Birth Spacing in the Presence of Son Preference and Sex-Selective Abortions: India's Experience over Four Decades

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Abstract

Using four rounds of India's National Family and Health Surveys and a competing-risk hazard model, I show that Hindu women's average birth intervals increased over the last four decades for all education groups. The most significant increases are among the women most likely to use sex selection. Despite the rise in average intervals, the likelihood of very short spacing did not change substantially. Hence, the increases come predominantly from the longer birth intervals getting even longer. As a result of the longer spacing, fertility rates significantly overestimated how fast cohort fertility fell. Although cohort fertility and the fertility rate have started to converge, the cohort fertility is still substantially higher than the fertility rate. Furthermore, cohort fertility is still at or above replacement level for all but the best-educated urban women. Finally, infant mortality risk has declined substantially over time for all groups, but fastest for the lower education groups, who are now close to the level of women with the most education. Short birth spacing is still associated with higher mortality, although the difference is small for the best-educated women. There is no evidence that the increasing use of sex selection is associated with higher infant mortality risk.

JEL: J1, O12, I1 Keywords: India, prenatal sex determination, censoring, competing risk, non-proportional hazard

1 Introduction

India has changed significantly over the last four decades: the economy has grown substantially, education levels have increased for both males and females, and the total fertility rate has fallen to 2.2 (Bosworth and Collins, 2008; Dharmalingam, Rajan and Morgan, 2014; International Institute for Population Sciences (IIPS) and ICF, 2017).

India has, however, also experienced a rapidly expanding access to prenatal sex determination. Combined with continued strong son preference, the result has been a dramatic increase in the males-to-females ratio at birth (Das Gupta and Bhat, 1997; Arnold, Kishor and Roy, 2002; Retherford and Roy, 2003; Guilmoto, 2012; Pörtner, 2015; Jayachandran, 2017).

What the prior research on India has not appreciated is that since each abortion increases the interval between births by six to twelve months, the growing use of sex-selective abortions may substantially increase birth spacing.[1] Furthermore, the combination of increasing female education, lower fertility, higher household income, and the low and declining female labor force participation are also likely to impact birth spacing. Hence, the changes in birth spacing may be much more substantial in India than what we have observed in other countries.

There are two primary motivations for examining birth spacing in this situation, besides gaining a better general understanding of how families make fertility decisions.

First, if birth intervals increased substantially over time, India's fertility may be higher than generally accepted based on the total fertility rate (TFR). Increasing birth spacing is a tempo effect, which, by postponing births, makes the TFR a downward biased estimate of cohort fertility (Hotz, Klerman and Willis, 1997; Bongaarts, 1999; Ní Bhrolcháin, 2011).

Second, longer birth spacing is associated with lower mortality and morbidity risk

[1] The increase consists of three parts. First, starting from the abortion, the uterus needs at least two menstrual cycles to recover; otherwise, the likelihood of spontaneous abortion increases substantially (Zhou, Olsen, Nielsen and Sabroe, 2000). The second part is the waiting time to conception, which is between one and six months (Wang, Chen, Wang, Chen, Guang and French, 2003). Finally, sex determination tests are reliable only from three months of gestation onwards.

(Conde-Agudelo, Rosas-Bermudez, Castaño and Norton, 2012; Molitoris, Barclay and Kolk, 2019). In India, the duration to the next birth has traditionally been shorter with fewer sons, which likely contributed to the higher mortality and morbidity risk for girls (Whitworth and Stephenson, 2002; Bhalotra and van Soest, 2008; Maitra and Pal, 2008; Jayachandran and Kuziemko, 2011; Jayachandran and Pande, 2017). Longer spacing between births then potentially lowers mortality, although there may be counteracting effects if the longer spacing arises because of multiple abortions. There has, so far, been no attempt to examine how mortality has responded to the increase in sex selection.

I examine how birth spacing in India has changed over time and across groups with the introduction of sex selection. Using data from the four National Family and Health Surveys (NFHS), I apply a competing risk hazard model to the birth histories of Hindu women, covering the period 1972 to 2016. The competing risk hazard model directly incorporates the effects of sex-selective abortions on birth intervals *and* the likelihood of a son but also works in cases without prenatal sex selection. The empirical model allows me to predict fertility, taking into account both the likelihood of parity progression and the likelihood of having a child of a specific sex. Finally, I examine how infant mortality risk has changed with the changing birth spacing and whether sex selection affects infant mortality.

There are four main sets of results.

First, birth intervals have increased for all education groups over the four decades, the more so, the higher the parity and the higher the education level. Women who are most likely to use sex selection—well-educated women with no sons—have seen the most substantial increases in birth intervals and the most biased sex ratios. As a result, we now see cases that reverse the traditional spacing pattern, with women with no sons having longer birth intervals than women with sons. Those least likely to use sex selection, women with less education in rural areas, still follow the traditional pattern of short spacing when they have girls and little evidence of the use of sex selection. Women with no sons still are the most likely to have an additional birth. Although the probability of having a next child has declined for this group over time, the declines are often substantially smaller than if a boy is present.

Second, there is little difference over time and across groups in the likelihood of having a very short birth interval given the sex composition of prior children, especially for the lower parities. Hence, the increases in average spacing come predominantly from the longer birth intervals getting even longer over time, driven in no small degree by substantial use of sex selection. The exception to this result is that the better-educated women with a *very high* predicted use of sex selection appear to conceive later precisely because the next child is almost certainly a boy.

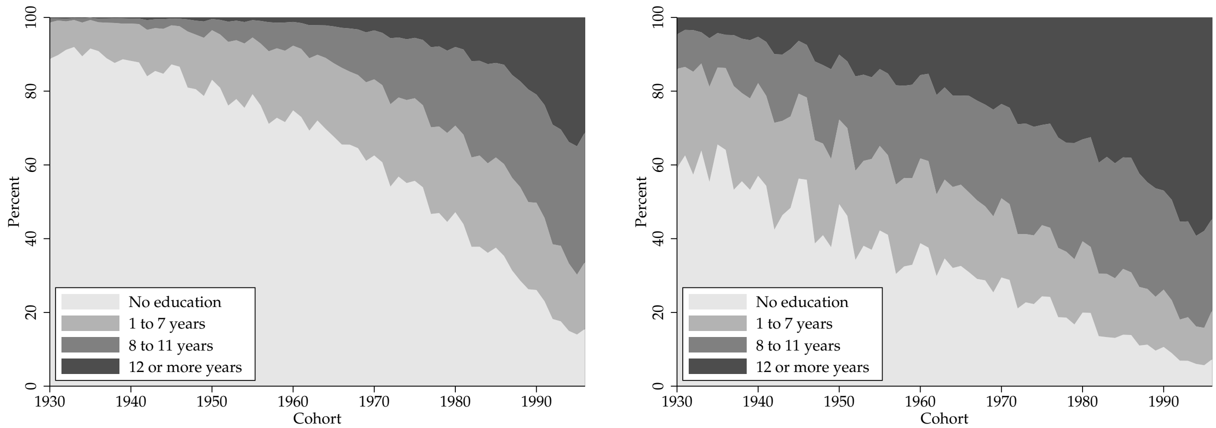
Third, the fertility rate substantially overestimated how fast cohort fertility fell in the 1990s and early 2000s when spacing began to increase. Although predicted cohort fertility and the fertility rate have lately begun to converge, the predicted cohort fertility is still ten to twenty percent higher than the fertility rate. Furthermore, even with the convergence, predicted cohort fertility is still at or above replacement level, except for the best-educated urban women.

Finally, infant mortality risk has declined substantially over time for all groups, but fastest for the lower education groups, who are now close to the level of women with the most education. The mortality risk is, however, still inversely related to education level, especially for very short birth intervals. There is no evidence that the increasing use of sex selection is associated with higher mortality risk.

2 Female Education and Labor Force Participation in India

To set the stage for the subsequent analyses, I first describe how female education and labor force participation has changed. Both are potentially important factors in the birth spacing decision, as I discuss in the next section.

Female educational attainment has increased substantially over time. Figure 1 shows the distribution of schooling by birth cohort for urban and rural women, twenty years or older, whether married or not, based on the four rounds of the NFHS. The education groups are no education, one to seven years, and eight to eleven years, and twelve years and above.



(a) Rural

(b) Urban

Figure 1: Distribution of education by cohort for women twenty years or older at survey

For rural areas, the percentage of women with no education has gone from around 90 percent for the 1930s cohorts to less than 20 percent for the 1990s cohorts. The proportion of women with one to seven years of education has remained remarkably constant at around ten percent. The difference is made up by the women with eight or more years of education, who have gone from almost zero for the 1930 cohort to more than sixty percent for the 1990s cohorts, with about half in the eight to eleven years group and the other half in the twelve years or more group.

Female education is higher in urban areas than in rural areas. Around sixty percent of urban women born in the 1930s had no education, 25 percent had between one and seven years, about ten percent had eight or more years of education, and only five percent has twelve years or more. The proportions with no education and one to seven years have both declined to just below ten percent for the latest cohort. Although the proportion of women with eight to eleven years of education has increased to about twenty, most of the increase in urban female education has come from the twelve plus group, which now account for more than half of all urban women.

Even as the level of female education has increased, the female labor force participation in both urban and rural areas has stagnated or decreased (Klasen and Pieters, 2015; Fletcher, Pande and Moore, 2017; Afridi, Dinkelman and Mahajan, 2018; Bhargava, 2018; Chatterjee, Desai and Vanneman, 2018; Bhargava, 2019). A decline in female labor force participation at the beginning of development is consistent with the hypothesis of a U-shaped labor force participation as a country develops (Goldin, 1994). India's female labor force participation is, however, lower than most other countries and more in line with countries in the Middle East and North Africa, and does not yet show any signs of increasing (Klasen and Pieters, 2015; Chatterjee et al., 2018).

The NFHS data show a U-shaped relationship between education and working for married women, with the highest percent working for women with either no education or with twelve or more years and the lowest for women with eight to eleven years of education.[2] Women are more likely to report working if they live in rural than urban areas and the older they are. For married women, the percentage currently working changes relatively little over time. All education and age groups have, however, become substantially more likely to work for a family member.

The increases in female educational attainment imply that access to education has expanded beyond the higher castes. One possible effect of the rapid expansion in female education, and the associated change in the composition of better-educated women, is that the behavior of the better-educated would change. However, "Sanskritization" implies that as lower castes females gain access to education and their husbands' income increases, the women adopt higher caste norms such as stronger son preference and a retraction from the formal labor market (Srinivas, 1956; Chen and Dreze, 1995; Abraham,

[2]See Appendix Figures A.1 through A.3.

2013; Chatterjee et al., 2018). The low and declining female labor force participation is an indication that this process still operates.

3 Birth Spacing: Mechanisms and Prior Findings

To provide a conceptual framework for understanding how birth spacing may respond to the substantial changes in income, female education, and female labor force participation that India has experienced, I discuss in this section relevant theories and prior findings on birth spacing.

The standard economic argument for the predominant association between increasing female education and shorter spacing is that parents incur time costs when they have children (Hotz et al., 1997; Schultz, 1997). Specifically, if having children require the mother to reduce her market work, parents can lower the cost of children by shortening birth spacing to take advantage of economies of scale in childrearing (Vijverberg, 1982).

The low and declining female labor force participation, especially for younger women, suggests, however, that families face little incentive to space children more closely together for economic reasons. One explanation is that household income has increased so substantially that the income effect dominates any substitution effect. Two findings speak for this effect. First, although real wages for both men and women have almost doubled between 1987 and 2011, the mean male wage is still close to 70 percent higher than the female wage (Klasen and Pieters, 2015; Bhargava, 2018). Second, women's labor supply appears to be more negatively elastic to their husbands' wages than it is positively elastic to their wages (Bhargava, 2018).

The combination of rising incomes and continued son preference may lead to even longer spacing than the standard income effect alone predicts. As women's education increases, their productivity in the production of offspring human capital also increases. With relatively more boys born because of increased access to sex-selective abortions and an increasing potential income for (male) offspring, demand for better-educated women can increase, even if they do not participate in the labor market (Behrman, Foster, Rosenzweig and Vashishtha, 1999). If more and "better" parental attention per child results in higher child "quality," we should expect longer birth intervals (Zajonc and Markus, 1975; Zajonc, 1976; Razin, 1980). The evidence on spacing's effect on child quality measures such as IQ and education is, however, mixed for developed countries and non-existing for developing countries (Powell and Steelman, 1993; Pettersson-Lidbom and Thoursie, 2009; Buckles and Munnich, 2012; Barclay and Kolk, 2017). The exception is one crucial aspect of child quality—health and mortality—where longer spacing does lead to better outcomes, although this relationship weakens with maternal education (Whitworth and Stephenson, 2002; Conde-Agudelo et al., 2012; Molitoris et al., 2019).

The introduction of sex selection allows parents to avoid the birth of girls but increases the expected duration to the next birth. Theory suggests that sex selection increases with lower desired fertility, and, for a given desired number of children, the higher the parity (Pörtner, 2015). The increased use of sex selection in India with education and in urban areas is consistent with a lower desired fertility for both groups (Das Gupta and Bhat, 1997; Retherford and Roy, 2003; Guilmoto, 2009; Pörtner, 2015; Jayachandran, 2017). Better-educated and urban women also tend to live in households with higher income, which better enables them to access prenatal sex determination and lowers the relative costs of using sex selection and have long birth intervals.

We may even observe a "delay" effect, where parents conceive later because they know that short spacing is detrimental to the next child's health and that the next child is more likely to be a boy because of access to sex selection. Working in the opposite direction is that women with more education can, in principle, space their children closer together without substantially increasing child mortality risk. Given the apparent lack of pressure to return to the labor force, this effect is, however, likely to be small.

In summary, with substantial increases in husbands' income and a declining female labor force participation, I expect a push toward longer birth spacing over time, independent of education levels, based on the income effects and the effects of spacing on child outcomes. As desired fertility decreases with increasing education, I, furthermore, expect birth spacing to increase the most among the better-educated because their household income increases the most—even with declining female labor participation—and their use of sex selection. Even with the substantial increase in the number of better-educated women, "Sanskritization" implies that the changing composition does not substantially change this group's use of sex selection.

4 Estimation Strategy

The standard approach in the birth spacing literature is to use proportional hazard models with a single exit, the birth of a child.[3] There are two problems with the standard approach in this setting.

First, and most importantly, the introduction of sex selection means that the sex of the next child is no longer necessarily random and that parents' choices will impact the spacing to the birth of a girl or a boy differently. I, therefore, use a competing risk set-up, which can capture both the non-randomness of the birth outcome and the differential spacing.[4]

Second, it is unlikely—even in the absence of prenatal sex determination—that characteristics, such as the sex composition of previous births, have the same effects throughout the entire spell, as is assumed by the proportional hazard model. If proportionality does not hold, the results are biased. The proportionality assumption is especially problematic for higher-order spells where there are substantial differences across groups both in the likelihood of progressing to the next birth and how soon couples want their next child if

[3]See Sheps, Menken, Ridley and Lingner (1970) and Newman and McCulloch (1984) for early discussions of why hazard models are the preferred way to deal with the censoring of birth intervals.

[4]Merli and Raftery (2000) used a discrete hazard model to examine whether there were under-reporting of births in rural China, although they estimated separate waiting time regressions for boys and girls.

they are going to have one.

The introduction of prenatal sex determination exacerbates any bias from the proportionality assumption for two reasons. First, sex-selective abortion use varies across groups, which affects birth spacing. Second, a household's use of sex selection may vary within a spell, which means that the effects of covariates vary within the spell as well.

I, therefore, use a non-proportional hazard specification, which allows the shape of the hazard functions to vary across groups. The use of a non-proportional specification also mitigates any potential effects of unobserved heterogeneity when used in conjunction with a flexible baseline hazard (Dolton and von der Klaauw, 1995).

The model is a discrete-time, non-proportional, competing risk hazard model with two exit states: either a boy or a girl is born. The unit of analysis is a spell, the period from nine months after one birth to the next. For each woman, $i = 1, \ldots, n$, the starting point for a spell is time $t = 1$, and the spell continues until time t_i when either birth or censoring of the spell occurs. The time of censoring is assumed independent of the hazard rate, as is standard in the literature. There are two exit states: the birth of a boy, $j = 1$, or the birth of a girl, $j = 2$, and J_i is a random variable indicating which event took place. The discrete-time hazard rate h_{ijt} is

$$h_{ijt} = \frac{\exp(D_j(t) + \alpha'_{jt}\mathbf{Z}_{it} + \beta'_j\mathbf{X}_i)}{1 + \sum_{l=1}^{2} \exp(D_j(t) + \alpha'_{lt}\mathbf{Z}_{it} + \beta'_l\mathbf{X}_i)} \quad j = 1, 2 \tag{1}$$

where the explanatory variable vectors, $\mathbf{Z}_{it}$ and $\mathbf{X}_i$, capture individual, household, and community characteristics discussed below, and $D_j(t)$ is the piece-wise constant baseline hazard for outcome j, captured by dummies and the associated coefficients,

$$D_j(t) = \gamma_{j1}D_1 + \gamma_{j2}D_2 + \ldots + \gamma_{jT}D_T, \tag{2}$$

with $D_m = 1$ if $t = m$ and zero otherwise. This approach to modeling the baseline hazard is flexible and does not restrict the baseline hazard unnecessarily.

The explanatory variables in $\mathbf{Z}$, and the interactions between them, constitute the non-proportional part of the model:

$$\mathbf{Z}_{it} = D_j(t) \times (\mathbf{Z}_1 + Z_2 + \mathbf{Z}_1 \times Z_2). \tag{3}$$

$D_j(t)$ is the piece-wise constant baseline hazard, $\mathbf{Z}_1$ captures sex composition of previous children, and Z_2 captures the area of residence. The remaining explanatory variables, $\mathbf{X}$, enter proportionally.[5] However, to further minimize any potential bias from assuming proportionality, estimations are done separately for different levels of mothers' education and different periods.[6]

Equation (1) is equivalent to the logistic hazard model and has the same likelihood function as the multinomial logit model (Allison, 1982; Jenkins, 1995). Hence, transforming the data, so each observation is an interval—here equal to three months—I can estimate the model using a standard multinomial logit model. In the reorganized data the outcome variable is 0 if the woman does not have a child in a given interval (the base outcome), 1 if she gives birth to a son in that interval, and 2 if she gives birth to a daughter in that interval.

The interpretation of the model coefficients is challenging (Thomas, 1996). It is, however, possible to calculate the predicted probabilities of having a boy, b, and of having a girl, g, in period t, conditional on a set of explanatory variables and not having had a child before that period. It is then straightforward to calculate the estimated percentage of children born that are boys, $\hat{Y}$, at each t:

$$\hat{Y}_t = \frac{P(b_t|\mathbf{X}_k, \mathbf{Z}_{kt}, t)}{P(b_t|\mathbf{X}_k, \mathbf{Z}_{kt}, t) + P(g_t|\mathbf{X}_k, \mathbf{Z}_{kt}, t)} \times 100. \tag{4}$$

[5]With sex selection, the composition of prior children is, in principle, endogenous. It is beyond the scope of this paper to develop a method for dealing with this issue.

[6]I discuss the choice of which variables to use for non-proportionality in more detail in the "Explanatory Variables" section.

Combining the percentage of boys and the likelihood of exiting the spell across all t gives the predicted percent of births that are boys over the entire spell.

5 Data

The data come from the four rounds of the National Family Health Survey collected in 1992–1993, 1998–1999, 2005–2006, and 2015–2016. The surveys are large: 89,777, 90,303, 124,385, and 699,686 women, respectively. NFHS-1 and NFHS-2 surveyed only ever-married women, while the later surveys also included never-married.

I exclude visitors, as well as women in any of the following categories: never married; no gauna yet; married more than once; divorced; not living with husband; inconsistent age at marriage; or education information missing. The same goes for women who had at least one multiple births, reported giving birth before age 12, had a birth before marriage, or an interval between births of less than nine months.

Finally, I restrict the sample to Hindus, who constitute about 80 percent of India's population. If the use of sex selection differs across groups, assuming that the baseline hazard is the same leads to bias. Furthermore, the other groups are each too small to estimate different baseline hazards for each and so different that combining them into one group would not make sense.

In addition to a large number of women surveyed and the long period covered, a benefit of the NFHS is that enumerators pay careful attention to the spacing between births and probe for "missed" births. Nevertheless, systematic recall error, where the likelihood of reporting a deceased child depends on the sex of the child, remains a potential problem. Recall error is heavily dependent on how long ago a woman was married, and I, therefore, drop women married 22 years or more based on the discussion in the Appendix. The final sample consists of 395,695 women, with 815,360 parity one through four births.

I focus on the second through fourth spells, that is, on the intervals from the first birth until at most the fourth birth. I exclude the marriage to the first birth spell because many are imputed.

The spells all begin nine months after the previous birth, which is the earliest we should expect to observe a new birth. A spell continues until either a child is born or censoring occurs. Censoring can happen for three reasons: the survey takes place, sterilization of the woman or her husband, or too few births are observed for the method to work.[7] For all spells, censoring is set at 96 months (eight years) after a woman can first give birth in the spell. With these cut-offs, less than one percent of observed births occur after the spell cut-off.

Direct information on the use of sex selection is not available, so I compare different periods, based on the changes in access and legality of prenatal sex determination in India. Abortion has been legal in India since 1971. Reports of sex determination appeared around 1982–83, and the number of clinics quickly increased (Sudha and Rajan, 1999; Bhat, 2006; Grover and Vijayvergiya, 2006). In 1994, the Prenatal Diagnostic Techniques (PNDT) Act made determining and communicating the sex of a fetus illegal.[8] Although the use of sex selection increased even after 1994, we may have passed a turning point in its use (Das Gupta, Chung and Shuzhuo, 2009; Diamond-Smith and Bishai, 2015). I, therefore, use four periods: 1972–1984, 1985–1994, 1995–2004, and 2005–2016. The allocation of spells into periods is determined by when conception, and, therefore, decisions on sex selection, can begin. Hence, some spells cover two periods, which may bias downward the differences between the periods.

[7]Most sterilizations take place right after a woman gives birth, and, therefore, do not show up in the samples used. Furthermore, sterilization depends strongly on the sex composition of prior children with lower probabilities, the fewer boys. The effect is that the differences in parity progression probabilities are biased downwards.

[8]Details about the act are at http://pndt.gov.in/. There is little evidence that the ban significantly affected sex ratios (Das Gupta, 2016).

5.1 Explanatory Variables

I divide the explanatory variables into two groups. The first group consists of characteristics that the prior literature finds affect the spacing choice and the use of sex selection: mother's education, sex composition of previous children, and area of residence. The second group of variables consists of those expected to have an approximately proportional effect on the hazard. These include the mother's age when the spell begins, the household's land ownership, and whether the household belongs to a scheduled tribe or caste.

Women with different education levels have different hazard profiles (Whitworth and Stephenson, 2002; Bhalotra and van Soest, 2008; Kim, 2010). Furthermore, as discussed above, the use of sex selection increases with education. I, therefore, divide women into four educationgroups: no education, one to seven years of education, eight to eleven years of education, and twelve and more years of education. The models are estimated separately for each group to reduce any potential problem from including other variables as proportional.

I capture sex composition with dummy variables for the possible combinations, ignoring the ordering of births. Area of residence is a dummy variable for living in an urban area.

Appendix Tables C.1 and C.2 presents descriptive statistics. The level of censoring increases with parity and time, as we should expect with later childbearing, falling fertility, and the hypothesized increases in birth intervals from sex-selective abortions.

6 How Birth Spacing has Changed

I estimate the model for each spell/education/period subsample, the results of which I use to predict average birth spacing, sex ratio, and the probability of having a birth in that spell. Figures 2 through 5 show these predicted outcomes for the four education levels separated by the area of residence.[9]

To find the expected average duration, I first calculate, for each woman, the probability of giving birth in each period t, which I use as weights to calculated her expected duration. I then average the individual expected durations across women using the parity progression probabilities as weights.

The predicted parity progression probability is the likelihood of giving birth by 96 months after the beginning of the spell.

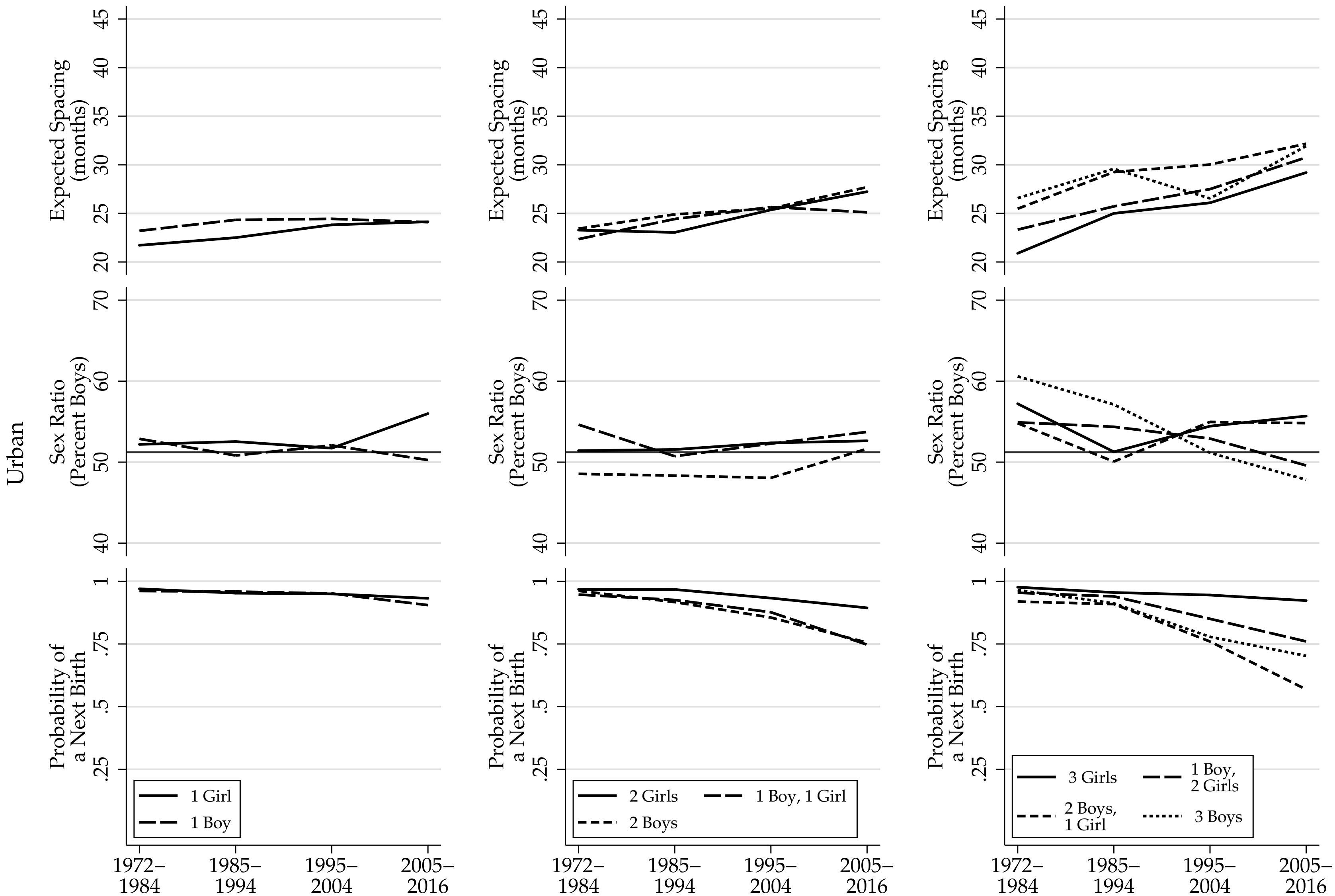
The predicted sex ratio captures the percent of births that are boys for women in the sample when childbearing for that spell is over. A woman's predicted sex ratio is the weighted average of the predicted percentage boys over each t in the spell, calculated using equation (4), using the probability of giving birth at time t as weights.[10] The predicted sex ratio shown is the weighted average of the individual predicted sex ratios, using the parity progression probabilities as weights. For comparison, the graphs also show the natural sex ratio, approximately 51.2 percent (Ben-Porath and Welch, 1976; Jacobsen, Moller and Mouritsen, 1999; Pörtner, 2015).

Average birth intervals have increased over time across all groups, but the higher the parity and the higher the schooling, the larger the increases.

In the latest period, the shortest average birth interval is 25 months for women with no education in the second spell, an increase of a couple of months from the first period. The longest average interval was 42 months for the third spell for women with twelve or more years of education who had no boys, which is an increase of approximately a year. For comparison, the median birth intervals reported for the NFHS have barely moved over time, staying at approximately 22 months calculated with the starting point nine months

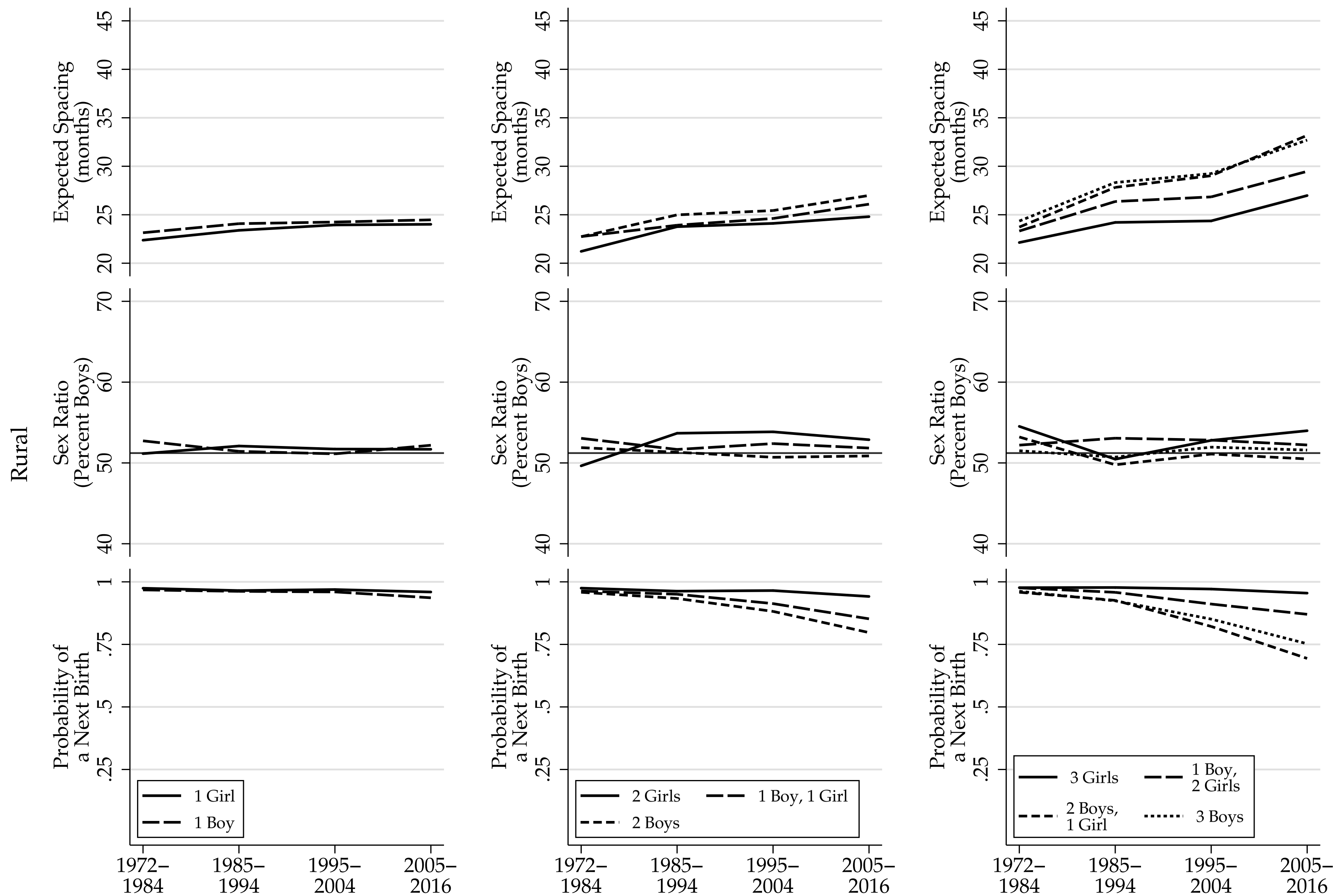
[9]For legibility, the graphs do not show standard errors. The graphed values, with standard errors, are shown in Appendix Tables D.1 through D.4. Furthermore, I do not show the results for the fourth spell the best-educated women since the low number of births, especially with one or more boys, make the spacing and sex ratio results very noisy. Results are available upon request.

[10]With T=2, if 54 and 66 percent of the births are boys and the likelihoods of giving birth 20 and 40 percent, then $\frac{54*0.2+66*0.4}{0.2+0.4} = 62$ percent of the births are boys.



(a) Second Spell (b) Third Spell (c) Fourth Spell

Figure 2: Estimated average spell length, sex ratio, and probability of a next birth for women with no education

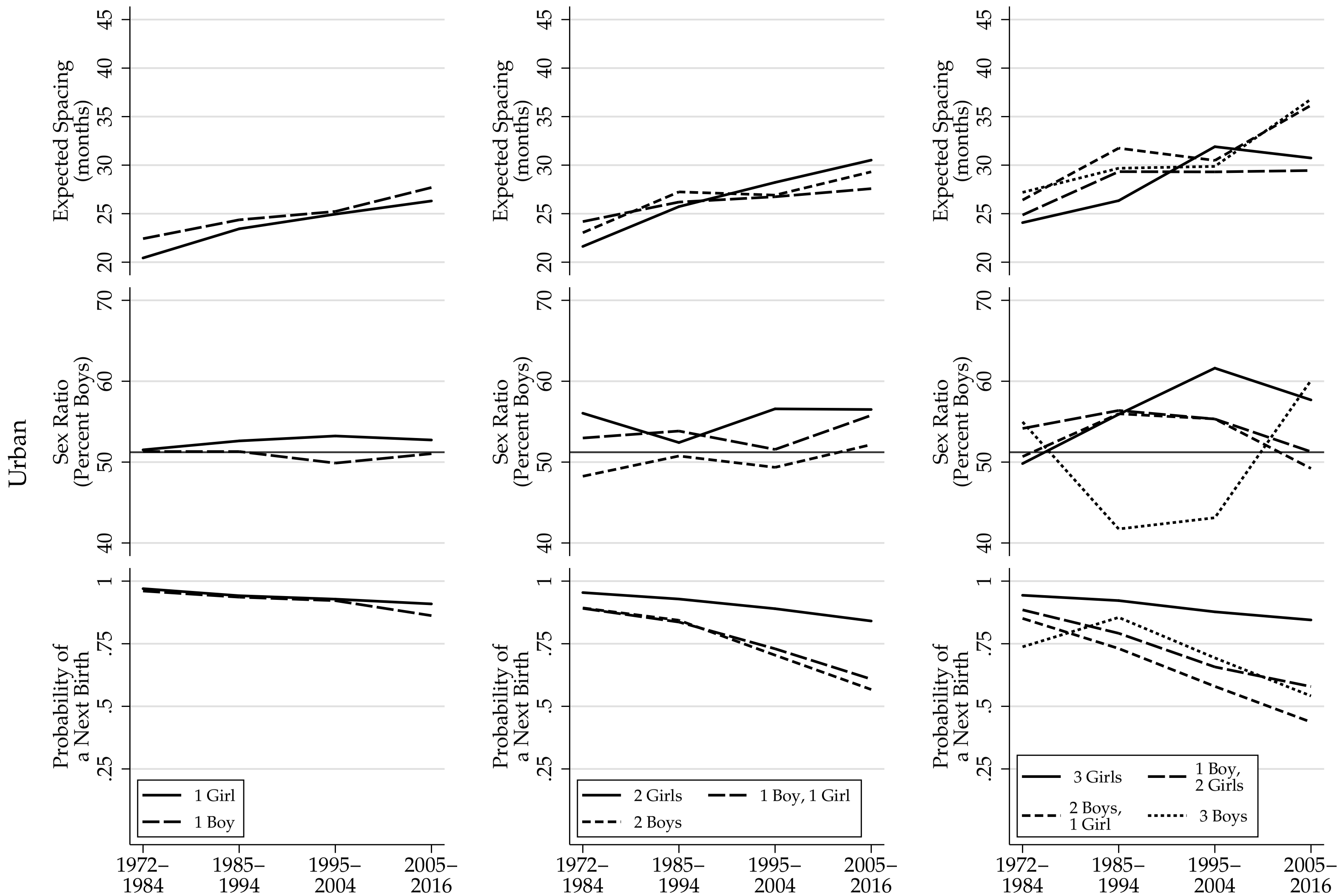


(d) Second Spell

(e) Third Spell

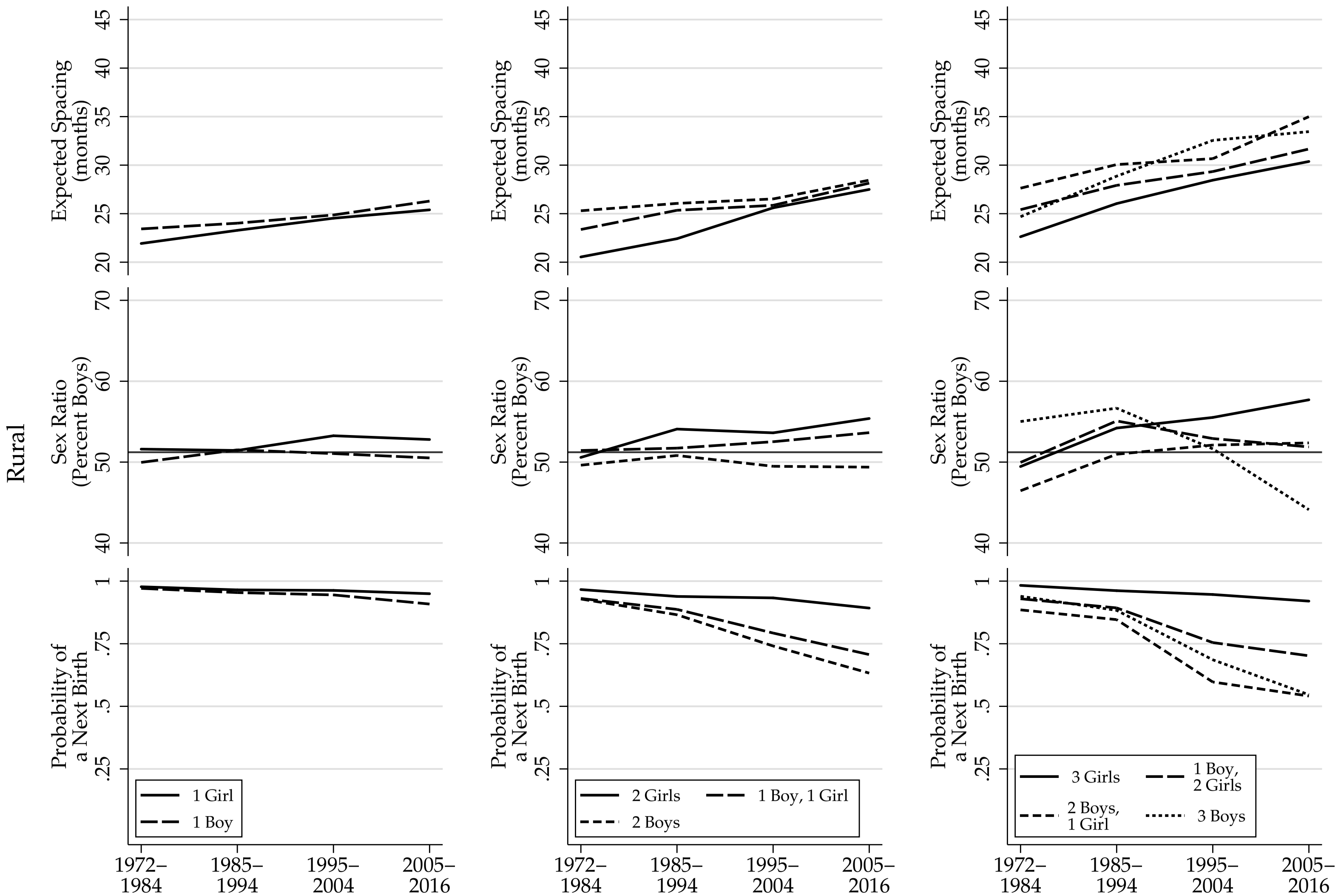
(f) Fourth Spell

Figure 2: (Continued) Estimated average spell length, sex ratio, and probability of a next birth for women with no education



(a) Second Spell (b) Third Spell (c) Fourth Spell

Figure 3: Estimated average spell length, sex ratio, and probability of a next birth for women with one to seven years of education

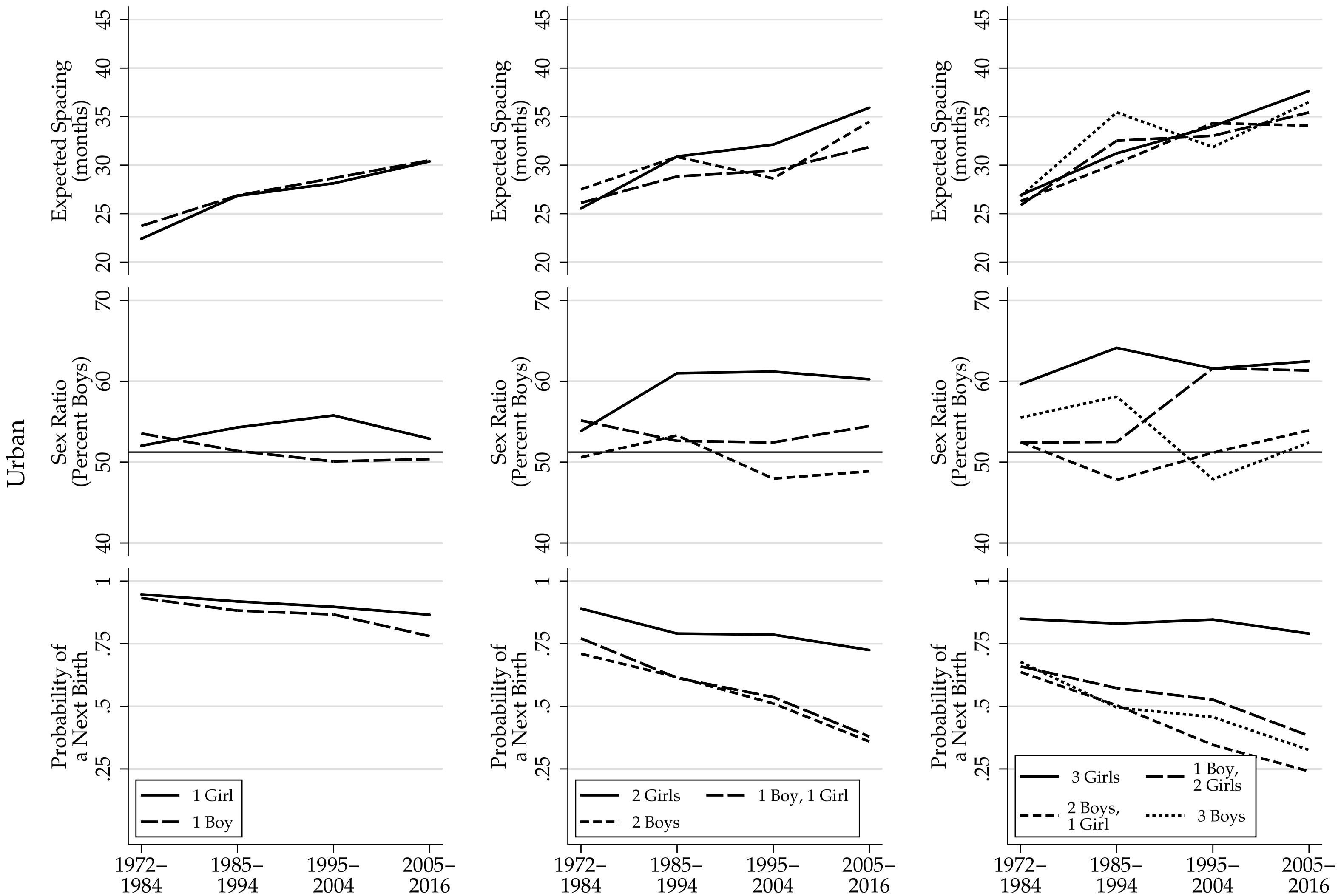


(d) Second Spell

(e) Third Spell

(f) Fourth Spell

Figure 3: (Continued) Estimated average spell length, sex ratio, and probability of a next birth for women with one to seven years of education

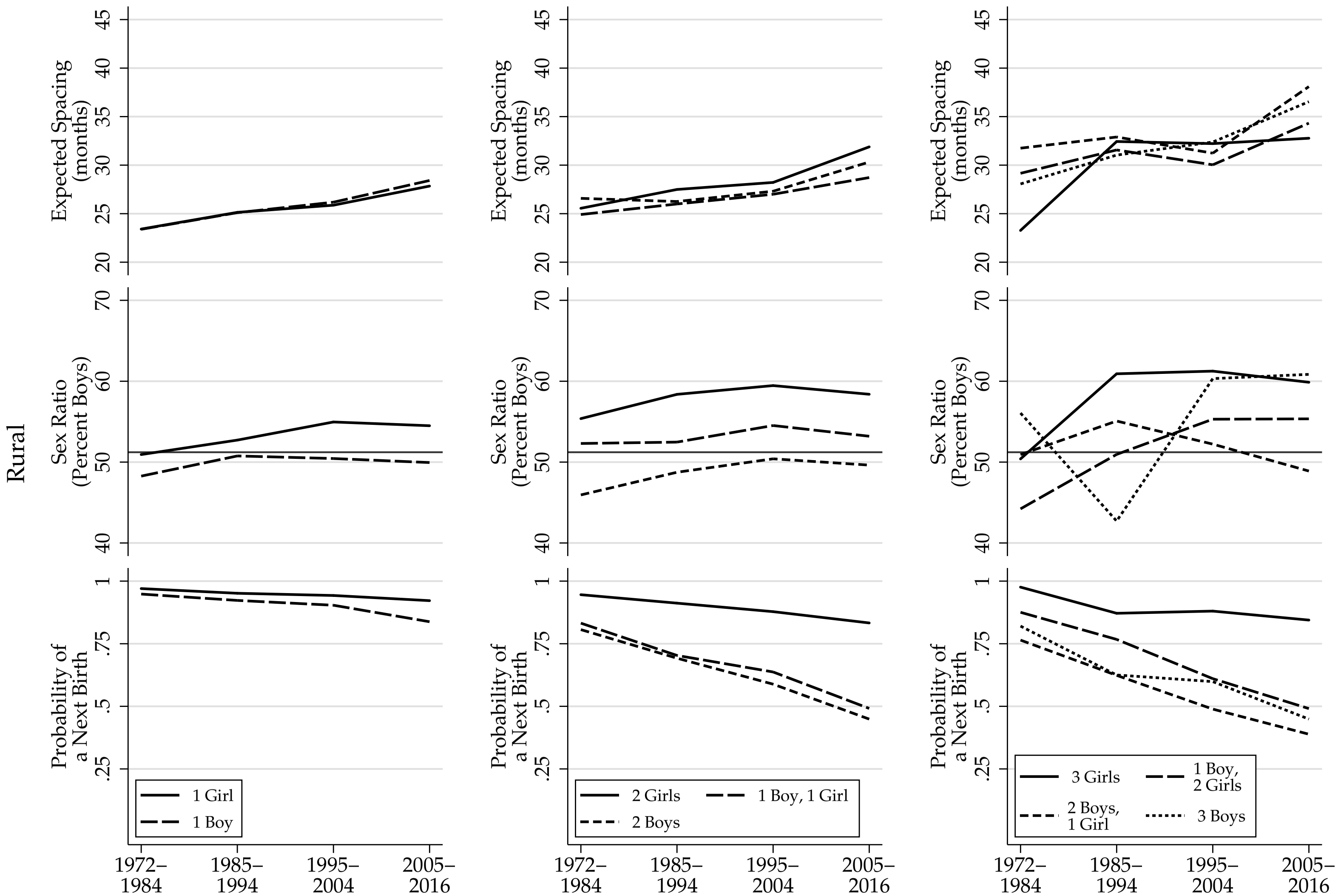


(a) Second Spell

(b) Third Spell

(c) Fourth Spell

Figure 4: Estimated average spell length, sex ratio, and probability of a next birth for women with eight to eleven years of education

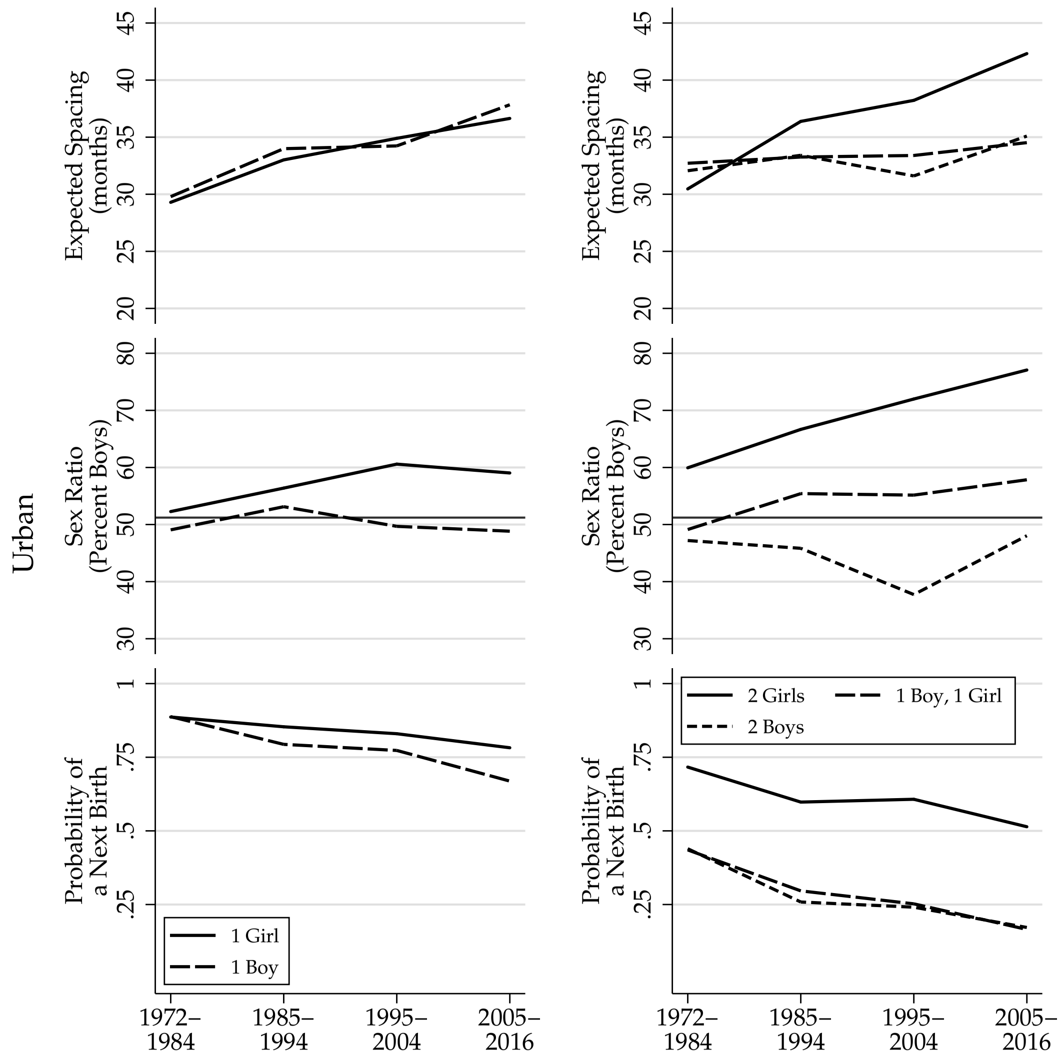


(d) Second Spell

(e) Third Spell

(f) Fourth Spell

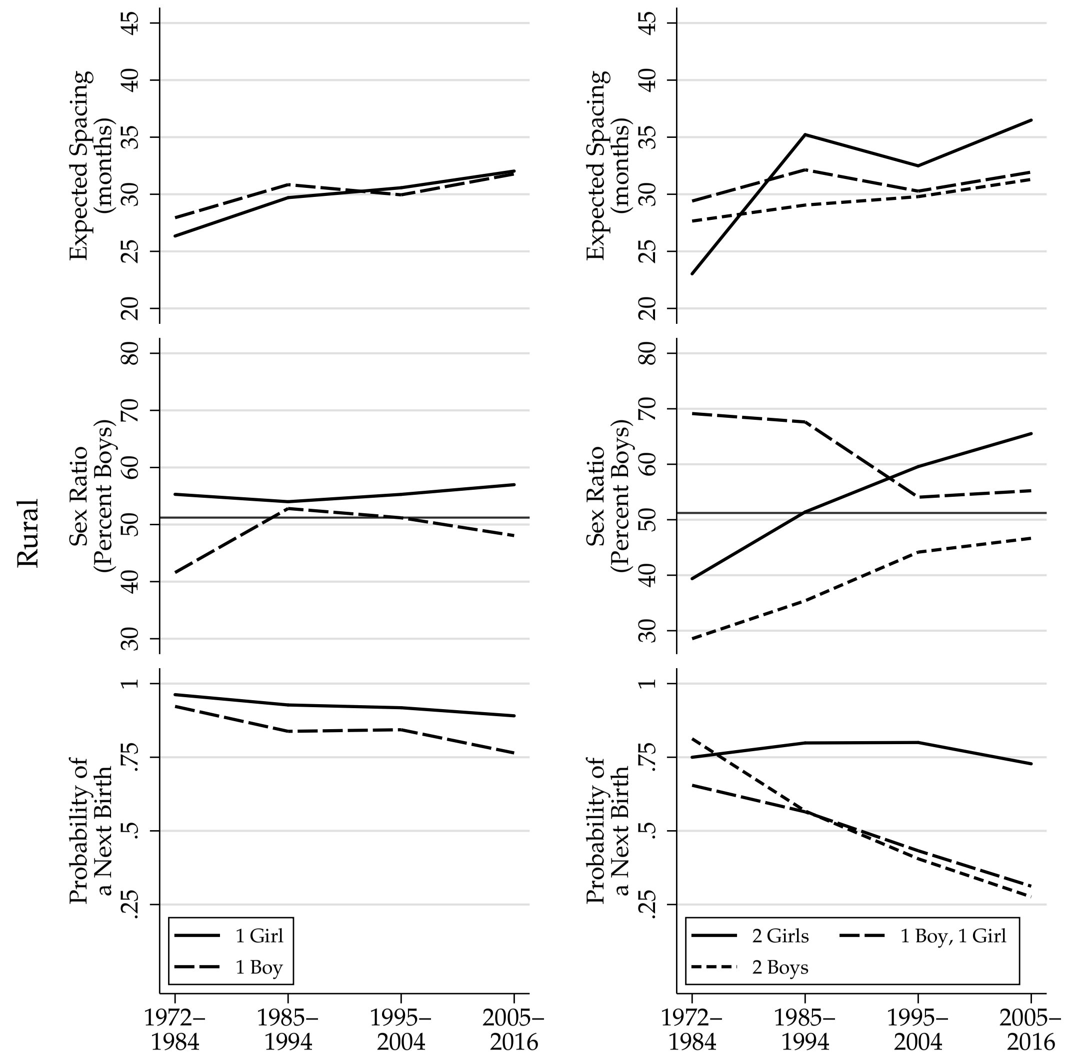
Figure 4: (Continued) Estimated average spell length, sex ratio, and probability of a next birth for women with eight to eleven years of education



(a) Second Spell

(b) Third Spell

Figure 5: Estimated average spell length, sex ratio, and probability of a next birth for women with twelve or more years of education



(c) Second Spell

(d) Third Spell

Figure 5: (Continued) Estimated average spell length, sex ratio, and probability of a next birth for women with twelve or more years of education

after the prior birth used here.[11] This lack of change underscores the importance of accounting for censoring of birth spells when trying to understand how birth spacing is changing over time.

Parity progression probabilities are lower the higher the education and are falling across all groups over time, but the extent of the decline depends crucially on the sex composition of prior children and the parity. Women with no sons still are the most likely to have the next birth, and this group has seen often substantially smaller declines in the likelihood of having another birth than women with one or more sons.[12] For urban women with eight to eleven years of education, for example, the second spell probability of a next child declined by eight percentage points if the first child was a girl, but 15 percentage points if it was a boy. Even more extreme is the fourth spell, where the likelihood of a birth declined by six percentage points to 75 percent if the woman had three children, but by almost 40 percentage points to 25 percent if she had two boys and a girl.

To what extent has the introduction of sex selection changed birth spacing across sex compositions? There are three broad groups in the data.

First, women who have only girls but do not use sex selection had, and continue to have, the shortest spacing, as shown, for example, by rural women with no education. For this group, spacing is shortest with only girls across all spell, and the difference between sex compositions have even grown over time.

Second, even with sex selection and the associated increases in expected spacing, the intervals for the other sex compositions have increased even more, and the relative pattern, therefore, remains more or less the same. An example is for the second spell for women with eight to eleven and twelve or more years of education.

Finally, women with the most biased sex ratios have the longest spacing in the absence

[11]See International Institute for Population Sciences (IIPS) and ORC Macro (1995, p. 110–112), International Institute for Population Sciences (IIPS) and ORC Macro (2000, p. 98–103), International Institute for Population Sciences (IIPS) and Macro International (2007, p. 88–91), and International Institute for Population Sciences (IIPS) and ICF (2017, p. 81–82). Median estimates are in Appendix Tables D.5 through D.8.

[12]There is, however, also some evidence that parents prefer a mix of boys and girls: for the fourth spell women with two boys *and* a girl consistently have the lowest parity progression probability.

of boys, and this spacing is longer than for the other possible sex compositions. The most extreme example is that with a sex ratio for the best-educated urban women approaching 80 percent, the 42 months birth intervals with two girls is seven months longer than with at least one boy. However, even urban women with eight to eleven years of education show the longest intervals with only girls in the last period.

7 Distribution of Birth Spacing

Average spacing is a convenient way to understand the overall changes in behavior but may hide crucial differences in the distribution of spacing. For example, if sex selection drives the changes in birth spacing, most of the increase in spacing will come from people who have two or more pregnancies rather than one and, therefore, from changes in the longer intervals. In contrast, a general increase in spacing would show up as an increase in spacing across the board.

Figures 6 and 7 show how the predicted 25th and 75th percentile birth intervals have changed over time by spell and education. For each woman in a given spell/period combination, I calculate the time point at which there is a given percent chance that she will have given birth, relative to the probability that she will eventually give birth in that spell. The reported statistics is the average of the percentile duration across all women in a given sample using the individual predicted probabilities of having had a birth by the end of the spell as weights.[13]

For women with no or little education, the increases in average spacing come predominantly from increases in the long end of the spacing distribution rather than from a general increase. Hence, spacing is still very short for many women, with 25 percent or more having their next birth within two years of the prior birth, even in the last period. Furthermore, the increases in the 75th percentile birth intervals are relatively small for the

[13] The Appendix shows conditional survival curves for all groups, and Appendix Tables D.5 through D.8 show 25th, 50th, and 75th percentiles durations with bootstrapped standard errors.

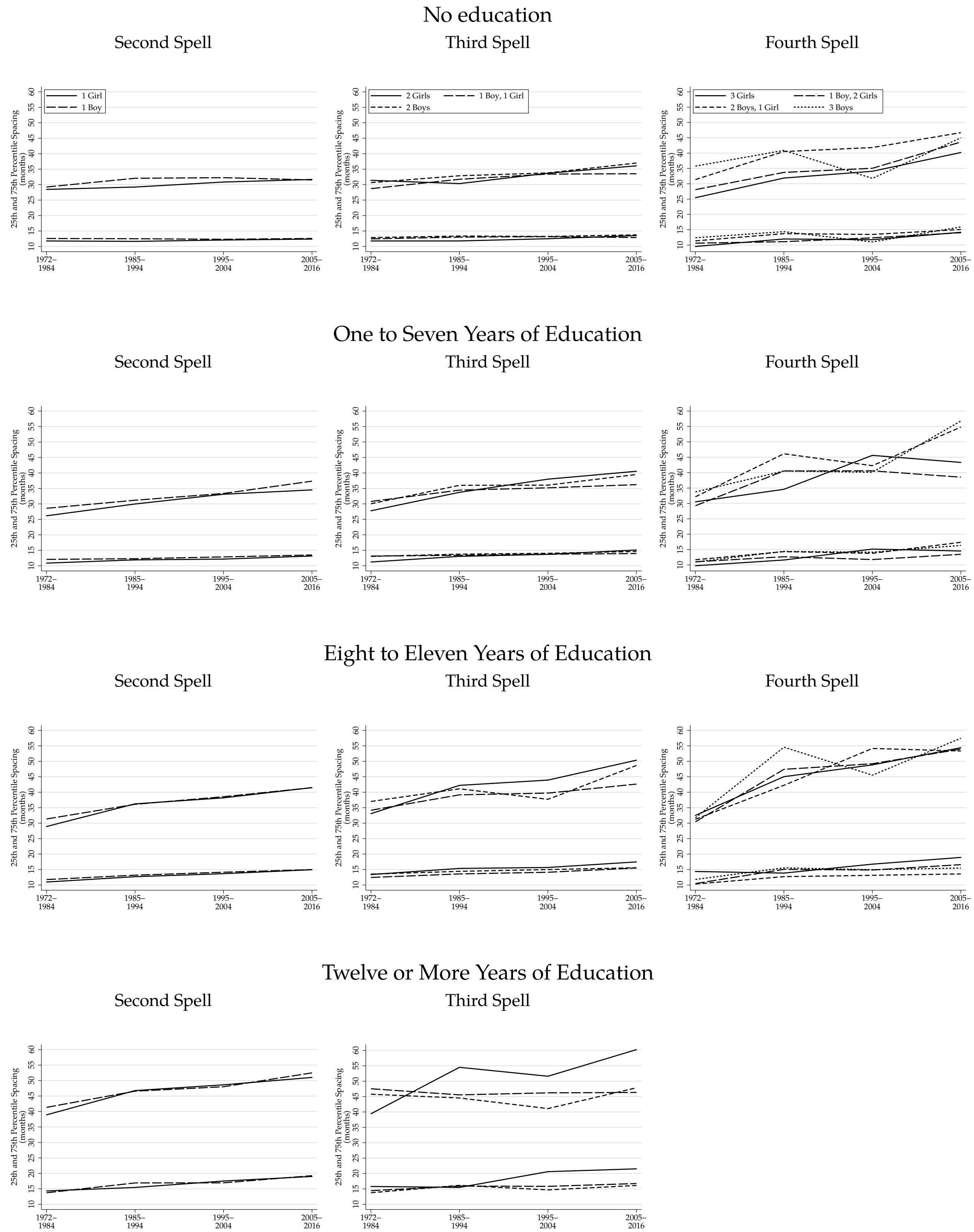


Figure 6: 25th and 75th Percentile Birth Intervals for Urban Women by Spell and Education

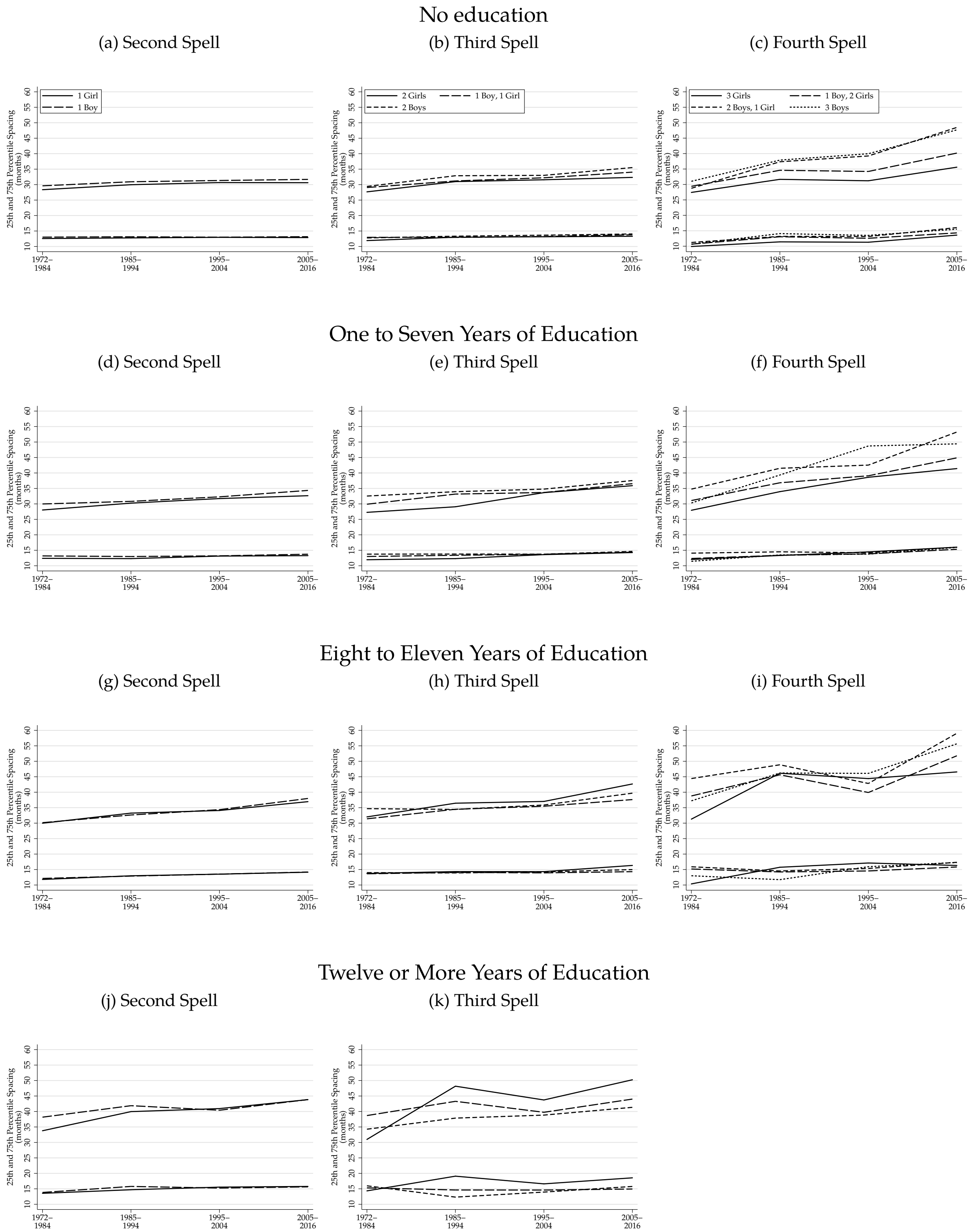


Figure 7: 25th and 75th Percentile Birth Intervals for Rural Women by Spell and Education

second spell and slightly more substantial for the third spell at around five months. Most of the divergence across sex compositions happen for the fourth spell, where the most significant increases are for women with two or three sons. However, even for women with no or one son, the birth intervals have increased by a half to a full year, consistent with some use of sex selection.

The 25th percentile birth intervals for women with eight to eleven years of education also changed relatively little over time and is, as for the less-educated women, close to around two years since the prior birth. Hence, the increases in the longer end of the distribution drive the change in average spacing. For example, the 75th percentile spacing length for women with two girls in the third spell increased by more than 15 months, mainly as the result of more widespread use of sex selection as the sex ratios above indicate.

The most educated urban women show an unusual pattern for the third spell, where there is virtually no change in either the 25th or 75th percentile birth intervals in the presence of at least one boy. The 75th percentile birth interval, however, increases by more than 20 months, corresponding to the massive increase in the sex ratio to almost 80 percent in the latest period. Hence, the increases in the length of the longer intervals over time are the main reason for the increases in average birth spacing and the reversal in the spacing pattern by sex composition, consistent with substantial use of sex selection.

Although most of the increases come from among the longer intervals, there is some evidence for the "delay" effect discussed above, where parents conceive later precisely because they know that the next child is likely to be a boy since they plan to use sex selection. The best example is for the best-educated urban women in the third spell, where, in the last two periods, the spacing to the third child is significantly longer if the two prior children were girls than if they already had one or two boys. These two periods are the periods where the predicted sex ratios are 70 and 80 percent, respectively. There is also a significantly longer spacing with only girls for women with eight to eleven years of education in the last period for the third and fourth spell, although the difference is substantially smaller.

8 What has Happened to Fertility?

A potential effect of the substantial increases in birth spacing is that TFR may underestimate cohort fertility, at least temporarily. I, therefore, compare predicted fertility based on a variation of the TFR and the hazard model by urban/rural and education groups in Table 1.

To make the fertility rate comparable to the hazard model, it uses only births up to parity four, and is, therefore, not directly comparable to those in the NFHS reports. Otherwise, I follow the procedure used in the NFHS reports (Croft, Marshall and Allen, 2018). I calculate age-specific fertility rates for five-year age groups using the number of births in months 1 to 36 before the survey month and the number of women in each age group.

Because NFHS-1 was after the introduction of sex selection, it is not possible to calculate a fertility rate in precisely the same manner for a period before sex selection was widely available. Instead, I calculate the fertility rates for women who were between 15 and 39 years of age five years before the survey month, again using the number of births three years before that, shown as "1987–88". Given the relatively low number of births to women 40 to 45 years of age, this approach provides the best estimate of the fertility rate at the time when sex selection still was not widespread.

To predict cohort fertility based on the hazard models above, I estimate the probability of progression to the next parity for each spell. Since the parity progression depends on the sex composition for prior children for parity two and above, I estimate the progression probability for each possible sex composition and weigh those probabilities with the likelihood that they will occur based on the prior spells.

Sterilizations are not incorporated into the hazard model because most occur imme-

Table 1: Predicted Fertility based on Four-Parity Fertility Rate and on Hazard Model

	NFHS–1		NFHS–2	NFHS–3	NFHS–4
Fertility Rate Period	1987–88	1992–93	1998–99	2005–06	2015–16
Hazard Model Period	1972–84		1985–94	1995–04	2004–16
			Urban		
			No Education		
Fertility Rate[a]	3.55	3.06	2.80	2.54	2.45
Hazard Model[b]	3.44		3.29	3.06	2.79
			One to Seven Years of Education		
Fertility Rate[a]	2.85	2.29	2.09	1.99	2.04
Hazard Model[b]	3.18		2.88	2.62	2.42
			Eight to Eleven Years of Education		
Fertility Rate[a]	2.43	2.04	1.84	1.81	1.87
Hazard Model[b]	2.72		2.41	2.28	2.07
			Twelve or More Years of Education		
Fertility Rate[a]	2.05	1.68	1.57	1.55	1.51
Hazard Model[b]	2.29		2.06	1.94	1.80
			Rural		
			No Education		
Fertility Rate[a]	3.57	2.93	2.63	2.74	2.81
Hazard Model[b]	3.55		3.38	3.26	3.09
			One to Seven Years of Education		
Fertility Rate[a]	3.01	2.52	2.39	2.25	2.37
Hazard Model[b]	3.29		3.08	2.83	2.70
			Eight to Eleven Years of Education		
Fertility Rate[a]	2.56	2.21	2.22	2.16	2.19
Hazard Model[b]	2.93		2.68	2.49	2.31
			Twelve or More Years of Education		
Fertility Rate[a]	1.95	1.68	2.13	2.08	1.96
Hazard Model[b]	2.64		2.39	2.25	2.11

Note. All predictions based on births up to and including parity four births for both fertility rate and model predictions. NFHS-1 was collected 1992–93 and model results for 1972–1984 were applied for the predictions. NFHS-2 was collected 1998–99 and model results for 1985–1994 were applied for the predictions. NFHS-3 was collected 2005–06 and model results for 1995–2004 were applied for the predictions. NFHS-4 was collected 2015–16 and model results for 2005–2016 were applied for the predictions.

[a] The fertility rate is based on five-year age groups, counting births that occurred 1 to 36 months before the survey months. For NFHS-1 and NFHS-2 the total number of women in the five-year age groups is based on the household roster since only ever-married women are in the individual recode sample. For NFHS-3 and NFHS-4 the total number of women is based on the individual recode sample since all women were interviewed.

[b] The model predictions for fertility are the average predicted fertility across all women in a given sample, using their age of marriage as the starting point and adding three years for each spell. Observed births are not taken into account for the predictions. For each spell, the predicted probability is the likelihood of having a next birth given sex composition multiplied with probability of that sex composition and the likelihood of getting to the spell, corrected for the probability of sterilization.

diately after giving birth. To compensate, I estimate the likelihood of sterilization using a Logit model, predict the probability of not getting sterilized, and then use that to scale down the parity progression probability when predicting cohort fertility.

I include the spell from marriage to first birth, despite the problems capturing the exact timing of marriages since the estimated progression probabilities should not be affected by this problem. To ensure that the predictions depend solely on sample composition and the estimate, I use the age at marriage for each woman and predict the likelihood of progressing to each parity, assuming three years increases in age between each parity. Shorter assumed duration between births leads to slightly higher predicted fertility.

The survey rounds do not coincide directly with the periods used for the hazard model. I, therefore, use the model results for 1972–1984, 1985–1994, 1995–2004, and 2005–2016 for rounds 1 through 4 of the NFHS, respectively.

The predicted cohort fertility based on the hazard model is higher than the four-parity fertility rate in almost all cases. Only for women with no education in the first period is there almost no difference between the two fertility measures; a situation where fertility is high, spacing very short and likely unchanged for an extended period before.

Consistent with a more substantial bias in the fertility rate when the age of marriage and the length of birth intervals are increasing, the absolute bias is least in the first and the last period and highest in the middle two periods. Hence, the fertility rate declined too fast from the mid-1980s to the century's end. Only recently, as the rate of increase for the birth intervals have slowed, are the predicted cohort fertility and the fertility beginning to converge again. Even with the convergence, however, the predicted cohort fertility for 2005–16 is above the 1992–93 fertility rate for every group except urban women with no education. Furthermore, for the last period, the predicted cohort fertility is still between ten and 20 percent higher than the fertility rate.

Another indication of the fertility rate bias is that it is increasing over time for some groups. For example, urban women with eight to eleven years of education showed 1.84, 1.81, and 1.87 over the last three surveys. These increases likely arise from the stabilization of the age of first birth and the spacing between births.

Despite the declines in the predicted cohort fertility, it is still mostly above the generally accepted replacement level of 2.1. Only for urban women with twelve or more years of education is the predicted cohort fertility clearly below 2.1, and even then, it is still more than 0.3 children higher than the fertility rate estimate of 1.5. Furthermore, the predicted cohort fertility numbers are likely too low, especially for the lower education groups, since it relies only on the first four births and because the model ignores births that took place past the end of the 96 months long spell.

9 Mortality and the Changing Birth Spacing

The prior literature shows that shorter birth spacing, especially very short spacing, is associated with a higher risk of infant mortality. Hence, the longer spacing, both from the increasing use of sex-selective abortions and from secular changes, may directly reduce infant mortality.

To the extent that the longer birth intervals arise from multiple abortions, the short duration between *pregnancies* could, however, increase mortality risk. This section addresses how infant mortality has changed and whether there is evidence of a negative impact of sex-selective abortions.

Starting with the sample used for estimating birth spacing, I select children born more than 12 months before the survey month. I restrict the analyses to parities two and three because of the small number of births and deaths for parity four. Furthermore, I do not show results for women with twelve or more years of education for the 1972–84 period because of the low number of women.

The dependent variable is whether the child died within the first twelve months of life. The main set of explanatory variables consists of dummies for birth spacing covering 12 months intervals, starting from nine months after the prior birth as above, until 48 months, which includes all births until 96 months. I use dummies for sex of the index child and the sex composition of the prior children. The birth spacing dummies, the sex of index child, and the sex composition dummies are all interacted. Since the actual number of abortions is unobserved, the interactions between the sex composition of prior children and the sex of the index child serve as proxies for the use of sex selection. The other explanatory variables are the same as above, and estimations are done separately by education level and parity.

I estimate the probability of infant mortality using a logit model. Figures 8 and 9 present the predicted probability of the second child dying within the first year at the possible combinations of index child sex, sex composition of prior children, and the birth spacing dummied.[14] All other variables take their average values. The graphs do not show confidence intervals to ease their legibility.

An important caveat is that the estimations do not address potential selection problems. For example, if women who have difficulties conceiving or carrying a pregnancy to term also have a higher mortality risk for their offspring, a spurious correlation between long birth spacing and mortality may arise (Kozuki and Walker, 2013). Unfortunately, methods used previously to address selection, such as family fixed effects, do not work well when the number of births is low as it is for better-educated women (Kozuki and Walker, 2013; Molitoris et al., 2019). However, in prior research, the fixed effects results and linear probability do not deviate substantially.

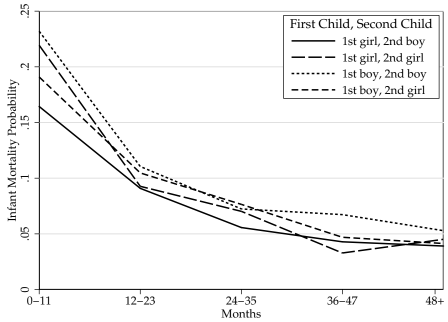
There has been substantial convergence in mortality risk across groups over time. For intervals 12 months or longer, there is now little difference across the education groups, with even the no education group showing an infant mortality risk below five percent.

Very short birth intervals still exhibit a higher mortality risk, although the effect declines with education level. For the best-educated women, the mortality risk is three to

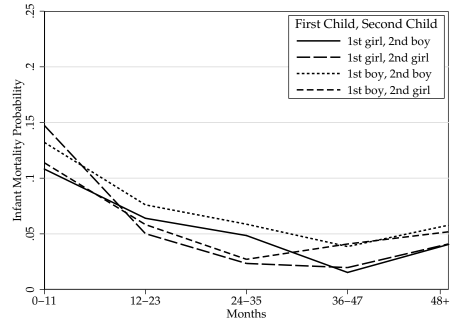
[14]The online Appendix shows the corresponding graphs for the third child.

No Eduction | One to Seven Years of Education

1972-1984

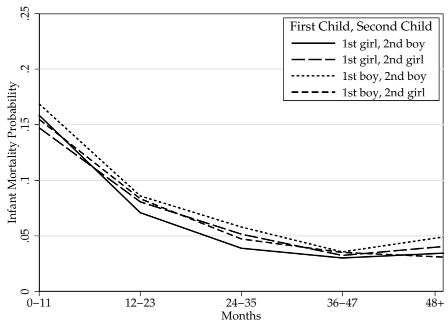


(a) Second Spell

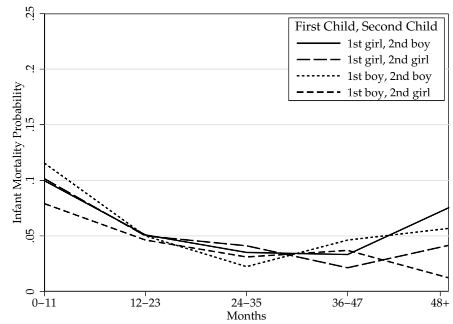


(b) Second Spell

1985-1994

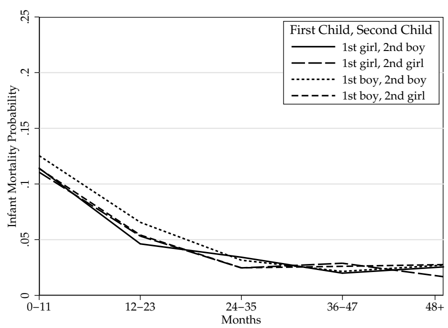


(c) Second Spell

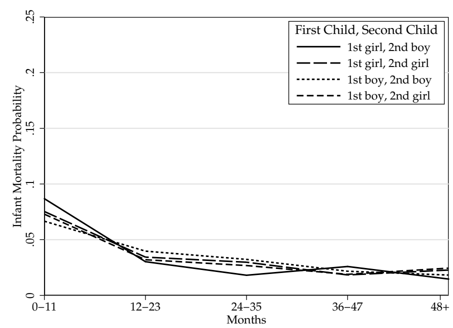


(d) Second Spell

1995-2004

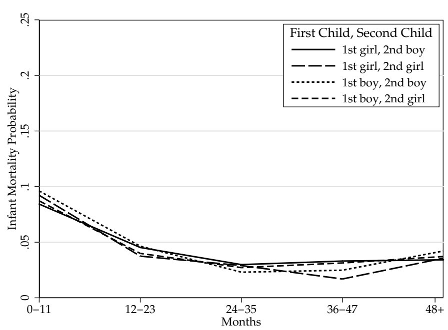


(e) Second Spell

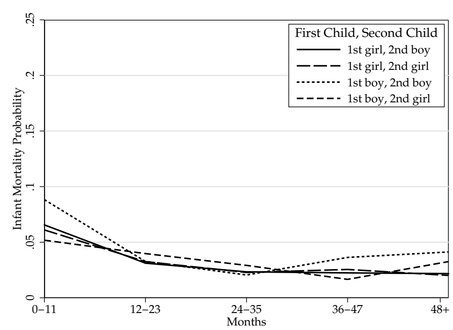


(f) Second Spell

2005-2016



(g) Second Spell



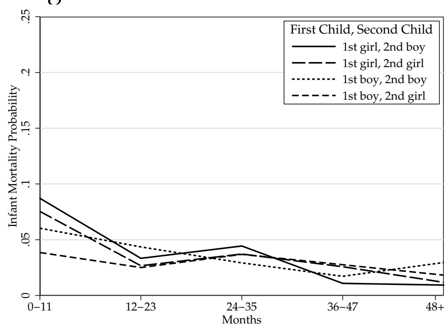
(h) Second Spell

Figure 8: Predicted Probability of Second Child's Infant Mortality for Women with No Education and Women with One to Seven Years of Education

Eight to Eleven Years of Education

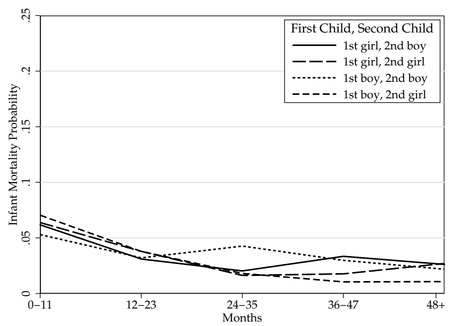
Twelve or More Years of Education

1972-1984

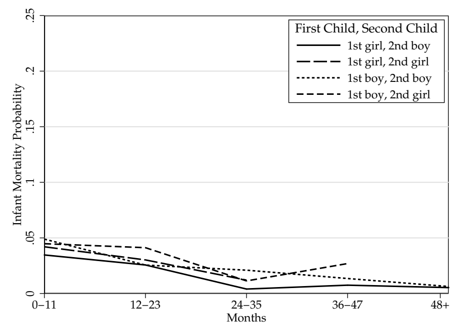


(a) Second Spell

1985-1994

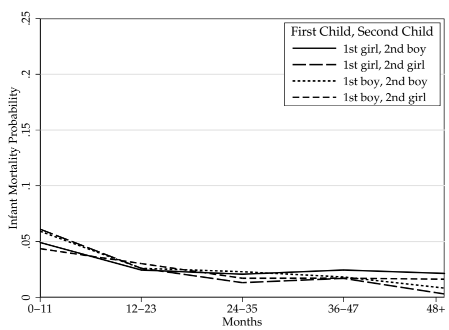


(b) Second Spell

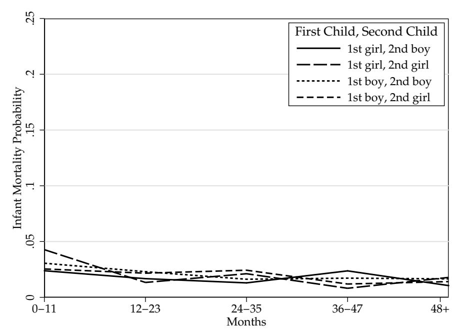


(c) Second Spell

1995-2004

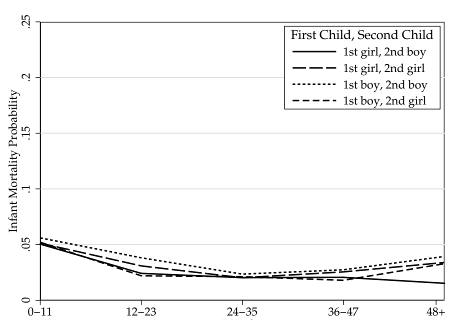


(d) Second Spell

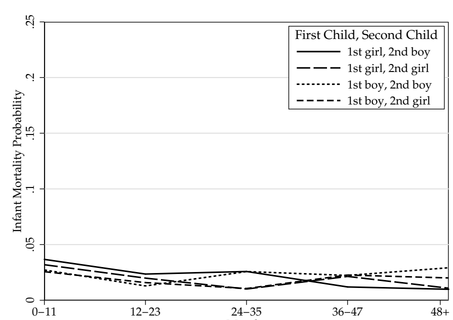


(e) Second Spell

2005-2016



(f) Second Spell



(g) Second Spell

Figure 9: Predicted Probability of Second Child's Infant Mortality for Women with Eight to Eleven of Education and Women with Twelve or More Years of Education

four percent, whereas women with no education still show a risk that is close to ten percent.

Despite the prior findings of differential mortality by sex, there is little evidence that girls have substantially higher mortality risk. There is some weak evidence that a boy born after a girl has a lower mortality risk in the earliest periods. This difference disappears, however, with the general decline in mortality risk.

If sex selective abortions lead to higher mortality risk, boys born after a girl (the solid lines) should have an increased risk with longer spacing for the two highest education groups in the last two periods. There are, however, no apparent consistent differences between these groups and the other potential combinations.

The raw numbers for the group with the most uneven sex ratio indicates that there is no impact on child mortality, even with high use of sex selection. A total of 1,004 women with twelve or more years of education, who have no boys at the start of the third spell in the last period, had a third child, of which 685 were boys. Of these 685 boys, only six died within the first year of life, and half of those were born in the 0-23 months interval, and none in 48 months or more interval.

10 Conclusion

One effect of the significant changes that India has experienced over the last four decades is that spacing between births has increased. The size of the increase is increasing in parity and the mother's education and is larger in urban than in rural areas.

The most substantial increases in birth intervals arise, however, with heavy use of sex selection. Some of these increases are so large that we even observe a reversal of the traditional spacing pattern where strong son preference was associated with shorter birth intervals, the fewer sons a family has (Ben-Porath and Welch, 1976; Leung, 1988).

Despite the longer average birth intervals, a large number of women still have very short birth intervals. Hence, the changes in birth spacing are driven by the longer intervals becoming even longer over time, both for women who do not use sex selection, but especially for those who do and end up with multiple abortions. The exception to the small change in short spacing is the delay in conception for women with very high use of sex selection, presumably because this group knows that the next child will be a boy.

Fertility has declined for all groups, but the likelihood of having an additional child still depends strongly on the number of sons, with women with no sons having the highest probabilities.

That those women most likely to use sex selection are also the most likely to have a next birth, combined with the secular increases in spacing, makes the total fertility rate a more biased measure of cohort fertility. This bias was most prominent early in the spread of sex selection when the fertility rate was up to one child lower than the predicted cohort fertility. It is, however, still present with the predicted cohort fertility ten to twenty percent higher than the fertility rate.

Tempo effects are studied extensively in the literature (See, for example, Bongaarts, 1999). Still, there are, to my knowledge, no other cases where there has been as substantial an increase in birth intervals and associated bias in fertility rates as for India. It is conceivable that we might see increases in TFR as birth spacing stabilizes or even shortens again if interventions against sex selection are successful.

The best-educated urban women are the only group for whom the predicted cohort fertility is below replacement at 1.8. A caveat to the predicted cohort fertility is that only Hindu women are in the sample and that the model only includes births up to parity four. However, almost everybody marries, and Hindu constitute 80 percent of the population. Furthermore, with only the first fourth births used, these estimates may be lower-bound, especially for the less educated women.

There has been a substantial reduction in infant mortality over time, and the size of the reductions is inversely related to the mother's education. Hence, there is now little difference in mortality risk across education groups if the birth took place more than 21 months from the prior birth. Short birth spacing is still associated with higher mortality, although the difference is small for the best-educated women. There is no evidence that children born to women who are the most likely to use sex selection have higher mortality risk.

An implication of the results here is that population growth in India will be higher than expected. There has been a rapid reduction in infant mortality risk, the longer spacing should further reduce mortality risk, and cohort fertility is higher than previously realized.

There are two critical questions that future research should address. Sex selection means that girls-only families are less likely to have very short birth intervals, which may reduce sibling competition. Hence, better health outcomes for girls with sex selection could be an unintended side-effect, rather than a result of girls becoming more valued as is often assumed. Comparing prior children's outcomes across sex composition and the sex of the next child could be a way to understand why girls' health outcomes improve in the presence of sex selection.

Second, is there a relationship between female labor force participation and sex selection? Women may be staying out of the labor market precisely because sex selection makes them more likely to have a boy and increases the expected birth spacing. Better job opportunities for women would affect sex selection for two reasons. First, it makes it more expensive to be out of the labor market for long periods. Second, it would moderate the differential in potential earnings between husband and wife and make it more attractive to invest in female compared to male offspring's human capital. This approach could, however, be a double-edged sword. If better job opportunities further lower desired fertility, the use of sex selection may increase, everything else equal. Hence, understanding the trade-off between long-term benefits from improvements in women's labor force participation and short-term costs from potential increases in sex selection is of paramount importance.

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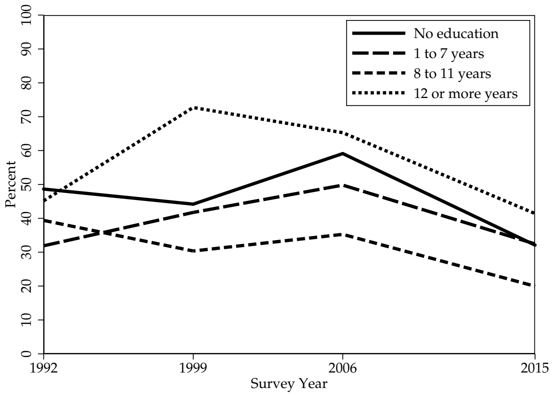
Appendices for Online Publication

These appendices are intended for online publication. They provide the descriptive statistics, additional estimated duration tables, and graphs for all education groups and spells.

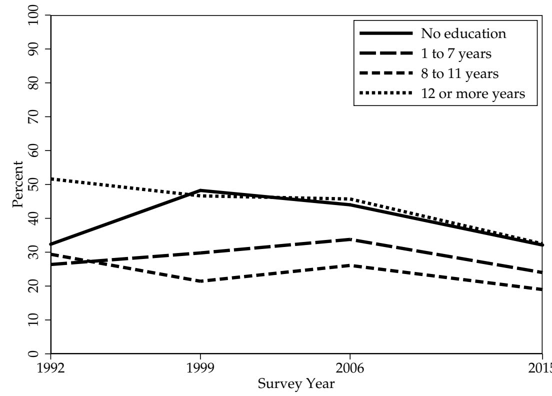
A Characteristics of Women's Work Experiences

Figure A.1 shows the percent of married women who are currently working at the time of the survey by age group and education level. No other labor force participation question is consistently available across all four surveys. Because the question refers to currently working, the percentages are lower in previous studies.

40 Years or Older

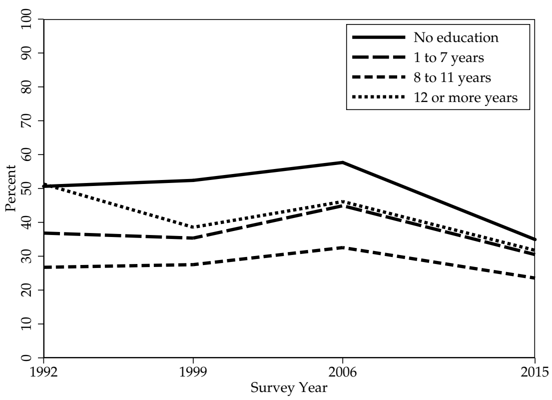


(a) Rural

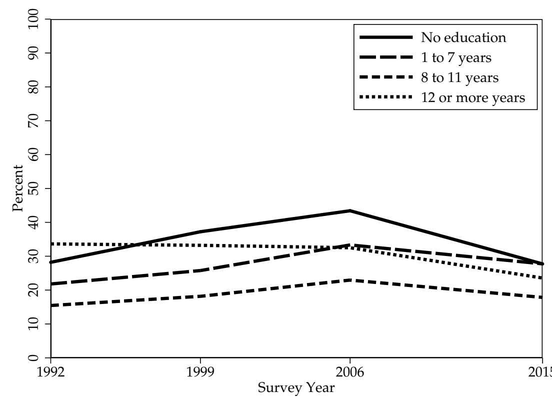


(b) Urban

30 to 39 Years Old

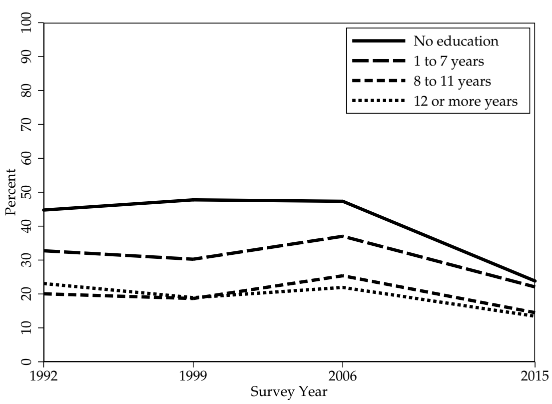


(c) Rural

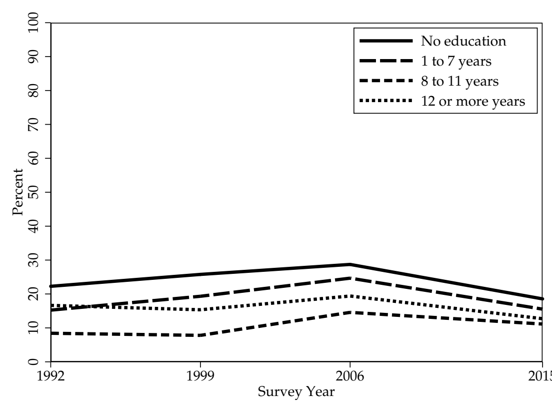


(d) Urban

20 to 29 Years Old



(e) Rural



(f) Urban

Figure A.1: Percentage of married women who were working at the time of the survey by age group and area of residence

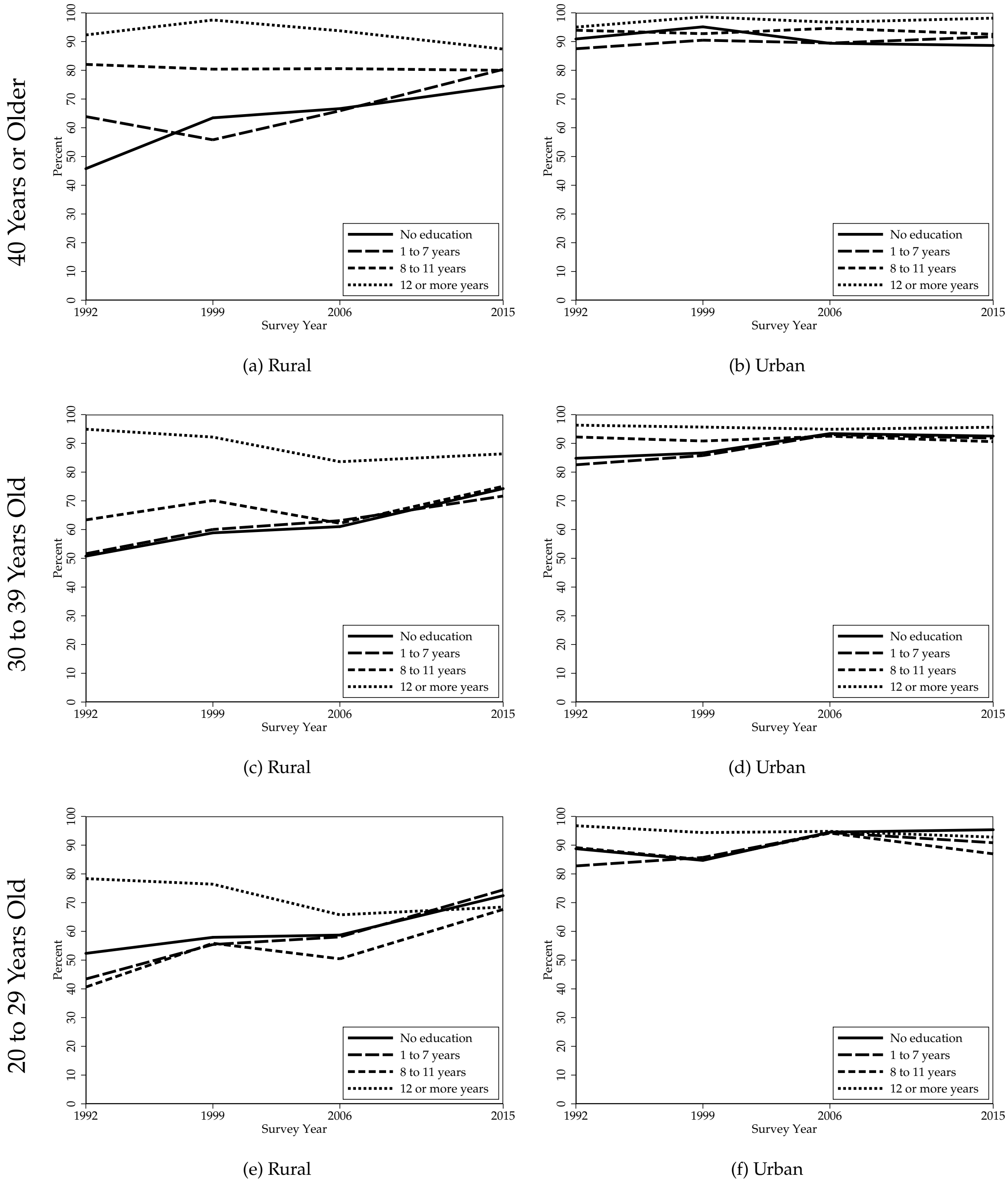
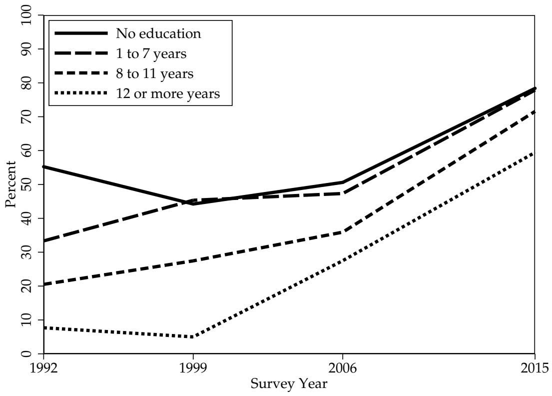
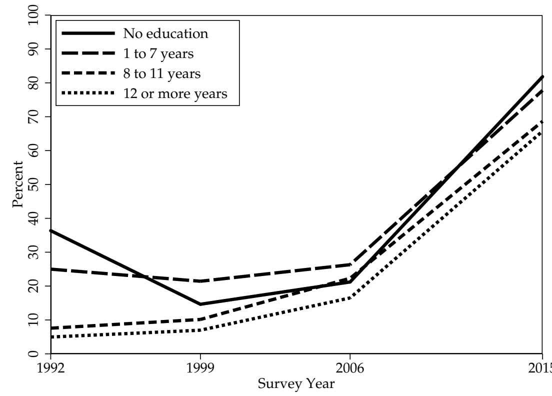


Figure A.2: Percentage of women paid cash or cash and in-kind of those women who were working at the time of the survey by age group and area of residence

40 Years or Older

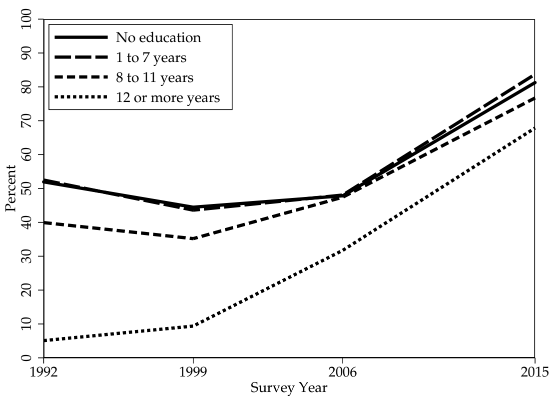


(a) Rural



(b) Urban

30 to 39 Years Old



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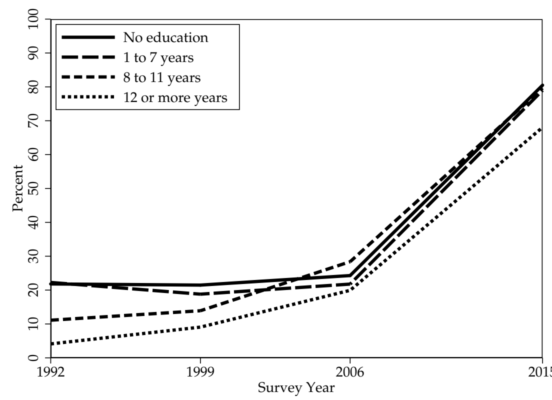
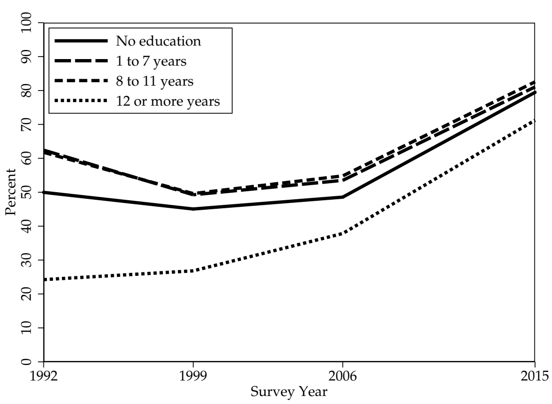
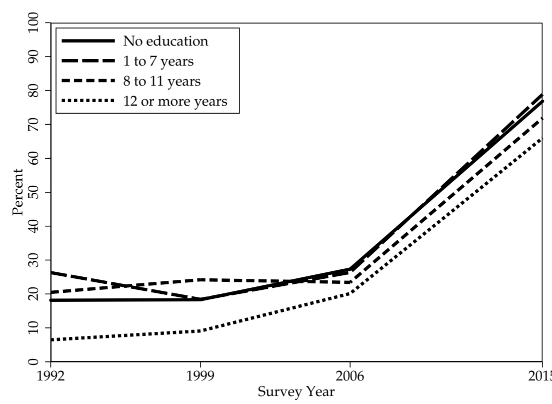


(d) Urban

20 to 29 Years Old



(e) Rural



(f) Urban

Figure A.3: Percentage women who worked for a family member of those working at the time of the survey, by age group and area of residence

B Recall Error and the Sex Ratio

The reliability of the results depends on the correctness of the birth histories provided by the respondents. A significant concern here is underreporting of child mortality, especially a systematic recall error where respondents' likelihood of reporting a deceased child depends on the sex of that child. This Appendix section assesses the degree of recall error across the surveys and discusses methods to address it.

NFHS enumerators probe for any missed births, although the method depends on the survey. NFHS-1 probe for each calendar birth interval that is four or more years. NFHS-2 asked for stillbirths, spontaneous and induced abortions and also probed for each calendar birth interval four or more years. NFHS-3 and NFHS-4 did not directly use birth intervals, but asked whether there were any other live births between (name of previous birth) and (name), including any children who died after birth, and asked for births before the birth listed as first birth and after the last birth listed as the last birth.

Probing catches many initially missed births, but systematic recall error based on son preference may still be a problem. First, son preference leads to significantly higher mortality for girls than boys. Secondly, son preference makes it more likely that parents will remember deceased boys than deceased girls. Finally, in the absence of sex-selective abortions, parents with a preference for sons may have the next birth sooner if the last child was a girl than if it was a boy. If this girl subsequently dies, she is more likely to be missed if probing for missed births is only done for long intervals as in NFHS-1 and NFHS-2.

I use two approaches to examine the degree of recall error. The first approach is to test whether the observed sex ratio is significantly different from the natural sex ratio. The natural sex ratio is approximately 105 boys to 100 girls or 51.2% (Ben-Porath and Welch, 1976; Jacobsen et al., 1999; Pörtner, 2015). Prenatal sex determination techniques did not become widely available until the mid-1980s, so any significant deviation from the natural sex ratio before that time is likely the result of recall error. The second approach is to compare births that took place during the same period but where captured in different surveys. Recall error is likely to increase with time, so births and deaths that took place earlier are more likely to be subject to recall error than more recent events.

Table B.1 shows the sex ratios of children recorded as first-born by year of birth, together with tests for whether the observed sex ratio is significantly higher than the natural sex ratio and whether more recent surveys have a higher sex ratio for the cohort than earlier surveys for the same period births. Births are combined into five-year cohorts to achieve sufficient power.

The "first-born" sex ratios illustrate the systematic recall error problem well. In all four

Table B.1: Observed Ratio of Boys for Children Listed as First-born by Year of Birth in Five-Year Cohorts

	NFHS-1 1992–1993	NFHS-2 1998–1999	NFHS-3 2005–2006	NFHS-4 2015–2016	Diff. test[a]
1960–1964	0.5430***	.	.	.	
	(0.0007)	(.)	(.)	(.)	
	[2,744]	[.]	[.]	[.]	
1965–1969	0.5295***	0.5500***	.	.	A
	(0.0052)	(0.0004)	(.)	(.)	
	[5,551]	[2,011]	[.]	[.]	
1970–1974	0.5365***	0.5329***	0.5432*	.	
	(0.0000)	(0.0011)	(0.0851)	(.)	
	[7,898]	[5,543]	[521]	[.]	
1975–1979	0.5206*	0.5151	0.5257*	.	
	(0.0577)	(0.3126)	(0.0512)	(.)	
	[8,913]	[7,455]	[3,738]	[.]	
1980–1984	0.5213**	0.5240**	0.5271***	0.5567***	CEF
	(0.0272)	(0.0104)	(0.0048)	(0.0000)	
	[11,241]	[9,618]	[7,646]	[4,135]	
1985–1989	0.5180	0.5134	0.5121	0.5562***	CEF
	(0.1095)	(0.4060)	(0.5080)	(0.0000)	
	[11,293]	[10,912]	[9,345]	[22,243]	
1990–1994	0.5197	0.5193*	0.5176	0.5481***	CEF
	(0.1150)	(0.0643)	(0.1357)	(0.0000)	
	[6,523]	[11,457]	[10,475]	[41,624]	
1995–1999	.	0.5237**	0.4980	0.5322***	EF
	(.)	(0.0171)	(0.9986)	(0.0000)	
	[.]	[8,514]	[10,996]	[50,480]	
2000–2004	.	.	0.5123	0.5214***	F
	(.)	(.)	(0.4924)	(0.0000)	
	[.]	[.]	[10,743]	[56,853]	
2005–2009	.	.	0.5171	0.5182***	
	(.)	(.)	(0.3160)	(0.0017)	
	[.]	[.]	[2,537]	[59,383]	
2010–2016	.	.	.	0.5197***	
	(.)	(.)	(.)	(0.0000)	
	[.]	[.]	[.]	[73,474]	

Note. Sample consists of Hindu women only. First number in cell is ratio of boys to children. Second number, in parentheses, is p-value for the hypothesis that observed sex ratio is greater than 105/205 using a binomial probability test (bitest in Stata 13) with significance levels: * sign. at 10%; ** sign. at 5%; *** sign. at 1%. Third number, in square brackets, is number of observations.
[a] Test (prtest in Stata 13) whether recall error increases with time passed, which would manifest itself in a higher sex ratio for a more recent survey than an earlier for the same cohort. A: Cohort sex ratio significantly larger in NFHS-2 than NFHS-1 at the 10 percent level. B: Cohort sex ratio significantly larger in NFHS-3 than NFHS-1 at the 10 percent level. C: Cohort sex ratio significantly larger in NFHS-4 than NFHS-1 at the 10 percent level. D: Cohort sex ratio significantly larger in NFHS-3 than NFHS-2 at the 10 percent level. E: Cohort sex ratio significantly larger in NFHS-4 than NFHS-2 at the 10 percent level. F: Cohort sex ratio significantly larger in NFHS-4 than NFHS-3 at the 10 percent level.

surveys around 55 percent of children reported as first-born are boys for the first cohort of births observed. Given that these cohorts cover from 1960-1964 to 1980-1984, which is before sex selection techniques became available in India, the most likely explanation for the skewed sex ratio is that some children listed as first-borns were not, in fact, the first children born in their families. Instead, for a substantial proportion of families, their first-born was a girl who died and went unreported when enumerators asked about birth history.

As expected, the difference between the observed sex ratio and the natural sex ratio is less pronounced the closer to the survey date the cohort is. The observed sex ratio for children born just before the NFHS-1 survey and listed as first-born is 0.517, which is not statistically significantly different from the natural sex ratio. The same general pattern holds for the other three surveys, with cohorts further away from the survey date more likely to have a sex ratio skewed male.

Finally, across surveys, the same cohort tends to show a higher sex ratio the more recent the survey (births in the cohort took place earlier relative to the survey date). Despite this, few cohorts show significantly different sex ratios across surveys, most likely because of a lack of power. The exception is that comparisons involving NFHS-4 are mostly statistically significant since the number of surveyed households in NFHS-4 were much larger than in prior surveys.

The problem with the above approach is that the year of birth is affected by recall error; a second born child listed as first-born is born later than the real first born child. Year of marriage should, however, be affected neither by parental recall error nor the use of sex-selective abortions. Tables B.2 and B.3, therefore, shows sex ratios of children recorded as first-born and second-born by year of parents' marriage, together with tests for whether the observed sex ratio is significantly higher than the natural sex ratio and whether more recent surveys show a higher sex ratio for the cohort than earlier surveys. The basic recall error pattern remains, with women married longer ago more likely to report that their first-born is a boy. Similarly, comparing women married in the same five-year period across surveys shows that women married longer ago are more likely to report having a son.

The relationship between the length of marriage and recall error can also be seen in Figures B.1 and B.2, which show the observed sex ratio for children reported as first born as a function of the duration of marriage at the time of the survey. The solid line is the sex ratio of children reported as first-born by the number of years between the survey and marriage, while the dashed lines indicate the 95 percent confidence interval and the horizontal line the natural sex ratio (approximately 0.512). To ensure sufficient cell sizes I group years into twos. In line with the results from Tables B.2 and B.3, the observed ratio

Table B.2: Observed Ratio of Boys for Children Listed as First-born by Year of Parents' Marriage in Five-Year Cohorts

	NFHS-1 1992–1993	NFHS-2 1998–1999	NFHS-3 2005–2006	NFHS-4 2015–2016	Diff. test[a]
1960–1964	0.5364***	.	.	.	
	(0.0001)	(.)	(.)	(.)	
	[6,298]	[.]	[.]	[.]	
1965–1969	0.5357***	0.5431***	.	.	
	(0.0001)	(0.0000)	(.)	(.)	
	[6,801]	[4,279]	[.]	[.]	
1970–1974	0.5242**	0.5223*	0.5269	.	
	(0.0150)	(0.0526)	(0.1010)	(.)	
	[8,274]	[6,527]	[1,953]	[.]	
1975–1979	0.5269***	0.5203*	0.5314***	0.5617***	CDEF
	(0.0017)	(0.0666)	(0.0019)	(0.0005)	
	[9,956]	[8,602]	[5,749]	[1,127]	
1980–1984	0.5152	0.5133	0.5192	0.5512***	CEF
	(0.2658)	(0.4166)	(0.1023)	(0.0000)	
	[10,894]	[9,805]	[8,237]	[12,033]	
1985–1989	0.5176	0.5210**	0.5094	0.5530***	CEF
	(0.1409)	(0.0339)	(0.7148)	(0.0000)	
	[10,017]	[10,825]	[9,620]	[33,241]	
1990–1994	0.5237	0.5196*	0.5119	0.5405***	CEF
	(0.1460)	(0.0663)	(0.5315)	(0.0000)	
	[2,198]	[10,464]	[10,458]	[45,940]	
1995–1999	.	0.5257**	0.5019	0.5254***	F
	(.)	(0.0292)	(0.9846)	(0.0000)	
	[.]	[5,007]	[10,863]	[52,679]	
2000–2004	.	.	0.5166	0.5207***	
	(.)	(.)	(0.2022)	(0.0000)	
	[.]	[.]	[9,119]	[56,143]	
2005–2009	.	.	.	0.5204***	
	(.)	(.)	(.)	(0.0000)	
	[.]	[.]	[.]	[58,511]	
2010–2016	.	.	.	0.5176***	
	(.)	(.)	(.)	(0.0091)	
	[.]	[.]	[.]	[48,481]	

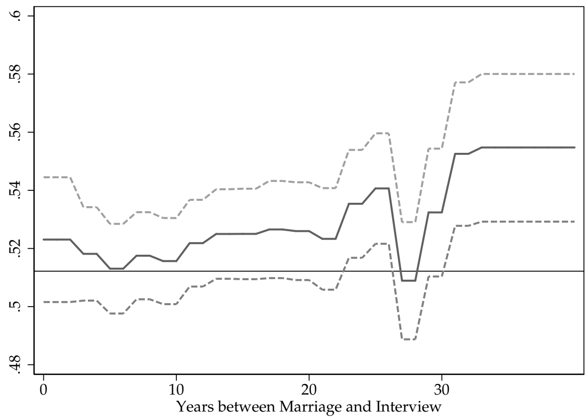
Note. Sample consists of Hindu women only. First number in cell is ratio of boys to children. Second number, in parentheses, is p-value for the hypothesis that observed sex ratio is greater than 105/205 using a binomial probability test (bitest in Stata 13) with significance levels: * sign. at 10%; ** sign. at 5%; *** sign. at 1%. Third number, in square brackets, is number of observations. [a] Test (prtest in Stata 13) whether recall error increases with time passed, which would manifest itself in a higher sex ratio for a more recent survey than an earlier for the same cohort. A: Cohort sex ratio significantly larger in NFHS-2 than NFHS-1 at the 10 percent level. B: Cohort sex ratio significantly larger in NFHS-3 than NFHS-1 at the 10 percent level. C: Cohort sex ratio significantly larger in NFHS-4 than NFHS-1 at the 10 percent level. D: Cohort sex ratio significantly larger in NFHS-3 than NFHS-2 at the 10 percent level. E: Cohort sex ratio significantly larger in NFHS-4 than NFHS-2 at the 10 percent level. F: Cohort sex ratio significantly larger in NFHS-4 than NFHS-3 at the 10 percent level.

Table B.3: Observed Ratio of Boys for Children Listed as Second-born by Year of Parents' Marriage' in Five-Year Cohorts

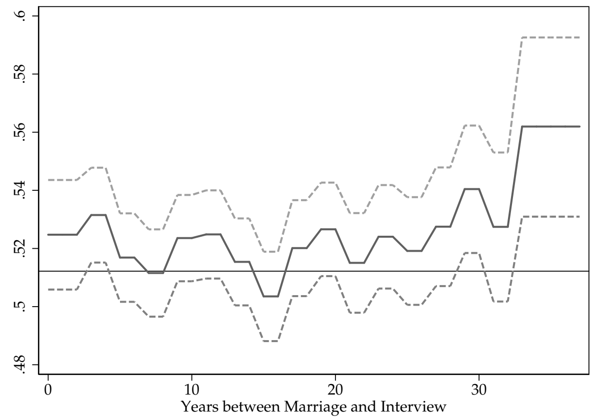
	NFHS-1 1992–1993	NFHS-2 1998–1999	NFHS-3 2005–2006	NFHS-4 2015–2016	Diff. test[a]
1960–1964	0.5264**	.	.	.	
	(0.0135)	(.)	(.)	(.)	
	[6,113]	[.]	[.]	[.]	
1965–1969	0.5269***	0.5378***	.	.	
	(0.0090)	(0.0005)	(.)	(.)	
	[6,571]	[4,163]	[.]	[.]	
1970–1974	0.5192	0.5220*	0.5374**	.	B
	(0.1085)	(0.0619)	(0.0148)	(.)	
	[7,984]	[6,307]	[1,898]	[.]	
1975–1979	0.5147	0.5198*	0.5287***	0.5453**	BCE
	(0.3143)	(0.0850)	(0.0072)	(0.0172)	
	[9,469]	[8,288]	[5,582]	[1,049]	
1980–1984	0.5213**	0.5173	0.5170	0.5346***	CEF
	(0.0348)	(0.1650)	(0.1984)	(0.0000)	
	[9,932]	[9,343]	[7,866]	[11,513]	
1985–1989	0.5133	0.5178	0.5251***	0.5301***	BCE
	(0.4376)	(0.1312)	(0.0074)	(0.0000)	
	[5,901]	[10,036]	[9,035]	[31,639]	
1990–1994	0.4362	0.5197*	0.5256***	0.5274***	ABC
	(0.9737)	(0.0926)	(0.0045)	(0.0000)	
	[149]	[7,918]	[9,555]	[43,344]	
1995–1999	.	0.5630***	0.5312***	0.5230***	
	(.)	(0.0007)	(0.0002)	(0.0000)	
	[.]	[1,016]	[8,940]	[49,053]	
2000–2004	.	.	0.5252*	0.5199***	
	(.)	(.)	(0.0688)	(0.0003)	
	[.]	[.]	[3,307]	[50,804]	
2005–2009	.	.	.	0.5231***	
	(.)	(.)	(.)	(0.0000)	
	[.]	[.]	[.]	[46,164]	
2010–2016	.	.	.	0.5218**	
	(.)	(.)	(.)	(0.0110)	
	[.]	[.]	[.]	[14,370]	

Note. Sample consists of Hindu women only. First number in cell is ratio of boys to children. Second number, in parentheses, is p-value for the hypothesis that observed sex ratio is greater than 105/205 using a binomial probability test (bitest in Stata 13) with significance levels: * sign. at 10%; ** sign. at 5%; *** sign. at 1%. Third number, in square brackets, is number of observations.

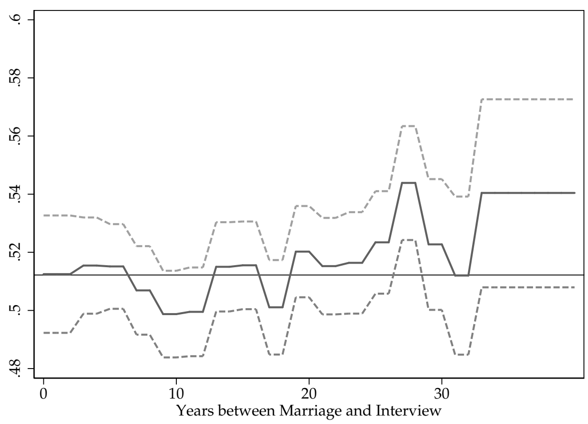
[a] Test (prtest in Stata 13) whether recall error increases with time passed, which would manifest itself in a higher sex ratio for a more recent survey than an earlier for the same cohort. A: Cohort sex ratio significantly larger in NFHS-2 than NFHS-1 at the 10 percent level. B: Cohort sex ratio significantly larger in NFHS-3 than NFHS-1 at the 10 percent level. C: Cohort sex ratio significantly larger in NFHS-4 than NFHS-1 at the 10 percent level. D: Cohort sex ratio significantly larger in NFHS-3 than NFHS-2 at the 10 percent level. E: Cohort sex ratio significantly larger in NFHS-4 than NFHS-2 at the 10 percent level. F: Cohort sex ratio significantly larger in NFHS-4 than NFHS-3 at the 10 percent level.



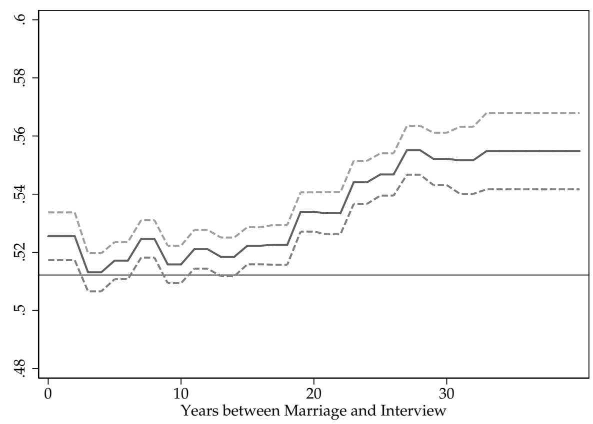
(a) NFHS-1



(b) NFHS-2



(c) NFHS-3

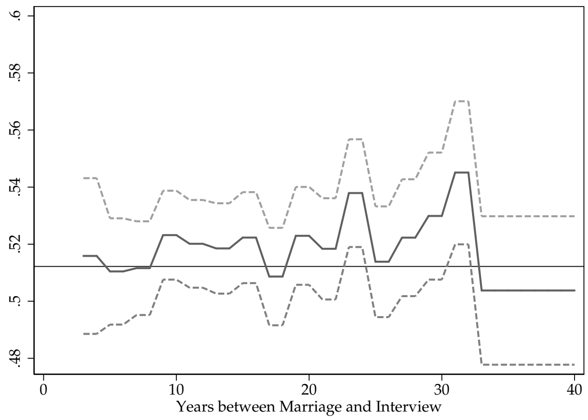


(d) NFHS-3

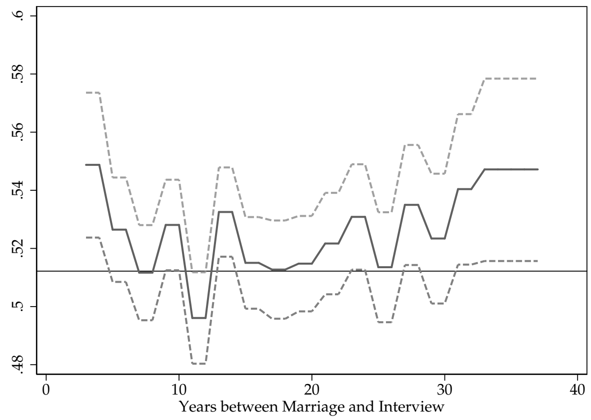
Figure B.1: Ratio of Boys for "First" Births by Survey Round

of boys is increasingly above the expected value the longer ago the parents were married.

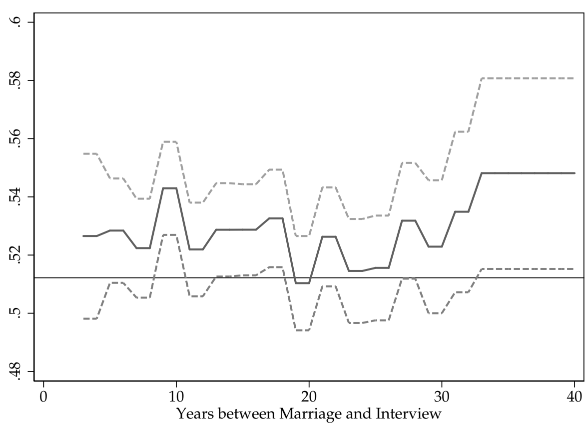
The increasingly unequal sex ratio with increasing marriage duration suggests that a solution to the recall error problem is to drop observations for women who were married "too far" from the survey year. The main problem is establishing what the best cut-off point should be, with the trade-off between retaining enough observations and the correctness of the information. As Tables B.2 and B.3 show, there are differences in recall error across the three surveys and between the two birth orders, although this may be the result of differences in the number of observations across surveys. Furthermore, the recall error pattern is not entirely consistent across observed birth orders. Since most of the surveys start showing significantly biased sex ratio from around 22 years of marriage on, I drop all observations where the marriage took place 22 years or more.



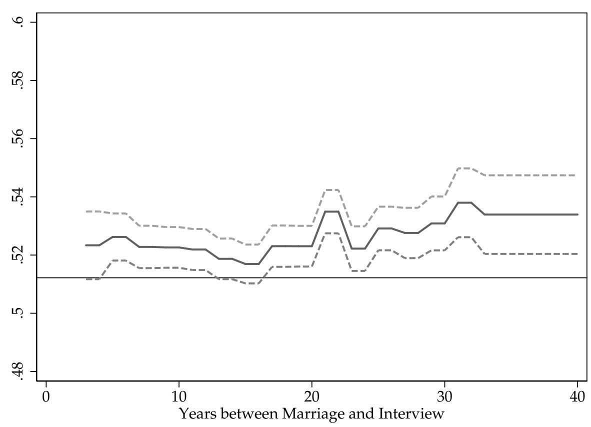
(a) NFHS-1



(b) NFHS-2



(c) NFHS-3



(d) NFHS-3

Figure B.2: Ratio of Boys for “Second” Births by Survey Round

C Descriptive Statistics

Table C.1: Descriptive Statistics by Education Level and Beginning of Spell For Two Lowest Education Levels

		No Education				1–7 Years of Education			
		1972–1984	1985–1994	1995–2004	2005–2016	1972–1984	1985–1994	1995–2004	2005–2016
Second Spell	Boy born	0.504	0.452	0.468	0.413	0.493	0.450	0.460	0.380
		(0.500)	(0.498)	(0.499)	(0.492)	(0.500)	(0.498)	(0.498)	(0.485)
	Girl born	0.464	0.421	0.440	0.380	0.474	0.423	0.426	0.353
		(0.499)	(0.494)	(0.496)	(0.485)	(0.499)	(0.494)	(0.494)	(0.478)
	Censored	0.032	0.127	0.092	0.207	0.032	0.127	0.114	0.266
		(0.175)	(0.333)	(0.289)	(0.405)	(0.177)	(0.333)	(0.317)	(0.442)
	1 boy	0.523	0.515	0.518	0.516	0.521	0.514	0.522	0.519
		(0.499)	(0.500)	(0.500)	(0.500)	(0.500)	(0.500)	(0.500)	(0.500)
	1 girl	0.477	0.485	0.482	0.484	0.479	0.486	0.478	0.481
		(0.499)	(0.500)	(0.500)	(0.500)	(0.500)	(0.500)	(0.500)	(0.500)
	Urban	0.169	0.175	0.155	0.122	0.350	0.341	0.259	0.192
		(0.375)	(0.380)	(0.362)	(0.327)	(0.477)	(0.474)	(0.438)	(0.394)
	Age	17.773	18.274	19.432	20.740	18.637	19.141	19.485	20.527
		(2.739)	(3.005)	(3.410)	(3.520)	(2.889)	(3.176)	(3.284)	(3.271)
	Owns land	0.602	0.573	0.510	0.482	0.506	0.493	0.474	0.468
		(0.509)	(0.503)	(0.500)	(0.500)	(0.500)	(0.500)	(0.499)	(0.499)
	Sched. caste/tribe	0.347	0.391	0.444	0.486	0.154	0.219	0.337	0.416
		(0.476)	(0.488)	(0.497)	(0.500)	(0.361)	(0.414)	(0.473)	(0.493)
	3 months periods	163,580	232,552	392,924	244,364	59,182	106,165	255,925	229,242
	Women	18,650	27,563	43,952	29,527	6,889	12,191	27,225	26,446
Third Spell	Boy born	0.492	0.428	0.421	0.341	0.464	0.397	0.356	0.273
		(0.500)	(0.495)	(0.494)	(0.474)	(0.499)	(0.489)	(0.479)	(0.445)
	Girl born	0.455	0.398	0.386	0.314	0.437	0.360	0.325	0.236
		(0.498)	(0.489)	(0.487)	(0.464)	(0.496)	(0.480)	(0.469)	(0.424)
	Censored	0.053	0.174	0.193	0.345	0.100	0.243	0.319	0.492
		(0.224)	(0.379)	(0.395)	(0.475)	(0.300)	(0.429)	(0.466)	(0.500)
	2 boys	0.275	0.256	0.251	0.249	0.251	0.246	0.241	0.239
		(0.447)	(0.436)	(0.434)	(0.432)	(0.434)	(0.431)	(0.427)	(0.426)
	1 boy, 1 girl	0.489	0.502	0.504	0.499	0.506	0.502	0.509	0.505
		(0.500)	(0.500)	(0.500)	(0.500)	(0.500)	(0.500)	(0.500)	(0.500)
	2 girls	0.235	0.243	0.245	0.252	0.243	0.252	0.251	0.256
		(0.424)	(0.429)	(0.430)	(0.434)	(0.429)	(0.434)	(0.434)	(0.436)
	Urban	0.173	0.171	0.159	0.121	0.365	0.341	0.263	0.192
		(0.379)	(0.376)	(0.365)	(0.326)	(0.482)	(0.474)	(0.440)	(0.394)
	Age	19.987	20.593	21.641	23.055	20.839	21.367	21.735	22.821
		(2.896)	(3.150)	(3.490)	(3.665)	(2.954)	(3.228)	(3.372)	(3.441)
	Owns land	0.607	0.581	0.523	0.489	0.507	0.509	0.493	0.475
		(0.506)	(0.497)	(0.499)	(0.500)	(0.500)	(0.500)	(0.500)	(0.499)
	Sched. caste/tribe	0.339	0.392	0.444	0.479	0.154	0.218	0.334	0.410
		(0.473)	(0.488)	(0.497)	(0.500)	(0.361)	(0.413)	(0.472)	(0.492)
	3 months periods	105,997	194,166	295,808	267,436	42,088	84,124	182,266	209,481
	Women	12,119	22,858	31,218	29,446	4,384	8,785	16,346	20,850
Fourth Spell	Boy born	0.483	0.390	0.357	0.286	0.414	0.358	0.293	0.222
		(0.500)	(0.488)	(0.479)	(0.452)	(0.493)	(0.479)	(0.455)	(0.416)
	Girl born	0.424	0.367	0.327	0.266	0.405	0.305	0.254	0.199
		(0.494)	(0.482)	(0.469)	(0.442)	(0.491)	(0.461)	(0.435)	(0.400)
	Censored	0.093	0.243	0.316	0.448	0.180	0.337	0.453	0.578
		(0.290)	(0.429)	(0.465)	(0.497)	(0.385)	(0.473)	(0.498)	(0.494)
	3 boys	0.136	0.123	0.115	0.105	0.110	0.107	0.099	0.087
		(0.343)	(0.329)	(0.319)	(0.307)	(0.312)	(0.310)	(0.299)	(0.281)
	2 boys, 1 girl	0.372	0.355	0.352	0.335	0.343	0.329	0.327	0.314
		(0.483)	(0.478)	(0.478)	(0.472)	(0.475)	(0.470)	(0.469)	(0.464)
	1 boys, 2 girls	0.362	0.392	0.397	0.407	0.400	0.407	0.413	0.423
		(0.481)	(0.488)	(0.489)	(0.491)	(0.490)	(0.491)	(0.492)	(0.494)
	3 girls	0.130	0.130	0.137	0.153	0.147	0.157	0.162	0.176
		(0.337)	(0.336)	(0.343)	(0.360)	(0.354)	(0.363)	(0.368)	(0.381)
	Urban	0.168	0.168	0.159	0.114	0.358	0.330	0.258	0.189
		(0.374)	(0.374)	(0.365)	(0.318)	(0.479)	(0.470)	(0.438)	(0.392)
	Age	21.948	22.777	23.583	25.284	22.644	23.444	23.821	24.893
		(3.019)	(3.296)	(3.497)	(3.799)	(2.910)	(3.385)	(3.455)	(3.523)
	Owns land	0.615	0.594	0.542	0.497	0.522	0.537	0.508	0.480
		(0.509)	(0.496)	(0.498)	(0.500)	(0.500)	(0.499)	(0.500)	(0.500)
	Sched. caste/tribe	0.333	0.402	0.451	0.481	0.148	0.219	0.339	0.414
		(0.471)	(0.490)	(0.498)	(0.500)	(0.355)	(0.413)	(0.473)	(0.493)
	3 months periods	55,942	140,909	162,841	217,023	20,121	46,646	75,858	110,944
	Women	6,421	16,278	17,105	22,496	2,008	4,771	6,496	10,620

Note. Means without parentheses and standard deviation in parentheses. Interactions between variables and baseline hazard dummies not shown.

Table C.2: Descriptive Statistics by Education Level and Beginning of Spell for Two Highest Education Levels

		8–11 Years of Education				12+ Years of Education			
		1972–1984	1985–1994	1995–2004	2005–2016	1972–1984	1985–1994	1995–2004	2005–2016
Second Spell	Boy born	0.486	0.432	0.441	0.325	0.452	0.392	0.400	0.268
		(0.500)	(0.495)	(0.497)	(0.468)	(0.498)	(0.488)	(0.490)	(0.443)
	Girl born	0.458	0.392	0.395	0.300	0.438	0.328	0.336	0.229
		(0.498)	(0.488)	(0.489)	(0.458)	(0.496)	(0.469)	(0.472)	(0.421)
	Censored	0.056	0.175	0.164	0.375	0.110	0.280	0.265	0.503
		(0.231)	(0.380)	(0.370)	(0.484)	(0.313)	(0.449)	(0.441)	(0.500)
	1 boy	0.521	0.520	0.521	0.518	0.512	0.519	0.526	0.519
		(0.500)	(0.500)	(0.500)	(0.500)	(0.500)	(0.500)	(0.499)	(0.500)
	1 girl	0.479	0.480	0.479	0.482	0.488	0.481	0.474	0.481
		(0.500)	(0.500)	(0.500)	(0.500)	(0.500)	(0.500)	(0.499)	(0.500)
	Urban	0.608	0.524	0.385	0.266	0.865	0.811	0.659	0.469
		(0.488)	(0.499)	(0.487)	(0.442)	(0.342)	(0.391)	(0.474)	(0.499)
	Age	20.340	20.630	20.528	21.117	22.803	23.312	23.099	23.170
		(3.203)	(3.318)	(3.405)	(3.349)	(3.330)	(3.499)	(3.712)	(3.704)
	Owns land	0.364	0.426	0.456	0.495	0.217	0.264	0.349	0.453
		(0.481)	(0.495)	(0.498)	(0.500)	(0.413)	(0.441)	(0.477)	(0.498)
	Sched. caste/tribe	0.076	0.138	0.231	0.309	0.030	0.065	0.124	0.195
		(0.266)	(0.345)	(0.422)	(0.462)	(0.172)	(0.246)	(0.330)	(0.396)
	3 months periods	45,828	106,296	334,766	372,999	25,305	71,602	230,155	297,850
	Women	4,850	10,823	31,512	40,204	2,034	5,605	17,314	28,198
Third Spell	Boy born	0.410	0.309	0.299	0.196	0.267	0.188	0.181	0.120
		(0.492)	(0.462)	(0.458)	(0.397)	(0.443)	(0.391)	(0.385)	(0.325)
	Girl born	0.366	0.261	0.244	0.163	0.233	0.137	0.139	0.078
		(0.482)	(0.439)	(0.429)	(0.370)	(0.423)	(0.344)	(0.346)	(0.268)
	Censored	0.224	0.430	0.457	0.640	0.499	0.674	0.680	0.802
		(0.417)	(0.495)	(0.498)	(0.480)	(0.500)	(0.469)	(0.467)	(0.398)
	2 boys	0.267	0.247	0.240	0.227	0.279	0.237	0.246	0.225
		(0.443)	(0.431)	(0.427)	(0.419)	(0.449)	(0.425)	(0.431)	(0.418)
	1 boy, 1 girl	0.482	0.508	0.517	0.513	0.495	0.515	0.535	0.538
		(0.500)	(0.500)	(0.500)	(0.500)	(0.500)	(0.500)	(0.499)	(0.499)
	2 girls	0.251	0.245	0.242	0.260	0.226	0.248	0.219	0.237
		(0.433)	(0.430)	(0.429)	(0.439)	(0.419)	(0.432)	(0.414)	(0.425)
	Urban	0.623	0.547	0.385	0.277	0.877	0.827	0.652	0.484
		(0.485)	(0.498)	(0.487)	(0.447)	(0.329)	(0.378)	(0.476)	(0.500)
	Age	22.322	22.882	22.751	23.537	25.085	25.810	25.524	25.963
		(3.126)	(3.390)	(3.429)	(3.577)	(3.463)	(3.743)	(3.945)	(4.116)
	Owns land	0.361	0.426	0.482	0.500	0.215	0.268	0.371	0.461
		(0.480)	(0.495)	(0.500)	(0.500)	(0.411)	(0.443)	(0.483)	(0.499)
	Sched. caste/tribe	0.074	0.132	0.234	0.291	0.034	0.058	0.127	0.186
		(0.262)	(0.339)	(0.423)	(0.454)	(0.181)	(0.234)	(0.333)	(0.389)
	3 months periods	36,611	81,074	222,974	296,060	18,805	51,144	134,925	185,578
	Women	2,897	6,637	16,314	25,328	973	2,995	7,494	13,774
Fourth Spell	Boy born	0.344	0.259	0.252	0.170	0.226	0.164	0.172	0.105
		(0.475)	(0.438)	(0.434)	(0.375)	(0.419)	(0.371)	(0.378)	(0.307)
	Girl born	0.319	0.224	0.190	0.132	0.246	0.129	0.127	0.077
		(0.466)	(0.417)	(0.392)	(0.338)	(0.432)	(0.335)	(0.333)	(0.266)
	Censored	0.337	0.517	0.558	0.699	0.528	0.707	0.701	0.818
		(0.473)	(0.500)	(0.497)	(0.459)	(0.500)	(0.455)	(0.458)	(0.386)
	3 boys	0.109	0.104	0.092	0.076	0.101	0.086	0.069	0.063
		(0.312)	(0.305)	(0.289)	(0.264)	(0.301)	(0.281)	(0.254)	(0.243)
	2 boys, 1 girl	0.363	0.305	0.317	0.291	0.337	0.314	0.331	0.282
		(0.481)	(0.461)	(0.465)	(0.454)	(0.474)	(0.464)	(0.471)	(0.450)
	1 boys, 2 girls	0.385	0.438	0.439	0.449	0.427	0.430	0.450	0.494
		(0.487)	(0.496)	(0.496)	(0.497)	(0.496)	(0.495)	(0.498)	(0.500)
	3 girls	0.142	0.152	0.153	0.185	0.136	0.170	0.151	0.162
		(0.349)	(0.360)	(0.360)	(0.388)	(0.343)	(0.376)	(0.358)	(0.369)
	Urban	0.639	0.534	0.359	0.253	0.824	0.769	0.574	0.395
		(0.481)	(0.499)	(0.480)	(0.434)	(0.382)	(0.421)	(0.495)	(0.489)
	Age	23.962	24.856	24.546	25.475	25.950	27.494	26.888	27.638
		(3.026)	(3.456)	(3.486)	(3.618)	(3.434)	(3.899)	(4.228)	(4.347)
	Owns land	0.353	0.444	0.502	0.523	0.271	0.338	0.455	0.506
		(0.478)	(0.497)	(0.500)	(0.499)	(0.446)	(0.473)	(0.498)	(0.500)
	Sched. caste/tribe	0.089	0.127	0.244	0.310	0.045	0.054	0.165	0.201
		(0.285)	(0.333)	(0.430)	(0.463)	(0.208)	(0.226)	(0.371)	(0.401)
	3 months periods	13,964	32,921	67,194	107,345	3,347	11,076	22,292	38,203
	Women	1,043	2,656	4,852	9,116	199	707	1,288	2,770

Note. Means without parentheses and standard deviation in parentheses. Interactions between variables and baseline hazard dummies not shown.

D Duration Results Tables

The first set of tables, Tables D.1, D.2, D.3, and D.4, show predicted average birth intervals, sex ratios, and probabilities of having a birth by decade, spell, and sex composition for the three education levels separated by the area of residence, together with standard errors for all three outcomes. The standard errors are based on bootstrapping for all three measures, where the model is repeatedly estimated using resampling with replacement.

I also show whether durations for sex composition other than only girls are statistically significantly different from the duration with only girls based on bootstrapped differences. The cleanest test is comparing durations after only boys with durations after only girls, but the number of births to women with only sons becomes small in the later periods. Hence, it is possible to have substantial differences in spacing that are not statistically significant because of low power, especially for the third and fourth spell.

Each predicted percent of boys is tested against the natural percentage of boys using the bootstrapped standard errors. The natural sex ratio is approximately 105 boys to 100 girls or 51.2% (Ben-Porath and Welch, 1976; Jacobsen et al., 1999; Pörtner, 2015). The predicted percentage boys may differ from the natural rate because of natural variation, any remaining recall error not corrected for, or sex selection.

Table D.1: Estimated Expected Duration in Months, Sex Ratio, and Probability of Parity Progression for Women with No Education

		1972–1984			1985–1994			1995–2004			2005–2016		
Spell	Composition of prior Children	Duration[a] (Mos)	Percent[b] boys	Probability birth[c]	Duration[a] (Mos)	Percent[b] boys	Probability birth[c]	Duration[a] (Mos)	Percent[b] boys	Probability birth[c]	Duration[a] (Mos)	Percent[b] boys	Probability birth[c]
								Urban					
	1 girl	21.7	52.2	0.970	22.5	52.5	0.953	23.8	51.7	0.950	24.1	56.0***	0.932
2		(0.4)	(1.3)	(0.004)	(0.3)	(1.1)	(0.005)	(0.3)	(0.8)	(0.004)	(0.5)	(1.2)	(0.009)
	1 boy	23.2***	52.9	0.961	24.3***	50.8	0.959	24.4	52.1	0.951	24.1	50.3	0.905
		(0.4)	(1.3)	(0.005)	(0.4)	(1.2)	(0.004)	(0.3)	(0.9)	(0.004)	(0.5)	(1.2)	(0.008)
	2 girls	23.3	51.4	0.968	23.0	51.6	0.967	25.4	52.4	0.933	27.2	52.6	0.894
		(0.7)	(2.1)	(0.009)	(0.7)	(1.6)	(0.009)	(0.5)	(1.6)	(0.008)	(0.9)	(2.0)	(0.015)
3	1 boy, 2 girl	22.4	54.6**	0.947	24.4*	50.7	0.925	25.7	52.3	0.877	25.1*	53.7*	0.747
		(0.5)	(1.5)	(0.007)	(0.4)	(1.3)	(0.007)	(0.4)	(1.2)	(0.008)	(0.7)	(1.5)	(0.014)
	2 boys	23.4	48.6	0.962	24.9*	48.3	0.917	25.5	48.1*	0.855	27.7	51.6	0.756
		(0.7)	(2.1)	(0.008)	(0.7)	(1.9)	(0.013)	(0.6)	(1.7)	(0.012)	(1.1)	(2.2)	(0.020)
	3 girls	20.9	57.2	0.977	25.0	51.3	0.955	26.1	54.4	0.945	29.2	55.7	0.923
		(1.3)	(4.1)	(0.016)	(0.9)	(2.6)	(0.015)	(0.9)	(2.7)	(0.017)	(1.0)	(3.1)	(0.016)
	1 boy, 2 girls	23.3	54.9	0.954	25.7	54.4*	0.940	27.5	52.9	0.850	30.8	49.6	0.760
4		(0.8)	(2.4)	(0.011)	(0.6)	(1.7)	(0.009)	(0.7)	(1.8)	(0.014)	(0.9)	(2.1)	(0.018)
	2 boys, 1 girl	25.5***	54.8	0.919	29.3***	50.1	0.909	30.0***	55.0*	0.760	32.2*	54.8	0.569
		(0.9)	(2.6)	(0.017)	(0.6)	(2.2)	(0.013)	(0.8)	(2.2)	(0.018)	(1.3)	(2.8)	(0.023)
	3 boys	26.6***	60.6**	0.965	29.6***	57.1	0.912	26.5	51.2	0.779	31.9	47.8	0.703
		(1.6)	(3.7)	(0.018)	(1.0)	(3.7)	(0.020)	(1.5)	(3.5)	(0.031)	(2.1)	(4.1)	(0.037)
								Rural					
	1 girl	22.4	51.2	0.974	23.4	52.1*	0.965	24.0	51.7	0.969	24.0	51.7	0.959
2		(0.2)	(0.6)	(0.002)	(0.2)	(0.5)	(0.003)	(0.1)	(0.4)	(0.001)	(0.2)	(0.5)	(0.003)
	1 boy	23.1***	52.7**	0.968	24.1***	51.4	0.962	24.3*	51.1	0.960	24.5**	52.2*	0.936
		(0.2)	(0.6)	(0.002)	(0.2)	(0.5)	(0.002)	(0.1)	(0.4)	(0.002)	(0.2)	(0.5)	(0.003)
	2 girls	21.2	49.6	0.975	23.8	53.7***	0.963	24.1	53.9***	0.965	24.8	52.9**	0.942
		(0.3)	(1.1)	(0.003)	(0.3)	(0.8)	(0.004)	(0.2)	(0.7)	(0.002)	(0.2)	(0.7)	(0.005)
3	1 boy, 2 girl	22.7***	53.0**	0.963	23.9	51.7	0.951	24.6**	52.4**	0.913	26.1***	51.8	0.852
		(0.2)	(0.7)	(0.003)	(0.2)	(0.6)	(0.003)	(0.2)	(0.5)	(0.003)	(0.2)	(0.6)	(0.004)
	2 boys	22.7***	51.9	0.958	25.0***	51.3	0.934	25.4***	50.7	0.882	27.0***	50.9	0.797
		(0.3)	(1.0)	(0.004)	(0.3)	(0.8)	(0.005)	(0.2)	(0.7)	(0.005)	(0.3)	(0.7)	(0.008)
	3 girls	22.1	54.5	0.977	24.2	50.5	0.977	24.4	52.8	0.971	27.0	54.0***	0.955
		(0.6)	(2.0)	(0.006)	(0.3)	(1.2)	(0.004)	(0.4)	(1.2)	(0.004)	(0.3)	(1.0)	(0.005)
	1 boy, 2 girls	23.3*	52.2	0.976	26.4***	53.1**	0.958	26.8***	52.8*	0.911	29.5***	52.2	0.870
4		(0.4)	(1.1)	(0.004)	(0.2)	(0.9)	(0.003)	(0.3)	(0.9)	(0.005)	(0.3)	(0.8)	(0.005)
	2 boys, 1 girl	23.7**	53.2*	0.958	27.8***	49.8	0.926	29.0***	51.1	0.822	33.2***	50.5	0.694
		(0.4)	(1.2)	(0.006)	(0.3)	(0.9)	(0.005)	(0.3)	(0.9)	(0.007)	(0.4)	(0.9)	(0.009)
	3 boys	24.3**	51.5	0.962	28.3***	50.7	0.924	29.2***	52.0	0.851	32.7***	51.6	0.753
		(0.6)	(2.1)	(0.009)	(0.5)	(1.3)	(0.009)	(0.7)	(1.5)	(0.014)	(0.7)	(1.7)	(0.015)

Note. The statistics for each spell/period combination are calculated based on the regression model for that combination as described in the main text, using bootstrapping to find the standard errors shown in parentheses. For bootstrapping, the original sample is resampled, the regression model run on the resampled data, and the statistics calculated. This process is repeated 100 times and the standard errors calculated.

[a] The expected duration is calculated as follows. For each woman in a given spell/period combination sample, I calculate the probability of that she will give birth for each period, conditional on the likelihood that she will eventually give birth in that spell, and use these probabilities as weights to calculated the expected or average duration. The reported statistics is the average of this expected duration across all women in a given sample using the individual predicted probabilities of having had a birth by the end of the spell as weights. Duration begins at 9 months after the birth of the prior child. Durations for sex compositions other than all girls are tested against the duration for all girls, with *** indicating significantly different at the 1% level, ** at the 5% level, and * at the 10% level.

[b] Percent boys is calculated as follows. For each woman in a given spell/period combination sample, I calculate the predicted percent boys for each month and sum this across the length of the spell using the likelihood of having a child in each month as the weight. The percent boys is then averaged across all women in the given sample using the individual predicted probabilities of having had a birth by the end of the spell as weights. The result is the predicted percent boys that will be born to women in the sample once child bearing for that spell is over. The predicted percent boys is tested against the natural percentage boys, 105 boys per 100 girls, with *** indicating significantly different at the 1% level, ** at the 5% level, and * at 10% level.

[c] Probability of giving birth by the end of the spell period.

Table D.2: Estimated Expected Duration in Months, Sex Ratio, and Probability of Parity Progression for Women with One to Seven Years of Education

Spell	Composition of prior Children	1972–1984 Duration[a] (Mos)	1972–1984 Percent[b] boys	1972–1984 Probability birth[c]	1985–1994 Duration[a] (Mos)	1985–1994 Percent[b] boys	1985–1994 Probability birth[c]	1995–2004 Duration[a] (Mos)	1995–2004 Percent[b] boys	1995–2004 Probability birth[c]	2005–2016 Duration[a] (Mos)	2005–2016 Percent[b] boys	2005–2016 Probability birth[c]
							Urban						
2	1 girl	20.4	51.5	0.970	23.4	52.6	0.942	24.9	53.2**	0.928	26.3	52.7	0.909
		(0.4)	(1.5)	(0.005)	(0.4)	(1.2)	(0.006)	(0.3)	(0.9)	(0.005)	(0.5)	(1.3)	(0.009)
	1 boy	22.4***	51.3	0.961	24.4	51.3	0.936	25.2	49.9	0.922	27.7**	51.0	0.862
		(0.5)	(1.6)	(0.006)	(0.5)	(1.3)	(0.006)	(0.3)	(0.9)	(0.006)	(0.6)	(1.2)	(0.009)
3	2 girls	21.6	56.0*	0.954	25.7	52.4	0.928	28.2	56.6***	0.890	30.5	56.5**	0.841
		(0.8)	(2.7)	(0.012)	(0.9)	(2.1)	(0.012)	(0.8)	(1.5)	(0.011)	(0.8)	(2.2)	(0.017)
	1 boy, 2 girl	24.2**	53.0	0.891	26.2	53.8*	0.837	26.7	51.6	0.730	27.6**	55.8***	0.609
		(0.6)	(1.8)	(0.011)	(0.7)	(1.6)	(0.012)	(0.6)	(1.4)	(0.013)	(0.9)	(1.7)	(0.017)
	2 boys	23.0	48.2	0.893	27.2	50.8	0.844	26.9	49.4	0.704	29.3	52.2	0.567
		(0.8)	(2.4)	(0.016)	(0.9)	(2.1)	(0.016)	(0.9)	(2.4)	(0.016)	(1.3)	(2.5)	(0.020)
4	3 girls	24.1	49.8	0.944	26.3	55.9	0.922	31.9	61.6***	0.877	30.7	57.7*	0.845
		(1.8)	(5.1)	(0.030)	(1.2)	(3.7)	(0.021)	(1.2)	(3.7)	(0.029)	(1.3)	(3.6)	(0.029)
	1 boy, 2 girls	24.9	54.2	0.885	29.3*	56.4**	0.792	29.3*	55.3	0.657	29.4	51.3	0.579
		(1.1)	(3.0)	(0.021)	(1.0)	(2.5)	(0.022)	(1.0)	(2.6)	(0.023)	(1.1)	(2.7)	(0.023)
	2 boys, 1 girl	26.4	50.7	0.851	31.7***	56.0	0.731	30.5	55.3	0.580	36.2**	49.2	0.437
		(1.4)	(3.6)	(0.031)	(1.2)	(3.3)	(0.027)	(1.2)	(3.0)	(0.024)	(1.8)	(4.1)	(0.027)
	3 boys	27.2	55.0	0.738	29.7*	41.7**	0.855	29.9	43.1	0.693	36.8*	60.1	0.542
		(3.5)	(6.7)	(0.068)	(1.6)	(4.2)	(0.033)	(2.1)	(5.5)	(0.043)	(3.2)	(6.7)	(0.053)
							Rural						
2	1 girl	21.9	51.6	0.977	23.3	51.4	0.965	24.5	53.3***	0.963	25.4	52.8**	0.950
		(0.3)	(1.1)	(0.003)	(0.3)	(0.9)	(0.004)	(0.2)	(0.5)	(0.002)	(0.3)	(0.7)	(0.004)
	1 boy	23.4***	50.0	0.971	24.0*	51.5	0.954	24.9	51.1	0.945	26.3***	50.5	0.908
		(0.3)	(1.0)	(0.004)	(0.3)	(0.8)	(0.004)	(0.2)	(0.5)	(0.002)	(0.2)	(0.6)	(0.004)
3	2 girls	20.5	50.6	0.966	22.4	54.1**	0.939	25.6	53.6**	0.933	27.5	55.4***	0.892
		(0.5)	(1.9)	(0.007)	(0.4)	(1.4)	(0.008)	(0.4)	(1.0)	(0.005)	(0.4)	(1.0)	(0.007)
	1 boy, 2 girl	23.4***	51.4	0.931	25.4***	51.7	0.887	25.9	52.5*	0.793	28.1	53.6**	0.707
		(0.5)	(1.3)	(0.007)	(0.4)	(1.2)	(0.007)	(0.3)	(0.8)	(0.006)	(0.4)	(1.0)	(0.008)
	2 boys	25.3***	49.6	0.929	26.1***	50.8	0.866	26.5*	49.5	0.741	28.5	49.4	0.633
		(0.8)	(2.0)	(0.011)	(0.7)	(1.5)	(0.011)	(0.5)	(1.1)	(0.009)	(0.6)	(1.4)	(0.011)
4	3 girls	22.6	49.5	0.983	26.0	54.2	0.962	28.5	55.5**	0.947	30.4	57.7***	0.920
		(1.1)	(3.7)	(0.011)	(0.7)	(2.7)	(0.009)	(0.7)	(2.0)	(0.009)	(0.5)	(1.5)	(0.011)
	1 boy, 2 girls	25.4**	50.0	0.930	27.9**	55.1**	0.893	29.3	52.9	0.755	31.7*	51.9	0.702
		(0.8)	(2.4)	(0.014)	(0.6)	(1.6)	(0.011)	(0.6)	(1.4)	(0.015)	(0.5)	(1.4)	(0.013)
	2 boys, 1 girl	27.6***	46.5*	0.885	30.1***	51.0	0.846	30.7**	52.1	0.597	35.0***	52.4	0.541
		(0.9)	(2.7)	(0.020)	(0.8)	(2.1)	(0.015)	(0.9)	(1.8)	(0.017)	(0.7)	(1.8)	(0.014)
	3 boys	24.7	55.0	0.939	28.9**	56.7*	0.883	32.6***	51.6	0.686	33.5**	44.1*	0.546
		(1.4)	(4.5)	(0.022)	(1.2)	(3.2)	(0.024)	(1.4)	(3.8)	(0.029)	(1.4)	(3.7)	(0.027)

Note. The statistics for each spell/period combination are calculated based on the regression model for that combination as described in the main text, using bootstrapping to find the standard errors shown in parentheses. For bootstrapping, the original sample is resampled, the regression model run on the resampled data, and the statistics calculated. This process is repeated 100 times and the standard errors calculated.

[a] The expected duration is calculated as follows. For each woman in a given spell/period combination sample, I calculate the probability of that she will give birth for each period, conditional on the likelihood that she will eventually give birth in that spell, and use these probabilities as weights to calculated the expected or average duration. The reported statistics is the average of this expected duration across all women in a given sample using the individual predicted probabilities of having had a birth by the end of the spell as weights. Duration begins at 9 months after the birth of the prior child. Durations for sex compositions other than all girls are tested against the duration for all girls, with *** indicating significantly different at the 1% level, ** at the 5% level, and * at the 10% level.

[b] Percent boys is calculated as follows. For each woman in a given spell/period combination sample, I calculate the predicted percent boys for each month and sum this across the length of the spell using the likelihood of having a child in each month as the weight. The percent boys is then averaged across all women in the given sample using the individual predicted probabilities of having had a birth by the end of the spell as weights. The result is the predicted percent boys that will be born to women in the sample once child bearing for that spell is over. The predicted percent boys is tested against the natural percentage boys, 105 boys per 100 girls, with *** indicating significantly different at the 1% level, ** at the 5% level, and * at 10% level.

[c] Probability of giving birth by the end of the spell period.

Table D.3: Estimated Expected Duration in Months, Sex Ratio, and Probability of Parity Progression for Women with Eight to Eleven Years of Education

		1972–1984			1985–1994			1995–2004			2005–2016		
Spell	Composition of prior Children	Duration[a] (Mos)	Percent[b] boys	Probability birth[c]	Duration[a] (Mos)	Percent[b] boys	Probability birth[c]	Duration[a] (Mos)	Percent[b] boys	Probability birth[c]	Duration[a] (Mos)	Percent[b] boys	Probability birth[c]
							Urban						
	1 girl	22.4	52.0	0.947	26.8	54.3***	0.919	28.1	55.8***	0.897	30.4	52.9*	0.866
2		(0.4)	(1.4)	(0.005)	(0.4)	(1.1)	(0.007)	(0.3)	(0.7)	(0.004)	(0.4)	(1.0)	(0.007)
	1 boy	23.7*	53.5*	0.932	26.9	51.4	0.882	28.7	50.1*	0.867	30.5	50.4	0.780
		(0.6)	(1.2)	(0.007)	(0.4)	(1.0)	(0.007)	(0.3)	(0.7)	(0.004)	(0.4)	(0.9)	(0.009)
	2 girls	25.5	53.8	0.891	30.9	61.0***	0.790	32.1	61.2***	0.786	35.9	60.2***	0.725
		(1.0)	(2.5)	(0.015)	(0.9)	(2.3)	(0.018)	(0.7)	(1.6)	(0.013)	(0.8)	(1.8)	(0.015)
3	1 boy, 2 girl	26.1	55.1*	0.771	28.8	52.6	0.613	29.4***	52.4	0.537	31.9***	54.5**	0.379
		(0.8)	(2.0)	(0.014)	(0.8)	(1.7)	(0.013)	(0.6)	(1.3)	(0.010)	(1.0)	(1.6)	(0.012)
	2 boys	27.5	50.6	0.710	30.9	53.3	0.617	28.6***	48.0	0.512	34.5	48.9	0.360
		(0.9)	(2.9)	(0.023)	(1.2)	(2.1)	(0.020)	(0.8)	(2.3)	(0.017)	(1.4)	(3.2)	(0.019)
	3 girls	26.9	59.6	0.850	31.2	64.1***	0.831	34.0	61.6**	0.846	37.6	62.5***	0.790
		(1.9)	(6.7)	(0.038)	(1.5)	(3.8)	(0.025)	(1.6)	(4.1)	(0.026)	(1.2)	(3.7)	(0.025)
	1 boy, 2 girls	25.9	52.4	0.660	32.5	52.5	0.573	33.0	61.6***	0.527	35.4	61.3***	0.383
4		(1.6)	(4.3)	(0.035)	(1.3)	(2.9)	(0.025)	(1.3)	(2.7)	(0.024)	(1.4)	(3.3)	(0.023)
	2 boys, 1 girl	26.3	52.5	0.637	30.2	47.8	0.504	34.3	51.2	0.346	34.1	53.9	0.241
		(1.8)	(4.3)	(0.040)	(1.8)	(4.0)	(0.033)	(2.0)	(4.8)	(0.024)	(2.7)	(5.0)	(0.025)
	3 boys	26.8	55.5	0.677	35.4	58.1	0.495	31.9	47.9	0.457	36.5	52.4	0.325
		(3.2)	(7.9)	(0.065)	(3.2)	(8.0)	(0.052)	(2.8)	(7.3)	(0.050)	(4.0)	(8.8)	(0.044)
							Rural						
	1 girl	23.4	50.9	0.970	25.1	52.7	0.951	25.9	55.0***	0.943	27.8	54.5***	0.922
2		(0.6)	(1.7)	(0.006)	(0.4)	(1.1)	(0.005)	(0.2)	(0.5)	(0.003)	(0.3)	(0.5)	(0.004)
	1 boy	23.4	48.3*	0.948	25.1	50.8	0.923	26.2	50.4	0.904	28.4	49.9**	0.838
		(0.6)	(1.7)	(0.007)	(0.5)	(1.2)	(0.006)	(0.2)	(0.6)	(0.003)	(0.3)	(0.6)	(0.005)
	2 girls	25.6	55.4	0.946	27.5	58.4***	0.912	28.2	59.5***	0.878	31.9	58.4***	0.833
		(1.1)	(3.3)	(0.014)	(0.9)	(2.2)	(0.013)	(0.4)	(1.1)	(0.008)	(0.4)	(1.0)	(0.007)
3	1 boy, 2 girl	24.9	52.3	0.832	26.0	52.5	0.703	27.0**	54.5***	0.637	28.7***	53.2**	0.492
		(0.8)	(2.3)	(0.017)	(0.7)	(1.9)	(0.014)	(0.4)	(0.9)	(0.008)	(0.5)	(1.0)	(0.007)
	2 boys	26.6	45.9	0.806	26.3	48.7	0.692	27.3	50.4	0.589	30.3	49.6	0.449
		(1.3)	(3.3)	(0.025)	(1.1)	(2.5)	(0.021)	(0.6)	(1.4)	(0.013)	(0.8)	(1.6)	(0.011)
	3 girls	23.3	50.4	0.976	32.4	60.9**	0.872	32.2	61.3***	0.880	32.8	59.9***	0.844
		(2.6)	(7.5)	(0.025)	(1.4)	(4.6)	(0.027)	(0.9)	(2.8)	(0.017)	(0.7)	(1.9)	(0.014)
	1 boy, 2 girls	29.2**	44.2	0.876	31.6	51.0	0.767	30.0*	55.3*	0.611	34.3	55.3**	0.491
4		(1.6)	(4.3)	(0.035)	(1.0)	(2.8)	(0.024)	(0.8)	(2.1)	(0.017)	(0.8)	(1.9)	(0.013)
	2 boys, 1 girl	31.8***	50.9	0.764	32.9	55.1	0.624	31.2	52.2	0.489	38.1***	48.9	0.389
		(2.0)	(5.1)	(0.051)	(1.6)	(4.2)	(0.033)	(1.2)	(3.1)	(0.020)	(1.1)	(2.7)	(0.019)
	3 boys	28.1	56.1	0.820	31.0	42.7	0.625	32.4	60.3*	0.599	36.5*	60.9**	0.449
		(3.6)	(10.6)	(0.072)	(3.0)	(6.9)	(0.060)	(1.8)	(4.9)	(0.043)	(1.9)	(4.5)	(0.031)

Note. The statistics for each spell/period combination are calculated based on the regression model for that combination as described in the main text, using bootstrapping to find the standard errors shown in parentheses. For bootstrapping, the original sample is resampled, the regression model run on the resampled data, and the statistics calculated. This process is repeated 100 times and the standard errors calculated.

[a] The expected duration is calculated as follows. For each woman in a given spell/period combination sample, I calculate the probability of that she will give birth for each period, conditional on the likelihood that she will eventually give birth in that spell, and use these probabilities as weights to calculated the expected or average duration. The reported statistics is the average of this expected duration across all women in a given sample using the individual predicted probabilities of having had a birth by the end of the spell as weights. Duration begins at 9 months after the birth of the prior child. Durations for sex compositions other than all girls are tested against the duration for all girls, with *** indicating significantly different at the 1% level, ** at the 5% level, and * at the 10% level.

[b] Percent boys is calculated as follows. For each woman in a given spell/period combination sample, I calculate the predicted percent boys for each month and sum this across the length of the spell using the likelihood of having a child in each month as the weight. The percent boys is then averaged across all women in the given sample using the individual predicted probabilities of having had a birth by the end of the spell as weights. The result is the predicted percent boys that will be born to women in the sample once child bearing for that spell is over. The predicted percent boys is tested against the natural percentage boys, 105 boys per 100 girls, with *** indicating significantly different at the 1% level, ** at the 5% level, and * at 10% level.

[c] Probability of giving birth by the end of the spell period.

Table D.4: Estimated Expected Duration in Months, Sex Ratio, and Probability of Parity Progression for Women with Twelve or More Years of Education

		1972–1984			1985–1994			1995–2004			2005–2016		
Spell	Composition of prior Children	Duration[a] (Mos)	Percent[b] boys	Probability birth[c]	Duration[a] (Mos)	Percent[b] boys	Probability birth[c]	Duration[a] (Mos)	Percent[b] boys	Probability birth[c]	Duration[a] (Mos)	Percent[b] boys	Probability birth[c]
								Urban					
	1 girl	29.3	52.3	0.887	33.0	56.4***	0.853	34.9	60.6***	0.830	36.6	59.0***	0.782
2		(0.7)	(1.8)	(0.011)	(0.6)	(1.2)	(0.009)	(0.4)	(0.8)	(0.006)	(0.4)	(1.0)	(0.008)
	1 boy	29.8	49.1	0.888	34.0	53.1	0.794	34.2	49.7**	0.773	37.8	48.8**	0.669
		(0.7)	(1.9)	(0.010)	(0.5)	(1.2)	(0.010)	(0.3)	(0.7)	(0.006)	(0.6)	(1.0)	(0.008)
	2 girls	30.5	59.9*	0.717	36.4	66.7***	0.598	38.2	72.0***	0.607	42.3	77.1***	0.514
		(1.4)	(5.0)	(0.031)	(1.5)	(2.5)	(0.025)	(1.1)	(1.9)	(0.017)	(1.3)	(2.0)	(0.019)
3	1 boy, 2 girl	32.7	49.1	0.435	33.3	55.4	0.296	33.4***	55.2*	0.252	34.5***	57.8**	0.165
		(1.7)	(4.2)	(0.028)	(1.5)	(3.2)	(0.016)	(0.9)	(2.0)	(0.009)	(1.4)	(2.9)	(0.009)
	2 boys	32.1	47.2	0.439	33.4	45.8	0.259	31.6***	37.7***	0.241	35.1***	48.0	0.172
		(2.2)	(5.2)	(0.033)	(2.3)	(4.7)	(0.021)	(1.3)	(3.1)	(0.015)	(2.1)	(4.1)	(0.012)
								Rural					
	1 girl	26.3	55.3	0.962	29.7	54.0	0.927	30.6	55.3***	0.918	32.0	57.0***	0.891
2		(1.7)	(5.0)	(0.017)	(1.1)	(3.0)	(0.014)	(0.4)	(1.0)	(0.005)	(0.4)	(0.9)	(0.007)
	1 boy	27.9	41.6**	0.923	30.8	52.8	0.838	30.0	51.2	0.843	31.8	48.1***	0.765
		(1.5)	(4.9)	(0.026)	(1.1)	(2.6)	(0.019)	(0.4)	(1.1)	(0.007)	(0.5)	(1.0)	(0.009)
	2 girls	23.0	39.4	0.750	35.2	51.4	0.799	32.5	59.6***	0.800	36.5	65.5***	0.728
		(2.8)	(11.5)	(0.075)	(2.2)	(6.4)	(0.038)	(1.0)	(2.4)	(0.016)	(0.8)	(1.8)	(0.017)
3	1 boy, 2 girl	29.4	69.1	0.655	32.1	67.6***	0.565	30.3	54.1	0.433	31.9***	55.2*	0.312
		(3.1)	(11.0)	(0.070)	(2.4)	(5.1)	(0.037)	(1.1)	(2.4)	(0.017)	(1.1)	(2.1)	(0.012)
	2 boys	27.7	28.6**	0.813	29.1	35.4**	0.568	29.8	44.2**	0.405	31.3***	46.7	0.276
		(3.6)	(9.2)	(0.072)	(3.6)	(7.0)	(0.059)	(1.7)	(3.4)	(0.023)	(1.8)	(3.9)	(0.017)

Note. The statistics for each spell/period combination are calculated based on the regression model for that combination as described in the main text, using bootstrapping to find the standard errors shown in parentheses. For bootstrapping, the original sample is resampled, the regression model run on the resampled data, and the statistics calculated. This process is repeated 100 times and the standard errors calculated.

[a] The expected duration is calculated as follows. For each woman in a given spell/period combination sample, I calculate the probability of that she will give birth for each period, conditional on the likelihood that she will eventually give birth in that spell, and use these probabilities as weights to calculated the expected or average duration. The reported statistics is the average of this expected duration across all women in a given sample using the individual predicted probabilities of having had a birth by the end of the spell as weights. Duration begins at 9 months after the birth of the prior child. Durations for sex compositions other than all girls are tested against the duration for all girls, with *** indicating significantly different at the 1% level, ** at the 5% level, and * at the 10% level.

[b] Percent boys is calculated as follows. For each woman in a given spell/period combination sample, I calculate the predicted percent boys for each month and sum this across the length of the spell using the likelihood of having a child in each month as the weight. The percent boys is then averaged across all women in the given sample using the individual predicted probabilities of having had a birth by the end of the spell as weights. The result is the predicted percent boys that will be born to women in the sample once child bearing for that spell is over. The predicted percent boys is tested against the natural percentage boys, 105 boys per 100 girls, with *** indicating significantly different at the 1% level, ** at the 5% level, and * at 10% level.

[c] Probability of giving birth by the end of the spell period.

Table D.5: Estimated 25th, 50th, and 75th Percentile Durations for Women with No Education

		1972–1984			1985–1994			1995–2004			2005–2016		
		Duration (Months)[a] Percentile			Duration (Months)[a] Percentile			Duration (Months)[a] Percentile			Duration (Months)[a] Percentile		
Spell	Composition of Prior Children	25th	50th	75th	25th	50th	75th	25th	50th	75th	25th	50th	75th
							Urban						
	1 girl	11.8	17.6	28.5	11.7	18.4	29.2	12.1	19.0	30.8	12.4	19.7	31.7
2		(0.4)	(0.3)	(0.6)	(0.3)	(0.4)	(0.5)	(0.2)	(0.3)	(0.5)	(0.4)	(0.5)	(0.8)
	1 boy	12.6*	18.9***	29.2	12.5**	20.1***	32.1***	12.3	19.6	32.3**	12.6	20.1	31.5
		(0.3)	(0.4)	(0.5)	(0.3)	(0.4)	(0.7)	(0.2)	(0.3)	(0.5)	(0.3)	(0.5)	(0.8)
	2 girls	11.8	19.3	31.4	11.8	18.7	30.3	12.5	20.5	33.7	13.5	21.8	36.1
		(0.6)	(0.7)	(1.0)	(0.5)	(0.6)	(1.0)	(0.3)	(0.5)	(0.8)	(0.4)	(0.7)	(1.5)
3	1 boy, 1 girl	12.5	18.4	28.7*	13.0**	20.0*	31.7	13.2*	20.8	33.4	12.9	20.6	33.5
		(0.3)	(0.4)	(0.9)	(0.2)	(0.4)	(0.6)	(0.2)	(0.3)	(0.7)	(0.4)	(0.5)	(1.2)
	2 boys	12.9	19.1	30.7	13.4***	21.1**	32.9*	13.2	21.5	33.8	13.8	22.9	37.0
		(0.4)	(0.6)	(1.1)	(0.4)	(0.7)	(0.9)	(0.3)	(0.6)	(0.8)	(0.5)	(0.8)	(1.6)
	3 girls	9.5	17.8	25.4	12.0	20.2	31.9	11.7	20.7	34.1	14.2	23.2	40.2
		(1.2)	(0.8)	(1.7)	(0.9)	(0.6)	(1.7)	(1.1)	(0.8)	(2.1)	(1.0)	(1.0)	(2.1)
	1 boy, 2 girls	10.6	18.9	28.1	11.1	20.3	33.7	12.4	21.1	35.1	14.0	23.2	43.6
4		(0.9)	(0.6)	(1.3)	(0.6)	(0.5)	(1.4)	(0.7)	(0.5)	(2.2)	(0.8)	(0.7)	(2.4)
	2 boys, 1 girl	11.4	20.0**	31.4**	13.7	23.0***	40.5***	13.5	22.6*	41.8**	15.1	24.0	46.7
		(1.1)	(0.7)	(2.0)	(0.7)	(0.6)	(1.3)	(0.9)	(0.6)	(2.4)	(0.9)	(0.9)	(3.5)
	3 boys	12.4	21.5**	35.8***	14.4*	23.4***	40.9***	11.0	20.2	31.8	15.9	24.0	45.0
		(1.8)	(1.5)	(2.9)	(0.9)	(1.0)	(2.1)	(1.3)	(1.0)	(3.5)	(1.3)	(1.5)	(5.8)
							Rural						
	1 girl	12.6	18.6	28.4	12.8	19.4	30.0	13.0	19.7	30.7	12.9	19.7	30.6
2		(0.1)	(0.2)	(0.3)	(0.1)	(0.1)	(0.2)	(0.1)	(0.1)	(0.2)	(0.1)	(0.1)	(0.2)
	1 boy	13.0**	19.6***	29.6***	13.1**	20.1***	30.9***	13.0	19.8	31.3***	13.2*	20.1*	31.7***
		(0.1)	(0.2)	(0.2)	(0.1)	(0.2)	(0.2)	(0.1)	(0.1)	(0.2)	(0.1)	(0.2)	(0.3)
	2 girls	11.9	17.8	27.7	13.0	20.0	31.0	13.2	20.0	31.6	13.3	20.5	32.3
		(0.3)	(0.3)	(0.5)	(0.2)	(0.3)	(0.4)	(0.1)	(0.2)	(0.3)	(0.1)	(0.2)	(0.3)
3	1 boy, 1 girl	13.0***	19.1***	29.1**	12.9	19.9	31.2	13.2	20.1	32.2*	13.8***	21.3***	34.0***
		(0.1)	(0.2)	(0.3)	(0.1)	(0.2)	(0.3)	(0.1)	(0.1)	(0.2)	(0.1)	(0.2)	(0.3)
	2 boys	12.8***	19.2***	29.4***	13.3	20.9**	32.9***	13.7***	21.0***	33.0***	14.0***	22.4***	35.5***
		(0.2)	(0.3)	(0.4)	(0.1)	(0.3)	(0.4)	(0.1)	(0.2)	(0.3)	(0.2)	(0.3)	(0.5)
	3 girls	9.9	18.4	27.4	11.4	20.1	31.7	11.3	19.9	31.2	13.6	21.8	35.6
		(0.7)	(0.4)	(0.8)	(0.4)	(0.3)	(0.7)	(0.4)	(0.3)	(0.7)	(0.4)	(0.2)	(0.6)
	1 boy, 2 girls	10.7	19.2*	29.4*	13.1***	21.3***	34.6***	12.6***	21.0***	34.2***	14.3	22.8***	40.2***
4		(0.3)	(0.3)	(0.7)	(0.3)	(0.2)	(0.5)	(0.3)	(0.2)	(0.7)	(0.3)	(0.2)	(0.7)
	2 boys, 1 girl	11.2*	19.3*	28.8	13.2***	22.0***	37.3***	13.1***	22.1***	39.2***	16.0***	25.0***	48.5***
		(0.4)	(0.2)	(0.6)	(0.3)	(0.3)	(0.7)	(0.4)	(0.2)	(0.9)	(0.2)	(0.3)	(0.8)
	3 boys	10.6	19.6*	31.0**	14.1***	22.4***	37.9***	13.5***	22.4***	40.0***	15.5***	24.9***	47.7***
		(0.6)	(0.5)	(1.3)	(0.6)	(0.5)	(1.2)	(0.6)	(0.6)	(1.8)	(0.5)	(0.6)	(1.4)

Note. The statistics for each spell/period combination are calculated based on the regression model for that combination as described in the main text, using bootstrapping to find the standard errors shown in parentheses. For bootstrapping, the original sample is resampled, the regression model run on the resampled data, and the statistics calculated. This process is repeated 100 times and the standard errors calculated.

[a] Percentile durations calculated as follows. For each woman in a given spell/period combination sample, I calculate the time point at which there is a given percent chance that she will have given birth, conditional on the probability that she will eventually give birth in that spell. For example, if there is an 80% chance that a woman will give birth by the end of the spell, her median duration is the predicted number of months before she passes the 40% mark on her survival curve. The reported statistics is the average of a given percentile duration across all women in a given sample using the individual predicted probabilities of having had a birth by the end of the spell as weights. Duration begins at 9 months after the birth of the prior child. Durations for sex compositions other than all girls are tested against the duration for all girls, with *** indicating significantly different at the 1% level, ** at the 5% level, and * at the 10% level.

Table D.6: Estimated 25th, 50th, and 75th Percentile Durations for Women with One to Seven Years of Education

		1972–1984			1985–1994			1995–2004			2005–2016		
		Duration (Months)[a] Percentile			Duration (Months)[a] Percentile			Duration (Months)[a] Percentile			Duration (Months)[a] Percentile		
Spell	Composition of Prior Children	25th	50th	75th	25th	50th	75th	25th	50th	75th	25th	50th	75th
							Urban						
	1 girl	10.9	17.4	26.2	11.9	18.6	30.0	12.2	19.9	33.1	13.2	21.4	34.5
2		(0.4)	(0.3)	(0.6)	(0.3)	(0.4)	(0.6)	(0.2)	(0.3)	(0.5)	(0.3)	(0.4)	(0.8)
	1 boy	12.1**	18.3	28.6***	12.3	20.2***	31.2	12.9**	20.5	33.4	13.5	22.3*	37.3**
		(0.3)	(0.5)	(0.7)	(0.3)	(0.4)	(0.7)	(0.3)	(0.3)	(0.5)	(0.3)	(0.5)	(1.0)
	2 girls	11.2	17.6	27.8	13.0	20.7	33.7	13.7	22.9	38.0	15.1	24.1	40.5
		(0.7)	(0.7)	(1.2)	(0.4)	(0.7)	(1.3)	(0.4)	(0.7)	(1.4)	(0.4)	(0.7)	(1.6)
3	1 boy, 1 girl	13.1***	19.9***	30.8**	13.4	20.7	34.4	13.7	21.5	35.2	13.9**	22.1**	36.2**
		(0.3)	(0.5)	(0.9)	(0.3)	(0.5)	(1.1)	(0.2)	(0.5)	(0.9)	(0.4)	(0.6)	(1.3)
	2 boys	13.0**	19.3	30.0	13.7	21.4	36.0	14.0	22.1	36.1	14.6	23.8	39.5
		(0.5)	(0.8)	(1.2)	(0.4)	(0.8)	(1.4)	(0.4)	(0.8)	(1.3)	(0.6)	(1.1)	(1.8)
	3 girls	9.7	19.0	30.5	11.6	20.7	34.6	15.2	25.6	45.6	14.5	23.8	43.3
		(1.5)	(1.4)	(3.3)	(1.3)	(1.0)	(2.6)	(1.2)	(1.5)	(2.1)	(1.1)	(1.3)	(3.2)
	1 boy, 2 girls	11.0	19.5	29.2	12.7	22.2	40.5	11.8**	21.8**	40.6	13.5	22.2	38.5
4		(1.1)	(0.7)	(2.1)	(1.0)	(0.8)	(2.5)	(1.0)	(0.8)	(3.1)	(1.1)	(0.7)	(3.8)
	2 boys, 1 girl	11.7	20.3	32.2	14.3	24.0**	46.1***	13.8	22.8	42.3	17.4**	26.9	54.8**
		(1.3)	(0.9)	(3.5)	(1.0)	(1.1)	(2.9)	(1.1)	(0.9)	(3.8)	(0.9)	(1.8)	(3.6)
	3 boys	11.0	20.5	33.7	14.4	22.9	40.5	14.1	22.5	40.1	16.3	28.3	56.8**
		(2.4)	(2.5)	(7.7)	(1.4)	(1.3)	(3.9)	(1.8)	(1.6)	(6.1)	(2.3)	(4.5)	(5.4)
							Rural						
	1 girl	12.4	18.0	28.0	12.3	19.1	30.2	13.1	20.1	31.7	13.3	20.5	32.6
2		(0.2)	(0.3)	(0.5)	(0.2)	(0.3)	(0.4)	(0.1)	(0.2)	(0.3)	(0.1)	(0.2)	(0.4)
	1 boy	13.2***	19.6***	30.0***	13.0***	19.8*	30.8	13.2	20.5	32.3	13.7**	21.3**	34.4***
		(0.2)	(0.3)	(0.4)	(0.2)	(0.3)	(0.4)	(0.1)	(0.2)	(0.3)	(0.1)	(0.2)	(0.4)
	2 girls	11.9	18.0	27.3	12.3	19.3	29.1	13.6	21.3	33.6	14.3	22.4	35.9
		(0.5)	(0.4)	(0.7)	(0.3)	(0.4)	(0.6)	(0.2)	(0.3)	(0.5)	(0.2)	(0.3)	(0.6)
3	1 boy, 1 girl	13.0**	19.4**	29.9***	13.4***	20.9***	33.2***	13.7	21.2	33.7	14.4	22.5	36.5
		(0.2)	(0.4)	(0.7)	(0.2)	(0.3)	(0.5)	(0.1)	(0.2)	(0.4)	(0.1)	(0.3)	(0.6)
	2 boys	13.8***	21.3***	32.5***	13.8***	21.2**	34.0***	13.7	21.5	34.8	14.6	23.3	37.5
		(0.4)	(0.6)	(1.0)	(0.3)	(0.6)	(1.0)	(0.2)	(0.4)	(0.7)	(0.2)	(0.5)	(0.9)
	3 girls	12.0	19.2	27.9	13.3	21.3	34.0	14.5	23.2	38.6	16.0	24.3	41.4
		(1.3)	(0.7)	(1.6)	(0.7)	(0.6)	(1.5)	(0.6)	(0.6)	(1.2)	(0.4)	(0.4)	(1.0)
	1 boy, 2 girls	12.3	20.2	31.1	13.4	21.8	36.8	13.8	22.2	39.1	15.3	23.8	44.9**
4		(1.0)	(0.6)	(1.6)	(0.6)	(0.5)	(1.4)	(0.5)	(0.4)	(1.8)	(0.3)	(0.4)	(1.4)
	2 boys, 1 girl	14.1	21.5**	34.8**	14.5	23.1**	41.5***	14.2	22.9	42.5	16.0	26.3**	53.2***
		(0.9)	(0.7)	(2.4)	(0.6)	(0.7)	(1.9)	(0.7)	(0.6)	(2.8)	(0.5)	(0.6)	(1.3)
	3 boys	11.4	19.7	30.3	13.5	22.4	39.3*	13.8	24.5	48.7***	15.9	24.9	49.4**
		(1.3)	(0.9)	(2.8)	(1.2)	(1.1)	(2.7)	(1.3)	(1.4)	(3.0)	(0.8)	(1.1)	(3.5)

Note. The statistics for each spell/period combination are calculated based on the regression model for that combination as described in the main text, using bootstrapping to find the standard errors shown in parentheses. For bootstrapping, the original sample is resampled, the regression model run on the resampled data, and the statistics calculated. This process is repeated 100 times and the standard errors calculated.

[a] Percentile durations calculated as follows. For each woman in a given spell/period combination sample, I calculate the time point at which there is a given percent chance that she will have given birth, conditional on the probability that she will eventually give birth in that spell. For example, if there is an 80% chance that a woman will give birth by the end of the spell, her median duration is the predicted number of months before she passes the 40% mark on her survival curve. The reported statistics is the average of a given percentile duration across all women in a given sample using the individual predicted probabilities of having had a birth by the end of the spell as weights. Duration begins at 9 months after the birth of the prior child. Durations for sex compositions other than all girls are tested against the duration for all girls, with *** indicating significantly different at the 1% level, ** at the 5% level, and * at the 10% level.

Table D.7: Estimated 25th, 50th, and 75th Percentile Durations for Women with Eight to Eleven Years of Education

		1972–1984			1985–1994			1995–2004			2005–2016		
		Duration (Months)[a] Percentile			Duration (Months)[a] Percentile			Duration (Months)[a] Percentile			Duration (Months)[a] Percentile		
Spell	Composition of Prior Children	25th	50th	75th	25th	50th	75th	25th	50th	75th	25th	50th	75th
							Urban						
	1 girl	11.0	17.8	28.9	12.7	21.5	36.2	13.7	22.9	38.2	15.0	25.3	41.5
2		(0.4)	(0.3)	(0.7)	(0.3)	(0.4)	(0.7)	(0.2)	(0.3)	(0.5)	(0.3)	(0.4)	(0.9)
	1 boy	11.8	18.6	31.4**	13.2	22.0	36.1	14.1*	23.2	38.6	15.0	24.9	41.5
		(0.4)	(0.5)	(0.9)	(0.3)	(0.5)	(0.7)	(0.2)	(0.3)	(0.5)	(0.2)	(0.4)	(0.7)
	2 girls	13.4	20.5	33.1	15.4	25.6	42.2	15.7	26.2	43.9	17.5	30.3	50.4
		(0.4)	(0.8)	(1.6)	(0.6)	(0.9)	(1.6)	(0.5)	(0.8)	(1.3)	(0.5)	(1.0)	(1.6)
3	1 boy, 1 girl	12.4	20.0	34.2	13.6**	23.2*	39.2	14.1***	23.4***	39.7**	15.5***	26.0***	42.6***
		(0.4)	(0.7)	(1.3)	(0.4)	(0.7)	(1.2)	(0.3)	(0.6)	(1.0)	(0.5)	(0.9)	(1.7)
	2 boys	13.5	22.0	37.0*	14.4	24.7	41.1	15.0	23.3***	37.7***	15.6***	28.0	48.7
		(0.5)	(1.0)	(1.4)	(0.7)	(1.0)	(2.1)	(0.4)	(0.7)	(1.1)	(0.5)	(1.8)	(2.7)
	3 girls	14.4	21.1	32.5	13.9	24.6	45.0	16.7	27.9	48.8	18.9	32.6	54.4
		(1.7)	(1.2)	(4.1)	(1.2)	(1.8)	(3.0)	(1.3)	(2.1)	(2.4)	(1.0)	(1.9)	(1.5)
	1 boy, 2 girls	10.5*	19.7	30.4	15.1	24.3	47.4	14.9	24.6	49.2	16.6*	26.3***	54.0
4		(1.4)	(1.0)	(3.6)	(1.0)	(1.0)	(3.1)	(1.0)	(1.2)	(3.0)	(0.8)	(1.2)	(3.1)
	2 boys, 1 girl	10.3*	19.8	31.3	12.7	22.5	42.2	13.1	25.5	54.2	13.6***	25.1**	53.3
		(1.5)	(1.2)	(4.0)	(1.4)	(1.3)	(5.6)	(1.7)	(2.1)	(4.1)	(1.7)	(2.4)	(6.5)
	3 boys	11.8	20.5	31.8	15.5	26.8	54.6	15.0	23.7	45.5	15.5	27.5	57.4
		(2.3)	(2.0)	(7.3)	(2.3)	(3.9)	(6.4)	(1.7)	(2.0)	(8.0)	(2.9)	(5.6)	(7.8)
							Rural						
	1 girl	11.8	20.1	30.0	13.0	20.6	33.2	13.5	21.3	34.1	14.1	22.7	37.0
2		(0.4)	(0.5)	(0.8)	(0.2)	(0.3)	(0.6)	(0.1)	(0.2)	(0.3)	(0.1)	(0.2)	(0.5)
	1 boy	12.1	19.3	30.2	12.9	20.3	32.6	13.5	21.1	34.4	14.2	23.2	38.0
		(0.4)	(0.5)	(1.1)	(0.3)	(0.4)	(0.8)	(0.1)	(0.2)	(0.3)	(0.1)	(0.2)	(0.5)
	2 girls	13.7	21.0	32.0	14.3	22.9	36.5	14.3	23.2	37.0	16.3	26.2	42.7
		(0.7)	(0.9)	(1.5)	(0.4)	(0.9)	(1.5)	(0.2)	(0.4)	(0.7)	(0.2)	(0.4)	(0.8)
3	1 boy, 1 girl	13.6	20.0	31.4	14.1	22.0	34.5	13.9	21.9**	35.5*	14.3***	23.2***	37.6***
		(0.4)	(0.7)	(1.1)	(0.3)	(0.5)	(0.9)	(0.2)	(0.3)	(0.6)	(0.2)	(0.4)	(0.6)
	2 boys	14.0	22.3	34.7	13.9	21.6	34.4	14.2	22.0*	35.9	15.0***	24.3***	39.7*
		(0.7)	(1.2)	(1.8)	(0.5)	(0.8)	(1.8)	(0.3)	(0.5)	(1.0)	(0.3)	(0.6)	(1.2)
	3 girls	10.4	19.5	31.3	15.7	26.9	46.1	17.1	25.8	44.4	16.3	26.2	46.6
		(2.2)	(2.2)	(4.1)	(1.2)	(2.0)	(2.3)	(0.5)	(1.1)	(1.7)	(0.4)	(0.8)	(1.2)
	1 boy, 2 girls	15.2*	22.8	38.8	14.2	24.2	45.6	14.5***	22.6***	39.9	15.8	25.6	51.8***
4		(1.3)	(1.5)	(3.5)	(1.0)	(1.0)	(2.1)	(0.6)	(0.5)	(2.5)	(0.5)	(0.7)	(1.8)
	2 boys, 1 girl	15.9**	24.2*	44.4**	14.5	24.7	48.9	15.4*	23.4*	42.8	17.3	29.1	59.1***
		(1.3)	(1.7)	(5.0)	(1.3)	(1.6)	(3.7)	(0.8)	(0.8)	(4.1)	(0.8)	(1.8)	(1.6)
	3 boys	13.0	21.6	37.2	11.7*	23.0	46.2	15.9	24.2	46.1	17.3	27.4	55.6**
		(2.4)	(2.8)	(7.7)	(2.1)	(3.0)	(7.0)	(1.2)	(1.3)	(5.0)	(1.1)	(2.3)	(3.3)

Note. The statistics for each spell/period combination are calculated based on the regression model for that combination as described in the main text, using bootstrapping to find the standard errors shown in parentheses. For bootstrapping, the original sample is resampled, the regression model run on the resampled data, and the statistics calculated. This process is repeated 100 times and the standard errors calculated.

[a] Percentile durations calculated as follows. For each woman in a given spell/period combination sample, I calculate the time point at which there is a given percent chance that she will have given birth, conditional on the probability that she will eventually give birth in that spell. For example, if there is an 80% chance that a woman will give birth by the end of the spell, her median duration is the predicted number of months before she passes the 40% mark on her survival curve. The reported statistics is the average of a given percentile duration across all women in a given sample using the individual predicted probabilities of having had a birth by the end of the spell as weights. Duration begins at 9 months after the birth of the prior child. Durations for sex compositions other than all girls are tested against the duration for all girls, with *** indicating significantly different at the 1% level, ** at the 5% level, and * at the 10% level.

Table D.8: Estimated 25th, 50th, and 75th Percentile Durations for Women with Twelve or More Years of Education

		1972–1984			1985–1994			1995–2004			2005–2016		
		Duration (Months)[a] Percentile			Duration (Months)[a] Percentile			Duration (Months)[a] Percentile			Duration (Months)[a] Percentile		
Spell	Composition of Prior Children	25th	50th	75th	25th	50th	75th	25th	50th	75th	25th	50th	75th
							Urban						
	1 girl	14.3	24.4	38.9	15.4	28.8	46.8	17.5	30.9	48.6	19.0	33.3	51.0
2		(0.6)	(0.7)	(1.3)	(0.5)	(0.6)	(1.1)	(0.3)	(0.5)	(0.7)	(0.3)	(0.5)	(0.7)
	1 boy	13.7	25.4	41.3	16.9**	30.3	46.6	16.9	29.4**	48.0	19.3	34.0	52.5
		(0.6)	(0.8)	(1.2)	(0.5)	(0.7)	(0.8)	(0.3)	(0.4)	(0.6)	(0.4)	(0.7)	(0.9)
	2 girls	15.8	24.8	39.4	15.5	30.0	54.5	20.6	34.1	51.6	21.5	39.4	60.3
		(1.0)	(1.4)	(2.6)	(1.2)	(1.8)	(3.5)	(1.0)	(1.2)	(1.6)	(1.1)	(1.8)	(2.5)
3	1 boy, 1 girl	14.4	24.9	47.5**	15.9	27.5	45.6**	15.8***	26.4***	46.2**	16.7***	28.5***	46.3***
		(0.8)	(2.1)	(2.9)	(0.8)	(1.6)	(2.8)	(0.6)	(1.0)	(2.1)	(0.8)	(1.5)	(3.1)
	2 boys	13.8	26.6	45.8	16.2	29.8	44.5*	14.7***	25.3***	41.1***	16.1***	29.6***	47.9**
		(1.6)	(2.7)	(3.6)	(1.3)	(2.3)	(3.9)	(0.8)	(1.3)	(2.4)	(1.2)	(2.2)	(5.6)
							Rural						
	1 girl	13.5	21.6	33.8	14.7	24.7	40.0	15.6	25.2	40.9	15.8	26.9	43.8
2		(1.1)	(1.7)	(2.9)	(0.6)	(0.9)	(2.1)	(0.3)	(0.5)	(0.7)	(0.2)	(0.4)	(0.7)
	1 boy	13.8	23.2	38.2	15.8	25.9	41.9	15.3	25.1	40.4	15.6	26.4	43.9
		(1.0)	(2.0)	(2.9)	(0.7)	(1.0)	(2.2)	(0.3)	(0.5)	(0.7)	(0.3)	(0.4)	(0.8)
	2 girls	14.3	21.5	31.0	19.1	29.2	48.2	16.6	26.7	43.7	18.6	31.9	50.3
		(2.5)	(3.5)	(3.6)	(1.6)	(2.4)	(4.5)	(0.7)	(1.1)	(1.8)	(0.6)	(1.0)	(1.5)
3	1 boy, 1 girl	15.3	23.0	38.7	14.6**	27.5	43.3	14.6**	24.3	39.7	14.9***	25.3***	44.0**
		(1.6)	(3.1)	(6.1)	(1.0)	(2.5)	(3.9)	(0.5)	(1.0)	(1.8)	(0.4)	(0.8)	(2.2)
	2 boys	16.0	25.2	34.3	12.3***	24.0	37.9	13.9**	22.9**	38.8	15.8**	25.9***	41.3**
		(2.9)	(2.6)	(5.3)	(2.1)	(3.7)	(6.0)	(0.9)	(1.4)	(3.0)	(0.8)	(1.5)	(3.0)

Note. The statistics for each spell/period combination are calculated based on the regression model for that combination as described in the main text, using bootstrapping to find the standard errors shown in parentheses. For bootstrapping, the original sample is resampled, the regression model run on the resampled data, and the statistics calculated. This process is repeated 100 times and the standard errors calculated.

[a] Percentile durations calculated as follows. For each woman in a given spell/period combination sample, I calculate the time point at which there is a given percent chance that she will have given birth, conditional on the probability that she will eventually give birth in that spell. For example, if there is an 80% chance that a woman will give birth by the end of the spell, her median duration is the predicted number of months before she passes the 40% mark on her survival curve. The reported statistics is the average of a given percentile duration across all women in a given sample using the individual predicted probabilities of having had a birth by the end of the spell as weights. Duration begins at 9 months after the birth of the prior child. Durations for sex compositions other than all girls are tested against the duration for all girls, with *** indicating significantly different at the 1% level, ** at the 5% level, and * at the 10% level.

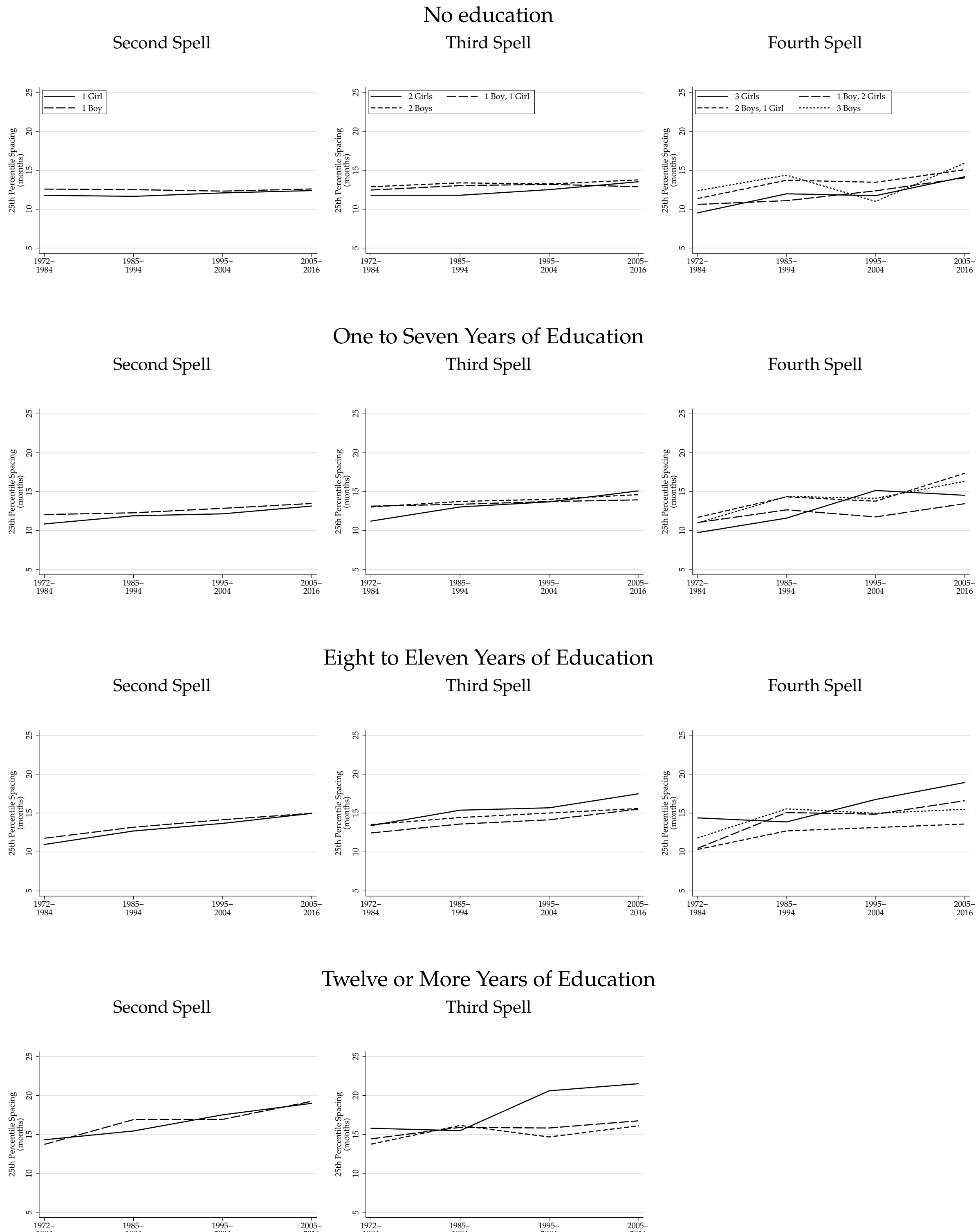


Figure D.1: Changes in 25th Percentile Birth Intervals for Urban Women by Spell and Education

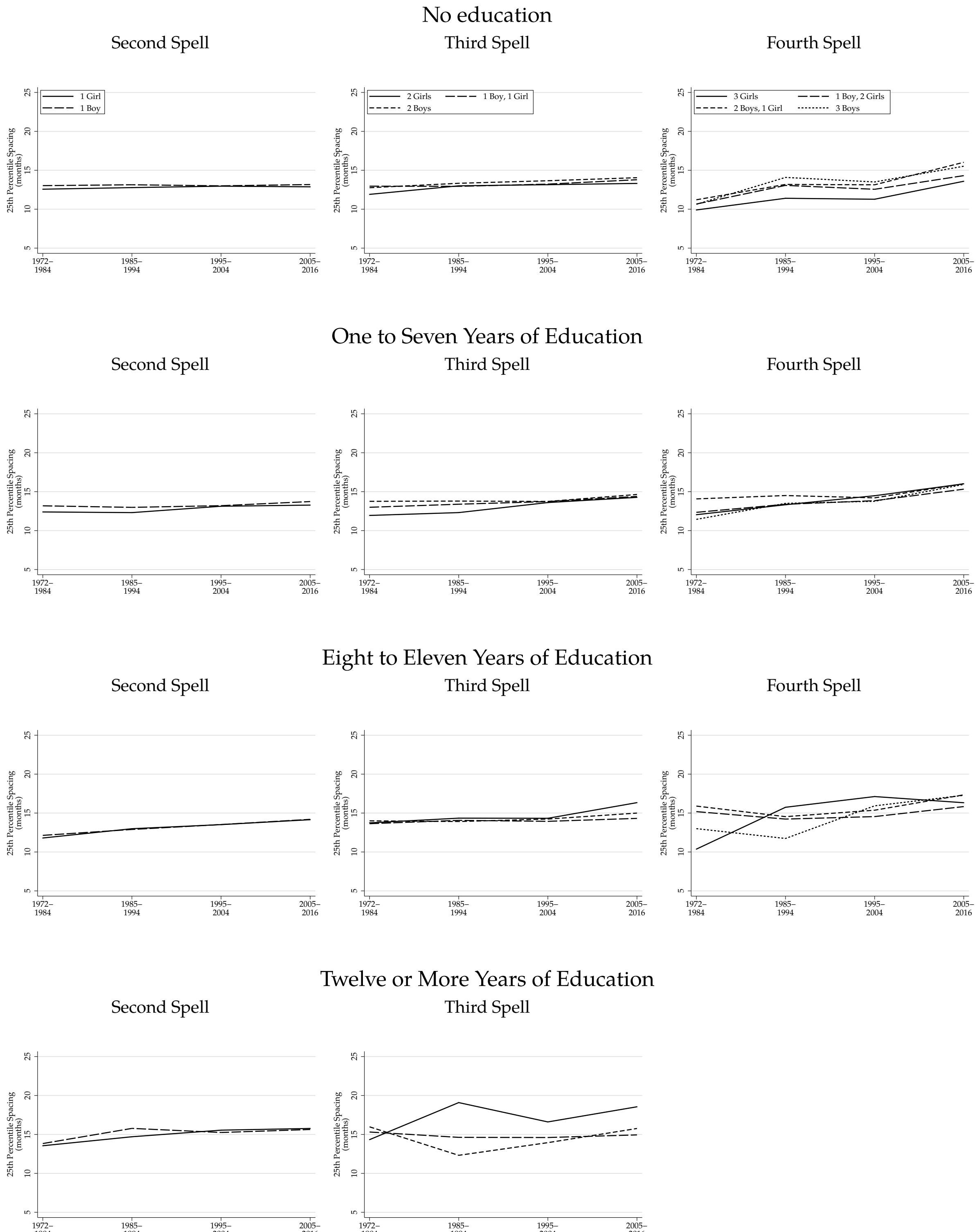


Figure D.2: Changes in 25th Percentile Birth Intervals for Rural Women by Spell and Education

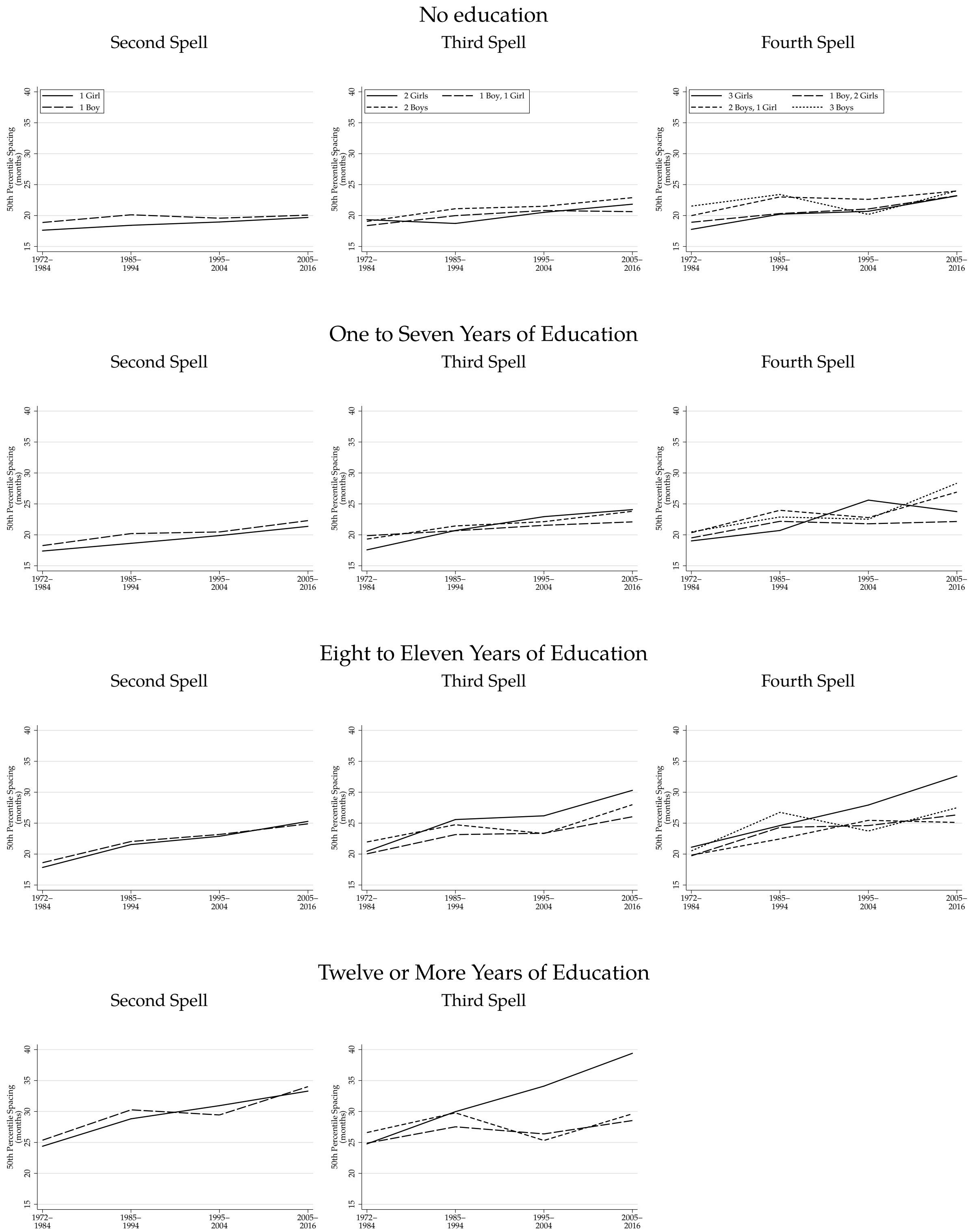


Figure D.3: Changes in 50th Percentile Birth Intervals for Urban Women by Spell and Education

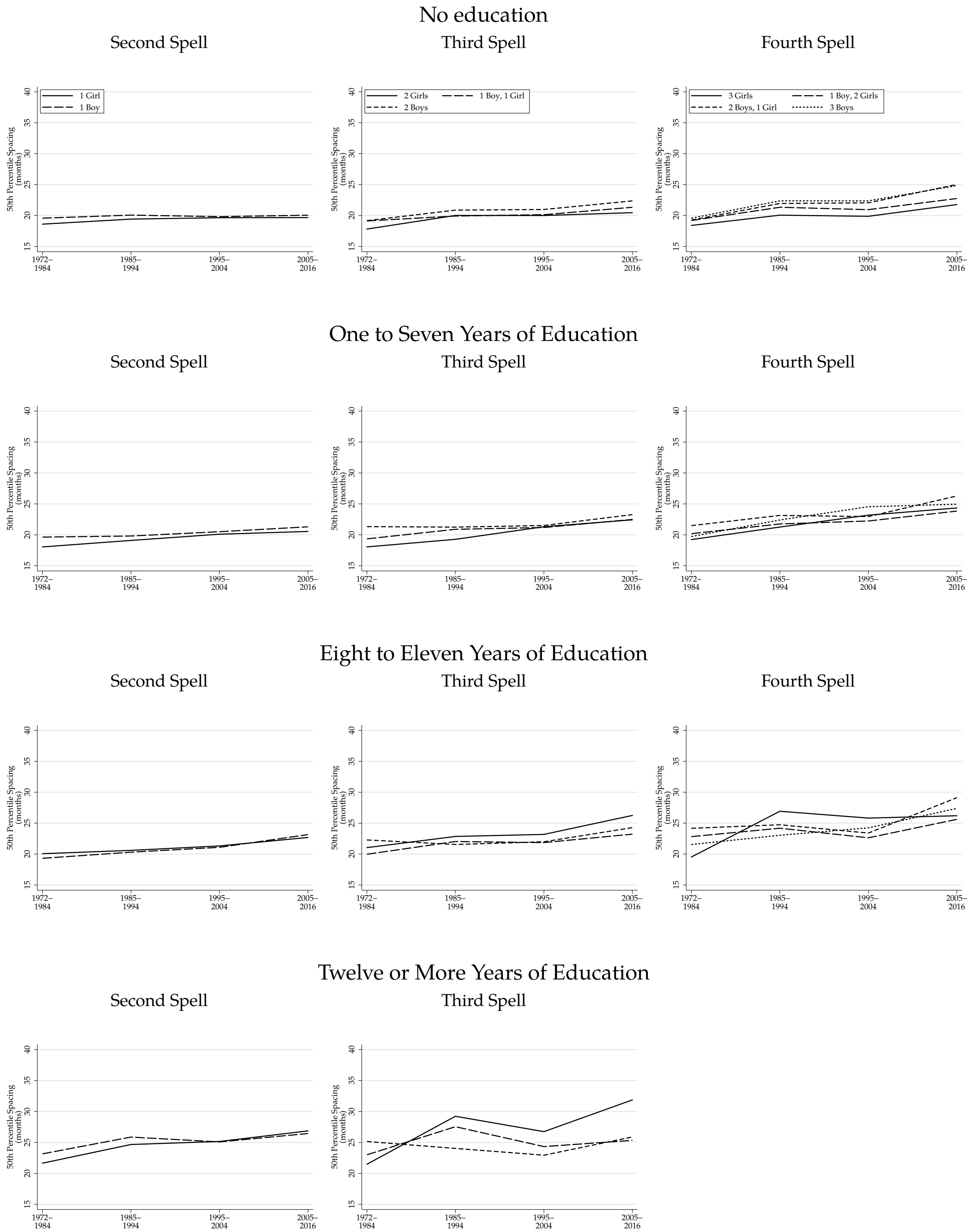


Figure D.4: Changes in 50th Percentile Birth Intervals for Rural Women by Spell and Education

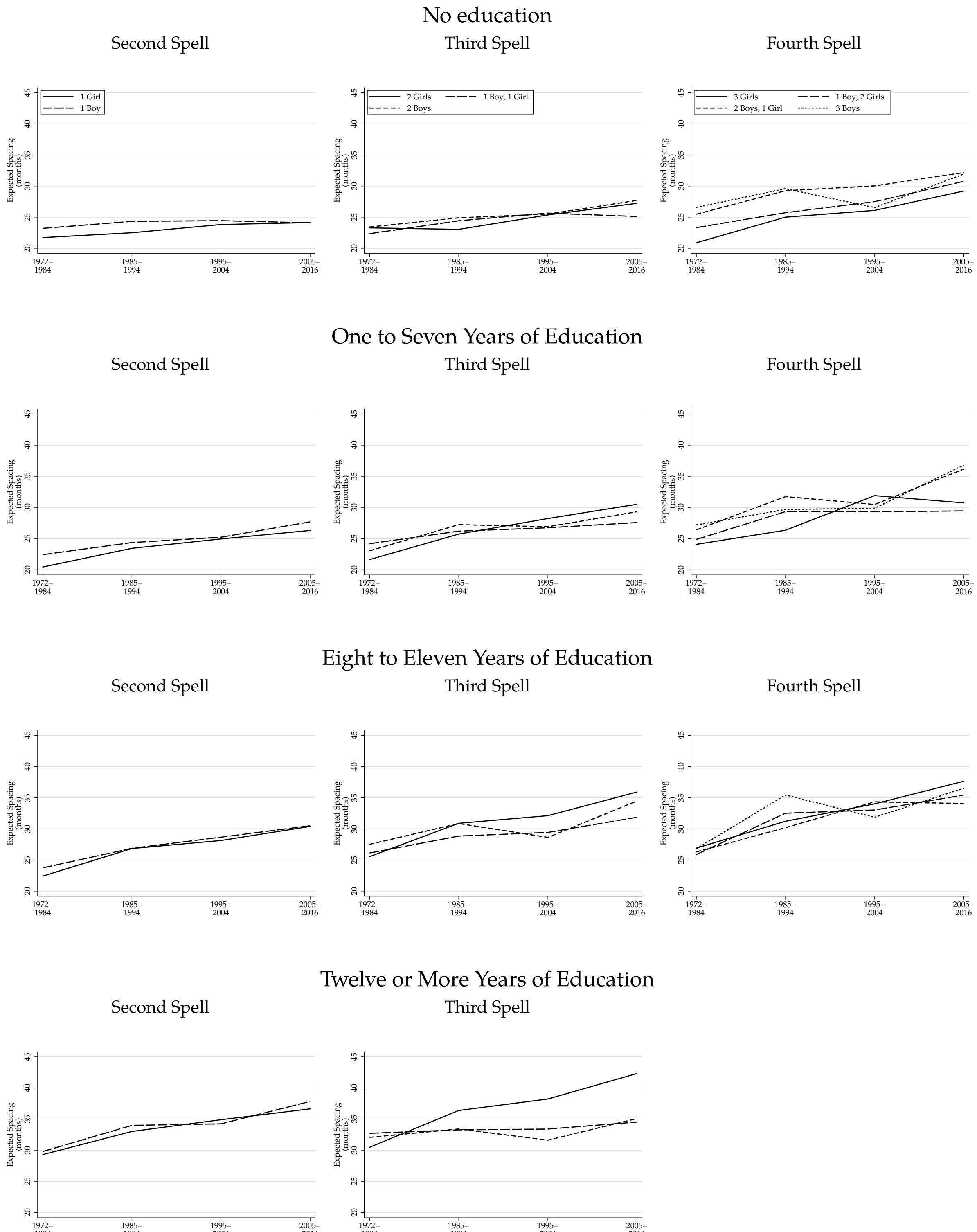


Figure D.5: Changes in Average Birth Intervals for Urban Women by Spell and Education

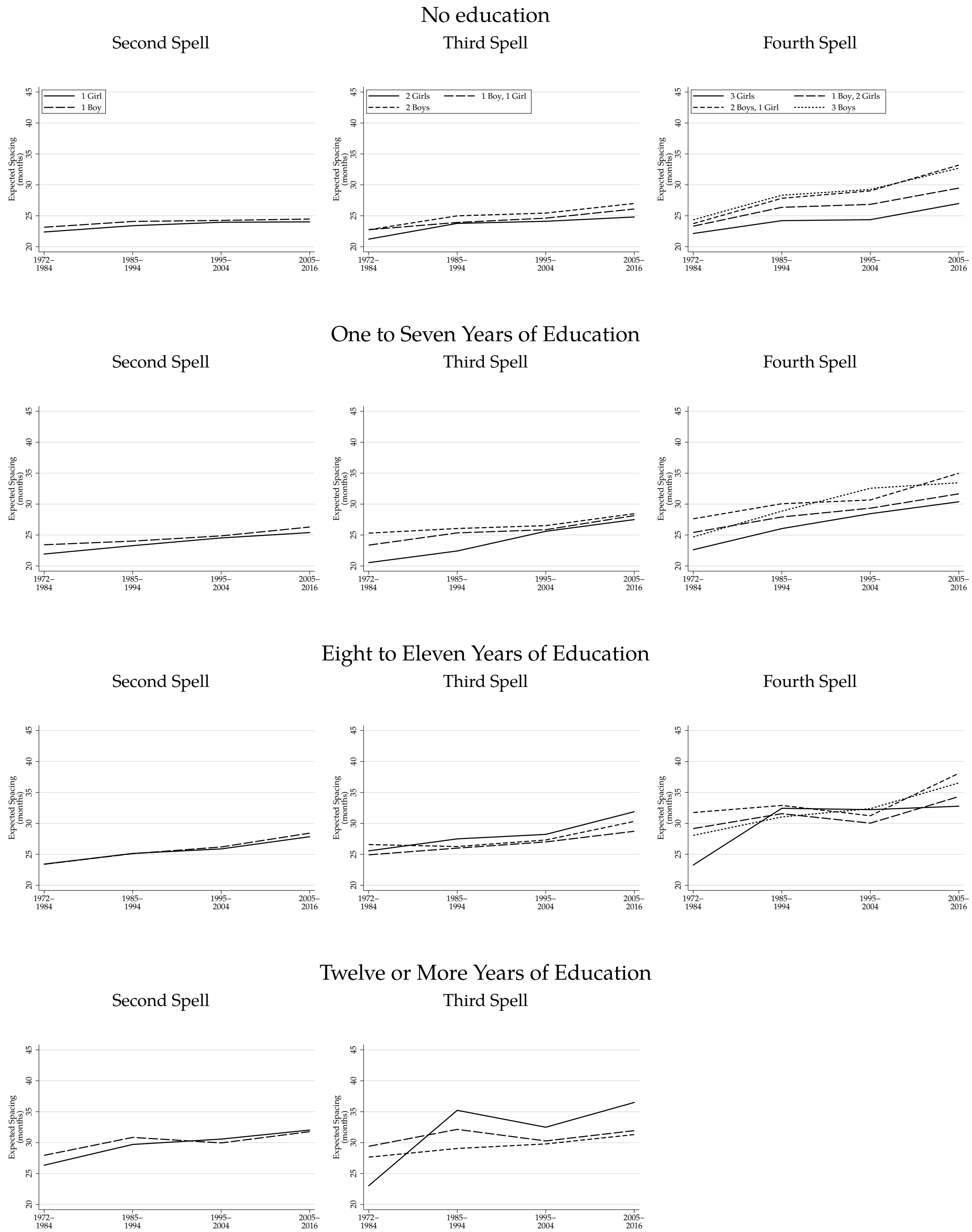


Figure D.6: Changes in Average Birth Intervals for Rural Women by Spell and Education

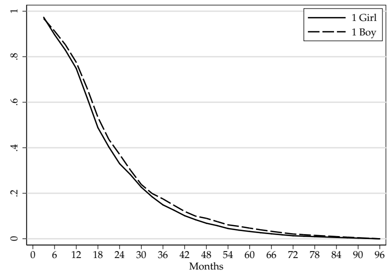
E Survival Curves Conditional on Parity Progression for All Education and Spell Groups

E.1 Second Spell

Urban

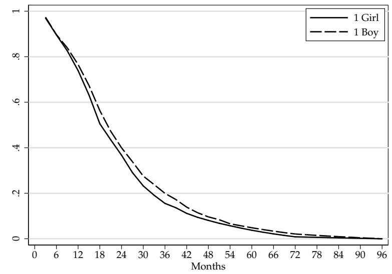
(a) 1972–1984

Prob. no birth yet



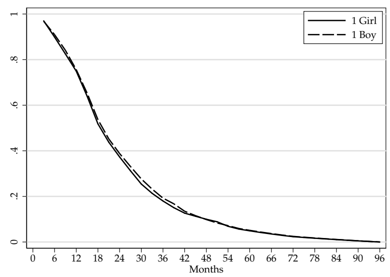
(b) 1985–1994

Prob. no birth yet



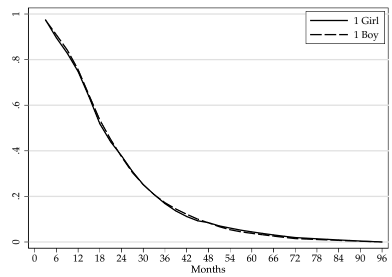
(c) 1995–2005

Prob. no birth yet



(d) 2005–2016

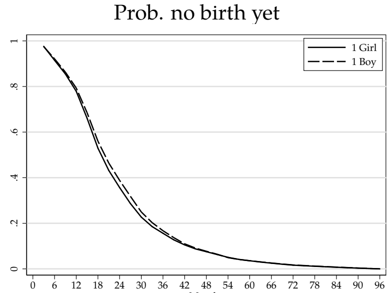
Prob. no birth yet



Rural

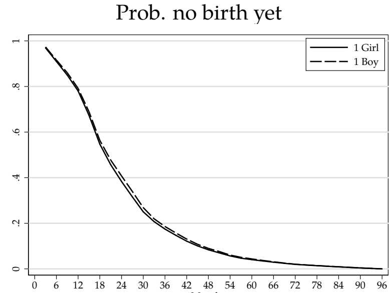
(e) 1972–1984

Prob. no birth yet



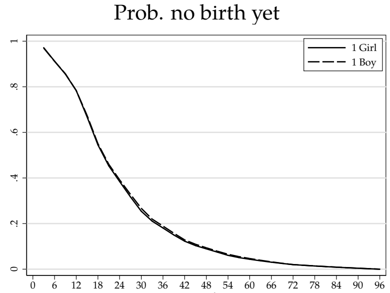
(f) 1985–1994

Prob. no birth yet



(g) 1995–2004

Prob. no birth yet



(h) 2005–2016

Prob. no birth yet

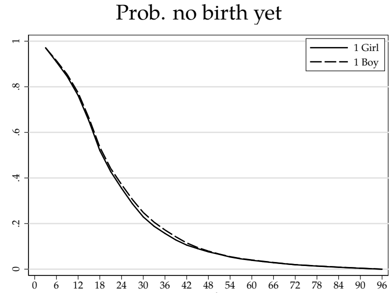


Figure E.1: Survival curves conditional on parity progression for women with no education by month beginning 9 months after prior birth.

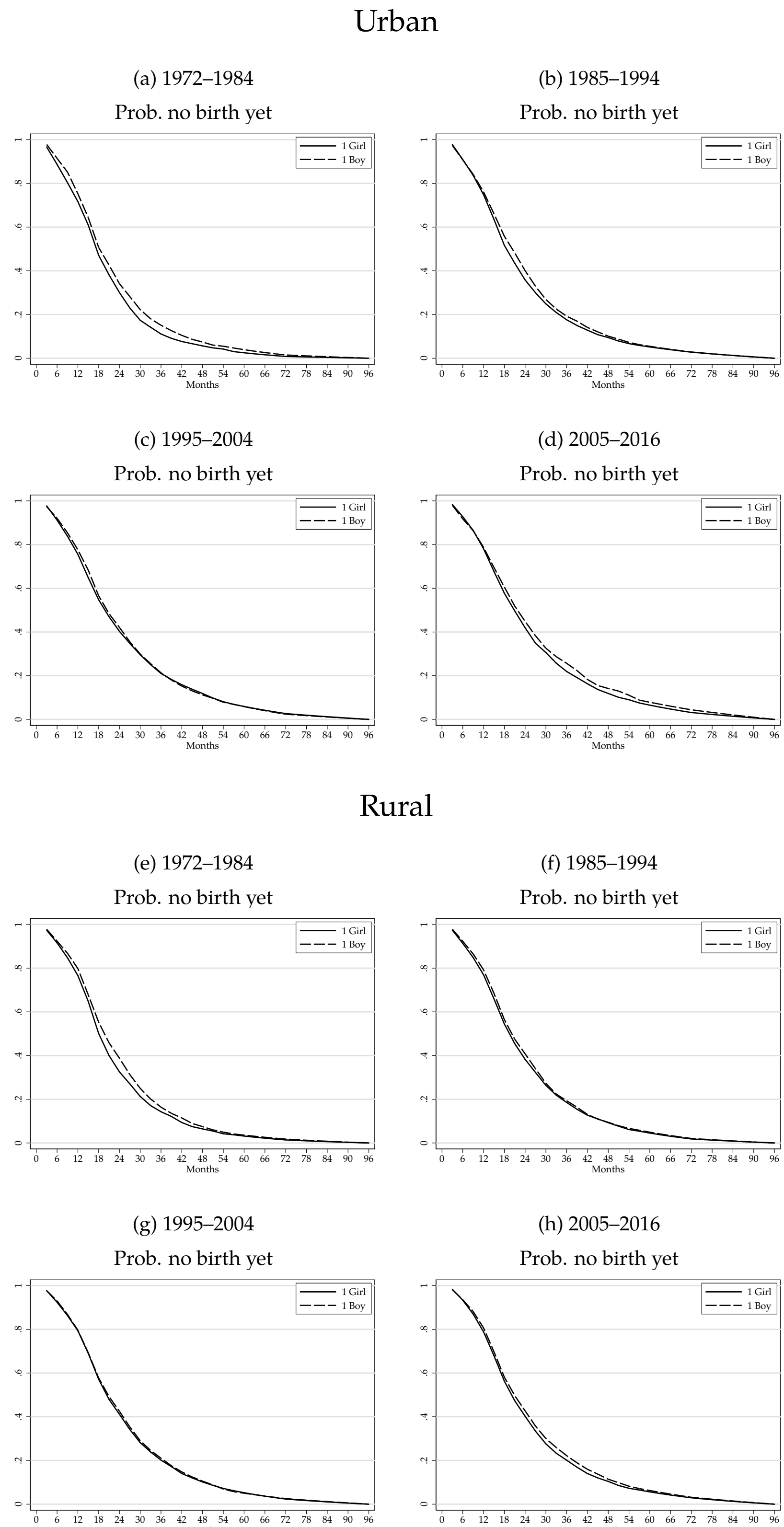
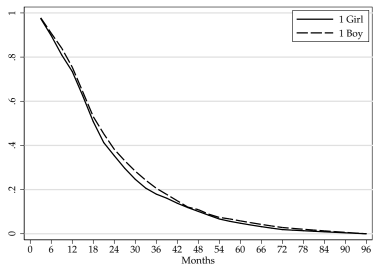


Figure E.2: Survival curves conditional on parity progression for women with 1-7 years of education by month beginning 9 months after prior birth.

Urban

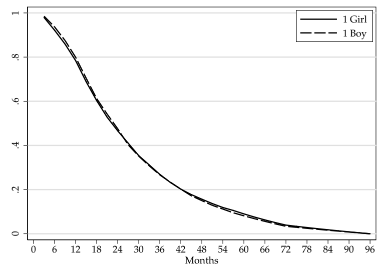
(a) 1972–1984

Prob. no birth yet



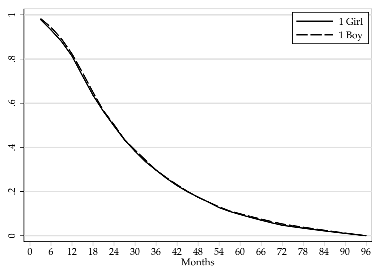
(b) 1985–1994

Prob. no birth yet



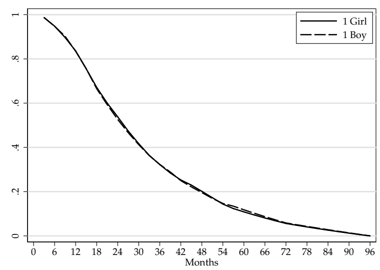
(c) 1995–2004

Prob. no birth yet



(d) 2005–2016

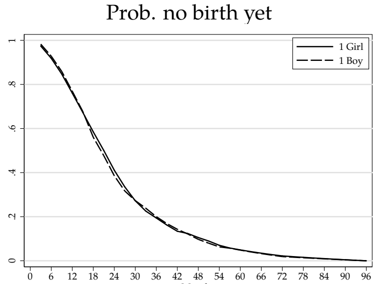
Prob. no birth yet



Rural

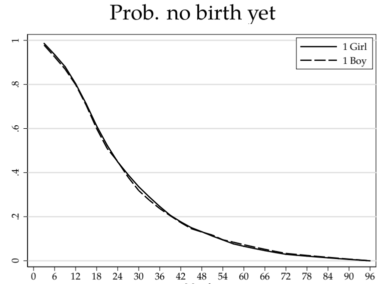
(e) 1972–1984

Prob. no birth yet



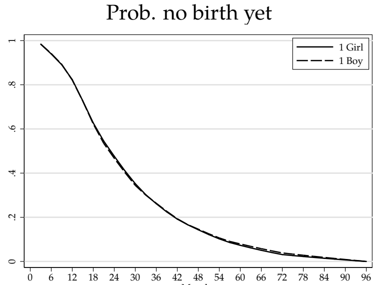
(f) 1985–1994

Prob. no birth yet



(g) 1995–2004

Prob. no birth yet



(h) 2005–2016

Prob. no birth yet

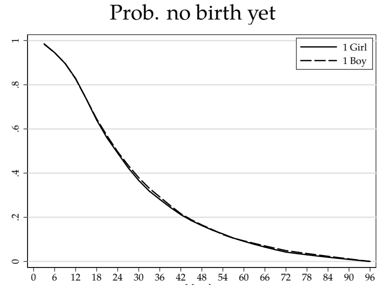
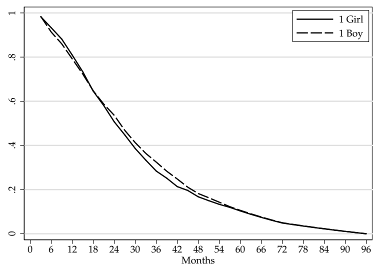


Figure E.3: Survival curves conditional on parity progression for women with eight to eleven years of education by month beginning 9 months after prior birth.

Urban

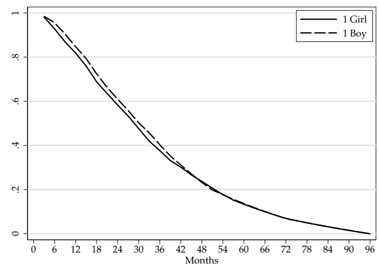
(a) 1972–1984

Prob. no birth yet



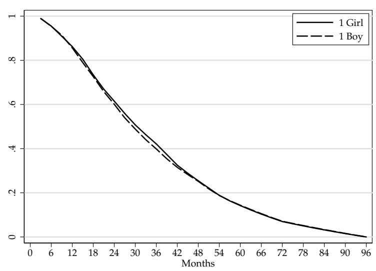
(b) 1985–1994

Prob. no birth yet



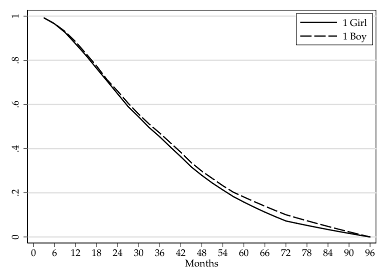
(c) 1995–2004

Prob. no birth yet



(d) 2005–2016

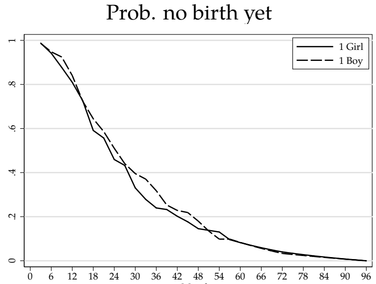
Prob. no birth yet



Rural

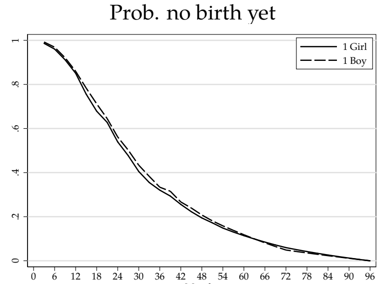
(e) 1972–1984

Prob. no birth yet



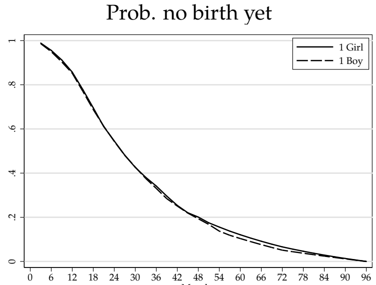
(f) 1985–1994

Prob. no birth yet



(g) 1995–2004

Prob. no birth yet



(h) 2005–2016

Prob. no birth yet

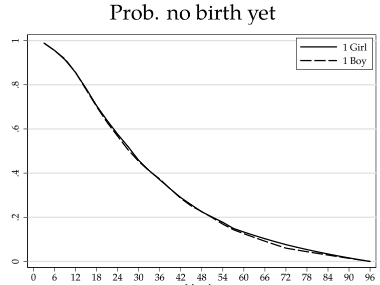


Figure E.4: Survival curves conditional on parity progression for women with twelve or more years of education by month beginning 9 months after prior birth.

E.2 Third Spell

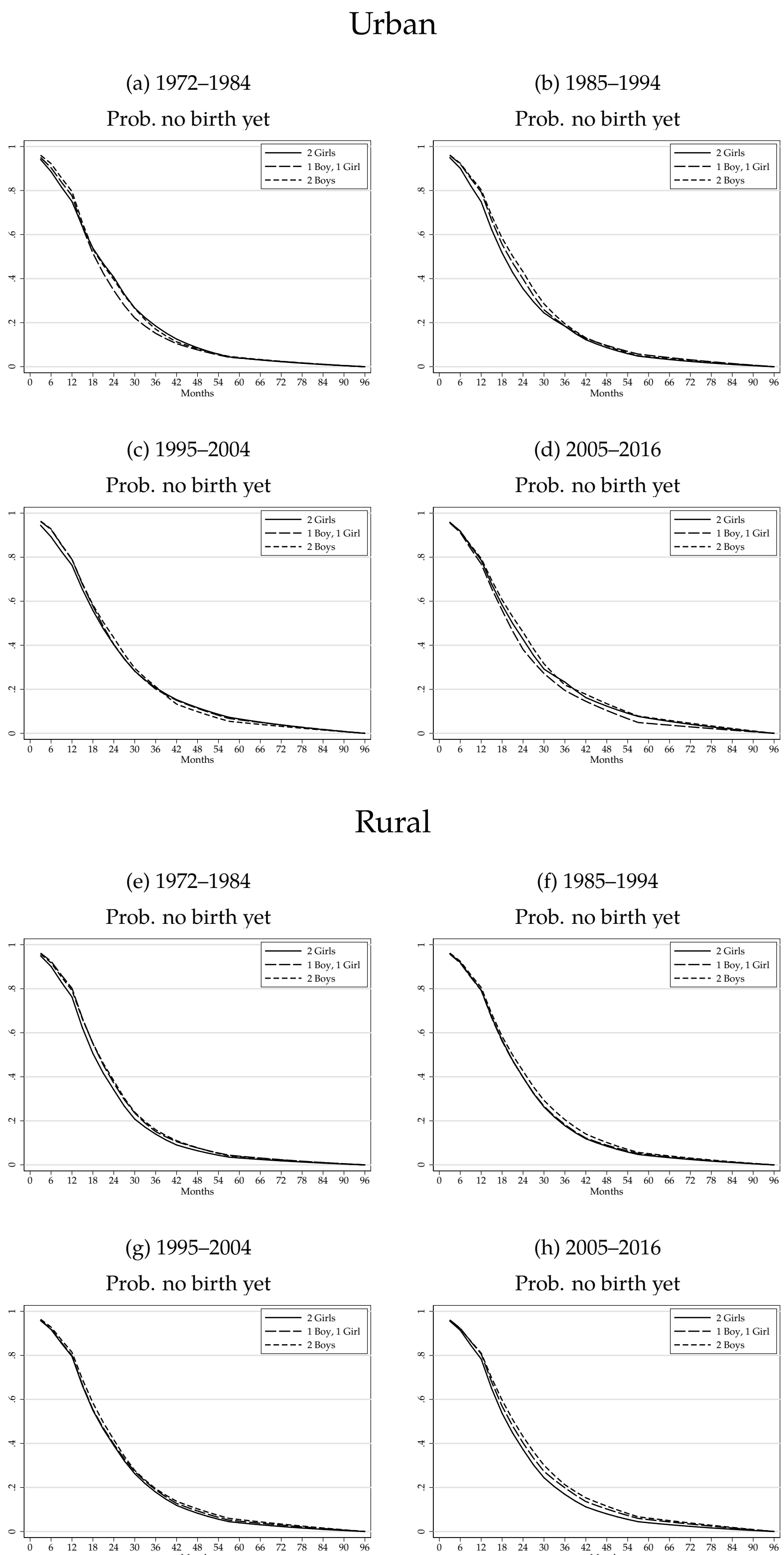
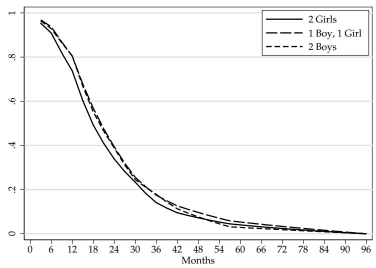


Figure E.5: Survival curves conditional on parity progression for women with no education by month beginning 9 months after prior birth.

Urban

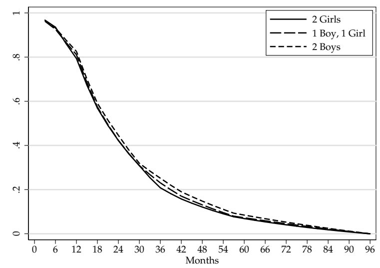
(a) 1972–1984

Prob. no birth yet



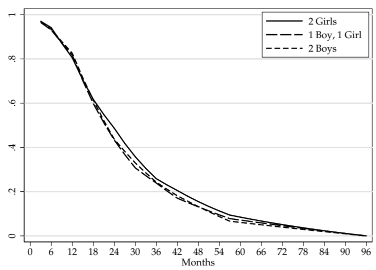
(b) 1985–1994

Prob. no birth yet



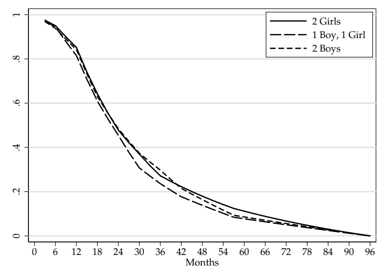
(c) 1995–2004

Prob. no birth yet



(d) 2005–2016

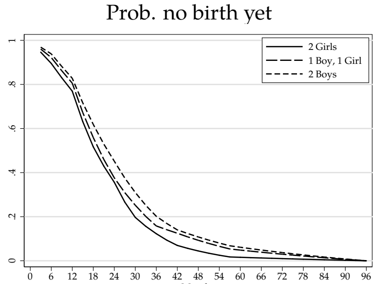
Prob. no birth yet



Rural

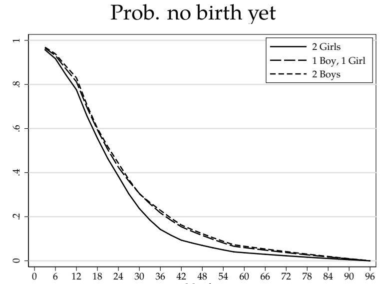
(e) 1972–1984

Prob. no birth yet



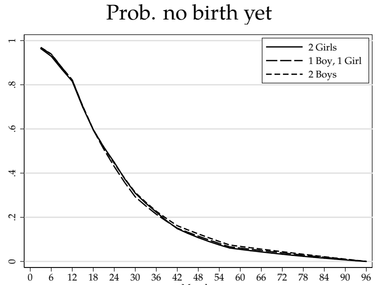
(f) 1985–1994

Prob. no birth yet



(g) 1995–2004

Prob. no birth yet



(h) 2005–2016

Prob. no birth yet

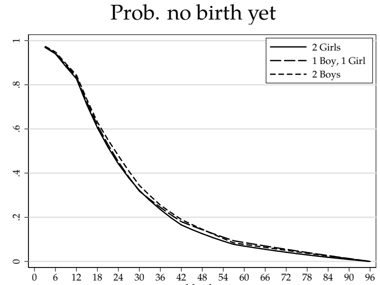
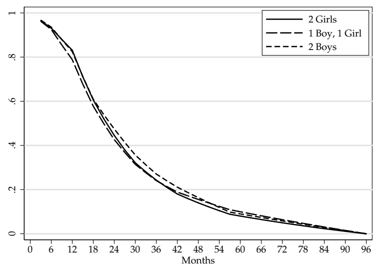


Figure E.6: Survival curves conditional on parity progression for women with 1 to 7 years of education by month beginning 9 months after prior birth.

Urban

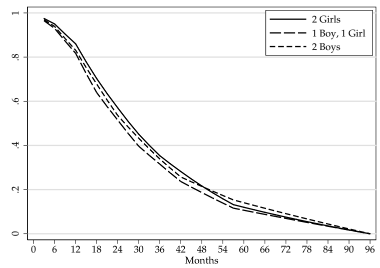
(a) 1972–1984

Prob. no birth yet



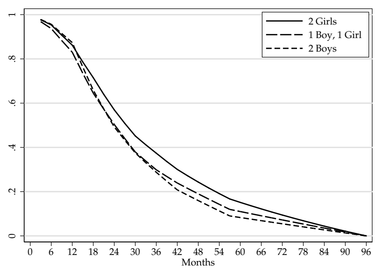
(b) 1985–1994

Prob. no birth yet



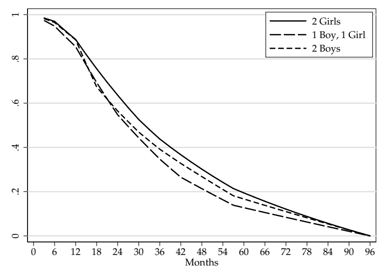
(c) 1995–2004

Prob. no birth yet



(d) 2005–2016

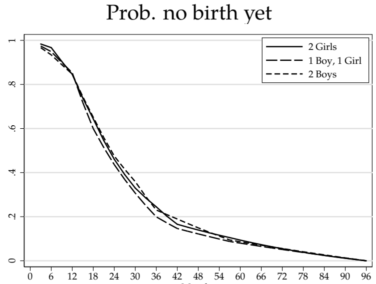
Prob. no birth yet



Rural

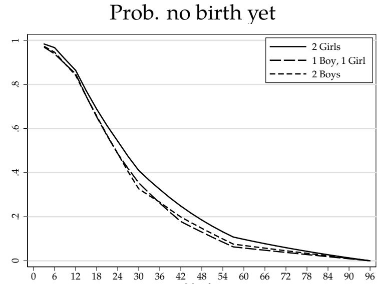
(e) 1972–1984

Prob. no birth yet



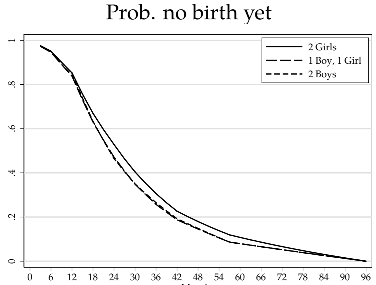
(f) 1985–1994

Prob. no birth yet



(g) 1995–2004

Prob. no birth yet



(h) 2005–2016

Prob. no birth yet

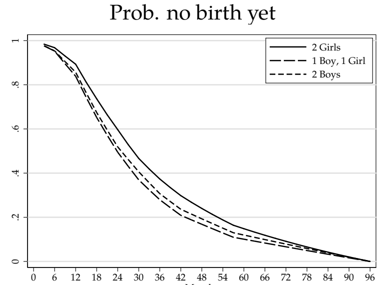
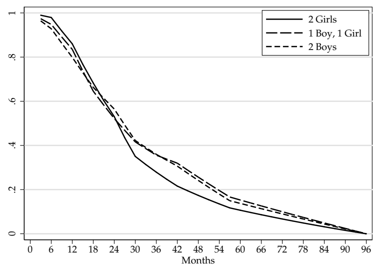


Figure E.7: Survival curves conditional on parity progression for women with eight to eleven years of education by month beginning 9 months after prior birth.

Urban

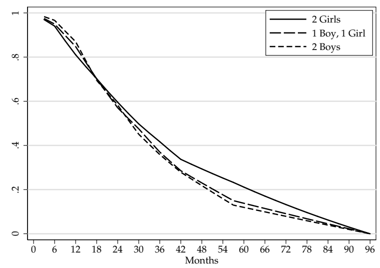
(a) 1972–1984

Prob. no birth yet



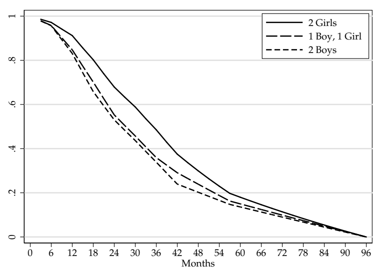
(b) 1985–1994

Prob. no birth yet



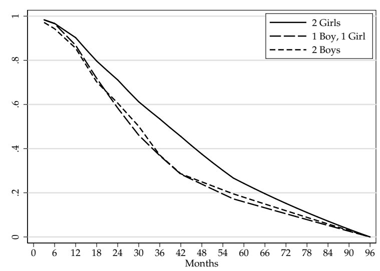
(c) 1995–2004

Prob. no birth yet



(d) 2005–2016

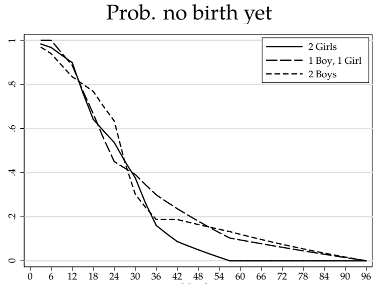
Prob. no birth yet



Rural

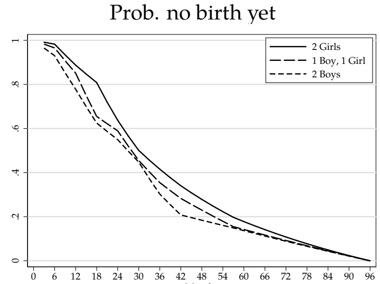
(e) 1972–1984

Prob. no birth yet



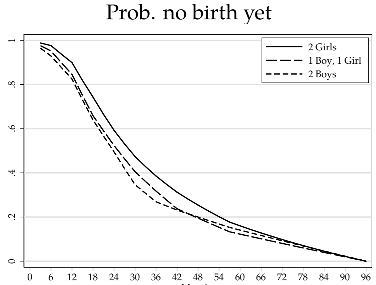
(f) 1985–1994

Prob. no birth yet



(g) 1995–2004

Prob. no birth yet



(h) 2005–2016

Prob. no birth yet

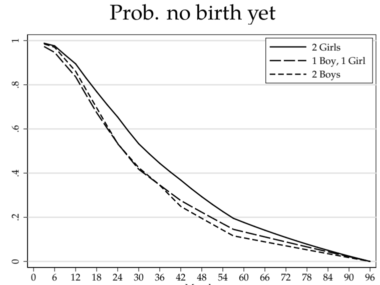


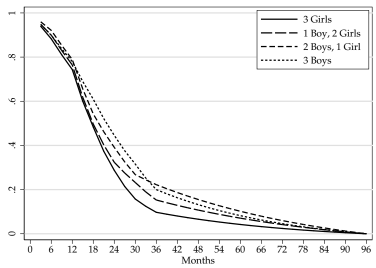
Figure E.8: Survival curves conditional on parity progression for women with twelve or more years of education by month beginning 9 months after prior birth.

E.3 Fourth Spell

Urban

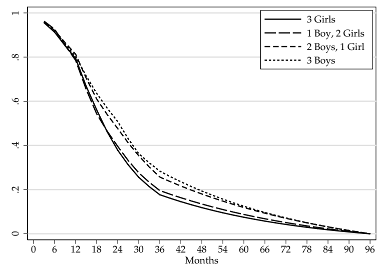
(a) 1972–1984

Prob. no birth yet



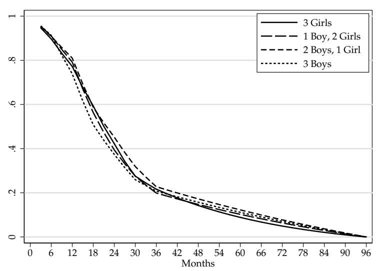
(b) 1985–1994

Prob. no birth yet



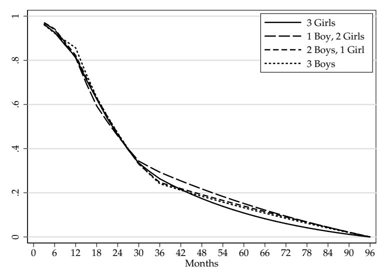
(c) 1995–2004

Prob. no birth yet



(d) 2005–2016

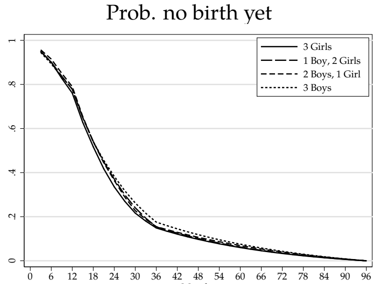
Prob. no birth yet



Rural

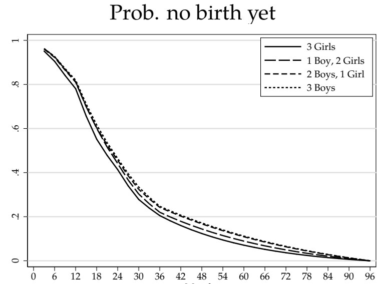
(e) 1972–1984

Prob. no birth yet



(f) 1985–1994

Prob. no birth yet



(g) 1995–2004

Prob. no birth yet

(h) 2005–2016

Prob. no birth yet

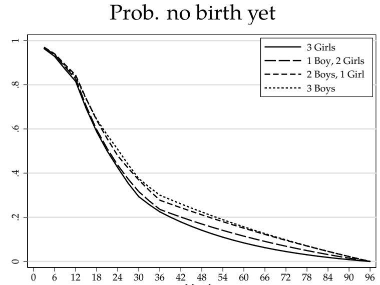
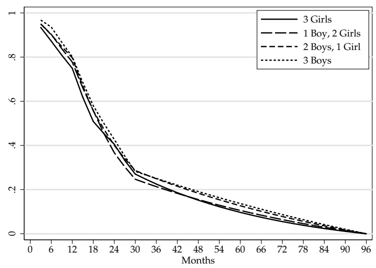


Figure E.9: Survival curves conditional on parity progression for women with no education by month beginning 9 months after prior birth.

Urban

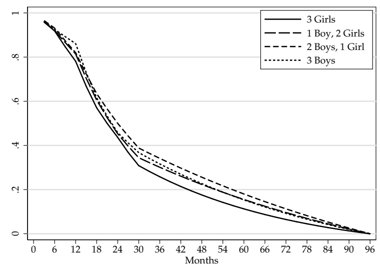
(a) 1972–1984

Prob. no birth yet



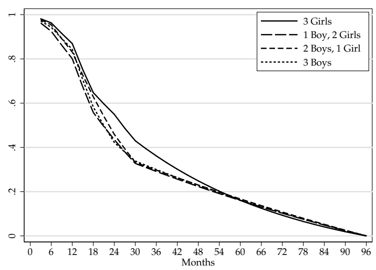
(b) 1985–1994

Prob. no birth yet



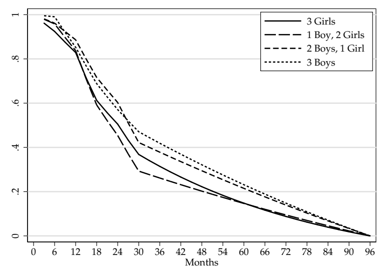
(c) 1995–2004

Prob. no birth yet



(d) 2005–2016

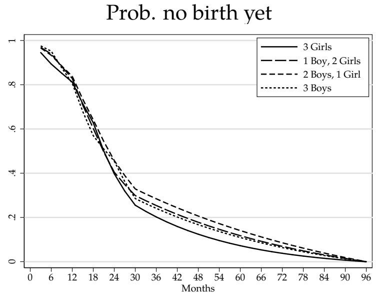
Prob. no birth yet



Rural

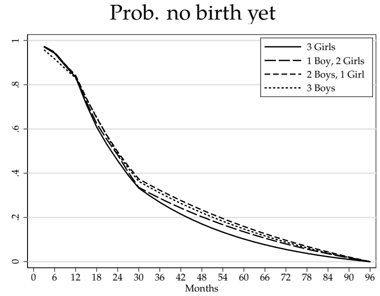
(e) 1972–1984

Prob. no birth yet



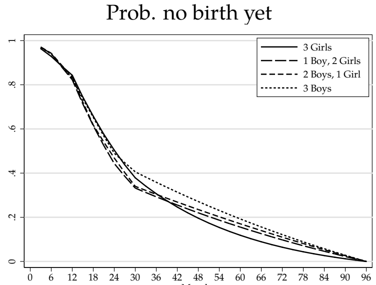
(f) 1985–1994

Prob. no birth yet



(g) 1995–2004

Prob. no birth yet



(h) 2005–2016

Prob. no birth yet

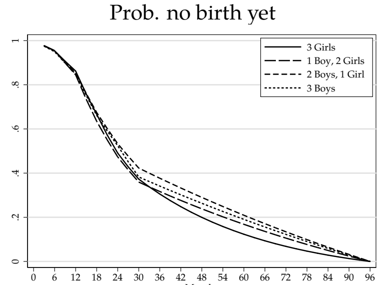


Figure E.10: Survival curves conditional on parity progression for women with 1 to 7 years of education by month beginning 9 months after prior birth.

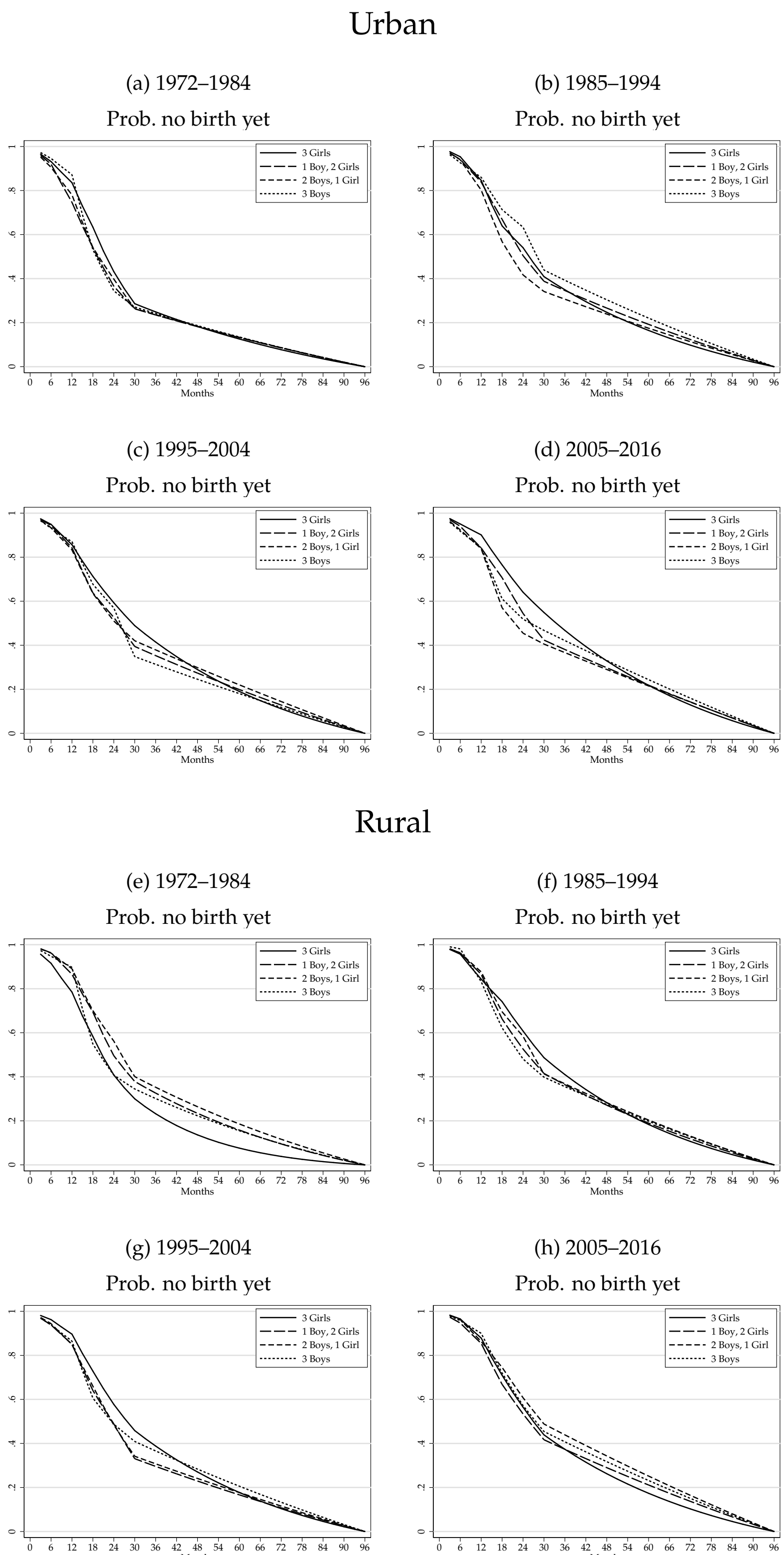
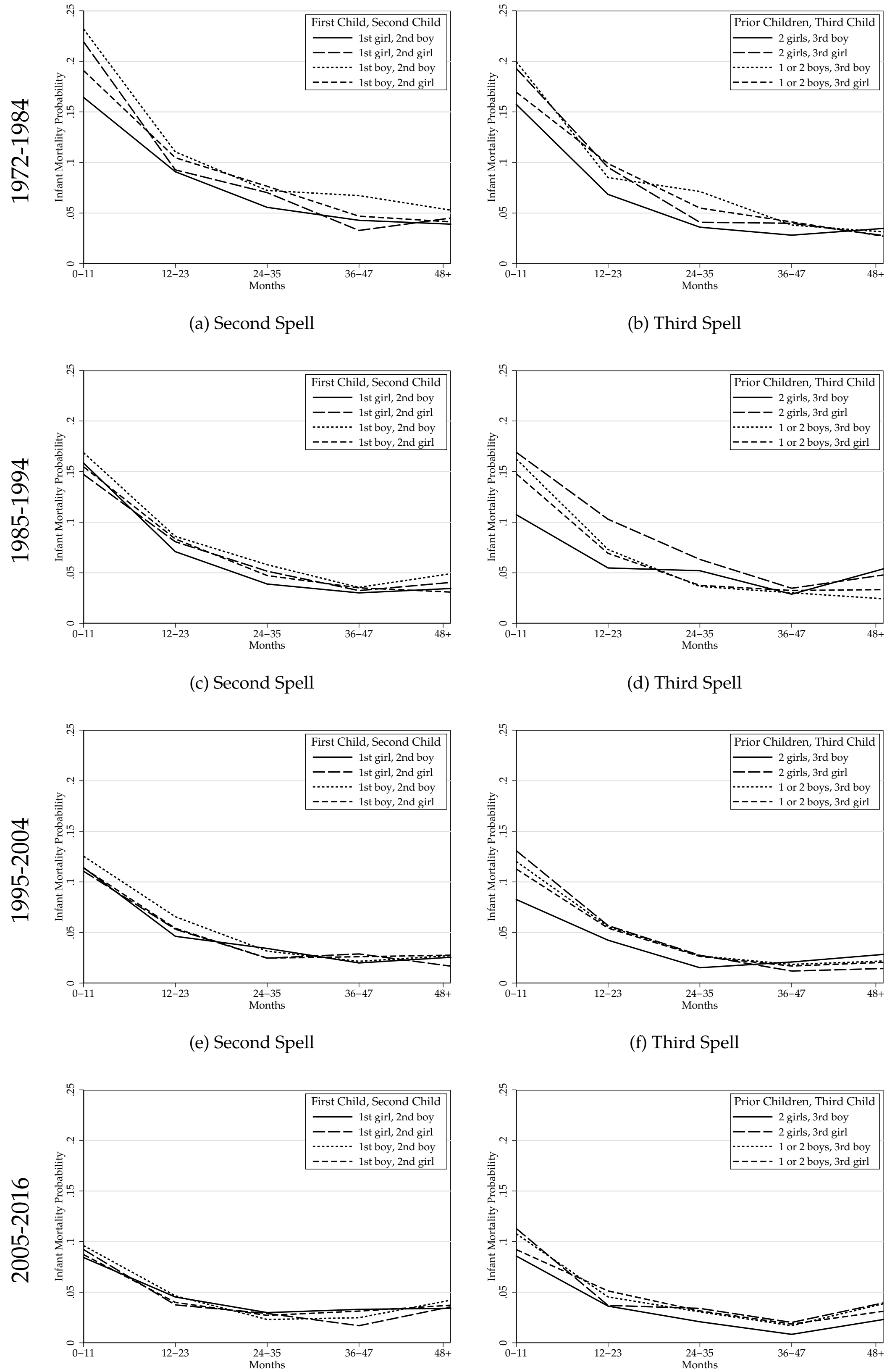


Figure E.11: Survival curves conditional on parity progression for women with eight to eleven years of education by month beginning 9 months after prior birth.

F Infant Mortality Graphs



(a) Second Spell

(b) Third Spell

(c) Second Spell

(d) Third Spell

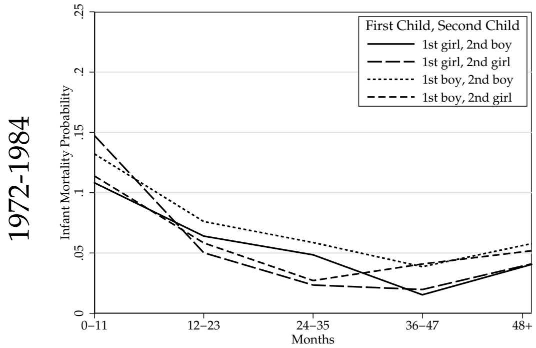
(e) Second Spell

(f) Third Spell

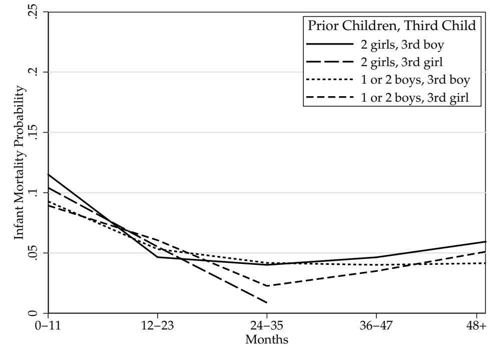
(g) Second Spell

(h) Third Spell

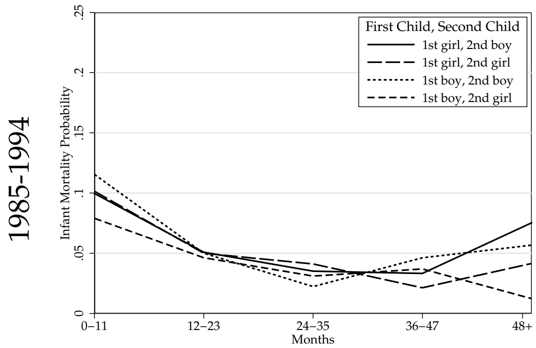
Figure F.1: Predicted Probability of Infant Mortality for women with no education



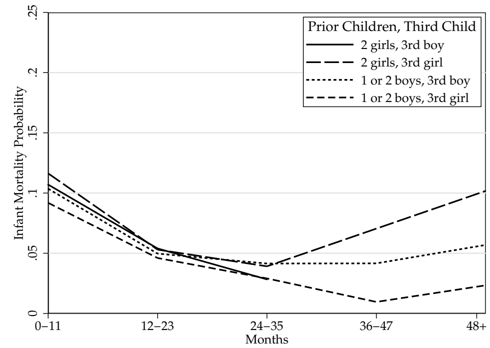
(a) Second Spell



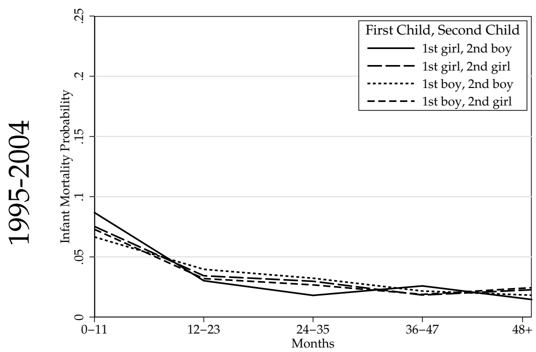
(b) Third Spell



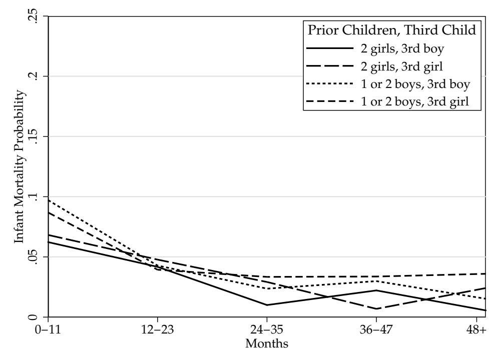
(c) Second Spell



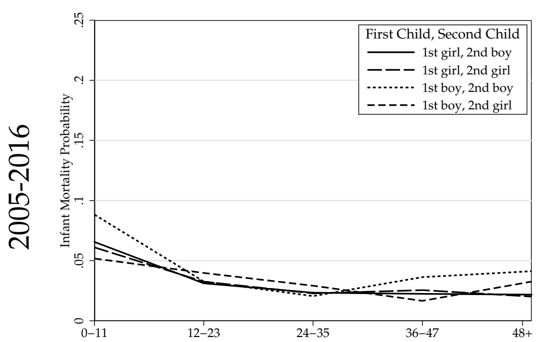
(d) Third Spell



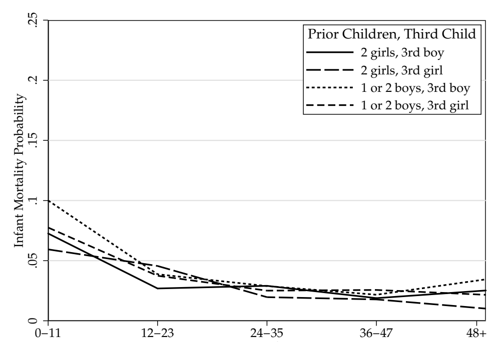
(e) Second Spell



(f) Third Spell

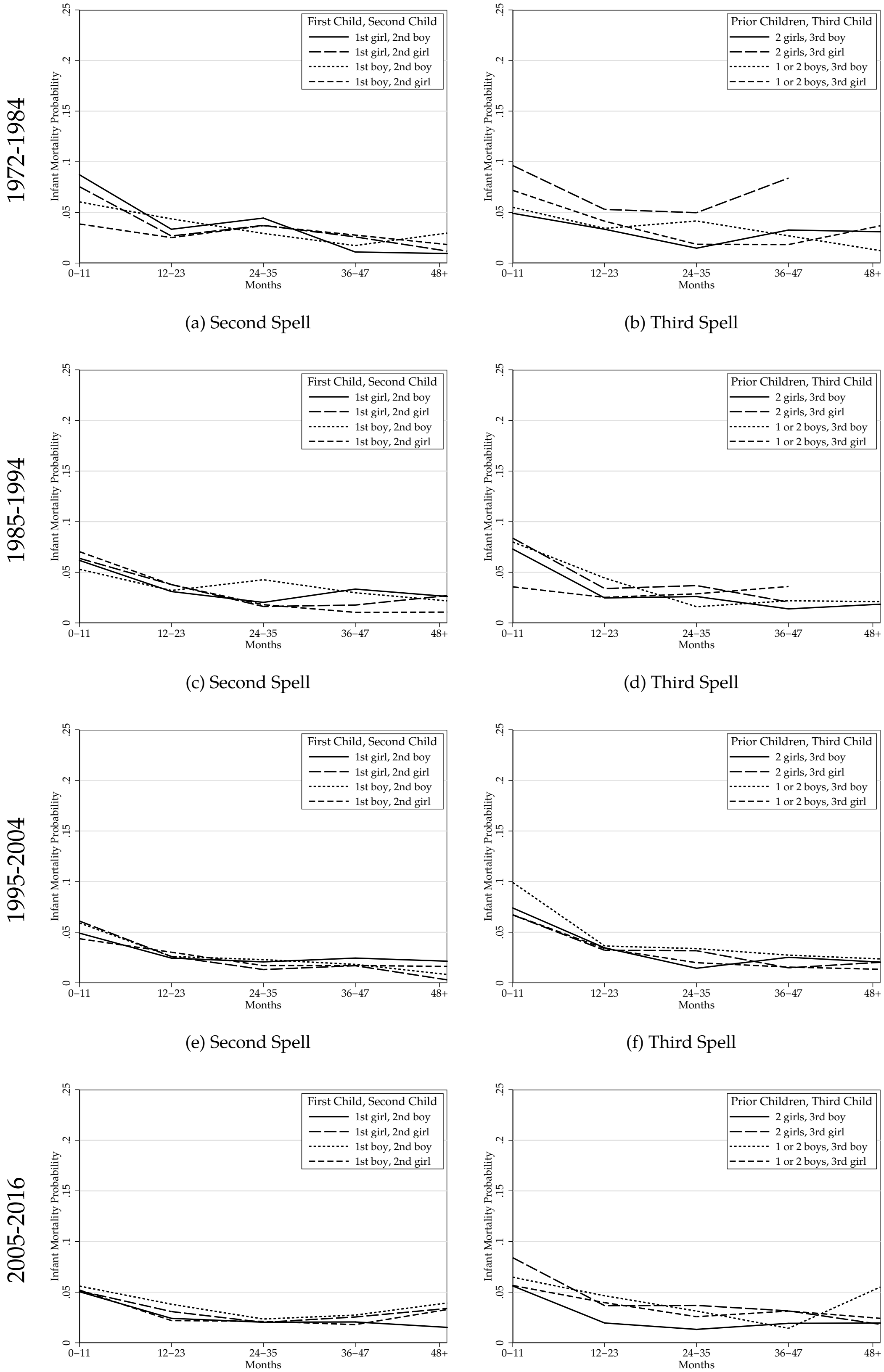


(g) Second Spell



(h) Third Spell

Figure F.2: Predicted Probability of Infant Mortality for women with one to seven years of education



(a) Second Spell

(b) Third Spell

(c) Second Spell

(d) Third Spell

(e) Second Spell

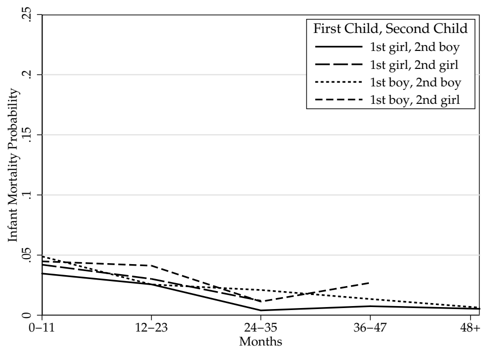
(f) Third Spell

(g) Second Spell

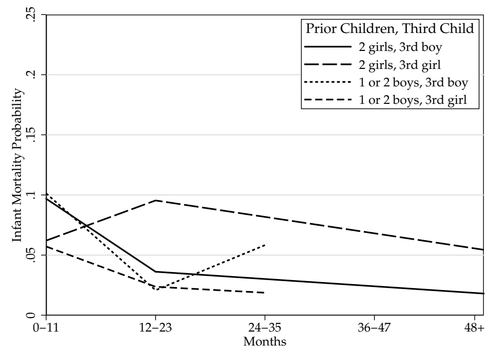
(h) Third Spell

Figure F.3: Predicted Probability of Infant Mortality for women with eight to eleven years of education

1985-1994

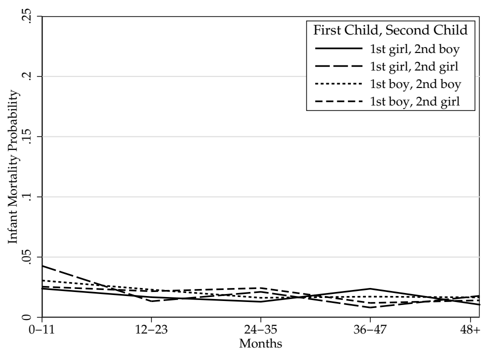


(a) Second Spell

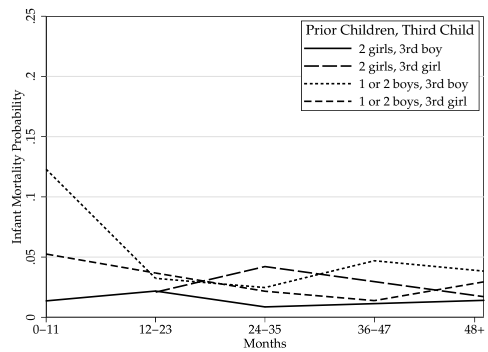


(b) Third Spell

1995-2004

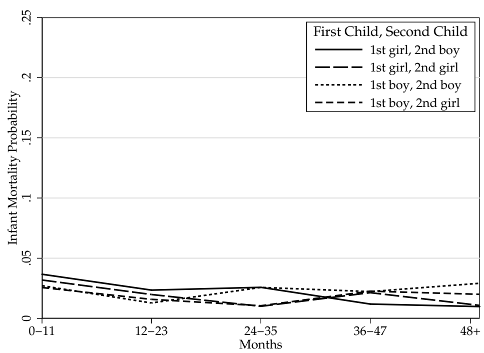


(c) Second Spell

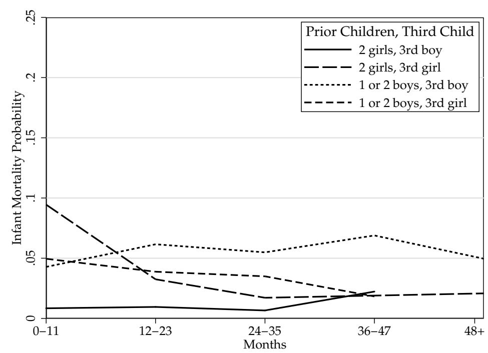


(d) Third Spell

2005-2016



(e) Second Spell



(f) Third Spell

Figure F.4: Predicted Probability of Infant Mortality for women with twelve or more years of education