Demographic Theory and Mortality-Fertility Interactions

Although the question of how human populations are regulated lies at the core of demography as a scientific discipline, relatively little research on the topic is currently available (Cleland 2001). In part, this reflects that most demographers distance themselves from grand theory, instead specializing in one of the components of population change (i.e., fertility, mortality, or migration) when population regulation concerns primarily the interplay of those components. Early demographic theories directly or indirectly linked mortality and fertility changes. In the Malthusian paradigm, interestingly enough, fertility indirectly influences mortality, inasmuch as unchecked fertility invariably leads to excessive population growth, bringing with it a concomitant negative impact on wealth, health, and survival. In the classic demographic transition theory (DTT) framework, fertility and mortality declines were not explicitly linked processes at first; rather, they were both described as influenced by factors associated with "modernization." Although mortality decline was sometimes included among factors that would eventually lower fertility, fears of a population explosion grew precisely from doubts that mortality declines—found to quickly outpace economic development would, on their own, induce a sufficient fertility response (e.g., Notestein 1953:20). The mortality-fertility link became more explicit with Davis' (1963) emphasis on strains on family systems, thus linking mortality and other social changes to demographic responses, including (but not limited to) reproductive change.

The subsequent empirical analyses of past European fertility transitions and more recent fertility declines have "dramatically shattered" the DTT (Alter 1992:13), ushering in a disenchantment with theories of population change as a whole process as well as a gradual focus instead on its components and their proximate determinants. The relationship between mortality and fertility has not entirely disappeared from the demographic agenda but has instead narrowed to more specific questions: primarily, whether declines in infant mortality induce fertility declines. Coordinating an NAS panel on the issue, Preston (1978) laid out a framework of four direct mechanisms through which a decline in infant mortality can depress fertility (see Figure 1). The empirical findings have again been disappointing. When physiological, hoarding, and replacement effects were found, they were too small to account for much decline in fertility. A second NAS panel reached essentially the same conclusion two decades later (Montgomery and Cohen 1998; also see Palloni and Rafalimanana 1999).

Demography has been described as a science "short on theory, but rich in quantification" (Kirk 1996:361). However, on the role of mortality change in fertility decline, several leading demographers (e.g., Cleland 2001; Hirschman 1994; Mason 1997) have upheld compelling theoretical arguments against the disappointing quantitative record and have also been critical of extant empirical investigations. Preston has long noted that most empirical investigations of the mortality-fertility links bore only on the individual-level factors of his framework (physiological, hoarding, and replacement effects), and that the "continued pursuit of the aggregate relations is probably the most important business left unfinished" (1978:16). The increasing availability of individual-level data has only accentuated the imbalance, but the few analyses of the aggregate-level changes in child survival and in fertility have had more success documenting the expected relationship (e.g., LeGrand and Barbieri 2002).

Mason (1997) elaborated on the various shortcomings of research on the determinants of fertility transitions, including a narrow focus on infant mortality and on the exact timing of the onset of fertility decline. Montgomery (1998) also observed that to result in reproductive change, mortality changes must be perceived by the population. Some evidence suggests the contrary. Mortality declines might fail to be accurately perceived immediately because they result in nonevents (fewer deaths) rather than observable events. Mortality declines did not just result in fewer deaths, however. With time, they also generated tremendous population growth and changes in age structure in many parts of the world until fertility also declined (Heuveline 1999). Examining cross-national changes in life expectancy at birth over a 30-year period (1960–1990) suggests that mortality change might account for one-fourth of fertility change (Heuveline 2001). Such empirical analyses are greatly complicated, however, by the gradual decline of mortality over several decades. This decline raises thorny (if not intractable) statistical issues, including (but not limited to): (1) omitted variables, with respect to the many other potential factors that greatly changed during the period as well; (2) the uncertain lag structures between dependent variables and their influence on fertility; (3) the possibility of feedback mechanisms; and (4) the appropriate level of aggregation for these "social-level" effects (see LeGrand and Sandberg 2006 for a review).

Research on communities affected by rapid mortality swings that are well defined in time and place is less subject to these empirical challenges, speaking to the more ambitious agenda of understanding how "demographic equilibria [are] reestablished after mortality declines" (Hirschman 1994:228). Unfortunately, historical demography provides abundant examples of unusual hardship (e.g., war, famine, or epidemic). The extant record suggests that such crises might induce a birth dearth, but that afterward, fertility often rebounds to precrisis levels, sometimes temporarily rising above those levels (Eversley 1957; Festy 1984; Lee 1997; Palloni et al. 1996; Watkins and Menken 1985). Biometric models of marital fertility (Sheps and Menken 1973) showed that contrary to a common perception, post-crisis baby booms typically have little to do with changes in nuptiality. Instead, the decline in pregnancies during crises yields an unusually high number of married women who are "susceptible" to the risk of conception at the end of a crisis, as well as record numbers of births one to two years later, given the typical waiting period for conception and pregnancy. Short-term baby booms alone do not provide sufficient evidence that the existing social mechanisms of reproductive regulation were amended as a result of the mortality experience. More-detailed data than are typically available from historical populations would be necessary to study this issue more directly.

Precious few demographic studies of recent mortality swings exist, and the conclusions of such studies are contradictory. After fertility rates fell in China during the 1958–1961 famine, they rose sharply in 1962–1963 to above their pre-famine levels (Ashton et al. 1984). Wartime drop and postwar rebound were also found in Angola (Agadjanian and Prata 2002). In contrast, war and famine in Ethiopia seem to have induced both short-term and long-term fertility declines (Lindstrom and Berhanu 1999) yet induced a short-term decline and a baby boom in Eritrea (Blanc 2004). Comparatively, fertility was virtually the same before and after the 1974–1975 famine in Bangladesh (Watkins and Menken 1985). Likewise, in Rwanda, one of the most intense crises of the twentieth century did not seem to have any great impact on fertility, either (Hill 2004). Even though richer data are available on the contemporary populations cited here than on historical populations, the data were ostensibly collected for purposes other than those intended by the studies noted earlier. Therefore, these data have their own limitations (see Hill 2004 for a review). Overall, limited evidence is available that when conditions responsible for a mortality crisis lead to the temporary separation of spouses or when the physiological impact on the survivors is severe enough to lower fecundity and increase the risk of spontaneous abortion, fertility is depressed in the short-to-medium term. At most, this is a temporary phenomenon, however. Very little is known of the long-term effects of such dramatic experiences on the fertility of survivors (Hill 2004).

Cambodia, 1970 to the Present

Prince Norodom Sihanouk, who governed Cambodia since negotiating its independence from France in 1953, was overthrown in a military coup in 1970. Cambodia then entered a civil war, during which eastern Cambodia, near its border with Vietnam, was also subjected to intensive bombing by U.S. B-52s. Many Cambodians sought refuge in the capital city, Phnom Penh, which the KR seized on April 17, 1975. What the KR undertook then has been described as the most radical, social transformation ever attempted (Kiernan 1996; Weitz 2003), and it certainly stands as among the deadliest ones of the twentieth century. Extant estimates of excess deaths range anywhere from 500,000 to 3 million, but subsequent demographic data indicate 1.5 to 2.0 million excess deaths from political violence, malnutrition, exhaustion from overwork, lack of appropriate medicine, and increased exposure to malaria (Heuveline 1998; Kiernan 1996; Sliwinski 1995). These excess deaths amount to nearly one-quarter of the Cambodian population in 1975. The KR attempt to radically transform Cambodian society also included a frontal attack on the family, which was perceived as the core institution of social reproduction. Whereas until then, nearly all marriages were being arranged by parents and relatives, union formation was hampered by the regime's separation of the population into age and sex work teams. Local KR cadres oversaw marriage decisions, and marriages were routinely contracted in brief, mass ceremonies. Some marriages appear to have been forced (Ngor 1987:292; Ponchaud [1977]1998:160–161, 294–95). From a subsample of the 2000 Cambodian Demographic and Health Survey (CDHS 2000, described herein), Heuveline and Poch (2006) estimated that 32.4% of women who married during the 1975–1978 period had their husband chosen by a nonrelative and/or did not give their consent to the marriage, compared with 6.9% of those married in other years.

In December 1978, conflict with Vietnam escalated. Within a few weeks, the KR lost control of most of the country and took refuge in the forest-clad hills near the Thai border (Robinson 1998). Although a government composed of Cambodians was promptly established, Vietnamese troops remained in the country for 10 years, during which the KR continued to fight the central government and controlled a few outlying districts. Peace was restored to most provinces, but land mines continued to kill farmers as well as those who returned to claim land. Nevertheless, living conditions improved overall, with the establishment of administrative structures and infrastructure—health and education, in particular—along the Vietnamese model. Still, a political impasse lasted until the 1991 Paris agreements. This was attributable to the U.S. opposition to legitimize any expansion of communist Vietnam as well as the increasingly clear record of the KR atrocities, which made the restoration of the KR an unpalatable alternative to the Vietnamese occupation. During the entire period 1979–1991, Cambodia's international economic and cultural ties remained largely limited to Soviet-bloc countries, on whose aid it depended.

United Nations–sponsored elections in 1993 brought dramatic changes to the country in the form of foreign investments and aid as well as international visitors and cultural representations from the West. International aid allowed the National Institute of Statistics (NIS) to conduct the first national census since 1962 the 1998 General Population Census (GPC)—and the CDHS 2000. In spite of the foreign investments, the country remained one of the poorest in Asia, with a gross domestic product of only $238 per capita in 2000 (NIS 2001). The 1998 GPC showed that the population remained 84% rural (NIS 1999) and beared the marks (e.g., the low male to female ratio) of the KR reign but also of the demographic reconstruction that followed. The greater toll of excess mortality among males is reflected in a sex ratio for the population aged 15 and older, which has slowly recovered from a low of about 75 males per 100 females in 1980 (Huguet 1992), suggesting unusual constraints on the marriage "market" in the post-KR years. A post-KR baby boom is clearly visible in census data, although its magnitude cannot be determined from these data alone. At the time of the census, annual birth cohorts were about 50% greater for the 1980s than for the KR years (1975–1978); however, this reflects, in part, higher infant survival rates.

Meanwhile, the CDHS 2000 sheds some light on current fertility levels. With a total fertility rate (TFR) of 4.0 live births per woman (NIS 2001), Cambodia remained (along with Laos) an exception to the region's rapid fertility transition. Fertility appears to be declining, however, and is already substantially lower than at the time of the 1962 census, when the TFR was estimated between 6.7 and 7.1 live births per woman (Heuveline 1998; Migozzi 1973; Siampos 1970). The transition underway can be read in the strong provincial differences in TFR: 2.1 in Phnom Penh province, in which 44% of the households are located in rural areas surrounding the capital city; 4.2 in Kandal, the 95% rural province surrounding Phnom Penh province; and 6.3 in Mondulkiri and Ratanakiri, more remote rural provinces (NIS 2001). With a sample of women under age 50, however, assessing fertility trends around the time of the KR from these data is difficult. Moreover, the CDHS 2000 did not collect the complete marital histories that would have made possible the analysis of the specific contribution of marriage to fertility decline in the context of a marriage market severely constrained by the sex ratio of the adult population.

DATA AND METHODS

Data

We analyze data from the Mekong Island Population Laboratory (MIPopLab), a demographic-surveillance system launched in December 2000 in a rural district adjacent to Phnom Penh province and located in Kandal province. The basic demographics of the entire district population of 10,000 residents are updated twice yearly. A was designed to study the effect that the dramatic mortality increase under the KR might have had on reproductive behavior. The module includes the birth and marriage histories of all women aged 15 to 74. This age range—with a higher upper-age limit than in most fertility studies—was selected to reduce age selectivity concerns in the years before the civil war. Because of the common problem of date misplacement in retrospective surveys (Hill 2004), we used a calendar of the salient events in the village. Data were also collected on parental survivorship from all residents. These quantitative data were completed by focus group discussions with different cohorts of women on marriage formation and fertility preferences.

This module was administered in one village in December, 2001 and in three more villages in June and July, 2002. A total of 2,843 marriage and birth histories were collected. This population may not be representative of Cambodia, foremost because of its geographical location. Because of the aforementioned strong fertility gradient, we expect this rural population at the border of Phnom Penh and Kandal provinces to exhibit fertility levels below the national average but above those of the mostly urban Phnom Penh province.

Although the 1998 GPC data allow only for crude indicators of marriage patterns (e.g., the singulate mean age at marriage for women), MIPopLab (24.7 years) appears closer in this respect to Phnom Penh province (24.7 years) than to the national average (22.5 years) or even to Kandal province (23.0 years). The experience in the district under the KR cannot be held as either representative or extreme. A population composed almost entirely of farmers was likely less targeted by the KR regime than were urban dwellers or more educated people. As opposed to the rural residents of areas under KR control during the civil war (labeled as "base" people), the residents of this area close to the capital city (labeled as "new" people, together with urban dwellers) were *de facto* suspected of supporting the previous regime. Some residents of the district were forced to move as part of the KR redistribution of population from the eastern to the northwestern region of the country (Kiernan 1996). As described here, we will thus compare the results from this population with those from nationally representative data in any effort to isolate features that might be uncharacteristic of the rest of the country. For the pre-KR period, we will use extant estimates from the 1962 census (Heuveline 1998; Migozzi 1973; Siampos 1970). For the most recent period, we will analyze data from CDHS 2000.

Methods

From MIPopLab data, we estimate period and cohort trends in age-specific rates of fertility, marriage, and marital fertility. Respecting fertility and marital fertility rates, we consider five-year periods, beginning with 1961–1965 to 1996–2000. We divide the years 1976–1980 into two periods: 1976–1978 (the main KR years) and 1979–1980 (just after the KR fall). Periods for marriage rates are shifted by one year: that is, we examine marriage rates from 1960–1964 to 1970–1974, 1975–1977, 1978–1979, and from 1980–1984 to 1995–1999. Thus, we may compare marriage and fertility rates across birth cohorts grouped on the basis of their age at the time of the KR takeover.[2] We also estimate cohort rates and the probability of ever-marrying by certain ages.

We compare the early-period, age-specific marriage and fertility rates in MIPopLab with extant analyses of the 1962 census (see Appendix). To compare the early-cohort probabilities of ever marrying by certain ages in MIPopLab, we use the proportion of ever-married women by age that Migozzi (1973) estimated by applying life-table techniques to census tabulations. Comparing marital fertility estimates in MIPopLab with nationally representative estimates proves the most difficult because the corresponding estimates in Migozzi (1973) appear questionable (see Appendix).

To compare MIPopLab estimates for the more recent periods, 1981–1985 to 1996–2000, we estimate rates from CDHS 2000 for the entire country and for the two provinces (Phnom Penh and Kandal) bordering the district in which MIPopLab is located (see Appendix). CDHS 2000 does not provide marriage histories, however, but only the date when women "started to live with" their first husband as well as their marital status at the time of the survey. From this question, we can estimate only *first*-marriage rates and proportion ever-married women up to age 34, beginning with the 1981–1985 period. Because it is acceptable

[2]This strategy results in the odd pairing of marriage rates for the years 1978 and 1979—that is, a period centered on the time of the KR fall. A more appealing strategy would use the 1979–1980 period for marriage rates, shifted forward to 1980–1981 for birth rates. Unfortunately, this alternative is problematic for fertility analysis because many births were actually reported in 1979, likely because respondents remembered them as being relatively soon after the KR fall. In the strategy pursued here, the 1978–1979 marriage rates correspond largely with 1979 marriages, outnumbering 1978 marriages two to one even though more marriages are also reported for 1978 than previous years of the KR regime. Because of censoring attributable to the sample upper-age limit and its own issues with marriage dates discussed herein, CDHS 2000 data cannot be used to assert whether the KR actually conducted more marriages in 1978 than in previous years or whether misreporting births in 1979 led to misreporting marriages in 1978. In the end, we refer to marriages and births in the years they were actually reported, but our conclusions would not be affected by the likely shift or plausible contraction of the period in which they actually occur.

for the groom to start living with his future wife and her parents after the two nuptial families exchange gifts to seal the marriage agreement, the timing might differ from that which could otherwise be obtained from the marriage date. In addition, CDHS 2000 inferred about 16% of those dates from the respondent's birth date and her answer to the question, "How many years passed since your birth when you started living with him?" (NIS 2001).

Computing higher-order marriage rates and marital fertility rates from CDHS 2000 also requires the end date of marriages. Heuveline and Poch (2006) argued that for women who were divorced or widowed at the time of the survey, the date of the last marital disruption can be approximated from data on their last sexual partner. Using this approach allows us to estimate total marital fertility rates (TMFRs) for women married only once in the 1981–1985 to 1996–2000 periods (see Appendix), but the required inferences of dates may not make the timing of marital events around the KR period entirely consistent between the CDHS 2000 and MIPopLab. Moreover, using the onset of cohabitation with the first husband may yield more married person-years than would the actual marriage date, thus lowering the marital fertility estimates compared with the two other sources of data.

Demographic trends reconstructed retrospectively (from the data of either MIPopLab or CDHS 2000) might be biased by selective survival to the present. The existence of this potential bias cannot be tested from contemporary data, nor is its direction easy to anticipate. Because single young adults were drafted for the toughest work assignments, they might have experienced higher mortality rates than married people of the same age, which would tend to increase age-specific fertility rates among survivors compared with the entire population at the time. On the other hand, parents with many children could have possibly endured even greater sacrifices in order to slightly improve the lot of their children, which would induce a bias in the opposite direction.

RESULTS

Mortality During the Khmer Rouge Regime and Subsequent Sex Ratio

Although we cannot claim that the experience of the population in MIPopLab is typical of that of the entire country during the KR, we expected to find mortality rates close to national averages during the KR years. This rural population should have fared slightly better than urban populations yet worse than those referred to as "base" people by the KR regime. Questions on the survival of parents provide for a very rough test of the preceding proposition. We found that 20% of the respondents with a mother alive at the time of the KR takeover reported her death during the KR regime. The corresponding death proportion for fathers is 35%. At the same time, with excess deaths estimated at about 25% of the 1975 population and a sex ratio of about 1.5 male deaths per female death (Heuveline 1998), we estimate that excess mortality claimed about 30% of the 1975 male population and 20% of the 1975 female population nationwide. Finally, add to these estimates another 5% for each sex to account for normal mortality during those four years. This very crude comparison (e.g., multiple reporting on same parents by siblings, unknown age structure of the parents' population) suggests that the MIPopLab figures are fairly close to the national average for males, and perhaps slightly lower for females.

Another finding from questions about parents' survival is the dramatic impact that the KR years had on extant marriages. Among respondents whose parents were both alive at the time of the KR takeover, 8% lost only their mother, 21% more lost only their father, and 16% more lost both parents during the KR regime. Taken together, then, 45% of intact parental unions in 1975 were disrupted by the death of at least one spouse during the four years that followed. A further implication of the KR-period mortality is the resulting shortage of men in the adult population, estimated to be on the order of 75 males per 100 females aged 15 and older in 1980 (Huguet 1992), and hence probably about one single adult male for every two single adult women (see Appendix).

Period Fertility

Period TFRs from MIPopLab, CDHS 2000, and the 1962 census are compared in Figure 2. MIPopLab estimates exhibit three, clear fertility trends: (1) a sharp decline after 1975; (2) a dramatic surge in 1979–1980; and (3) a sustained decline thereafter. The most recent trend is in close agreement with the national trend found in the CDHS 2000 as well as the trends in Phnom Penh and Kandal provinces. As expected, the fertility level is also intermediate between that cited for these two provinces and consistently remains 21% to 23% lower than the national estimate throughout the two decades.

The 1961–1965 and 1966–1970 TFRs estimates from MIPopLab might be a bit low because they appear to be near the 1962 census figures for Phnom Penh province. Still, as in the 1980s and 1990s, they remain between 20% and 25% lower than the national indirect estimate from the 1962 census (24.9% and 22.4% lower, respectively). Inasmuch as little reason exists to expect fertility decline during the 1960s, a slight underestimation attributable to the omission of early births by the oldest women in the MIPopLab sample is plausible. At the same time, the decline from 5.2 to 4.9 live births per woman between 1965–1969 and 1970–1974 could well be attributable to the civil war.

To the best of our knowledge, these data provide the first direct evidence of a fertility decline in a large population during the KR regime. According to our estimates, the TFR declined sharply during the KR regime, down to 3.7 live births per woman in 1976–1978—that is, 29% lower than its level before the civil war. Taking into account the aforementioned possibility that the prewar births were slightly underreported, we conclude that in this population, fertility rates between 1976 and 1978 fell to two-thirds of their prewar levels.

The fertility rebound in the two years after the KR regime is quite striking. We estimate that the TFR increased to slightly over seven live births per woman for the 1979–1980 period, which was 91% larger than in the preceding 1976–1978 period and still 36% larger than the 1966–1970 level. After this two-year boom, fertility began a rather rapid decline, but more than likely remained above the prewar levels during the first subsequent five-year period. According to MIPopLab data, the 1981–1985 TFR was slightly higher than the 1966–1970 TFR (5.5 versus 5.2). For the same period, the national estimate that can be extrapolated from the CDHS 2000 is 7.1, which is also larger than the 1962 census estimate of 6.7 live births per woman. Both in the MIPopLab and the national populations, the 1981–1985 fertility level appears slightly higher than *ante bellum*.

Period and Cohort Nuptiality

Even a modest difference in the fertility levels of the late 1960s and the early 1980s may reveal important reproductive changes because the earlier-noted high proportion of unions terminated by death during the period would lead to a drastic decline in the proportion of married women, all else being equal. Figure 3 shows the period crude marriage rate (CMR) for women aged 15 to 34, from 1960–1964 to 1995–1999 based on MIPopLab data. From 1980–1984 on, it compares MIPopLab- and CDHS 2000–based estimates of period crude rates of first marriage for women between the same ages. No equivalent estimates exist for the earlier periods. However, the 1960–1974 average of female first-marriage rates from MIPopLab suggests that 87.8% of a female birth cohort married at least once by age 30, which compares with the 90.5% rate nationwide yielded by the 1962 census estimates (Migozzi 1973:248).

We find that the CMR of females aged 15 to 34 fell to only 35% of its prewar level during the KR regime but rebounded 86% higher than this prewar level. This occurred as early as 1978–1979. The 1978–1979 period is the only period in which a difference between the rates of first and all marriages is visible (Figure 3), suggesting a nonnegligible contribution of remarriages in that period only. The increase in marriage can also be seen in part as a catching up for cohorts that delayed entry into marriage during the KR period. Figure 4 shows the proportion of women who were ever-married at different ages for four sets of three-year birth cohorts: namely, birth cohorts that reached the corresponding age (1) just before the KR (around 1972), (2) around the time of the KR takeover (1975), (3) toward the end of the KR regime (around 1978), and (4) after the KR fall (around 1981). The proportions of women who were ever-married are shown at ages 18, 21, 24, 27, and 30, respectively, according to MIPopLab estimates, and at age 21, according to CDHS 2000 estimates. Cohorts of women who entered the prime ages for first marriage at the time of the KR were all able to compensate quite rapidly after the fall of the KR. For some cohorts, the post-KR marriage boom even resulted in a slightly higher proportion who married at a given age than had been the case before the KR. Consistent with the later pattern of marriage in the MIPopLab data than in the rest of the country (as documented by the 1997 GPC), national estimates from the CDHS 2000 exhibit a higher proportion who were ever married by age 21 but the same pattern of decreases and increases around the time of the KR (Figure 4).

The 1978–1979 CMR for females between ages 15 and 34 is all the more impressive (0.26 marriages per person-year) when a prevailing sex ratio on the order of one single male for every two single females aged 15 and older is taken into account. At this rate, 41% of single women aged 15 to 34 would marry within two years, suggesting that a substantial majority of unmarried men older than age 15 were married during this short period. Therefore, such high rates could not last very long. MIPopLab estimates show that in the early 1980s, marriage rates had already fallen below their pre-KR levels and would not recover their typical pre-KR value until the early 1990s, when the sex ratio in the cohorts of marriageable age returned near parity.[3] From 1980–1984 on, the national estimates derived from CDHS 2000 data display the same ups and downs albeit not as marked as those derived from the MIPopLab data (Figure 3).

In order to shed further light on these patterns, Figure 5 shows female age-specific marriage rates before the KR (1960–1974), during the KR (1975–1977), around the fall of the KR (1978–1979), and after its fall (1980–1984). The 1980–1984 pattern is quite similar to that of 1960–1974 up to age 25, when age-specific marriage rates become significantly lower than they were. This probably reflects the imbalance of the sex ratio as well as the fact that in Cambodia, a never-married woman is considered an “old maid” by age 25. An “old maid” can marry an old bachelor in a more casual ceremony than the traditional marriage, but the shortage of marriageable men aged 15 and older in the first years after the KR seems to have reduced women’s odds of marrying past age 25. As for the 1978–1979 marriage boom, although rates are higher than before the KR regime at all ages, the rebound is particularly pronounced between ages 15 and 25, with marriage rates that are more than twice their pre-KR level. Further evidence that the marriage boom was more than just a catch up for delayed marriages can be seen in marriage rates themselves, which more than doubled between 1960–1974 and 1978–1979 among women aged 15 to 19, who were too young in 1975 to have had to postpone greatly their entry into marriage.

[3]The latest decline in marital rates likely has less to do with KR-related events than with the restoration of schooling in the 1990s and the gradual transition to a market economy in the early 1990s that kept girls in school longer and provided young women with more wage-employment opportunities (Heuveline and Poch 2006).

Period and Cohort Marital Fertility

Period TMFRs from MIPopLab, the CDHS 2000, and the 1962 census are compared in Figure 6. MIPopLab estimates exhibit the three same trends that were visible in Figure 2. First, the TMFR declined in 1975–1978 compared with the 1965–1969 levels before the onset of the civil war, but its relative decline (–15%) is only one-half of the TFR decline over the same periods (–29%) because the latter is also affected in part by two earlier-mentioned marital trends: (1) over 20% of women married before the KR were widowed by the time of the KR fall; and (2) the rate of marriage formation declined during the KR reign. Second, the TMFR dramatically increased in 1979–1980; this time, however, its relative increase (+46%, compared with 1965–1969) even exceeded the TFR increase over the same period (+36%). In spite of the 1978–1979 marriage boom that gradually restored the proportion married to its earlier level, the contribution of marriage to total fertility (i.e., the TFR/TMFR ratio) was still lower, on average, during the 1979–1980 period than it had been before the civil war. Third, the TMFR declined by 15% from the 1979–1980 peak to the next five-year period. This relative decline is more moderate than the decline in total fertility over the same period (+21%), suggesting that this decline in total fertility was attributable in part to the constraints on the marriage market that effectively lowered marriage rates after 1980. According to these data, marital fertility remained high throughout the 1980s and early 1990s, and the TMFR was still 18% higher in 1991–1995 that it had been in 1966–1970.

The most recent trends closely parallel national trends derived from the CDHS 2000. For 1980–1999, the TMFR estimates for the country and the Kandal province are extremely close to those derived from MIPopLab data. The TFR estimates from MIPopLab data were instead intermediate between the Phnom Penh and Kandal estimates from the CDHS 2000, which might be explained in part by a marriage pattern in MIPopLab that is comparable to that of Phnom Penh and substantially later (2.2-year difference in the singulate mean age at marriage) than the pattern observed in the country. This difference appears insufficient to explain fully the 20%–25% difference in total fertility observed earlier between MIPopLab and national figures, however. Also, because of the earlier-mentioned potential overestimation of marital duration, the underestimation of marital fertility rates from the CDHS 2000 is another likely factor. This is further suggested by the 1960s TMFRs estimates from MIPopLab, which are significantly lower than the national estimates derived from the 1962 census, and again closer to that of Phnom Penh. Although a slight omission of early births by the oldest women in the MIPopLab sample is quite plausible, aligning the 1965–1969 MIPopLab figures with the national estimates would require adjusting MIPopLab estimates upward by as much as one-third (assuming the omission of one in every four births). As discussed earlier, both the 1962 census and the CDHS 2000 data require too many adjustments to yield marital fertility estimates reliable enough to back such a strong claim. Considering the ratio of the TFRs in MIPopLab and in the country, combined with the difference in the marriage pattern, we estimate that the prewar TMFR would be 10%–15% lower in MIPopLab than in the country, which would suggest a TMFR around eight live births per married woman among the MIPopLab population at the time as well as a 15% underestimation in the retrospective birth-history data. From this assessment, we conclude that marital fertility in the MIPopLab population most likely did not return to the prewar levels until the second half of the 1980s.

The high marital fertility of the post-KR years is also illustrated in Figure 7, which compares the marital fertility of three sets of cohorts. Clearly, each set has the highest marital fertility at the age the respondents were just after the KR: around age 40 for the cohorts born during 1936–1945, age 30 for the cohorts born during 1946–1955, and age 20 for the cohorts born during 1956–1965. The marital fertility boom is thus truly a period effect rather than a cohort effect because it affected all cohorts regardless of their age at the time. In particular, as similarly observed for the first-marriage rate, even women who were approximately age 15 at the time of the KR takeover contributed to the post-KR marital fertility surge, even though they most likely did not have their reproductive career interrupted by the KR.

SUMMARY AND DISCUSSION

The KR's unprecedented attempt to entirely overhaul the economic, social, and cultural fabric of Cambodia resulted in the excess deaths of about one-fourth of its population in less than four years. The following few years witnessed a baby boom when fertility rebounded rapidly after a drop during the KR reign. In this article, we present what we believe are the first estimates of the extent of fertility fluctuations in Cambodia that can be inferred, but not precisely measured, from previous demographic data (Huguet 1992). Using data collected specifically for these purposes, we estimate that fertility under the KR fell about one-third below its level before the onset of the civil war. This decline compares to the 33% decline during the 1974–1975 famine in Bangladesh and the 28%–31% decline during the 1958–1961 Chinese famine (Watkins and Menken 1985). After nearly doubling in the subsequent two years (1979–1980), fertility began to decline again but was still slightly higher in the early 1980s than it had been in the late 1960s.

A baby boom following a crisis-induced baby dearth is not unusual, but some of the features of the Cambodian fertility surge are. Reviews of the historical record (e.g., Lee 1997) suggest that the fertility rebound is typically commensurate with the short surge in marital fertility induced by the preceding drop in conceptions. First, in Cambodia, the proportion of women who were married but neither pregnant nor breast-feeding is unlikely to have increased substantially during the KR regime. In addition to a decline in conception among married women (nearly 20%), a decline in the proportion of married women also contributed to the overall fertility decline. About 20% of the married women who survived to the end of the KR regime were widowed. Under the KR, the marriage rate dropped to about one-third of its prewar level. Second, a marriage boom undoubtedly accompanied the post-KR marital fertility increase. In a two-year period—retrospectively reported as around the time of the KR fall (1978–1979) but possibly a little later than actually reported—the CMR between the ages of 15 and 34 years reached nearly twice its prewar levels. Third, the period of high fertility outlasted the marriage boom, which quickly leveled off because of another demographic legacy of the KR regime: a severe imbalance in the sex ratio of the adult population, resulting from the excess of male over female mortality during the KR. The approximately seven-year period during which post-KR fertility exceeded its prewar level thus derives from an at-least-equally long (perhaps even longer) stage during which marital fertility exceeded its prewar level. This prolonged period of high marital fertility cannot be explained by a preceding conception dearth. Last, all reproductive-age women participated in the post-KR marriage and marital fertility surge, even women at the outset of their reproductive career who were too young to have experienced reduced fertility during the KR regime.

In the case of the post-KR fertility increase, the typical explanation of decreases and increases in conception rates among married women must thus be complemented by at least two additional behavioral changes: a dramatic, albeit brief, marriage boom; and high marital fertility even after the first post-KR birth. Although our data do not document changes in all the factors that could have contributed to these two trends, the magnitude and the timing of the different changes leave us with no doubt that mortality change was the principal factor. Although the fall of the KR regime was abrupt, the war ended some 10 or more years later for the Cambodian people. Even when combat became more sporadic, food production continued to be hampered by land mines and a shortage of men in their most productive ages. Returning to normal conditions was a protracted process in all respects except mortality, which dropped almost instantly as soon as the KR lost control over a given area.

Strongly suggestive of a long-term effect of past mortality levels on fertility levels, the quantitative data at hand do not allow us to pinpoint the underlying mechanisms, however. One of the relatively well-documented mechanisms in previous studies operates through population density. The historical European record offers instances of mortality crises that temporarily reduced the social and economic barriers to marriage and induced faster, subsequent population growth (empty-niches argument; e.g., Eversley 1957). Whereas this effect operates mostly through marriage rates, the records of migrants to lower-density areas also suggest that they have higher fertility at destination than had been the case in their areas of origin. Examples include the frontier settlers in the nineteenth-century United States (Anderton and Bean 1985; Easterlin 1976) and the French migrants to the Saint Lawrence valley in the seventeenth century (Charbonneau et al. 2000). More recently, VanLandingham and Hirschman (2001) also documented a frontier effect in pretransitional Thailand, in which they showed that marital fertility accounts for at least one-half of the fertility differences across regions.

Our results are thus consistent with these earlier findings. On one hand, our results are less vulnerable to the self-selection biases that can apply to migration processes. In Cambodia, fertility increased as a result of a collective experience of extraordinary mortality. On the other hand, the effects of reduced population density cannot be directly tested here because intense internal migration in Cambodia prevents us from relating today’s community characteristics to those in the early 1980s. In the matrilocal Cambodian marriage system (Heuveline and Poch 2006), the excess of male over female mortality during the KR period could well have increased the competition among families for scarce male manpower. In the focus group discussions we conducted on marital and reproductive decisions, several women who married during this period described the pressure on single women to marry quickly, even from parties that might have been turned down in other times by the bride or her parents (e.g., potential husbands who were jobless or illiterate).

The period of high marital fertility extending beyond that of high marriage rates is harder to account for entirely by density effects. Unfortunately, focus group discussions 20 years later can hardly shed much light on the issue. All that focus group participants can now attest to is that contraceptives were not available until the late 1980s and that “conception[s] occurred on [their] own will.” The surge in marital fertility is particularly difficult to account for in a “natural fertility” regime, in the sense that fertility behaviors in pre-KR Cambodia—with the possible exception of in the capital city—were likely not parity specific (Henry 1961). The increase in marital fertility thus partly involved a change in spacing behavior. Van Bavel (2003) argued that the well-documented decline of marital fertility with marriage duration likely originates in changes in coital frequency rather than in any measurable alternative. The proportion of very recent marriages, as well as the shorter interval from marriage to first birth than between subsequent births, must have at first contributed to the increase in marital fertility. However, this could not have sustained it for as long as high fertility is observed in this population. If higher coital frequency than in previous periods was the mechanism, couples at all durations appear to have changed their behavior thusly. As speculative as this interpretation might be, we find no alternatives that are more clear or more likely. A shorter duration of breast-feeding could have resulted from poor nutritional status after the KR but not for the entire period of high fertility. In other settings, a transient fertility increase has been attributed to the erosion of traditional social control over younger adults (e.g., Lesthaeghe 1980). And, in the early 1980s, many Cambodian families were decimated or still scattered: most refugees did not return until the 1990s.

From this review of our evidence, we are forced to remain agnostic with regard to the exact proximate determinants of the fertility surge. Nevertheless, we are tempted to supplement indirect linkages from mortality to fertility through effects on the economic or social fabric with a more proactive role of individuals, families, and communities that had been seriously threatened in their very existence. In the wake of an exceptional surge in mortality levels, and with a continuing civil war that did not allow them to lay to rest fears that these levels could return,[4] the survivors might have considered insufficient prewar fertility levels that used to guarantee robust family, social, and population reproduction. This argument emphasizing the emotional value of children to parents is not incompatible with arguments of a more economic nature. In particular, because the school system abolished by the KR was only slowly restored, the costs of raising children remained comparatively low. In addition, other forms of investment (e.g., livestock and machinery) had been made scarce or nearly inexistent by the KR regime.

That the Cambodian experience reveals a stronger fertility response to mortality changes than most previous studies is consistent with Montgomery's (1998) argument that perceptions of mortality trends—unmistakable in KR Cambodia—should not be assumed to be accurate, especially in the case of mortality declines. The mortality-fertility relationship might, hence, be partly asymmetrical. That other recent increases in mortality did not seem to induce strong reproductive changes (Hill 2004) shows that the relationship is not linear, either, and might even suggest a dose response. Perceptions of mortality changes might not be necessary to link mortality and fertility because other mediating factors (e.g., population density) could indirectly relate these two demographic components. At the very least, however, the Cambodian tragedy shows a relationship between fertility levels and past mortality levels. As argued by Hirschman (1994), fertility is also likely to change when this relationship is disrupted by a rapid, unequivocally perceptible mortality change. Proponents of the demographic transition theory have long argued the existence of such a relationship, cast in the functionalist framework dominant at the time:

> Any society having to face the heavy mortality characteristic of the pre-modern era must have high fertility to survive. All such societies are therefore ingeniously arranged to obtain the required births. Their religious doctrines, moral codes, laws, education, community customs, marriage habits, and family organizations are all focused toward maintaining high fertility.
>
> (Notestein 1945:39, cited in LeGrand and Sandberg 2006)

The fertility increase shown here suggests, however, that the Cambodian doctrines, codes, customs, and habits were focused on maintaining not high fertility but rather sufficient fertility. Moreover, the corresponding reproductive norms proved flexible enough to allow for higher fertility after the KR that is, to adjust to a perception of sufficient fertility that had changed with the recent experience.

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[4]An anonymous reviewer mentioned conversations with Cambodian refugees that suggest another plausible factor in the threat perceived by Cambodian communities: the 10-year military occupation by Vietnam, Cambodia's historical rival. Fargues (2000) made a similar argument to explain the high fertility of Palestinians and Israelis.

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APPENDIX

Pre-1970 TFR Estimates

Census adjustments are presented in detail by Siampos (1970), who also provided indirect estimates of the TFR for Phnom Penh (5.3) and the entire country (7.0). In a reanalysis of the national data, Heuveline (1998) used Brass' (1975) technique and estimated a 5% lower estimate for the country (6.7), which we use, together with a similarly scaled-down TFR for Phnom Penh (5.1). At the end of the first period (1965), MIPopLab respondents were younger than age 40. We thus compute age-specific fertility rates up to age 39 in 1961–1965, up to age 44 in 1966–1970, and up to age 49 in all subsequent periods. We then estimate the 1966–1970 TFR from ages 15 to 49 by prorating the 1971–1975 TFR on the ratio of the partial TFR truncated at age 44 in 1966–1970 and in 1971–1975. The 1961–1965 TFR is then similarly estimated by prorating this TFR estimate for 1966–1970 on the ratio of the 1961–1965 and 1966–1970 partial TFRs truncated at age 39. For marriage rates, we use the same proration technique, but it applies only to ages at which marriage rates are already quite low: after age 39 (1960–1964 period) or even age 44 (1965–1969 period).

Pre-1970 Nuptiality and TMFR Estimates

Ongoing birth registration in MIPopLab suggests that extramarital births continue to be extremely rare (on the order of 1%). Birth dates retrospectively reported outside a marital period are more likely to result from a misreport of birth or marriage dates, or correspond to the rather long engagement period that can precede the actual marriage ceremony but during which future spouses might already live together (Heuveline and Poch 2006; Migozzi 1973:72–73). In his analysis of the 1962 census, Migozzi (1973:161) treated all births as marital births (i.e., kept in the rates' numerators), an approach that we follow in our analyses of data from both MIPopLab and CDHS 2000. Although it entails a slight overestimation in all periods, this approach is preferable to treating all dates as correct, thus excluding misreported births, which would likely result in a greater downward bias for earlier, rather than for later, periods. Migozzi (1973:163) estimated marital fertility rates by dividing the indirectly estimated, age-specific fertility rates (from Siampos 1970) by the proportion married in the corresponding age group as reported at the time of the census. The results, however, are surprisingly high in the youngest age groups: for instance, 0.79 births per married person-year in the 14–19 age group (Migozzi 1973:256). Siampos' (1970) indirect estimates were obtained after shifting a sizable fraction of an age group to the next-younger age group to reflect that age often starts as age 1 at the time of birth. If the age-specific proportions reported as married in the census are not similarly adjusted, a strong bias will occur in the age group in which the proportion married increases rapidly with age. As the proportion of married women reaches a plateau after age 30, we obtain age-specific marital fertility rates from ages 30–49 for the entire country and from Phnom Penh, dividing the age-specific fertility rates estimated as described earlier by the proportion of married women reported in the census (Migozzi 1973:247). We then obtain TMFR estimates by prorating the sum of these rates on the ratio of the sum to the TMFR estimated in MIPopLab in the 1961–1965 period. An alternative approach is to shift the age structure, as Siampos (1970) did, to correct the proportion married from age 15–50; it provided nearly identical results.

Post-1980 TFR and TMFR Estimates

Because the upper-age limit is 49 in CDHS 2000, a full TFR can be estimated only for the 1996–2000 period. For 1981–1985, 1986–1990, and 1991–1995, we estimate partial TFRs (truncated at age 34, 39, and 44, respectively) and obtain TFR estimates by prorating these partial TFRs on the TFR and similarly truncated, partial TFR estimates for the same period in MIPopLab. Likewise, only partial TMFRs can be estimated for 1981–1985 up to age 34, 1986–1990 up to age 39, and 1991–1995 up to age 44. TMFRs for these three periods are then estimated by prorating the partial estimates on the TMFR and partial TMFR for the same period from women married only once in MIPopLab.

Male/Female Ratio in the 1970 Single Population Aged 15 and Older

This ratio can be derived by assuming the pre-KR proportion of women aged 14 and older, married at around 62%, as estimated before the civil war (Migozzi 1973:137), ignoring potential survival differences between married and single women and applying our earlier estimate of 21% of pre-KR unions resulting in husband-only death. This admittedly rough calculation yields about one-half of the women older than age 15 as still married in 1978–1979; and, subtracting 50 married males and females from the sex ratio, it suggests that only 25 single males remained per 50 single females.

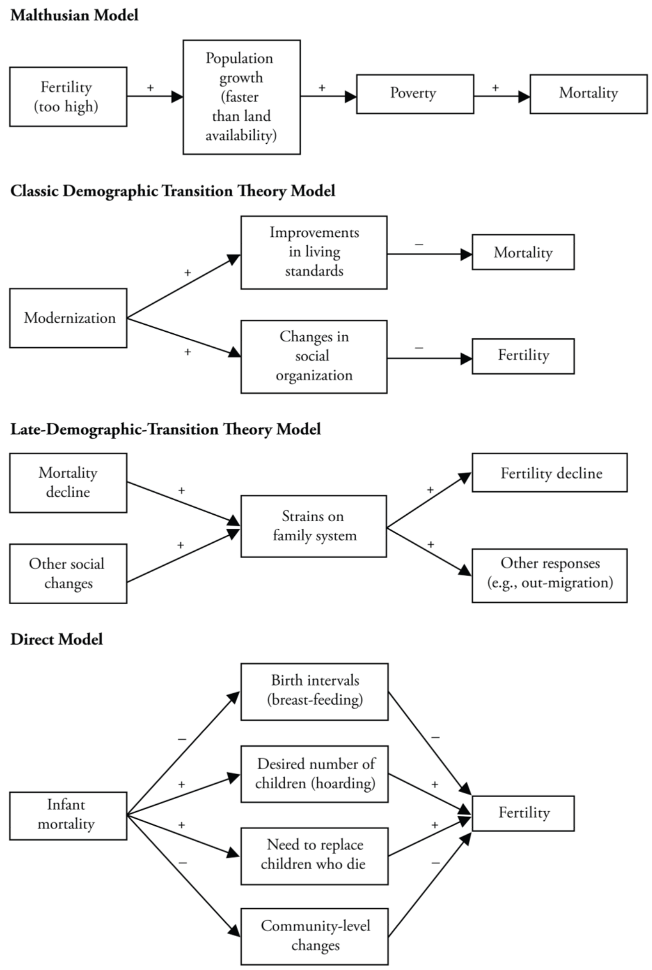

Figure 1.
Conceptual Models of Mortality-Fertility Links

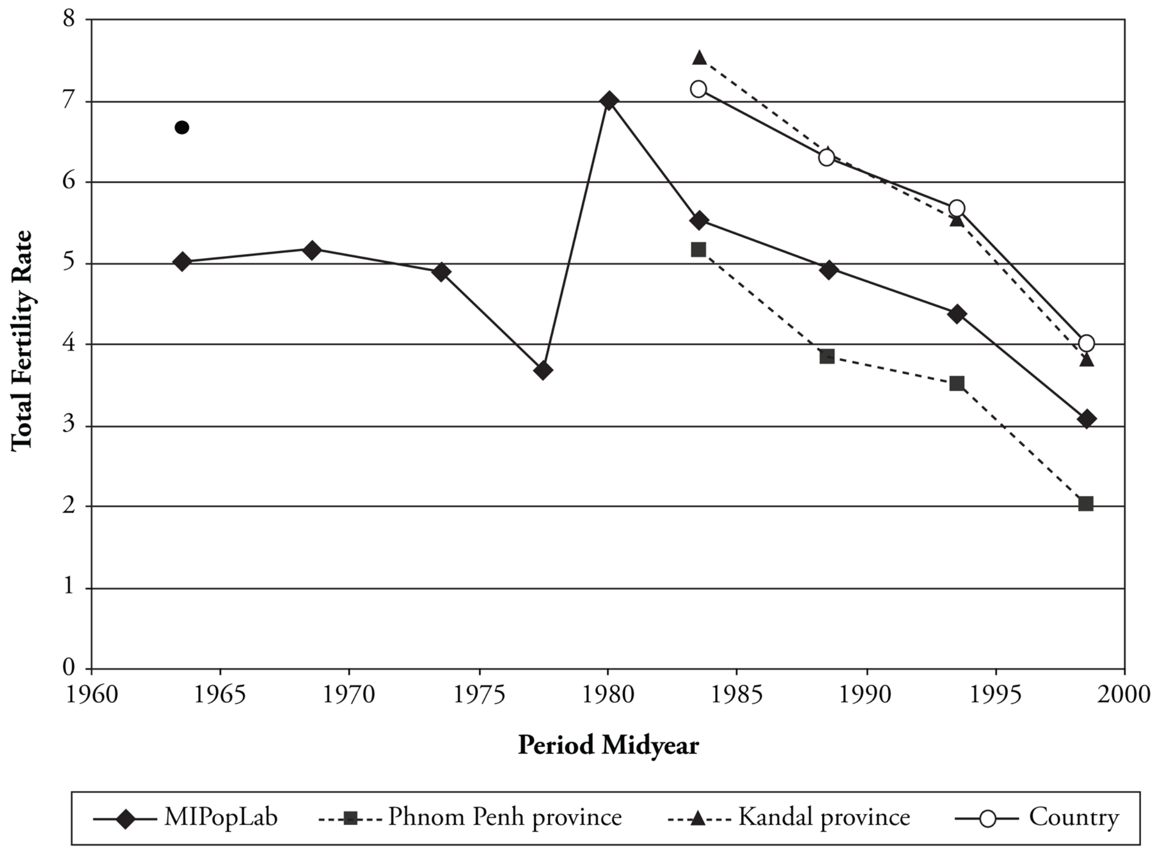

Figure 2.

Total Fertility Rates, by Period: 1961–1965 to 1996–2000

Notes: From 1961–1965 to 1996–2000, total fertility rates correspond to a five-year period, with the exception of the 1976–1980 period, which is divided into 1976–1978 and 1979–1980.

Sources: Estimates from MIPopLab are the authors' calculations. Estimates for the country, and for Phnom Penh and Kandal provinces, are also the authors' calculations based on the age groups available in the CDHS 2000 data in each period, and prorated to ages 15–49, assuming the same age structure of fertility as in MIPopLab during the same period. The 1961–1965 estimates for the country and for Phnom Penh province are Migozzi's (1973:254) indirect estimates from the 1962 census, adjusted as in Heuveline (1998:61–62).

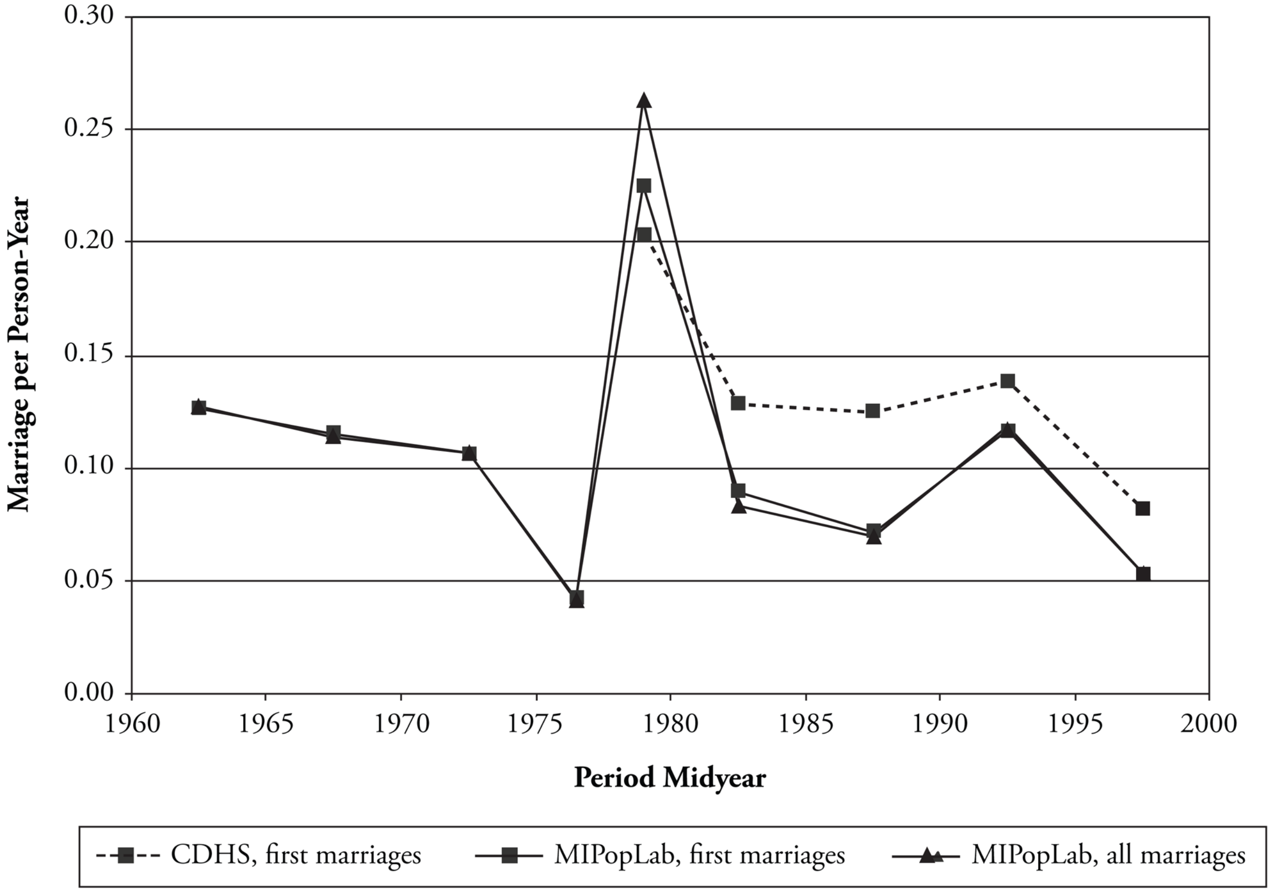

Figure 3.
Crude Rates of First Marriages and All Marriages for Respondents Aged 15 to 34, by Period: 1960–1964 to 1995–1999
Notes: From 1960–1964 to 1995–1999, marriage rates correspond to a five-year period, with the exception of the 1975–1979 period, which is divided into 1975–1977 and 1978–1979, respectively.
Sources: Authors' calculations from MIPopLab and CDHS 2000 data.

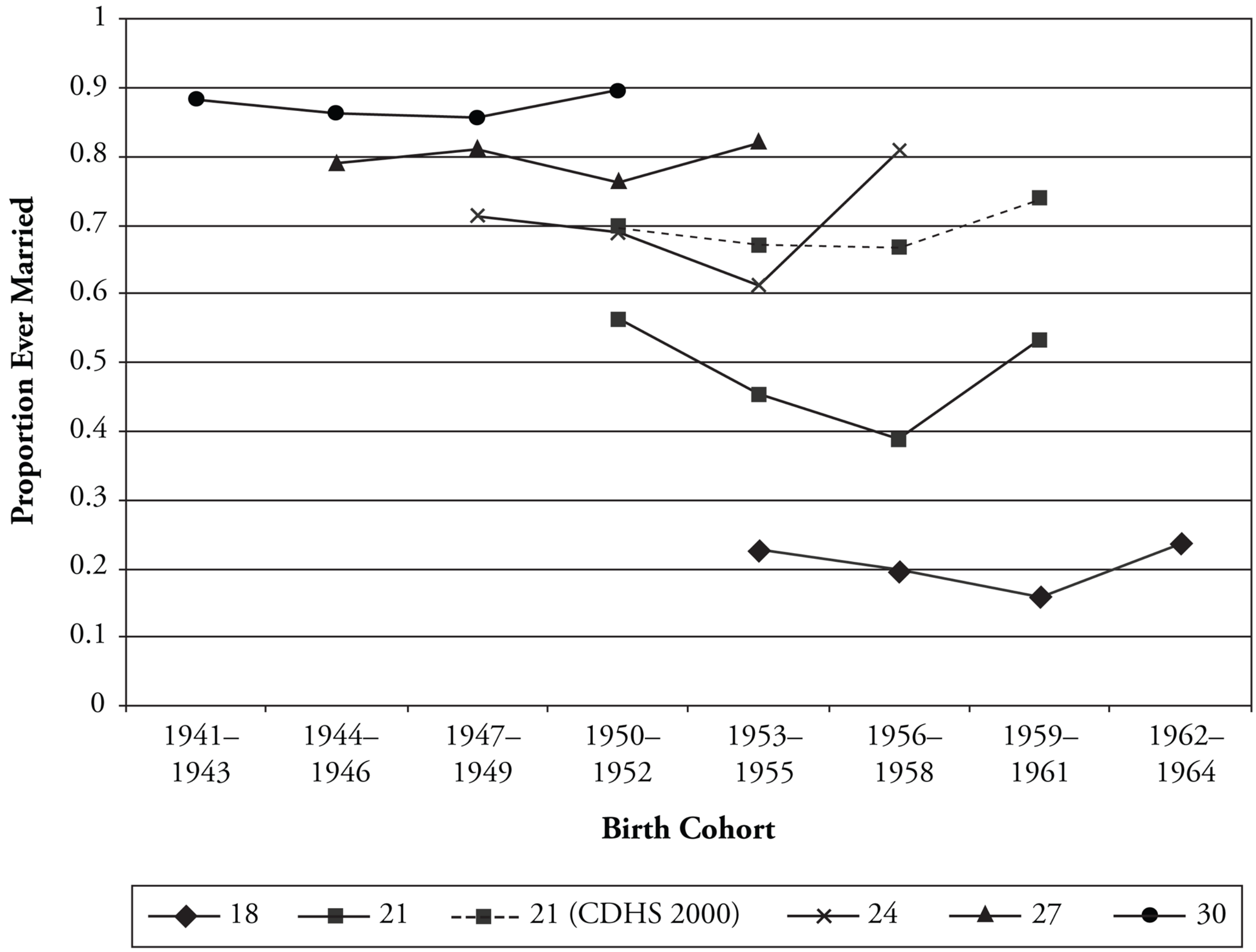

Figure 4.
Proportion of Women Who Were Ever Married at Ages 18, 21, 24, 27, and 30, by Birth Cohort
Notes: The broken line represents the proportion ever-married at age 21 from CDHS 2000. Solid lines represent the proportion at different ages from MIPopLab.
Sources: Authors' calculations from MIPopLab and CDHS 2000 data.

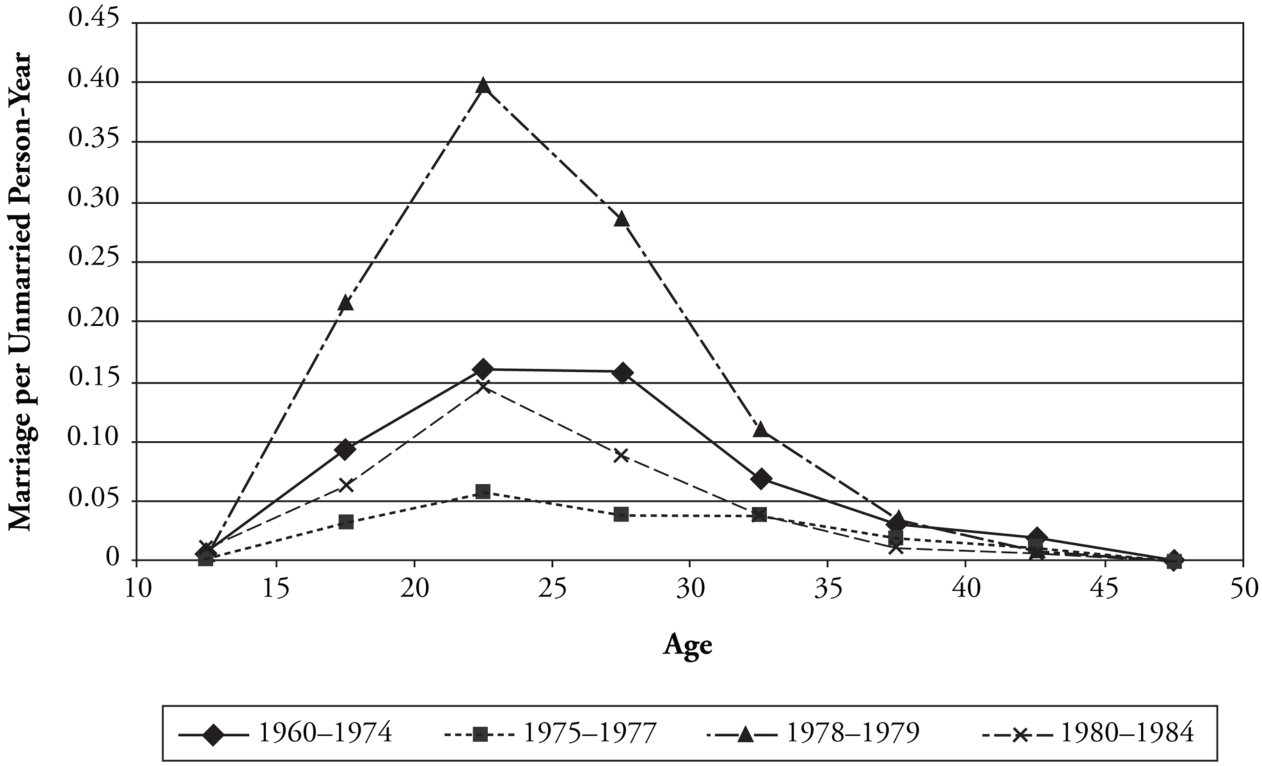

Figure 5.
Women's Age-Specific Marriage Rates by Period: 1960–1974, 1975–1977, 1978–1979, and 1980–1984
Sources: Authors' calculations from MIPopLab data.

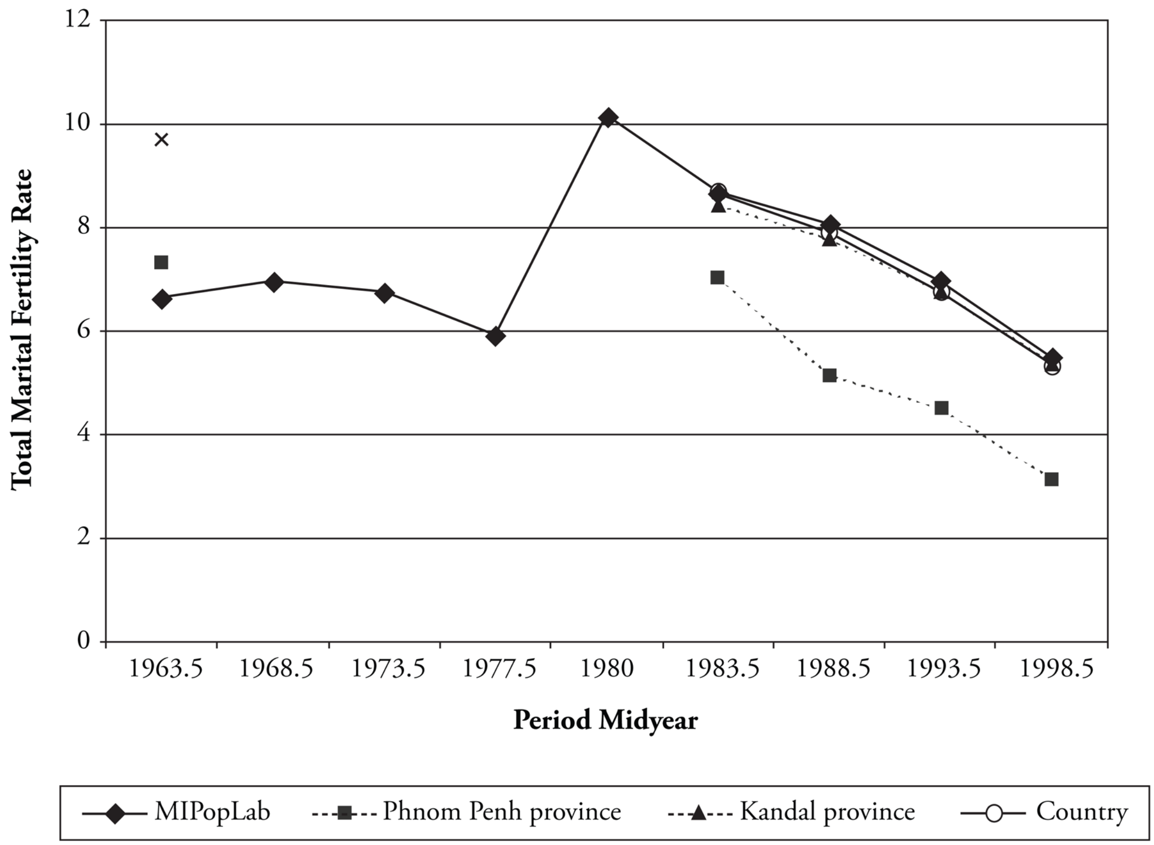

Figure 6.
Total Marital Fertility Rates, by Period: 1961–1965 to 1996–2000
Notes: From 1961–1965 to 1996–2000, total marital fertility rates correspond to a five-year period, with the exception of the 1976–1980 period, which is divided into 1976–1978 and 1979–1980.
Sources: Estimates from MIPopLab are the authors' calculations. Estimates for the country, and for Phnom Penh and Kandal provinces, are also the authors' calculations based on women who were married only once in the age groups available in the CDHS 2000 data in each period, and prorated to ages 15–49, assuming the same age structure of marital fertility as in MIPo-pLab during the same period. The 1961–1965 estimates for the country and for Phnom Penh province are Migozzi's (1973:165) estimates from the 1962 census from ages 30–50, adjusted as in Heuveline (1998:61–62), and prorated to ages 15–49, assuming the same age structure of marital fertility as in MIPopLab during the 1961–1965 period.

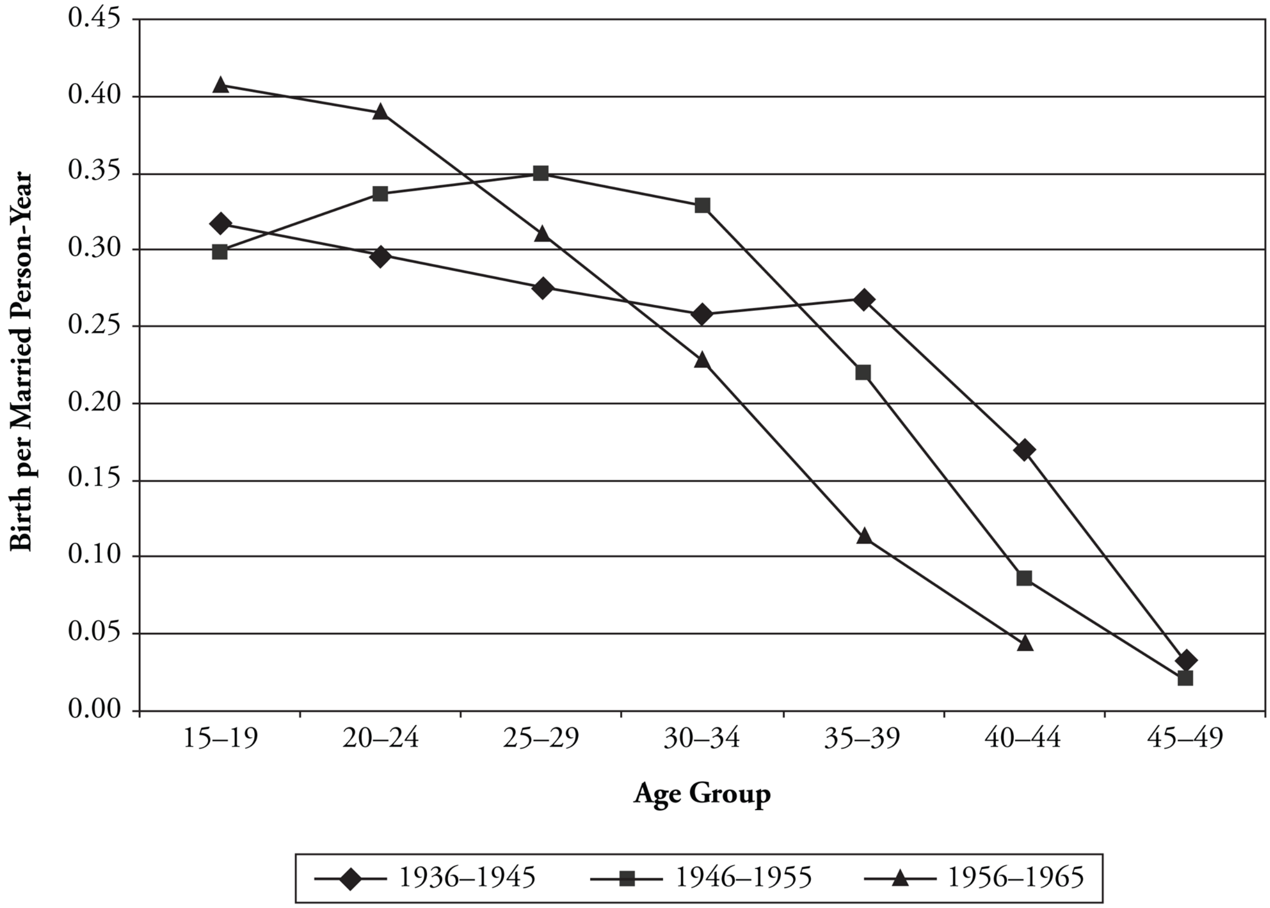

Figure 7.
Age-Specific Marital Fertility Rates, by Cohort
Source: Authors' calculations from MIPopLab data.