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ARE BIRTHS UNDERREPORTED IN RURAL CHINA? MANIPULATION OF STATISTICAL RECORDS IN RESPONSE TO CHINA'S POPULATION POLICIES*

M. GIOVANNA MERLI AND ADRIAN E. RAFTERY

Under the current family planning policy in China, the criterion for evaluating all parties involved in the birth planning system provides an incentive for everyone to see that the policy is met, either in reality through strict enforcement of family planning regulations, or statistically through manipulation of statistical records. We investigate underreporting of births in four rural counties of northern China, using data from a 1992 sample survey featuring a reproductive history. To clarify the mechanisms of underreporting, we focus on the ways in which reporting errors may affect the distribution of first births by time since marriage. The results of our investigation suggest that in three of the four counties, first-birth intervals are lengthened by underreporting of girl babies and by replacing them with second births reported as first births.

Not much was known about the demography of China until about 20 years ago, when the Chinese government initiated an era of reform and opening to the outside world. Since then, the country has produced a collection of censuses and surveys unmatched in scope. Previous research especially has praised the accurate dating of retrospectively recalled events given by respondents in Chinese censuses and fertility surveys (Banister 1992b; Coale 1984), and has attributed this accuracy to the traditional importance of knowing the date of birth, for astrological reasons, for any lifetime decision (Coale and Banister 1994:460).

Both Western and Chinese scholars, however, agree that Chinese birth and infant mortality statistics still suffer from severe underreporting and that censuses, surveys, and registration systems are complicated by respondents' failure to report births and infant deaths (see, among others, Banister 1987, 1989; Banister and Preston 1981; Gu 1990; Lavely 1982; Sun, Li, and Li 1993; Tu and Liang 1992). In most discussions of the reasons for underreporting, it is assumed that failure to report these events is not deliberate, but the product of traditional practices (Banister 1987; Coale and Banister 1994), or the origins of underreporting are sought in the imperfections of the registration system (Banister 1987; Cui 1990; Ji 1991; Lavely 1982).

However, birth data collected by both survey and nonsurvey means may have become less reliable for reasons attributable to population policies, particularly the one-child policy implemented in 1979. In this policy, a system of rewards and penalties is aimed at individual couples (Banister 1987; Hardee-Cleveland and Banister 1988) or at cadres through the implementation of the cadre responsibility system, whereby cadres sign a contract to meet certain birth planning targets (White 1991). In a context in which the number of children is determined by state policy and the desire for a son is strong, neither individuals nor birth planning cadres have great incentives to report births followed by infant deaths, births not approved by the birth planning system, or female births. To defy government imperatives and achieve their family target, couples may not report accurately on their fertility behavior. To meet the expectations of higher-level administrators, local birth planning officials may report the smallest possible number of births (Merli 1998).

More recent studies have drawn attention to underreporting of births in national vital registration systems and fertility surveys (Attané and Sun 1998; Blayo 1997:196–203; Feeney and Yuan 1994; Zeng 1996). All posit that population policies may be responsible for the occurrence of this phenomenon. According to one prominent Chinese demographer, births were underreported in previous enumerations because couples feared punishment for exceeding their birth quotas or because officials were overeager to meet the target. In recent years, however, underreporting has become more widespread because of the introduction of new economic mechanisms to improve local birth planning performance by making it a major criterion for evaluating cadres' job effectiveness at every level. As a result, officials have instructed respondents to underreport recent births in areas where fertility remained higher than the target figures, or have prepared answers for respondents to submit (Zeng 1996:29).

In this paper we investigate underreporting of births in a 1992 survey conducted by the Chinese State Family Planning Commission (SFPC). The data gathered for this survey, the baseline of a longitudinal data collection scheme, were part of the information collected for the evaluation of the project "Introducing New Contraceptives in Rural China" (INCRC), an experimental field study in three counties and one rural district of northern China. Fertility and contraceptive histories gathered from women of childbearing age are the source of data used for the present investigation.

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To clarify the mechanisms of underreporting of demographic events, we focus on the ways in which reporting errors may affect the distribution of first births by time since marriage. We also identify factors other than underreporting of births that may affect the length of the first-birth interval. The results of our analysis suggest that in three of the four counties, first-birth intervals are lengthened by underreporting of girl babies and by replacing them with second births reported as first births.

THE MECHANISMS OF UNDERREPORTING OF BIRTHS AND THEIR HYPOTHESIZED EFFECT ON THE FIRST-BIRTH INTERVAL

In studying the birth of a child of any parity, we must ask how a complex variety of factors will affect the probability and the timing of an event because the event is not certain to occur for everyone. Li and Choe (1997:189) noted that the distinction between the probability and the timing of birth is especially important in studying low-fertility populations; it also applies to second births in China because Chinese population policies consistently have emphasized one, or at most two, children per couple and the lengthening of intervals between births. Conversely, the analysis of events such as first births in rural China is somewhat simplified by the fact that marriage is virtually universal, newlyweds strongly desire to bear a child as soon as possible and use no deliberate fertility control in the first-birth interval (Zhou 1990), and the level of childlessness is very low, 3% or lower; this value is displayed by the average Hutterite woman with around nine children by the end of her reproductive life (Feeney and Wang 1993:71). Under these circumstances, behavioral factors, such as coital frequency and the ways in which coitus is distributed across the cycle, and biological factors, such as health and reproductive physiology, are expected to be the main determinants of the distribution of waiting times to first birth.

Beside these factors, however, the distribution of first-birth intervals will be affected by couples' failure to report first births to official inquiries in an effort to adjust to the strictures of birth planning policies. For example, couples who fail to report a female birth because of a strong desire to bear a son will try to conceive again to achieve a desired family size or sex composition that disagrees with the mandates of official policy. Similarly, out-of-plan births, such as births conceived before marriage or births not approved by the birth planning system for other reasons (Feng and Hao 1992), may go unreported. They may be replaced by second births as soon as parents become officially eligible for childbearing or at a time more consonant with the local fertility plan. Thus some *reported* first births in fact may be *replacement* births following unreported *true* first births. This phenomenon will affect the distribution of timing to first birth by lengthening the reported interval between marriage and first birth.

In our hypotheses about underreporting of births, we focus on the ways in which the distribution of first births by time since marriage may be affected by reporting errors to official inquiries associated with the implementation of birth planning policy. We also consider alternative explanations not produced by the interaction between policy and data collection because statistical artifice may be second only to actual reproductive behavior as a rational response to birth planning policies and policy changes.

The behaviors described below, either statistical or associated with actual reproduction, are expected to lengthen the interval between marriage and first birth:

(1) Couples whose first births are followed closely by death may fail to report both events, and may attempt to conceive again to replace the previously lost birth as soon as the period of postpartum infecundability comes to an end.

(2) Some surviving first births may go unreported because they are females, and may be replaced by another birth because of the desire to bear a son.

(3) Because most rural weddings occur in the winter months, the seasonality of marriage may result in a concentration of first births at the end of the calendar year. This pattern of marriage and childbearing may be at odds with the birth planning efforts of a meticulously maintained annual birth quota; thus the quota system may result in regular postponements of first births, though perhaps by only a single year (Feeney and Wang 1993:72–74). As a result, given the administrative constraints on the timing of first birth, not all newlyweds who marry around New Year and immediately request authorization to give birth may be allowed to do so in that year. They may agree to postpone their birth to the following year; alternatively, they may disregard the regulations and give birth in the year of marriage but register this event the following year, if at all.

(4) Couples who disregard regulations governing age at marriage may be asked to postpone their births until they reach the minimum legal age at marriage (20 years for women and 22 for men) or the late age at marriage (23 years for women and 25 for men; Fifth National People's Congress 1981). Alternatively, reporting of births not approved by the birth planning system to women younger than 20 or 23 may be postponed until the date of birth matches the official age at marriage.

(5) The incentive to manipulate birth records may be stronger in counties where birth planning performance is an important criterion for cadres' evaluation.

(6) Variation in the vigor with which birth planning policies have been implemented over the last two decades (Aird 1986; Greenhalgh 1990; Hardee-Cleveland and Banister 1988; Zeng 1989) may be associated with fluctuations in the magnitude of misreporting. Births may be more likely to go unreported if they occur in a period of policy tightening than in a period of policy relaxation.

(7) Because births conceived before marriage are at odds with the birth planning regulations, conceptions before marriage may be misreported as conceptions occurring immediately after marriage; alternatively, they may be omitted altogether from pregnancy histories and possibly replaced by another birth within plan. In the first instance, misreported premarital conceptions will shorten

the first-birth interval. In the second, they will have the opposite effect: Reporting second pregnancies as first pregnancies will lengthen the interval between marriage and first birth.

(8) Finally, some of the patterns we predict could be produced just as well by unreported fetal losses (miscarriages and stillbirths), which are often omitted from pregnancy histories for reasons other than deliberate responses to policy (Coale and Banister 1994). Like unreported first births that precede a reported birth, unreported miscarriages and stillbirths preceding a live birth will lengthen the interval between marriage and first birth.

It is well known that estimates of fetal loss based on data collected in retrospective surveys are subject to errors related to the differentiation between types of fetal loss and to underreporting (Bongaarts and Potter 1983:38–34; Gray 1979:232–33; Jain 1969:297). In the INCRC project areas, reporting of miscarriages is likely to be less accurate than reporting of stillbirths (H. Smith 1994). Among women interviewed in the baseline survey, the rate of reported fetal loss was 29 per 1,000. Although estimates of fetal mortality vary widely among populations, this rate is much lower than even the lowest of the rates reported by Bongaarts (1980) for both developed and developing countries, which range from 125 to 300 per 1,000. The stillbirth component of the fetal loss rate of 11 per 1,000 in the baseline survey is at the low end of the range reported by Bongaarts (from 10 per 1,000 in developing countries to 40 per 1,000 in developed countries).

THE FOUR INCRC COUNTIES

In previous analyses of INCRC baseline survey data and in observations gathered during numerous field trips to the study areas by project investigators, enough information has been obtained to produce distinctive portraits of the four counties in regard to their socioeconomic status and birth planning performance during the 1980s.

Huasheng (county names are pseudonyms), in Hebei Province, about a two to three hours' drive from Beijing, is semi-mountainous and contains a significant population of the Man ethnic minority. In 1991, the net per capita income of the rural population of Huasheng was 912 yuan (as of January 1992, US$100 = 570 yuan; Tu and Smith 1995). Huasheng was home to Wang Guofan, whose agricultural cooperative was singled out for praise by Mao Zedong in the early 1950s, and whose political connections made Huasheng a model county (Friedman, Pickowicz, and Selden 1991).

Huasheng County began the INCRC project as furthest removed from the one-son-two-child policy, the functional successor of the one-child policy, which allows couples to have two births with spacing if the firstborn is a girl (Li 1995; Tu 1995:170). A large proportion of women were having second births without meeting the policy requirements. The county displays the highest IUD removal and expulsion among the four counties (Tu 1995) and the lowest probability of a pregnancy being aborted, regardless of the sex of the first birth (Tu and Smith 1995). According to INCRC project investigators, township cadres are lenient and flexible in implementing birth planning rules and regulations (Qian 1992). Also, penalties for out-of-plan births represent a portion of the family planning budget, and cadres in Huasheng acknowledge the financial benefits they gain from their collection (Qian 1997).

Pangxie is another two hours' drive past Huasheng, on the coast of Hebei Province, with a rural net per capita income in 1991 of 606 yuan. This is a model county in terms of family planning, a status dating back to the mid-1970s.[1] Local authorities are reluctant to allow one-daughter families to have a second birth, and are very strict with spacing and other requirements. The probability of IUD removal is low; the probability of abortion is high. Yet in spite of their formal "success" in birth planning work, the morale of family planning workers is low. Turnover of personnel is much higher than in the other three counties. Birth planning cadres complain about their tight budget. Some even acknowledge that they would rather see more out-of-plan births, as a way to raise revenues through fines (Qian 1994).

Ciqixian and Shanshui are two representative counties of Shandong, a province renowned for its speed in adjusting to central birth planning directives and for the careful, effective management of its family planning program.

A former county, Ciqixian was recently redefined as a district of Zibo City, with the former county boundaries. Although part of the district of an industrial city, Ciqixian townships are mostly mountainous and rural;[2] in 1991 the net per capita income of the rural population was 969 yuan. In this county, the original one-child policy apparently still prevails. Not all eligible women progress to second birth. The county also displays the lowest IUD expulsion and the lowest overall IUD discontinuation. Norplant, regarded as a substitute for sterilization in the purview of the INCRC project, and typically adopted by parity 2 women, is quite common among women with one child.

Shanshui borders Ciqixian to the south, and is even more mountainous and rural. It is officially designated as a "poor" county (the net per capita income of the rural population in 1991 was 499 yuan). This may be an indication of good political connections, because being officially "poor" makes counties eligible for provincial subventions. Net of all other variables, in the 1980s, Shanshui women were twice as likely as their Ciqixian counterparts to have a second birth, although only 13% did so (Qian 1997).

In at least three of the four study counties, the one-son-two-child policy is certainly the administrative standard. This is not surprising: These areas were chosen by China's State Family Planning Commission for participation in the INCRC project because, as Tu (1995) points out, they represent the model in family planning that the government is trying to promote. Keeping the birth rate low is an explicit criterion

1. Family planning propaganda pamphlets distributed nationwide *circa* 1977 portray Pangxie women as enthusiastic acceptors of the later-longer-fewer policy, the predecessor of the one-child policy.

2. Insofar as Ciqixian is similar to other Zibo districts, 1990 census data show that 77% of the population of all Zibo districts combined (excluding Zibo central city proper) lives in rural villages (Ciqixian qu 1991).

for evaluating various administrative units and their leaders:[3] Township leaders in these counties are made responsible for fertility targets in the form of a contract signed between themselves and their superiors (Tu 1995).

DATA

The INCRC project examined the performance of an enhanced rural family planning system that integrates improved methods of contraception with better training of family planning personnel (Merli et al. 1996; Smith et al. 1997). A baseline survey (hereafter called "the Baseline Survey") was conducted in December 1991–January 1992 before the new policies were implemented. The survey questionnaire gathered information about fertility, pregnancy, and contraceptive histories from a sample of currently married women age 15–35 living in the four counties. The sample was selected according to a stratified multistage random sample; townships were the primary sampling units. Six townships were selected at random in each of the four study counties, eight villages per township. About 50 currently married women under 35 were sampled within each village, for a total of 192 villages and 8,603 complete questionnaires (Tu et al. 1992).

The INCRC project was an effort of the SFPC, with technical support from the Population Research Institute of Peking University and the Population Studies Center of the University of Pennsylvania, and funding from the Rockefeller Foundation. Academic researchers were heavily involved in the design of the sample and the questionnaire: They visited the study counties on at least 18 separate occasions. The purposes of these visits were to meet local officials and select study sites, to monitor the general course of the research, to participate in training survey interviewers, to interview birth planning workers and their clients, to set up the computerized record-keeping system, to maintain the family planning surveillance system, to collect surveillance data, to examine related health system records, and to convey and translate for other outside observers.

The survey, however, was a major operation, involving 192 villages, and thus ultimately was the product of the SFPC and the local birth planning workers. Interviewers were trained by faculty members of the Population Institute of Beijing University, but the interviewers were local birth planning personnel: township and village birth planning workers, and village women group leaders.

To minimize administrative interference with data collection, the SFPC told family planning units in the four counties, in writing, that the collection of accurate data was of the utmost importance; no one would be penalized if the data so collected showed evidence of a failure to meet birth planning directives. Yet despite these efforts, we are aware that respondents' answers, as a result of direct or indirect pressures from birth planning officials, may take the form of "reports" to birth planning authorities about "politically correct" reproductive behavior, and births less wanted by the birth planning system thus may go unreported.

PRELIMINARY EVIDENCE OF REPORTING ERRORS IN DATA COLLECTED IN THE FOUR INCRC COUNTIES

External validation of the INCRC baseline data helps in assessing data quality. Tu and Smith (1995:280), comparing the number of abortions enumerated in the Baseline Survey with township clinic records, noted that the reporting of these events in the survey was more accurate than that typically obtained in high-quality surveys, both in China and abroad. Abortion is a particularly sensitive event in China. It is a major target of international criticism of China because of the well-publicized controversies over this practice as a means of terminating unplanned pregnancies; hence it is at greater risk of going unreported. The quite accurate recording of abortions in the Baseline Survey is a reason for increased confidence in the overall quality of the data.

Despite the accuracy in recording abortions, preliminary analyses of Baseline Survey data reveal that the recording of other events is vexed by systematic errors and omissions, particularly an excess of reported male births relative to female births at both parity 1 and 2 (Qian 1997; Smith and Tian 1993) and an apparent underreporting of infant mortality in both sexes.

Sex ratios at birth are regarded as an important indicator of data quality because of their relative invariance across human populations (Johansson, Zhao, and Nygren 1991:28).[4] Demographers have attempted to explain the proximate causes of the ratios found in the Baseline Survey data. These include excess female infant mortality (Banister 1992a), out-adoption of female infants (Johansson and Nygren 1991), concealment of female births (Hull 1990), and sex-selective abortion (Zeng et al. 1993). Except for sex-selective abortion, each of these explanations would require an outright omission of female births from registration records regardless of whether those births survive or die shortly after birth.

All INCRC counties but Pangxie showed abnormally high sex ratios at both parities 1 and 2. Huasheng and Shanshui respectively displayed sex ratios of 1.14 and 1.15 at first birth. Ciqixian showed the most elevated sex ratio, 122 male births for 100 female births; this is well above the average of 115/100 for the four counties, and much higher than the sex ratio of 105.5 at first birth for all of China reported in the 1990 census (Tu 1992).

Greenhalgh and Li (1995) argue for an association between the intensity of policy enforcement and high sex ratios at birth: The more intense the policy enforcement, the higher the sex ratios. INCRC Baseline Survey data suggest

3. An exception is Huasheng, where the link between political favoritism and birth planning "performance" is not always straightforward. A possible explanation is that the county's political exceptionalism and the place of Wang Guofan in the socialist pantheon may obviate county politicians' need to curry favor with the municipal and provincial governments through strict enforcement of family planning regulations.

4. The biologically normal sex ratio at birth should be around 106 males per 100 females plus or minus variability due to chance. There is evidence, however, that Chinese in the United States have slightly higher sex ratios at birth than do whites; this is estimated at 107.1 (e.g., James 1985; Taffel 1984).

that sex ratios vary widely enough by county and period to make this association plausible. Sex ratios at first birth were higher than normal for the aggregate of the four counties at the beginning and at the end of the 1981–1991 decade, but were significantly lower than normal in 1987–1989 (Smith and Tian 1993).

Sex-selective abortion, the least often challenged explanation offered for high sex ratios at birth, cannot possibly explain high sex ratios in the 1980s; at that time, ultrasound machines enabling detection of the sex in utero were not available in the INCRC project areas. Similarly, infanticide or other forms of differential mortality and/or abandonment of baby girls do not emerge as a possible explanation of high sex ratios at birth. The first author's conversations with birth planning cadres and health officials were not revealing about reports of infanticide or abandonment of baby girls.

A more likely explanation is higher-than-normal sex ratios in the first half of the 1980s, a period of strong enforcement of the one-child policy (Greenhalgh 1990; Hardee-Cleveland and Banister 1988). Such ratios may signal respondents' strong motivation to conceal female births in order to be allowed to have another child. Lower-than-normal sex ratios, however, suggest a different reporting response to policy. Smith et al. (1997) provide statistical evidence of underreporting of boys in Shanshui; this suggests that the policy relaxation in 1987–1988, which allows couples to have a second child if the first one is a girl, induced couples to report the first child as a girl even if it was a boy in order to have a second child.

All four counties also show implausibly low levels of infant mortality. Infant mortality estimates from Baseline Survey data average 5.9 deaths per 1,000 live births in the four counties during the 1981–1991 period: Ciqixian displays the lowest rate, 2.2 per 1,000, and Huasheng the highest rate, 10 per 1,000, while Pangxie and Shanshui display respective rates of 5.2 and 4.9. In a country where the infant mortality rate (IMR) is believed to have leveled off to around 40 (per 1,000) by 1990 (Banister 1992a, 1992b; World Bank 1993), it is hard to accept such a low rate, which is comparable only to current rates in Japan (estimated at 5 per 1,000 in 1991; World Bank 1993) and in Sweden, Finland, and Singapore (estimated at 6 per 1,000 in 1991).

A detailed study of Ciqixian health and birth planning records revealed that underreporting of infant mortality is less severe in the district health records than in the Baseline Survey (8.3 per 1,000 in 1994, compared with 2.2 per 1,000 in 1981–1991), but that records routinely collected by the health and birth planning systems equally underreport births and infant deaths, because the definition of a reportable birth is determined by the statistical administrative apparatus established by the birth planning system (Merli 1998). From the standpoint of birth planning cadres, whose ability of meeting program goals is continuously evaluated, births followed by infant deaths are "negative" because as long as a birth is a live birth, it adds to the total birth figure of the village and the township. Omitting reports of infant deaths and the associated births is an easy, safe way to keep reported fertility below the quota ceiling.

METHODS

To investigate underreporting of births in the Baseline Survey, we conduct our analysis in several steps. First, to assess the impact of time on the hazard of first birth in month of exposure among women who are at risk of birth in each month since marriage, we fit a logit model for discrete-time data. The main advantage of this model is that it allows the hazard to change with time since marriage by the inclusion of a set of constants, one for each month of observation (Allison 1984). With increasing time since marriage, the risk set is diminished by the growing number of women who have had a birth. In the absence of any deliberate effort to delay first births, the smaller set of women still at risk at later exposures consists of a selected sample of less fecund women who have not yet experienced a birth; thus the hazard of birth declines as the number of months since marriage increases. The hazard is expected to *increase*, however, when replacement "first" births occur to women who failed to report their true first births.

Second, to pinpoint any changes in the hazard of birth, we fit a change-point regression (Raftery 1994; Raftery, Lewis, and Aghajanian 1995). Standard regression methods are not applicable to change-point regression models because the change point itself must be estimated, and uncertainty about it must be propagated through the final conclusions. This cannot be done in the standard way because the likelihood is an irregular function of the change point; thus the standard asymptotic results do not hold. Therefore we use a Bayesian approach in which we estimate the change point using its Bayesian posterior distribution. Inference about the existence of a change point is based on Bayes factors (Raftery 1994; Raftery and Akman 1986; A. Smith 1975).

Finally, we introduce explanatory variables to establish which factors associated with birth planning policies are responsible for the change in the hazard of birth. We present results for each county as well as for the total of the four counties.

For the present analysis, the interval between marriage and first birth, survey, or divorce is measured in month units up to the thirty-first month after marriage. This corresponds to the first two and a half years of marriage. At the end of this period, more than 90% of women living in the four counties have given birth to their first child. Women who have not yet had a birth by the last month of observation are considered to be censored.

To minimize the complexities introduced by factors that may shorten the first-birth interval, we focus on reproduction within marriage. Women with apparent premarital conceptions (i.e., those with first-birth intervals shorter than nine months) were excluded from the analysis. To this exclusion, we added women with intervals of less than nine months between marriage and survey or divorce. These two groups combined are only 4.5% of all interviewees. Other exclusions are (1) women who reported using any form of contraception during the first-birth interval, less than 1%, because the fraction of women practicing contraception before their first birth is too small to make the inclusion of this covariate a valuable addition; and (2) a small fraction of women who married before 1980, 2.4% of all interviewees, because they were married before the implementation of the one-child policy and are not subject to the same constraints as women married in the 1980s. This procedure yielded an effective sample size of 7,937 women and 7,395 births.

Figure 1 shows the cumulative distribution of first births by month since marriage and by county. Progression to first birth in all four counties is rapid and nearly universal: 93% of women interviewed in the Baseline Survey have had a birth by the thirty-first month after marriage. Women living in the two Shandong counties progress to first birth faster than their counterparts in Hebei. By the end of the first year of marriage, 61% and 62% of Ciqixian and Shanshui women have had their first birth, compared with 55% and 53% in Huasheng and Pangxie.

Table 1 presents the distribution of births by sex, month of marriage, age at marriage, year of birth, and county; the effects of these covariates on the length of the first-birth interval will be modeled in our analysis. As stated earlier, however, the sex ratios at first birth are high in all counties except Pangxie, as implied by the higher proportion of male to female births.

Most women marry in the winter months, especially in Pangxie; there 61% of the marriages occurred between January and March. Marriages in Ciqixian, however, are spread more evenly throughout the year. This is probably the case because Ciqixian's women participate more fully in nonagricultural activities than do women living in the other typically rural counties. The age pattern of marriage reflects county variation in the implementation of birth planning

FIGURE 1. CUMULATIVE DISTRIBUTION OF FIRST BIRTHS, BY COUNTY AND MONTH SINCE MARRIAGE

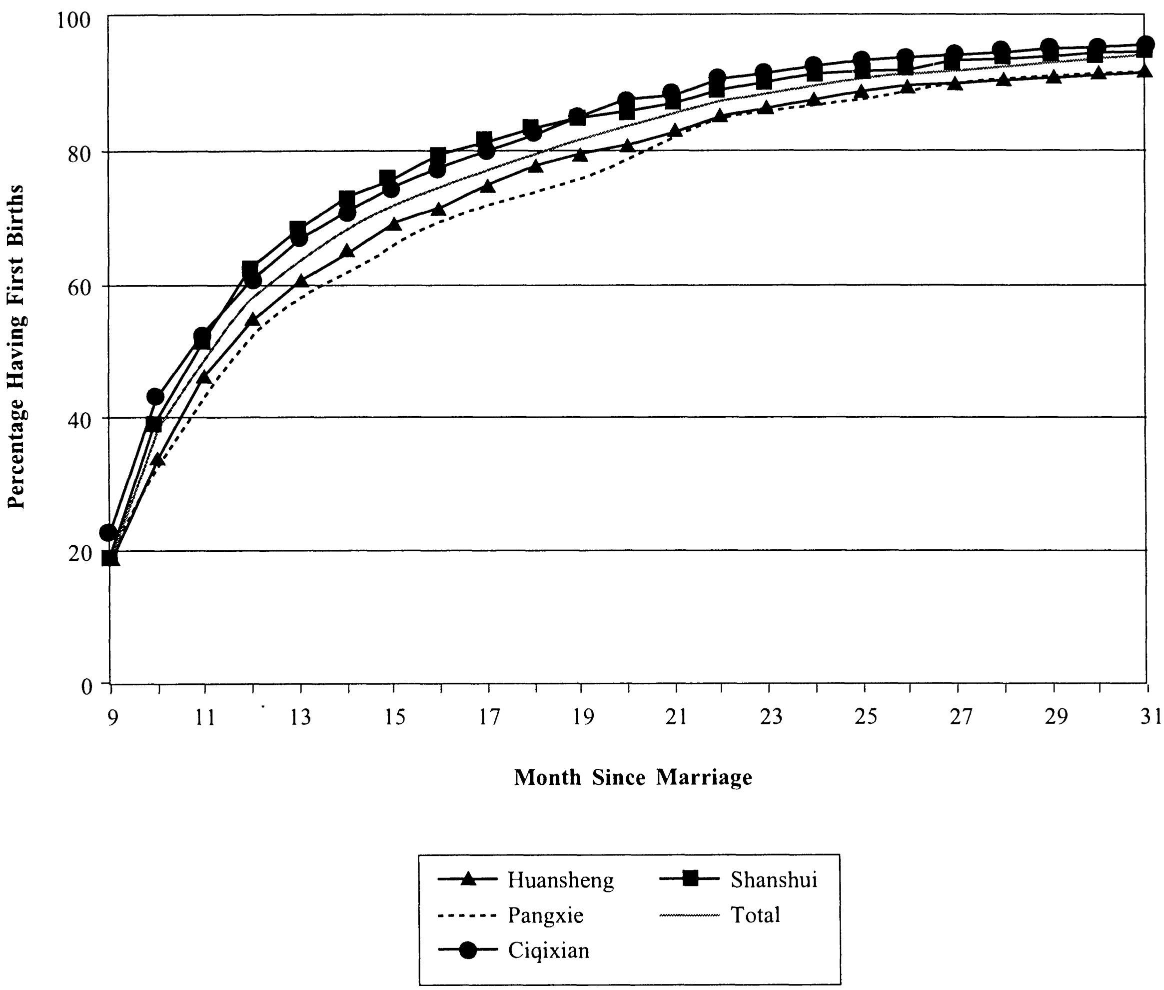


TABLE 1. PERCENTAGE DISTRIBUTION OF SELECTED CHARACTERISTICS OF WOMEN LIVING IN THE FOUR INCRC COUNTIES

	Huasheng	Pangxie	Ciqixian	Shanshui	Total
N	1,973	1,903	2,121	1,940	7,937
Male First Births	48.5	48.0	52.6	50.5	50.0
Female First Births	42.8	43.4	43.1	43.5	43.2
> 31 or No Birth	8.7	8.6	4.3	6.0	6.8
Total	100.0	100.0	100.0	100.0	100.0
Marriage Quarter					
Jan–March	27.7	60.8	22.2	33.1	35.5
Apr–June	11.6	11.2	22.5	16.7	15.7
Jul–Aug	11.6	5.4	27.8	18.7	16.1
Sep–Dec	49.1	22.6	27.5	31.5	32.7
Total	100.0	100.0	100.0	100.0	100.0
Age at Marriage					
< 20	17.3	6.3	3.0	4.9	7.8
20–22	54.5	58.0	50.0	50.5	53.2
≥ 23	28.2	35.7	47.0	44.6	39.0
Total	100.0	100.0	100.0	100.0	100.0
Period of Birth					
1980–1983	15.2	17.7	17.9	20.4	17.8
1984–1986	26.2	28.2	28.1	29.6	28.0
1987–1988	23.2	20.3	23.7	21.0	22.1
1989–1991	26.9	25.3	26.0	23.1	25.3
> 31 or No Birth	8.7	8.6	4.3	6.0	6.8
Total	100.0[a]	100.0[b]	100.0	100.0[b]	100.0

[a]Actual percentage is 100.2; column does not sum to 100.0 because of rounding.

[b]Actual percentage is 100.1; column does not sum to 100.0 because of rounding.

policies. Women in Huasheng marry at the youngest ages, while a large fraction of Ciqixian and Shanshui women marry at age 23 and above; this difference indicates strict enforcement of the regulations calling for late age at marriage in the two Shandong counties.

Women living in the INCRC counties were having first births at a faster pace than in rural China as a whole. The mean interval between marriage and first birth of 13.1 months is shorter than the mean interval of 16 months for the period 1981–1987 observed in all Chinese counties (Feeney and Wang 1993:73). The median length of the interval, just above 11 months, is close to the median duration of 12 months noted in other developing countries (Rodríguez and Hobcraft 1980).

Discrete-Time Hazard Modeling Results

We create a separate observation record for each month in which a woman is known to be at risk of birth. Individual observation records correspond to the period between marriage and first birth, survey, or divorce; the ninth month after marriage is taken as the starting point of observation. For each woman-month, the response is the occurrence or not of a birth in that month. Finally, all woman-months are pulled into a single sample ready for the estimation of a logit model. The final woman-month sample thus obtained contains 55,964 observations.

To identify specific patterns in the hazard of birth by time since marriage, we specify the dependence of the hazard of first birth on time, by estimating constants using a set of 22 dummy variables that correspond to month 10 after marriage, ..., month 31 after marriage. Month 9 serves as the reference category. The probability of woman i having her birth in month t of exposure is then given by

$$\log\left[\frac{P_{it}}{1-P_{it}}\right]=\alpha+\beta_t+\gamma x_{it}, \tag{1}$$

where P_{it} is the probability, β_t is a function of time expressed in months since marriage to indicate that for any particular woman the hazard of a first birth varies with time since marriage, $\boldsymbol{x}_{it}$ is a vector of explanatory variables, and γ is the corresponding vector of regression coefficients.

Initially we are interested in examining the effect of time since marriage on the probability of a male or a female birth across the four counties when month and county are the only variables in the model. No other covariates are considered for inclusion in this stage of the analysis. Because of the observed imbalance in the sex ratios, we estimate two separate logistic regression models contrasting the probabilities of male and of female birth respectively with no birth. The coefficient of level t of the month variable is the difference between the log-odds of having a birth in month t and the log-odds of having a birth in month 9 across four counties. The distribution of the monthly log-odds of having a male or a female birth is also examined separately by county, because counties may differ as a result of variation in the local implementation of birth planning policy and regulations.

Figures 2 through 6 plot the estimated log-odds represented by the sums of the intercept term and each of the month coefficients. Figure 2 shows the average county log-odds of birth by month since marriage for women interviewed in the Baseline Survey; Figures 3–6 depict the county-specific log-odds of birth. These figures show that the hazard of male and of female birth is highest in the first few months of observations, declines thereafter, rises towards the end of the second year of marriage, and then declines again. A deviation from a pattern of linear decline can be observed in each of the four counties for both male and female births, but it is more pronounced in Huasheng and Pangxie, the two Hebei counties.

Change-Point Regression Results

To pinpoint the month in which the hazard of birth begins to increase and to identify its most accurate predictors, we fit a change-point regression model to the log-odds of birth,[5] with

5. Here we focus on the hazard of birth without distinguishing male and female births, because the pattern of the hazard of birth by sex was similar for male and for female births.

FIGURE 2. ALL FOUR COUNTIES: AVERAGE LOG-ODDS OF MALE AND FEMALE FIRST BIRTHS, BY MONTH SINCE MARRIAGE

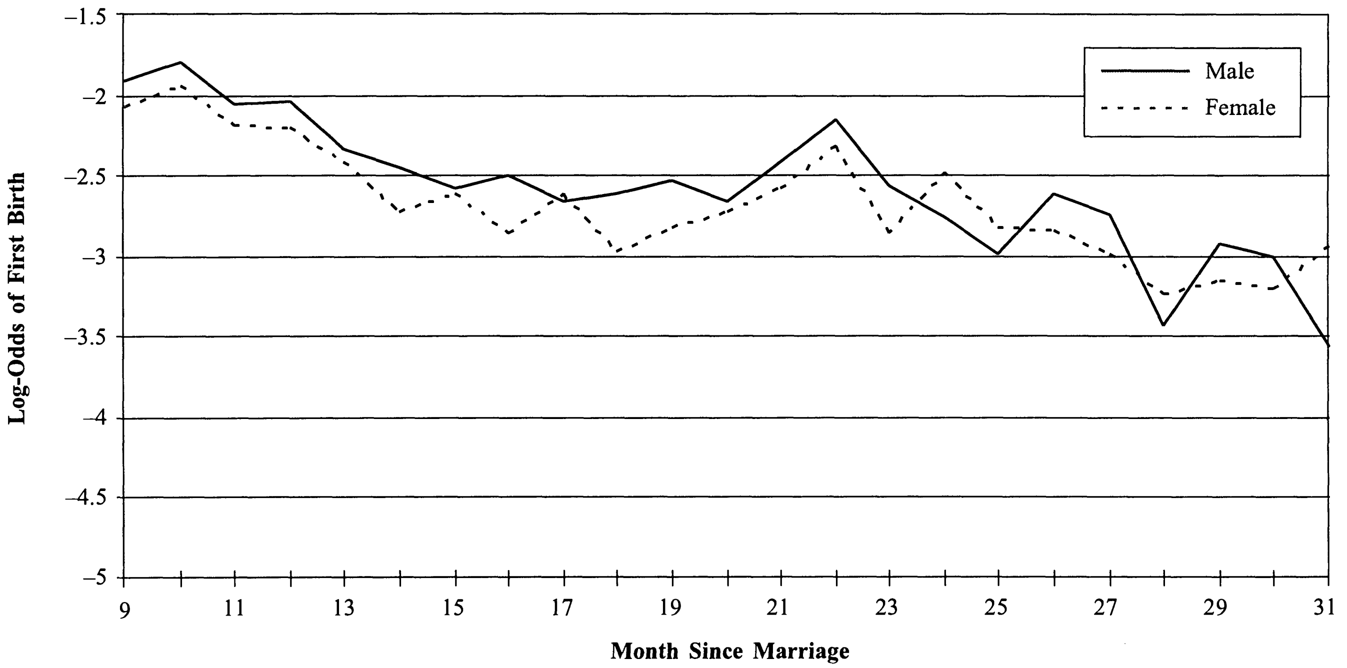


FIGURE 3. HUASHENG: ESTIMATED LOG-ODDS OF MALE AND FEMALE FIRST BIRTHS, BY MONTH SINCE MARRIAGE

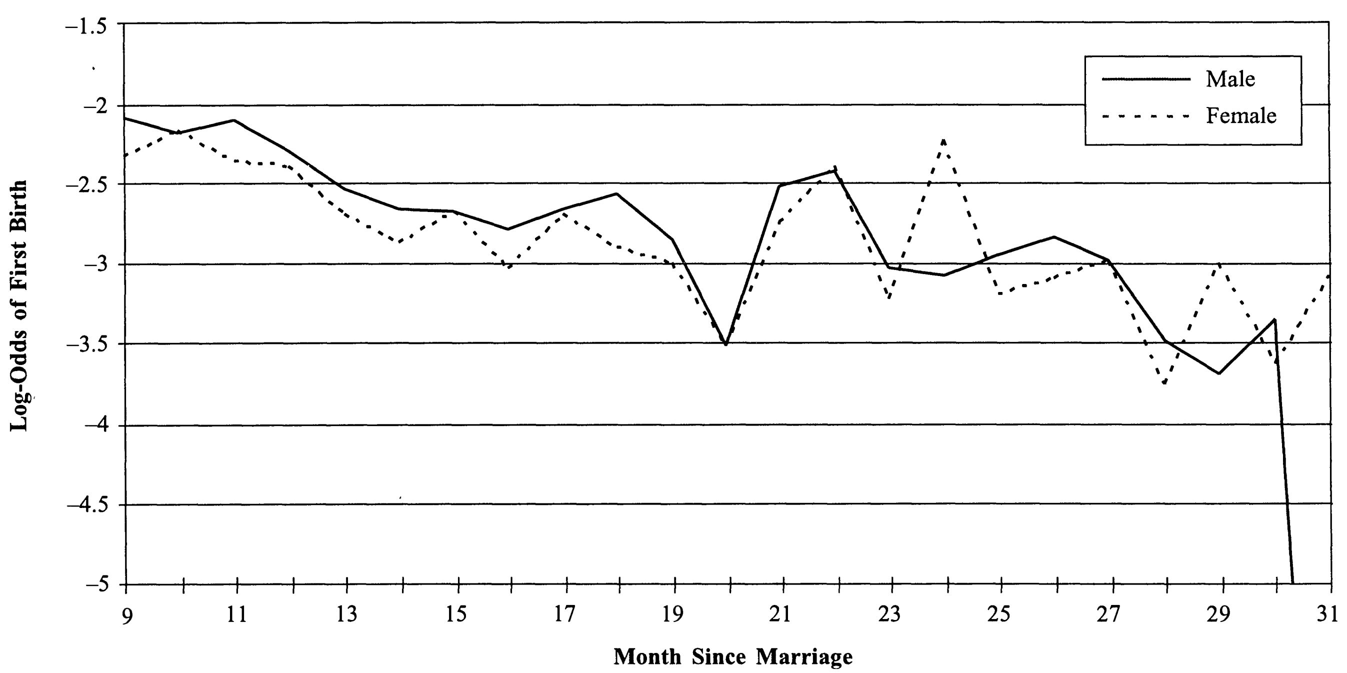


FIGURE 4. PANGXIE: ESTIMATED LOG-ODDS OF MALE AND FEMALE FIRST BIRTHS, BY MONTH SINCE MARRIAGE

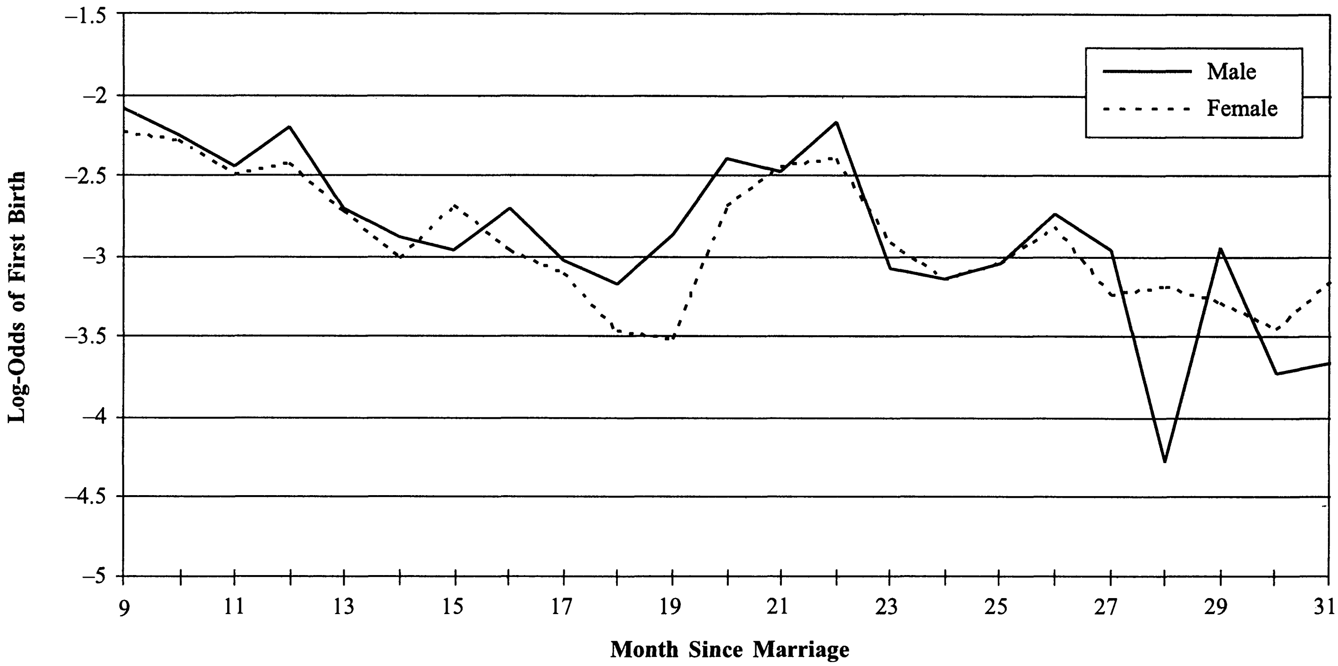


FIGURE 5. CIQIXIAN: ESTIMATED LOG-ODDS OF MALE AND FEMALE FIRST BIRTHS, BY MONTH SINCE MARRIAGE

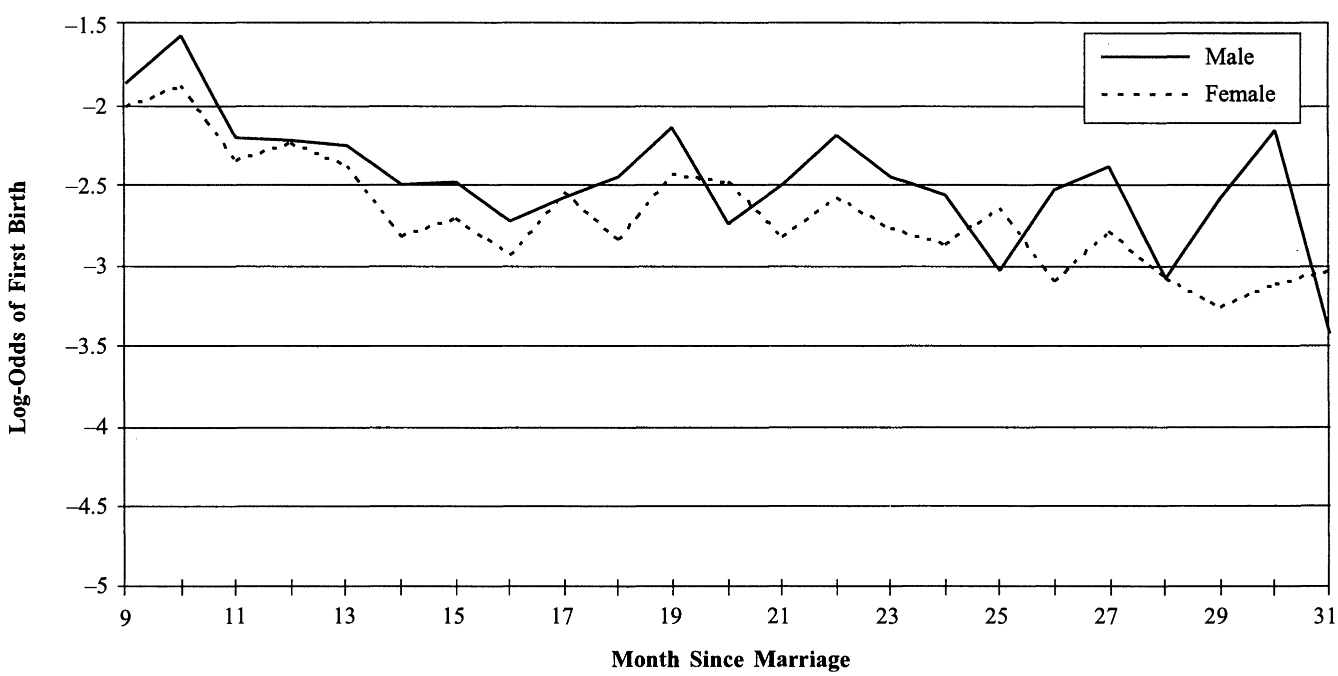
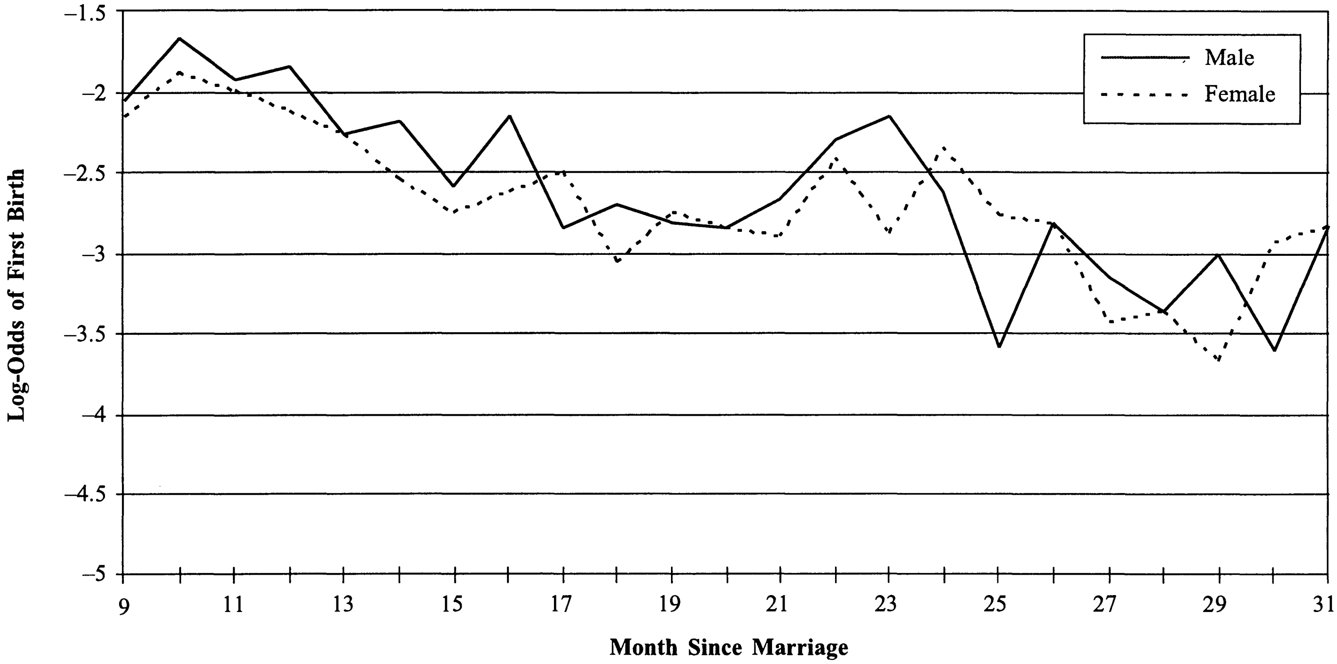


FIGURE 6. SHANSHUI: ESTIMATED LOG-ODDS OF MALE AND FEMALE FIRST BIRTHS, BY MONTH SINCE MARRIAGE



the number of observations corresponding to the number of months:

$$\log\left[\frac{P_{it}}{1-P_{it}}\right]=\beta_0+\beta_1(9-t)+\beta_2(t\geq\tau),$$
$$t=9,\ 10,\ \ldots,\ 31, \qquad (2)$$

where t is month since marriage and τ is the change point representing the month in which the hazard of birth begins to increase. The change point, τ, is assumed to lie between $t_0 = 18$ and $T = 23$ months. The choice of these values was guided by the intuition that the change point is likely to be slightly greater than $2 \times 9 = 18$ months,[6] and by the results of the discrete-time hazard models. Our results are relatively insensitive to changes in the values of t_0 and T.

To estimate τ, we fit the model in Eq. (2) for each value of τ considered, and chose the value that gave the best fit as measured by the lowest deviance. We then compared the change-point model with the no-change model defined by $\beta_2 = 0$. To carry out this comparison, we computed a Bayes factor (Kass and Raftery 1995) for a change point against the alternative of no change for the total of four counties and for each separate county. The overall Bayes factor $B_{10}(\tau)$ for a change at any time (M_1) versus no change (M_0) was approximated by

$$B_{10(\tau)}=\frac{\sum_{\tau=18}^{T}\left(\exp\left((DV_0-DV_\tau)/2\right)\right)}{\sqrt{n}\left[(T-t_0)+1\right]}, \qquad (3)$$

where n = total number of births, DV_0 is the deviance of M_0, and DV_τ is that of $M_1(\tau)$ for each possible value of τ; $M_1(\tau)$ is the model with a change point at τ (Raftery 1994). We interpret grades of evidence according to a scheme given in Raftery (1995:139), whereby evidence is viewed as weak, positive, strong, or very strong if the Bayes factor exceeds 1, 3, 20, or 150, respectively.

Table 2 displays the evidence for a change point in the hazard of birth for the aggregate of the four counties and for each county. We find evidence for a change point in all four counties. It is very strong in all counties except Shanshui, which shows only positive evidence. The estimated time at which the hazard of birth begins to increase ranges from month 19 in Ciqixian to month 22 in Shanshui. Figure 7 plots the fitted and the actual hazard of birth for the four-county change-point model. The figure shows that the model with a change point in month 21 fits the data well.

What factors are responsible for the increase in the hazard of birth at later exposures? The birth interval may be lengthened by the seasonal pattern of marriage in rural China, which is at odds with a precise annual birth plan, by official regulations governing the minimum age at marriage, or by the sex of the first birth. This may happen either through reporting of second births as first births following

6. This allows for the minimum length of postpartum anovulation of 1.5 months or, in the case of intrauterine mortality, two months (Bongaarts and Potter 1983:86) and a short waiting time to (second) conception.

TABLE 2. MONTH OF CHANGE POINT AND GRADES OF EVIDENCE CORRESPONDING TO VALUES OF THE BAYES FACTOR FOR A CHANGE POINT

County	Month of Change Point	Bayes Factor	Evidence
Huasheng	21	2,930	Very strong
Pangxie	20	$6.9\ 10^{11}$	Very strong
Ciqixian	19	16,248	Very strong
Shanshui	22	4	Positive
All Counties	21	$1.1\ 10^{18}$	Very strong

unreported first births, through delayed reporting of first births, or through delayed childbearing. The incentives to adopt any of these behaviors may vary across county and time, depending on the vigor with which birth planning policies are implemented at the local level and on the intensity of the policy in particular periods.

The change-point regression allows us to test all of these hypotheses except the one that posits underreporting of female births. That hypothesis will be investigated in the next section.

The change-point regression can cover a change in a regression parameter by introducing into Eq. (2) a multiplicative interaction term between the change point and the corresponding independent variable. To explore the factors responsible for the surge of the hazard of birth at the end of the second year of marriage, we fit a model with all two-way interactions between the change point and marriage quarter, age at marriage, and period of birth; then we use a backward elimination procedure to choose the best subset. We base model comparison on the *BIC* statistic in the form

$$BIC = -\chi^2 + p \log(n), \tag{4}$$

where χ^2 is the likelihood-ratio test statistic for comparing the null model with no covariates with the model of interest, p is the number of independent variables in the model of interest (not counting the intercept), and n is the sample size: that is, the number of events (births) in the logistic regression (Raftery 1995; Volinsky et al. 1997; Xie 1994). *BIC* is an approximation to twice the logarithm of the Bayes factor for the null model against the model of interest. The lower (i.e., the more negative) the *BIC*, the better the model, according to this criterion.

Table 3 shows the fits of various change-point models. For the aggregate of the four counties in the first panel, Model 3 is the best-fitting model according to *BIC*. It includes two interaction terms that provide a test for the increasing hazard of birth at later exposure with respect to marriage quarter and age at marriage. Yet when the analysis is broken down by county, the simpler change-point model with no interactions fits the data best for three of the four coun-

FIGURE 7. ACTUAL AND FITTED HAZARD OF BIRTH FOR THE CHANGE-POINT MODEL: ALL FOUR COUNTIES

TABLE 3. FACTORS RESPONSIBLE FOR THE SURGE IN THE HAZARD OF BIRTH AT THE END OF THE SECOND YEAR OF MARRIAGE

Variables	χ^2	*p*	*BIC*
All Counties (*N* = 7,389)			
1. M + CP	661.69	2	–643.874
2. M + CP + MQ + AM + Y + CP × MQ + CP × AM + CP × Y	801.80	12	–694.907
3. M + CP + MQ + AM + CP × MQ + CP × AM	**759.99**	**6**	**–706.543**
4. M + CP + MQ + CP × MQ	738.71	4	–703.079
5. M + CP + AM + CP × AM	690.16	4	–654.529
Huasheng (*N* = 1,802)			
1. M + CP	**163.98**	**2**	**–148.987**
2. M + CP + MQ + AM + Y + CP × MQ + CP × AM + CP × Y	207.36	12	–117.400
3. M + CP + MQ + AM + CP × MQ + CP × AM	174.04	6	–129.060
4. M + CP + MQ + CP × MQ	172.15	4	–142.163
5. M + CP + AM + CP × AM	166.11	4	–136.123
Pangxie (*N* = 1,737)			
1. M + CP	177.07	2	–162.150
2. M + CP + MQ + AM + Y + CP × MQ + CP × AM + CP × Y	247.65	12	–158.131
3. M + CP + MQ + AM + CP × MQ + CP × AM	233.48	6	–188.721
4. M + CP + MQ + CP × MQ	**226.33**	**4**	**–196.490**
5. M + CP + AM + CP × AM	187.82	4	–157.980
Ciqixian (*N* = 2,029)			
1. M + CP	**166.17**	**2**	**–150.939**
2. M + CP + MQ + AM + Y + CP × MQ + CP × AM + CP × Y	186.72	12	–95.336
3. M + CP + MQ + AM + CP × MQ + CP × AM	171.09	6	–125.400
4. M + CP + MQ + CP × MQ	168.84	4	–138.379
5. M + CP + AM + CP × AM	168.66	4	–138.198
Shanshui (*N* = 1,821)			
1. M + CP	**166.44**	**2**	**–151.426**
2. M + CP + MQ + AM + Y + CP × MQ + CP × AM + CP × Y	194.32	12	–104.234
3. M + CP + MQ + AM + CP × MQ + CP × AM	178.54	6	–133.497
4. M + CP + MQ + CP × MQ	172.90	4	–142.870
5. M + CP + AM + CP × AM	173.19	4	–143.161

Notes: The preferred model is shown in bold. The independent variables are as follows: M = month since marriage; CP = change point; MQ = marriage quarter (married in January–March and married in April–December (reference category)); AM = age at marriage (married before age 23, and married age 23 and above (reference category)); and Y = period of birth (coded in four categories: 1980–1983; 1984–1986; 1987–1988; 1989–1991 (reference category)). The quantities χ^2, *p*, and *BIC* are defined by Eq. (4).

ties. In Pangxie, however, the model featuring the interaction between the change point and the marriage quarter (Model 4) is preferred to other models.

Estimates of the preferred models for each of the four counties and for all counties are shown in Table 4. Indeed, when we pool the four counties together, women who marry early (at age 22 or younger) are more likely to delay their first births than women who marry in conformity to the regulations calling for late age at marriage, either through regular postponement of childbearing or through delayed reporting of births. By the same token, women married in January, February, or March must adjust their childbearing schedule to the strictures of a precisely maintained annual birth quota, which does not allow all women with winter weddings to give birth in the same year. They do so either by postponing their childbearing plans until the following year or by postponing registration of their birth.

The enforcement of annual birth quotas has a stronger effect on the increase in the hazard of birth at later exposures than does the enforcement of late-age-at-marriage regulations, as shown by the larger coefficient of the interaction between marriage quarter and the change point. When we examine the interaction coefficients for each county, marriage quarter alone in Pangxie explains the change point in the hazard of birth. Pangxie, the county that follows the birth planning rules most diligently, is also the

TABLE 4. ESTIMATES FOR THE PREFERRED MODELS IN TABLE 3

	All Counties	Huasheng	Pangxie	Ciqixian	Shanshui
Intercept	–0.3747	–0.5618	–0.2586	–0.3008	–0.4155
Month Since Marriage	–0.0902	–0.0936	–0.1068	–0.1008	–0.0892
Change Point (CP)	0.25367	0.6807	0.5752	0.6773	0.5476
Marriage Quarter (MQ)					
Jan–Mar	–0.2249		–0.4076		
(Apr–Dec)					
Age at Marriage (AM)					
≤ 22	–0.1106				
(> 22)					
MQ × CP	0.4283		0.5712		
AM × CP	0.3003				

Note: All coefficients are significant at $p < .01$.

place with the strongest evidence for a change point coinciding with month 20 after marriage. In this county, the vigorous management of the birth planning effort, expressed by the strict implementation of the birth quota system, seems to account for the rise in the hazard of birth. In the remaining counties, the absence of significant interactions between the change point and any covariate considered suggests that something other than seasonality of marriage, period of birth, or regulations governing the age at marriage is operating to produce the increase in the hazard of birth at the end of the second year of marriage.

Are Missing Girls Replaced by Second "First" Births?

To test the hypothesis that unreported female first births may be replaced by second "first" births, we examine the correspondence between the number of missing female births occurring at durations before the change point and the number of replacement births occurring at durations after the change point.

The second and third columns of Table 5 show total and county-specific sex ratios at first birth for durations before and after the change point. In all counties but Pangxie, the sex ratios for the months up to the estimated change point are higher than the biologically normal sex ratio of 1.06. Conversely, reported births after the change point exhibit a normal sex ratio in each of the four counties. The pooled sex ratio is also normal.

In the fourth column, we estimate the number of missing girls born at durations before the change point. Following Hull (1990), and later Smith and Tian (1993), we assume that the reports of male births are correct, and we estimate the number of female births that should be observed under the assumption of a normal sex ratio. The number "missing" is the difference between that number and the reported number of female births. Hull (1990) calculated a range of estimates by varying the normal sex ratio. Like Smith and Tian (1993), however, we keep this ratio fixed at 1.06 but generate a confidence interval under the assumption that the total number of expected births (observed boys plus expected girls) is distributed binomially. When we use this method, it appears that some girls are not reported in the survey data. The estimate in the "All Counties" row, calculated from the pooled sex ratio, is a deficit of reports of 222 to 384 female first births.

To put this in perspective, as previously noted by Smith and Tian (1993), the sample consists of data from 192 villages, in which (on average) 40 or more women with at least one live birth were interviewed. Thus the number of "missing" reports is about 1 or 2 per village, or 1 or 2 per 40+ women surveyed. This point suggests that the substantial "error" (at an aggregate level) may be statistically undetectable at the level at which the error is propagated. We argue that one or two "missing" girls per village could be concealed without much effort by individual couples or by birth planning officials.

The last column of Table 5 shows the estimated number of replacement births occurring at durations after the change point. This quantity is equal to the difference between the expected number of births predicted by the model with a change point specified in Eq. (2) and the expected number of births predicted by the same model in the absence of a change point. In three of the four counties, the number of replacement births falls within the 95% confidence interval for the number of missing female births. Only in Pangxie does the number of replacement births greatly exceed the number of missing girls. This is not surprising because Pangxie is the only county bearing evidence that the enforcement of birth planning policies impinges directly on the timing of first births, because of a meticulous accounting of the annual number of births maintained in this county. In Huasheng, Ciqixian, and Shanshui, however, failing to report baby girls born at short durations and replacing them with second births reported as first births appears to be the most plausible explanation for the increase in the hazard of birth at later exposures.

TABLE 5. ARE MISSING GIRLS REPLACED BY SECOND "FIRST" BIRTHS?

County	Sex Ratio for First Births Before the Change Point [95% CI] (First Births)	Sex Ratio for First Births After the Change Point [95% CI] (First Births)	Estimated Number of Missing Female Births [95% CI]	Estimated Number of Replacement Births
Huasheng	1.16	0.93	72	99
	[1.05–1.28]	[0.71–1.21]	[32 to 112]	
	(1,590)	(212)		
Pangxie	1.11	1.07	35	180
	[1.01–1.24]	[0.85–1.34]	[–3 to 73]	
	(1,440)	(300)		
Ciqixian	1.21	1.27	111	128
	[1.10–1.33]	[1.01–1.62]	[69 to 153]	
	(1,747)	(282)		
Shanshui	1.17	1.08	79	52
	[1.06–1.29]	[0.77–1.52]	[38 to 121]	
	(1,691)	(133)		
All Counties	1.17	1.08	303	354
	[1.11–1.22]	[0.94–1.24]	[222 to 384]	
	(6,600)	(795)		

DISCUSSION AND CONCLUSIONS

Under the current Chinese population policy, all parties involved in the birth planning system face serious conflicts of interest. Birth planning cadres must fulfill the preset targets and collect data that are used to evaluate their performance, that of their colleagues, and even that of their supervisors, while wishing to maintain good relations with the populace whose fertility it is their job to control. Individual couples face a conflict between the pressure from their families and neighbors to give birth as soon as possible, and the administrative constraints imposed on their fertility preferences when they are given only one, or at most two, chances to have a son.

In this context, nonreporting of births that are not wanted from the administrative and/or individual standpoints minimizes the complications involved in the requirements of local birth plans and in the penalties associated with out-of-plan births. Underreporting of births enables cadres to keep fertility within the limits of the birth quota, and allows couples to achieve targets of family size and sex composition of their offspring.

We investigate the underreporting of births and its association with the implementation of birth planning policies in four counties of northern China. The SFPC chose these counties to support a subsequent experiment. Three counties—Pangxie, Ciqixian, and Shanshui—are prominent for family planning performance in a system that rewards successful family planning work with political "points." The fourth county, Huasheng, exhibits secure political connections with higher administrative echelons.

We focus on the timing of first births because any factors, behavioral or biological, that affect fertility must do so by changing the timing of reproductive events, thereby influencing the length of the first-birth interval. We ask whether the distribution of the timing of first birth is different from what one would expect if all births were reported as soon as they occurred. Given the anomalies of birth reporting, we also ask what factors affect the decision as to when and whether to report a birth. We further attempt to identify factors that alternatively determine the patterns of fertility timing that we observe. These arguments are elaborated with data from a retrospective fertility survey conducted in the four counties as the baseline for the INCRC project.

The data provide evidence that the hazard of first birth declines as the number of months since marriage increases, up to the end of the second year of marriage; at that point it starts to increase again. This pattern is evident, to different degrees, in each of the four counties.

We consider several explanations associated with the implementation of population policies. In particular, the seasonality of marriage and the concentration of marriages in the winter months may result in an actual postponement of childbearing or in delayed reporting of first births until a time conforming with the local birth planning regulations, which impose a ceiling on the annual number of births allowed in each locality. Women who marry early may be asked to postpone their first births until they reach the minimum legal age at marriage or the encouraged late age at marriage. Similarly, women progressing to first births in periods of policy tightening may have longer first-birth intervals than women progressing to first births in periods of policy relaxation, because vigorous policy implementation may result in delayed reporting of births. Conversely, according to the hypothesis that underreporting of births directly affects the first-birth interval, unwanted first births (females and/or out-of-plan births) may go unreported, only to be replaced later by second births reported as "first" births.

Our results show that the birth planning policy exerts a strong effect on the length of the first-birth interval in all four counties but that this effect may be produced by different types of responses to the policy: Longer reported first-birth intervals are the result either of actual reproductive behavior or of manipulation of birth records. For three of the four counties—Huasheng, Ciqixian, and Shanshui—the data highlight higher-than-normal sex ratios of births occurring in the first year of marriage and reveal that the hazard of birth departs significantly from a pattern of gradual decline at the end of the second year of marriage. Sex ratios at birth that are higher than normal indicate, in themselves, a measurement problem. However, elevated sex ratios at early exposures which coincide with an increasing hazard of birth at later exposures suggest an association between failure to report female babies and their replacement with second "first" births at the end of the second year of marriage.

Only Pangxie, the county with normal sex ratios at birth at all durations but with the most pronounced increase in the hazard of birth at the end of the second year of marriage, seems to follow the rules in all respects. In this county, the vigorous enforcement of the birth planning quota through careful accounting of fertility has resulted in regular postponement of first births to the large number of couples married at the beginning of the year. Pangxie's birth planning leaders apparently have succeeded in tightening their grip on the fertility of the county's women, leaving room for little except abiding by birth planning policies.

Are the patterns we observe determined only by these "program effects," or could the increase in the hazard of birth at the end of the second year of marriage be produced by individual and behavioral factors not associated with policy implementation? How plausible is it that substantial numbers of couples have a first birth in months 9 or 10 after marriage and then go on to have a second birth in month 21? What would be the first birth rates in months 9 and 10? Is the likelihood of having a second birth at the end of the second year of marriage high enough to be attributed to the sudden increase in the log-odds of "first" birth?

To answer the first question, it is noteworthy that women's education does not explain these patterns satisfactorily. Analyses not shown here revealed that added interactions terms between various educational categories and the change point were not significant and did not improve the fit of the model.

We also considered changes in social norms affecting union formation as an explanation of the large number of women giving birth at short durations since marriage. This hypothesis was proposed by Rindfuss and Morgan (1983), who argued that the transition from arranged to romantic marriage in post–World War II Korea and Japan may explain the shortening of first-birth intervals among women living in those countries. According to this interpretation, one would observe an increasing hazard of first birth at the end of the second year of marriage if the population under study consisted of two groups of couples: one who met "romantically," had higher coital frequency early in marriage, and bore their children earlier; and the other, whose marriage was arranged, who had low coital frequency, and who bore their children later.

We believe that this explanation does not apply to contemporary rural China, and that marriage and childbearing patterns in the four INCRC counties suggest yet another explanation of short birth intervals. In rural China, childbearing early in marriage is not the result of a higher degree of intimacy defined by a new social meaning of marriage. Rather, it is the outcome of a compromise between a strong pronatalism in the Chinese and neighboring cultures,[7] where the ability to reproduce is regarded as a prerequisite to union formation, and birth planners' recognition, through prescription of a minimum age at marriage, that the age at marriage is one important determinant of fertility. This point suggests that some birth intervals of 9 and 10 months in fact may be initiated premaritally, but may be reported as birth intervals starting immediately after marriage to avoid the penalties associated with the violation of marriage and fertility regulations.

This hypothesis would increase the plausibility of high first birth rates implied by so many first births in month 9 or 10. Fecundability of women interviewed in the Baseline Survey, though high, is not implausible. Mean effective fecundability (Wood et al. 1994) of 18- to 29-year-old baseline women, estimated from the number of conceptions resulting in a first live birth at 0.26, is equal to the corresponding value estimated for Amish women, a population that comes as close to natural fertility as does any contemporary population (Merli 1996).

Similarly, the timing of second "first" births at the end of the second year of marriage is not unlikely. Li and Choe (1997:fig. 2) estimated the cumulative probability of second birth for rural Chinese women who bore their first children between 1978 and 1982 and who experienced or would experience a second birth. This probability begins to increase rapidly in month 21, from about 0.23 to 0.63 in month 33. This finding allows us to attribute more confidently the sudden increase in the log-odds of "first" birth at the end of the second year of marriage to the replacement of unreported first births with second births.

Can our findings be generalized to other areas in China? Surely the counties were not selected randomly; thus the data presented here do not allow us to generalize beyond the confines of the project areas. Yet even if four counties were selected at random from among all counties of China, we could hardly hope, at least on statistical grounds, that they would somehow mirror the distribution of China along geographic, economic, ethnic, and demographic lines. The counties selected by the SFPC possess "special characteristics"; yet it is not at all clear how "special" they are in China overall, where

7. In Taiwan, premarital pregnancies occurring to an engaged couple seal the contract between the two families (Chang 1994). Similarly, in Vietnam, shortening birth intervals characterize couples anxious to demonstrate their ability to reproduce (Vu Quy Nhan, Vietnam National Committee for Population and Family Planning, personal communication, May 1996).

conformity is the norm but institutionalized exceptionalism is important to the administration at all levels (Merli et al. 1996).

Moreover, although the four counties were not selected for investigation of birth reporting patterns, the differing environments they portray provide substantial variation in the organizational and institutional relations governing application of population policies. Administrative variation in the implementation of birth planning policies enables us to assess the effect of these policies on actual reproductive behavior and birth reporting patterns across counties.

To students of China and beyond, the Chinese birth planning program provides an interesting case in a setting marked by political, institutional, and socioeconomic change. For the last 20 years, the liberalization of the Chinese economy has symbolized China's era of reform and opening to the outside world; meanwhile the vestiges of totalitarianism have become institutionalized in its birth planning system. The criterion for evaluating the birth planning performance of cadres and couples alike provides everyone with an incentive to see that the policy is met in reality, through strict enforcement of birth planning regulations, and/or statistically, through manipulation of personal birth records. The degree of statistical manipulation may depend on the extent to which cadres are willing to accommodate peasants' demands, on the costs of policy enforcement, and on peasants' motivations and ability to evade the policy; nonetheless it represents one type of response by Chinese rural society to the strictures of the birth planning program.

It is important to find more evidence of underreporting directly from the data. This may help us to interpret Chinese demographic data correctly and to rethink and anticipate the problems and prospects of conducting demographic research—not only in China, but also in countries whose successful family planning programs are similarly based on top-down approaches.

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