MONASH UNIVERSITY

AUSTRALIA

Department of Economics
Discussion Papers
ISSN 1441-5429

Birth-spacing and Child Survival: Comparative Evidence from India and Pakistan

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No. 09/01

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Birth-spacing and Child Survival: Comparative Evidence from India and Pakistan[*]

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Abstract: This paper examines child mortality in India and Pakistan. Child survival is jointly estimated with birth spacing, because the duration between successive children is likely to significantly affect child quality and hence child survival. The analysis is based on National Family Health Survey (NFHS) 1992-93 household-level data from the Indian province of Punjab and Pakistan Integrated Household Survey (PIHS) 1991 data from the Pakistani Punjab province. There are interesting similarities and differences in the results from two provinces that have been separated by partition in 1947. While results relating to the importance of sibling competition and composition are similar, there are differences in results relating to household resource constraints and also paternal and maternal education in the two adjacent states. These also highlight the differential role of the state and the religion in these two samples.

Key words: Birth spacing, Child survival, Correlated simultaneous hazards, Sibling inequality, Resource constraint, Son preference, Differential role of parents.

JEL classification: J13, O10, C41, C24

[*] Pushkar Maitra wishes to thank the Faculty Research Grant Scheme, Faculty of Business and Economics, Monash University for research support. Sarmistha Pal wishes to thank Cardiff University and Cardiff Business School for funding this research.

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1. INTRODUCTION

Recent literature on the intra-household allocation of resources in developing countries suggests evidence of inequality among siblings for limited resources. Rosenzweig and Schultz (1982) in their seminal paper show that differences in individual endowments might affect intra-household distribution of resources. There are significant implications of such intra-household allocation resources on issues like child health and investment in schooling. Becker (1991) and Parish and Willis (1994) argue that if households are credit constrained, competition among siblings for limited resources may give rise to parental preference for certain children over others. In societies with pro-male bias, this competition may take the form of discrimination against female children that has commonly been labelled 'son preference'.[1] This preference for sons can take the form of better health or more schooling for boys (relative to girls) and or increased duration following the birth of a son.

Much of the existing empirical evidence is based on the estimation of child health (e.g., child survival or child mortality) functions only and ignores the fact that household decision regarding child health is closely related to household decision of spacing consecutive births. The present paper attempts to re-examine the nature of

[1] There now exists a large literature that documents son preference among parents in different developing countries (primarily Asian countries). Leung (1988) and Raut (1996) find evidence of preference for sons among the Chinese but not the Malays in Malaysia. Larsen, Chung and Dasgupta (1998) using data from Korea find that women who have a son are less likely to have another child and if they do proceed to have another child, take longer to conceive the subsequent child. Khan and Sirageldin (1977) find that son preference affects the actual childbearing intentions of parents in Pakistan. Gangadharan and Maitra (2001a) show that while overall child mortality rates are higher among boys in Pakistan, girls are more likely to die (compared to boys) in the age group 1 – 5. They argue that this is a consequence if differential resource allocation between boys and girls in the age group 1 – 5 years and is a reflection of parental preferences for sons. Using data from India, Sen and

sibling inequality in child survival, among other things, when household decisions regarding birth spacing and investment for child survival are both considered endogenous. We consider a sequential framework where a child may be born in each period or the parents may effectively postpone childbirth to the next period. The health production function depends not only on parental investment in child survival, but also depends on the duration between successive births. We consider women over the duration of successive births (until the survey date). From the time of a particular birth an individual woman is at risk of further conception and also at risk of experiencing death of a child. Both the hazard of child survival and the hazard of subsequent birth depend on a set of exogenous variables including the couple's age, literacy, contraception use, reproductive problems (if any), other household endowment, and also household (and mother) specific heterogeneity. In addition, the hazard of child survival is affected by the duration to the next birth. The idea here is that the closer apart the children are the greater is the sibling competition effect (the competition among siblings for limited resources) and the greater is the potential of the child not surviving. We jointly estimate a birth spacing hazard and a survival hazard as a correlated process.

The analysis is based on National Family Health Survey (NFHS) 1992-93 household-level data from the Indian province of Punjab and Pakistan Integrated Household Survey (PIHS) 1991 data from the Pakistani Punjab province. Comparative country-study of this sort is useful to study the differences in the nature of the problem across

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Sengupta (1983), Dasgupta (1987), Kishor (1993) and Arnold, Choe and Kim (1998) among others different societies. The comparison between India and Pakistan generates obvious interests because of the strained diplomatic relationship between the two countries since the partition of India in 1947 and the creation of the nation of Pakistan. While the two countries differ in terms of its religious and political institutions, households in these provinces on either sides of the border share a common socio-cultural background owing to their common origin. In terms of economic and demographic indicators, however the two countries have performed quite differently in the post-independence period. Though Pakistan has a higher GNP per capita than India, the indicators of demographic well-being are better in India. For example, the infant mortality rate, the crude birth rate and the total fertility rate are all higher in Pakistan.[2] Literacy rates are lower in Pakistan: the adult female literacy rate in Pakistan was 22% as against 39% in India in 1992; the corresponding figures for adult male literacy were 49% in Pakistan as against 64% in India.

Among various Indian states, Punjab had the highest per capita net state domestic product in 1991-92 and the lowest poverty head count ratio (both for the rural and urban areas). How has Punjab compared to the rest of India? In this context an interesting comparison can be made with the state of Kerala, which has achieved demographic indicators comparable with more developed countries. In the year 1991 – 92 the net state output per capita in Kerala was half the level in Punjab. However, the infant mortality rate in Indian Punjab was 57 per thousand live births (as opposed

find evidence of significant discrimination against girls.

[2] In 1992, the infant mortality rate in India was 79, compared to 95 in Pakistan. The crude birth rate was 29 per 1000 in India compared to 40 per 1000 in Pakistan and the total fertility rate was 3.7 in India compared to 5.6 in Pakistan.

to 17 per thousand in Kerala); the total fertility rate of the state was 3.1 in 1991 (as against 1.8 in Kerala). In addition, male (65.7%) and female (50.4%) literacy rates in 1991 in Punjab were significantly lower than those in Kerala. Unlike in Kerala, there is also some evidence of son preference in child health in this Indian state (see Dasgupta, 1987).

Among the four Pakistani provinces, (Punjab, Sindh, North-West Frontier Province and Balochistan) Punjab is the most prosperous and densely populated province in the country containing about 56.5% of the total population. In terms of other demographic and socio-economic indicators, Punjab has performed better compared to the rest of Pakistan. For example, the analysis of the Pakistan Integrated Household Survey (PIHS) 1991 data suggests that the average number of years of education for Punjabi women is 1.34 years compared to 0.91 years for women residing in the rest of Pakistan. The average number of years of education for Punjabi men is 4.16 years, which is significantly higher than an average of 3.33 years for men residing in the rest of Pakistan. Average household income in Punjab (Rp 51348) is significantly higher compared to that of the rest of Pakistan (Rp 49581).

Our comparative analysis of household behaviour between Indian and Pakistani Punjab provinces also highlight the role of religion and state. While all the sample households in the Pakistani province are Muslims, most households in Indian Punjab are either Sikhs (58%) or Hindus (39%). Only 1.5% households were Muslims. Thus, this analysis enables us to examine the differences in household behaviour in fertility and child survival decisions between Muslim and non-Muslim households. A welfare state has an important role to play in the spread of family planning measures. India was one of the first developing countries to launch its family planning programme in the early fifties. On the other hand evidence indicates that contraceptive prevalence did not begin to increase in Pakistan, especially in rural areas, until the 1990s. Of the four Pakistani provinces, Punjab has the highest prevalence levels (though the NWFP experienced the most rapid rise in contraceptive use in the early 1990s). According to the Pakistan Demographic and Health Survey 1990-91, use of any modern non-terminal method has been only 9% as against (14% in India and 32% in Indian Punjab).[3] Thus the comparison between India and Pakistan would also capture the welfare role of the state in subsidising and popularising the family planning measures.

The primary contribution of the paper is that using a sequential framework we jointly determine birth spacing and child survival that has not been looked at before and re-examine the role of household resource constraint, parental education and sibling composition to explain child survival. In doing so we use a correlated simultaneous hazard framework. Before proceeding further, let us now summarise the main results of the paper. The duration between children has a negative and significant effect on child mortality. Our results imply that the greater the duration between successive children, the lower is the competition among siblings for limited resources and the

[3] Source: National Family Health Survey data 1992-93, India. Male and/or female sterilization turn out to be a popular method in India, primarily provided free by the Government health services. The proportion of currently married sterilised women below age 49 years is 32% in Indian Punjab while the national average is 27%. On the other hand from most accounts, the fertility transition in Pakistan finally began in the 1990's – much later compared to its South Asian neighbours Bangladesh, India and Sri Lanka. See Sathar and Casterline (1998).

lower is the likelihood the child dies. There is some indirect evidence of son preference and significant and rather similar evidence of inequality among siblings in both the samples. The hazard of child mortality is lower if the spacing with the subsequent child is longer, if the child is male and has more elder sisters. In addition, the hazard of birth spacing is lower if there are more girls in the family at the time of birth of the current child, thus suggesting some aversion to the likelihood of having further girls when parents already have more girls. We interpret these results as reflecting competition for limited household resources in societies characterised by borrowing constraints and son preference.

The rest of the paper is organised as follows. Section 2 develops the analytical framework – we develop a simple theoretical model and then discuss the simultaneous hazard model that forms the basis of our estimation methodology. Section 3 discusses the data and selected descriptive statistics. Section 4 discusses the results and finally section 5 concludes.

2. AN ANALYTICAL FRAMEWORK

2.1. Theoretical Framework

Analysis of inequality between siblings is generally based on the static Beckerian model of household joint utility maximisation. Two important exceptions in this respect are Wolpin (1984) and Rosenzweig (1986). Wolpin (1994) develops a finitehorizon dynamic stochastic model of discrete choice with respect to life-cycle fertility in a world where infant survival is uncertain and presents implications for the number, timing and spacing of children for exogenous child mortality. Rosenzweig (1986) extended the Beckerian framework in a three period model to determine the optimum birth spacing. Both these models argue that childbirth is essentially sequential in nature and one therefore needs to develop a sequential framework to analyse the issue of child survival and sibling competition after accounting for the simultaneity between these two variables. The framework that we consider here is a derivative of Rosenzweig's (1986), three-period framework (see Makepeace and Pal, 2001). Parents care about child quality because higher quality may yield future benefits from children that supplement household income and parents maximise the net present value of earnings.[4]

A child may be born in each period or parents may postpone childbirth to the next period. A child if born in one period, starts earning the next period. But if childbirth is postponed, it yields some savings to the parents in that parents do not have to spend for the child when it is young in the first period. Child earnings in the subsequent periods are assumed to be contingent upon birth spacing as well as child health. The health production function depends on family endowment, net advantages of postponing childbirth as well as a random child-specific endowment. Thus child health is simultaneously determined with birth spacing.

[4] This is a significant way in which this model differs from Rosenzweig (1986). In his model Rosenzweig assumed that parents maximise total household utility. In our model we do not need to impose any restrictions on parental preference and hence we do not need to make assumptions on the

Let us for simplicity consider a three period framework where a child may be born in each period $t=1,2$ or childbirth may be postponed by parents (which yields some advantages θ). Let $S_t = 1$ if a child is born in t and zero otherwise. Child 1, if born in $t = 1$ starts earning $C \geq 0$[5] in $t = 2$ while child two if born in $t = 2$ earns $C \geq 0$ from $t = 3$. So the birth order i of the child born to family j and the time period t coincide. Suppose father and mother both work to earn E_M and E_F per period respectively.[6] In case a child is born, each parent needs to spend on child consumption as well. Let α_M, α_F be the proportions father and mother spend on child consumption respectively. Thus adult male (M_t) and female (F_t) incomes are:

$$M_t = (1-S_t)E_M + \alpha_M S_t E_M; F_t = (1-S_t)E_F + \alpha_F S_t E_F$$

Child earning in the year after the birth (X_t) depends on S_t and the quality H_t, $t=1,2$ is given by:

$$X_1 = \delta_1 f(H_1)S_1 C; X_2 = \delta_2 f(H_2)S_2 C$$

where $\delta_1 = \sum_{i=2}^{T} \frac{1}{(1+r)^i}; \delta_2 = \sum_{i=3}^{T} \frac{1}{(1+r)^i}$. The household maximises the net present discounted value (NPV) of expected family earnings (including child earnings):

$$M_1 + \delta M_2 + \delta_M M_3 + F_1 + \delta F_2 + \delta_F F_3 + \delta_1 f(H_1)S_1 C + \delta_2 f(H_2)S_2 C \quad (1)^7$$

where the discount factors are as follows:

form of the utility function. All we require is the assumption that higher child quality leads to higher future benefits in the form of higher future household income.

[5] This assumption accounts for the male-female differences observed in many south Asian societies including India. Very often female job opportunities are rather limited and more importantly the female child leaves parents' household after marriage while the male child when adult earns to look after the retired parents.

[6] This assumption can be simplified by assuming that women earn nothing while rearing children.

$$\delta = \frac{1}{1+r}; \delta_M = \sum_{i=2}^{T_M} \frac{1}{(1+r)^i}; \delta_F = \sum_{i=2}^{T_F} \frac{1}{(1+r)^i}$$

Parents maximise the net present discounted value of expected total earnings (given by equation (1)) subject to the technology of child quality production H_t:

$$H_1 = \mu - \gamma_1 S_2 + \varepsilon_1 \qquad (2)$$

$$H_2 = \mu + \theta - \gamma_2 S_1 + \varepsilon_1 + \varepsilon_2 \qquad (3)$$

where θ is the advantage of delayed child birth (net of any costs of postponing child birth), μ the family endowment (e.g., parental age, health, family reproductive history) and ε_t is the random child-specific endowment (e.g., gender or death of the child at birth), unknown to the parents before the birth of the child). However, parents know ε_2 only when the second child is born.

Suppose the optimum value of the Lagrangian is $L^*[S_1, S_2]$. So

$$\begin{aligned} L^*[S_1,S_2] = {} & M_1 + \delta M_2 + \delta_M M_3 + F_1 + \delta F_2 + \delta_F F_3 + \delta_1 f(H_1) S_1 C + \delta_2 f(H_2) S_2 C \\ & + \lambda_1(\mu - \gamma_1 S_2 + \varepsilon_1 - H_1) + \lambda_2(\mu + \theta - \gamma_2 S_1 + \varepsilon_1 + \varepsilon_2 - H_2) \end{aligned}$$

where λ_1 and λ_1 are the two Lagrange multipliers for the two constraints (2) and (3). Depending on the values of S_t, $t = 1,2$ one can conceive of four different states:

(a) $L^*[0,0]$: No children;

(b) $L^*[1,0]$: A child is born in the first period, but no child in the second period;

(c) $L^*[0,1]$: No child in the first period, but a child is born in the second period;

(d) $L^*[1,1]$: A child is born in each of the first two consecutive periods.

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[7] End of working life of each parent may be different.

For each of these four states, one can compute the value of $[H_1, H_2]$ and the corresponding value of the Lagrangean $L^*[S_1, S_2]$. Thus, this simple framework may rationalise how birth spacing and child survival are optimally correlated in household decision making process.

2.2. Econometric Framework

While we borrow the theoretical model from Makepeace and Pal (2001), the present empirical analysis extends their analysis: the primary difference is that here we jointly determine child survival and birth spacing as correlated hazards. The two variables of interest in our analysis are the number of years the child was alive before dying (*SURV*) and the duration, in years, to the next birth following the birth of a particular child (*NEXT*). While *SURV* is used as an indicator of child health, *NEXT* is an indicator of spacing with the next child. Both these variables are modelled as failure time processes represented by separate log hazard equations – log hazard of mortality and log hazard of subsequent birth.

The analysis is based on an estimation of simultaneous hazard model (see Lillard, 1993).[8] While the methodology is similar the problems are different. Lillard (1993) used the technique of simultaneous hazard models to jointly determine marital dissolution and birth conception hazard. This paper on the other hand uses the

[8] See also Panis and Lillard (1994), Brien and Lillard (1994), Brien, Lillard and Waite (1999) and Gangadharan and Maitra (2001b). These papers have used the framework of simultaneous hazards to examine very different problems.

technique of simultaneous hazards to examine the relationship between child spacing and child survival. The log hazard of the next birth equation for the j^{th} woman, $j = 1, \dots, n$ is:

$$h_j^{\,n}(t) = \beta_0 + \beta_1 T_2(t) + \beta_2 X_1 + \varepsilon$$

and the log hazard of survival equation for the i^{th} , $i = 1,2,\dots,k$, child born to the j^{th} woman is:

$$h_{ij}^{\,s}(t) = \alpha_0 + \alpha_1 T_1(t) + \alpha_2 X_2 + u$$

Here $T_1(t)$ and $T_2(t)$ represent separate "clocks" of duration dependence of the hazards that determine the baseline hazard. X_1 and X_2 are two sets of exogenous and potentially endogenous explanatory variables that affect the hazard of survival and the hazard of the next birth. Finally ε and u are the unobserved heterogeneity components such that

$$\begin{pmatrix} \varepsilon \\ u \end{pmatrix} \sim N\left(\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma_\varepsilon^2 & \sigma_{\varepsilon u} \\ \sigma_{\varepsilon u} & \sigma_u^2 \end{pmatrix}\right), \sigma_{\varepsilon u} = \rho_{\varepsilon u}\sigma_\varepsilon \sigma_u$$

Here $T_1(t)$ and $T_2(t)$ are splines in time since the individual becomes at risk of the event – risk of dying or risk of having a younger sibling. Let us denote the time at which an individual enters the risk of an event by t_0 and we subdivide the duration $t - t_0$ into S discrete periods. Then the baseline log hazard function is defined as a spline or a piecewise linear function and the log hazard of the event will have different slopes over the duration. So the baseline hazard functions can be written as:

$$\alpha_0 + \alpha_1 T_2(t) = \alpha_0 + \sum_{k=1}^{S+1} \alpha_{1k} T_{1k}(t)$$

$$\beta_0 + \beta_1 T_2(t) = \beta_0 + \sum_{k=1}^{S+1} \beta_{1k} T_{2k}(t)$$

In other words, the baseline log hazard is the sum of the effects of the various sources of time dependence within the period of risk for an individual and the resulting log hazard equation is piecewise linear in time since the episode began. Thus the model is very similar to one of proportional hazards with exogenous and endogenous covariates shifting the baseline hazard. .

Both the variables of interest, namely, *NEXT* and *SURV* are censored. If a particular child is alive at the time of the survey then *SURV* is censored and if a particular child is the youngest (or the only) child till the survey date then *NEXT* is censored. Also *SURV* equals the age of the child at the time of the survey if the observation is censored and *NEXT* equals the duration between the birth of the child and the survey date if the observation is censored.

The unobserved heterogeneity (given by ε and u) can be quite important. Some of the unobserved factors (reflected in the error term) refer to child level characteristics while others are mother-specific (i.e., similar across all siblings born to the same parents). An interesting feature of our estimation is that we include parents-specific heterogeneity as an additional regressor. This takes account of the fact that both child survival hazard and the hazard of subsequent birth might be affected by some unobserved common characteristics of the parents, biological and otherwise, (for example, health or genetic endowments of the parents).

We also allow for the possibility that some of the explanatory variables in a hazard equation may be jointly determined and potentially correlated with the residual or heterogeneity component of the log hazard equation. For example, we include the duration of the immediately subsequent birth as an explanatory variable in the child survival hazard. Given the assumption regarding the error structure of the two hazards, the latter may not be unrelated to the unobserved component of the hazard of child survival, i.e., $\rho \neq 0$. However, conditional on the residual heterogeneity components, the observed completed durations and outcomes are independent and thus no further identifying restrictions are formally required. The problem of endogeneity typically arises when the explanatory variable in one of the processes is the outcome of a potentially related process. In such a situation if the heterogeneity terms are correlated, then the estimates are likely to be biased, particularly if this correlation is ignored. Failure to incorporate the endogeneity and the corresponding correlation among the different processes could also result in inconsistent standard errors.

3. DATA

The empirical analysis is based on two data sets: NFHS 1992-93 household-level data and 1991 PIHS household-level data from the Indian and Pakistani Punjab provinces respectively. Since child mortality is more common among younger children, in each case we consider younger male and female children, aged 10 or below. Birth spacing is measured by the age difference between a child and its immediate next sibling (*NEXT*). Naturally, child's birth order is important in any sequential/joint analysis of birth spacing and survival. For example, the question of subsequent birth spacing is not of direct relevance for the only children and also for the youngest ones. Both of these sets of children are censored: in this case the duration to the next birth is equal to the duration between the birth year of the child and the survey date. There is no such problem of missing observations in the estimation of the child survival hazard (*SURV*) which is measured by the survival duration of the children aged 10 or below at the time of the survey in this paper. However even in this case there is a censoring problem: children who are alive at the time of the survey are censored. For these children therefore the age at death is replaced by the age of the child at the time of the survey.

3.1. Characteristics of the Indian sample

There are a total of 2708 women in the Indian sample who have given birth to a total of 8798 children. As we consider children aged 10 or below, this reduces the number of sample children to 4271 of whom 53.7% were boys. Out of a total of 4271 children, 285 (about 7%) died before reaching their 10^{th} birthday and more than half (150 out of 285) were boys. There were only about 1.3% twin births in this sample. Also, about 20% of the children were first born while 48.2% were either youngest or the only child. The average spacing between two successive children was about 3 years while the average age at death was 7 months for the children who died before reaching their tenth birthday. Before we move on to estimate the multivariate hazard functions for birth spacing (*NEXT*) and child survival (*SURV*), we examine the nature of the two Kaplan-Meyer hazard functions. These results for the Indian sample are summarised in Table 1. It follows from this non-parametric analysis that while the spacing hazard increases with time, the survival hazard decreases with time. Given the nature of the two hazards, this is an expected trend.

3.2. Characteristics of the Pakistan Sample

The Pakistan sample consists of 6363 children born to 1566 women residing in the Punjab province of Pakistan. The sample is restricted to children born between 1980 and 1990. Of the 6363 children in the sample, 51.55% were boys. Compared to the Indian sample, a larger proportion (14%) of children died before reaching the tenth birthday of whom about half were boys. Of the 6363 children, 1033 were first born and 319 were last born. The average years of survival for children (*SURV*) who are not alive at the time of the survey is 0.71 years. The average duration to the next birth (*NEXT*) is 2.2 years. As with the Indian sample, For the Pakistani sample also we compute the non-parametric hazard functions. These are presented in Table 2. While both the hazard functions are well behaved, the survival function for *SURV* is non-monotonic.

Tables 3 and 4 present the descriptive statistics on educational attainment for parents in the Indian and Pakistani sample respectively. Educational attainment of the parents (in the sample) is generally higher for the Indian sample, compared to the Pakistani sample. This has some interesting implications for birth spacing and child mortality, which we come back to later.

4. EMPIRICAL ANALYSIS

4.1. Model Specification

Following the analytical arguments of household behaviour in our simple illustrative framework (Section 2), we hypothesise that decisions regarding birth spacing and survival depend on a set of characteristics of the individual child, of its siblings and of its parents, in addition to other household and community characteristics. This helps us to specify the set of explanatory variables, with some variables to identify the two hazard equations *NEXT* and *SURV*.

The two child characteristics that we include are an indicator variable for the sex of the child (*BOY*) and a continuous variable to account for the birth order of the child (*BIRORDR*). Given the bias (perceived and otherwise) against girls in the Indian subcontinent, one could expect to find a higher mortality rates among girls and a greater duration to the subsequent birth following the birth of a son. The literature has argued that the birth order of a child could have a significant effect on child mortality. For example, Behrman (1988) and Birdsall (1991) have argued that since parents' incomes increase over the lifecycle, children born later in life benefit from the increase in the amount of resources available to the parents. Therefore the hazard of child mortality is likely to be higher for children born earlier in the order.

Since one of the central issues that we examine in this paper is the effect of sibling rivalry on child mortality and the duration to next birth, we include a number of sibling characteristics. We include slightly different variables in the two hazards to facilitate identification of the two equations: we include the proportion of older siblings at birth that are females (*POLDF*) in the spacing equation and the number of older sister (*NOLDF*) at the birth of the child in the survival equation. We also include an interaction between the sex of the child and number of older sisters at birth $(IBOYOLDF = BOY \times NOLDF)$ in the survival equation. We expect *POLDF* to increase the hazard of a subsequent birth and we also expect both *NOLDF* and *IBOYOLDF* to increase the hazard of survival. All of these variables measure the sibling composition effect.[9]

Parental characteristics are important in determining decisions on the duration between successive births and also allocating resources because they are the primary decision makers. Hence we include a range of characteristics pertaining to each parent, namely, three age splines ($AGEM1$, $AGEM2$, $AGEM3$ for the mother and $AGEF1$, $AGEF2$, $AGEF3$ for the father) depending on the age distribution in each

[9] The relationship between sibling composition and child quality is not very clear. Using data from Ghana, Garg and Morduch (1998) find that having more sisters at birth results in improved child health, particularly for boys, given the pre-male bias among parents. Butcher and Case (1994) on the other hand argue that if investment in male children have higher returns compared to investment in female children, female children who grow up with brothers receive more resources compared to those without brothers because parents are generally averse to earnings inequality among children.

sample.[10] The age splines account for the possible non-linearity in the parental age effect on child spacing and child survival. We also include dummies to indicate whether mother and father are literate (*LITMOTH* and *LITFATH*)[11] and the highest level of education attained by the mother (primary school, middle school, high school and beyond). For the Indian data-set, there is no information on household income/expenditure. We therefore included a variable *PCASSET*, which is a composite asset index, as a proxy. In the Pakistan data set we also include the log of household expenditure as an additional explanatory variable. For the Indian data we include two religion dummies (*HINDU* and *SIKH* where the omitted category refers to minorities like Muslim, Buddhist and Christians). In the Pakistani sample, however, there were no non-Muslim households. The identifying variables in each equation refer to variables more pertinent to the particular decision. For example, in the spacing hazard, we include information relating to whether the woman has ever used contraception (*EVERUSE*), if they had any reproductive problems (*REPPROB*). Similarly in the survival hazard we include if the couple had prenatal check-ups (*PRENAT*), if the child was vaccinated at birth (*VACCN*, only for the Indian sample) and if the child was born in a hospital (*WHERBRTH*, only for the Pakistani sample). In the absence of information on the supply side factors affecting these decisions at the time of birth (since the data set is not retrospective in nature), we include a rural dummy to denote the rural residential location and examine the rural-urban dichotomy

[10] For the Pakistan sample, the nodes for the age splines for the mother are at ages 22 and 30. For the father, the nodes are at 27 and 36. The corresponding nodes for the Indian sample are 20, 22 years for the mother and 24, 28 years for the father.

[11] *LITMOTH* = 1 if mother can read and write. *LITFATH* = 1 if the father can read and write.

in the provision of public services in many low-income countries.[12] Finally we include the variable *NEXT* (spacing between the current child and its subsequent sibling) in the survival equation since the survival hazard also depends on birth spacing.[13]

As argued in Section 2, the baseline hazards are specified as splines. The two baseline hazards $T_1(t)$ and $T_2(t)$ measure the duration dependence for survival and for subsequent birth. These essentially measure the time varying risk of child mortality and subsequent childbirth from the time the child is at risk of the event. The time dependency starts once the child is born. Several specifications of the baseline hazard were tried and we finally chose the one that fitted the data best.

While we have attempted to retain comparable variables for the two sets of regressions, there are some differences owing primarily to data availability. For example, per capita household expenditure is not available in the NFHS data but is present in the PIHS data. There is no information on whether the child was vaccinated at birth in the PIHS data and hence we had to exclude *VACCN* from the Pakistani survival equation. In addition, we did not have any information of the woman's reproductive problems (*REPPROB*) in the Pakistani case. On the other hand, the

[12] In principle we should also include community characteristics like availability of health facilities, including health centres, availability of doctors and the availability of nurses. However since the datasets are not retrospective including these community characteristics could result in endogeneity problems. For example, health centres could have been built in a particular region in response to historically high child mortality rates. See Rosenzweig and Wolpin (1986) for more on this issue.

[13] In principle both child survival and the duration to subsequent birth should depend on the duration between a particular child and the immediately elder sibling (*PREV*). However *PREV* is not defined for the children that are "first-born". Therefore we re-estimate the model restricting the sample to the non first-born children and including *PREV* as one of the explanatory variables. The results are generally similar to the complete sample case. These results are not presented because of space constraints but are available on request.

Indian NFHS data do not include any information on where the child was born; consequently *WHERBRTH* variable is not included in the Indian survival equation. There are other differences too and that really depended on the characteristics of the sample rather than the data availability. For example, the age splines of each parent are different in the Indian and the Pakistani sample, depending on the quartile distribution of age. Similarly, we use more disaggregated categories of mother's education in the Pakistani sample, but not in the Indian one, because it was the source of co-linearity and was causing problems for the likelihood function to converge. Simultaneous hazard results as presented in Tables 5 and 6 for India and Pakistan respectively reflect these differences in model specification for the two samples (definitions of variables are given in the Appendix).

4.2. Results

For each country, we jointly estimate the two hazards for all children taken together. For each case, we estimated two sets of results (i) individual hazard estimates of spacing and survival such that the correlation coefficient ρ is zero. (ii) Joint hazard estimates of spacing and survival where correlation coefficient ρ is not restricted. For each case (i) or (ii), we tried two specifications with and without the spacing variable *NEXT* in the survival equation. These results are presented in Table 5 for India and Table 6 for Pakistan. However, results (ii) from both samples suggest that ρ is positive and significant; hence we only discuss the results obtained from the joint hazard model with non-zero correlation. In particular, we consider the correlated hazard results with *NEXT* in the survival equation because this comprises the complete model. The unobserved household-level heterogeneity is always significant and ignoring this would therefore lead to biased and inconsistent estimates.

4.2.1. Results for India

Child Spacing: Considering the duration splines, the hazard of spacing increases in the first three years of a child's life, but it decreases thereafter. Spacing hazard depends on parental characteristics such that it falls when the mother is below age 22 years and the father is below age 24 years. It also falls if the mother had any reproductive problems. After controlling for various sibling characteristics, the proportion of older girls at birth reduces the spacing hazard. This is an interesting result and perhaps indicates the parental aversion to having additional girls, given that they have more daughters at a given point of time. One could regard this to be an indirect support of the son-preference hypothesis. Rural location is significant and the hazard is higher for the households living in rural areas, perhaps signifying the limited supply of publicly provided contraception, or limited knowledge of contraception and/or prejudice against using modern contraception. However, parental education, contraception use or household resource (measured by the composite asset index) is not significant in explaining the birth spacing decisions.

Survival: The mortality hazard falls between age 0 to 1 years than between age 1-5 years and the duration spline is not significant thereafter. The coefficient of the variable *NEXT* is negative and significant indicating that the greater the duration between successive births, the greater is the hazard of child survival (i.e., the child is less likely to die). This may also account for competition among younger siblings for parental time, care and resources which we label as the sibling competition effect. There are other evidence too supporting the sibling composition effect. For example, a male child has a higher hazard of mortality while the interaction term between *BOY* and *NOLDF* (*IBOYOLDF*) is negative and significant. The latter suggests that the hazard is lower if a male child has more elder sisters at birth (a result similar to that obtained by Garg and Morduch, 1998). Among various parental and household characteristics, the composite asset indicator *PCASSET* is negative and significant, thus suggesting that children from more wealthy families have lower mortality hazard. Taken together, results from the Indian sample suggest evidence in favour of competition for limited household resources, resulting in inequality in the distribution of resources among siblings and thus higher survival rates of some siblings relative to others.

4.2.2. Results for Pakistan

Spacing: The hazard of subsequent birth is high in the first five years following the birth of a child, particularly in the first two years following the birth of a child. However, five years after the birth of a child, the hazard of subsequent birth declines (the coefficient is negative and significant). Surprisingly the sex of the child does not have a significant effect on the hazard of subsequent birth, though the proportion of older siblings that are girls (*POLDF*) have a significant and negative effect on the hazard of subsequent birth. This is a somewhat surprising result as it essentially implies that the greater the proportion of elder sisters, the greater is the duration to the next birth following the birth of a child. One could argue that given the pro-male bias among parents in this part of the world, risk aversion dictates that parents delay the conception of the next child, as they already have the targeted number of daughters. Several of the parental and household characteristics have a significant effect on the hazard of subsequent birth. In particular the duration to the subsequent child is significantly lower if the mother is is more than thirty years at the time of birth of a particular child. On the other hand, father's age in the category 27 – 36 years at the time of birth of a particular child reduces the duration to subsequent birth. Interestingly neither mother's education nor father's education has a significant effect on the hazard of subsequent birth. Only *LITFATH* has a significant effect on the hazard of subsequent birth, but even this effect is quite weak (significant only at 10% level of significance).

Survival: Turning to the child survival estimates, we find that the hazard of child mortality is significantly lower in the first five years following the birth of the child. The hazard of child mortality is higher for a boy and is higher the higher the number of elder sisters at birth. Interestingly however, the interaction terms *IBOYOLDF* reduces the hazard of child mortality, as does the duration between successive children. All three age splines of the mother are negative and significant. The hazard of child mortality is higher for children with literate mothers and children whose mothers have primary schooling. We discuss this issue in greater detail below. Unlike the Indian sample, the hazard of mortality is significantly lower for children with literate fathers. Pre-natal care has a significant and positive effect on the hazard of child mortality.

4.2.3. A Comparison

A comparison of the estimates for the Indian and the Pakistan samples presents some interesting similarities and differences. Let us first examine the duration between consecutive births. The following results are worth noting:

1. Neither for the Indian nor for the Pakistan sample is *BOY* significant. This implies that the gender of the current child does not have a significant effect on the duration to subsequent birth. Thus this result does not offer any direct evidence in favour of son preference in birth spacing.

2. For both the Indian and the Pakistan sample, *PROPF* is negative and significant, implying that the higher the proportion of elder sisters, the lower is the hazard of subsequent birth and hence the higher is the duration between births. This may be an indirect evidence of son preference or aversion to have further girls given that they already have more than targeted number of girls.

3. For the complete model (model including *NEXT*1 and accounting for correlation between the heterogeneity terms) mother's education does not have any effect on the duration to the subsequent child. This result holds for both the Indian and the Pakistan sample. For the Pakistan sample however, *FATHLIT* is weakly significant, though the sign is the opposite of what we would expect. In contrast to much of the established wisdom, this turns out to be a significant result.

4. Considering the results for non-zero correlation in the two hazards, both resource constraint variables *LNHHEXP* and *PCASSET* are significant for Pakistan, but not for India. This perhaps signifies the effective role of the state in birth spacing, by subsidising the use of modern contraception.

Let us now turn to the child mortality hazard estimates:

1. The composite asset index *PCASSET* has a significant and negative effect on the child survival hazard in the Indian sample but not for the Pakistan sample. One could argue that the non-significance of the composite asset index for the Pakistan sample is because of the inclusion of the additional household expenditure variable for Pakistan. We therefore re-ran the regressions by excluding the *LNHHEXP* variable. The results however remain unaffected.

2. The hazard of mortality is significantly higher for a male child – the estimated coefficient for *BOY* is positive and significant. The effect is significantly stronger for the Pakistan sample, compared to the Indian sample.

3. For the Pakistan sample, *NOLDF* is positive and significant, but not for the Indian sample. However, for both the Indian and the Pakistani samples, the interaction term *IBOYOLDF* is negative and significant. This provides some indirect evidence of son preference in child survival.

4. Birth spacing (measured by *NEXT*1) has a significant effect on child survival for both the Indian and the Pakistan sample.

5. For both the Indian and the Pakistan samples, children of higher birth order (children born later) have a higher hazard of mortality.

Taken together, results (2), (3), (4) and (5) can be thought as reflecting competition among siblings for available parental care and resources, thus resulting in some inequality among siblings so far as survival is concerned. In particular, our results suggest that younger children and closely spaced children are at a disadvantage while boys with older sisters are at an advantage.

6. Mother's education has a significant (though not favourable) effect on the child mortality hazard in Pakistan (but not in India) while father's education has a more significant and favourable impact. Likewise the child survival hazard is positively and significantly affected by the literacy status of the father in the Pakistan sample, while the effect is not significant among the Indian children.

This is an important result from the estimation of simultaneous hazard models. As indicated in Tables 3 and 4, in general women's educational levels are relatively low in Pakistan; this in turn may suggest that a marginal increase in educational attainment has a significantly higher impact on child survival in Pakistan relative to that in India. Also noteworthy is the significance of mother's age in child spacing and child survival in both India and Pakistan. To some extent, mother's age may proxy for the mother's experience and education and there is a significant correlation between mother's age and education in India. In particular the Indian results suggest that children born to older mothers are likely to have a greater duration between successive births, which in turn lowers the survival hazard. In other words, there is some indirect evidence of favourable impact of mother's education on child survival even in India. However, father's age or education does not seem to have a significant impact on Indian children. In Pakistani case, however, father's age and education have more favourable impact on child spacing and child survival relative to those of mothers.[14] This difference in the role of paternal and maternal education on child

[14] Previous literature does not find any consistent association between women's literacy and fertility. The results vary according to the sample used and the survey region. Generally women's education has a negative effect on completed family size in rural samples but there is no such effect in urban samples. See Sathar (1984).

survival in the two adjacent states separated by partition may indicate the cultural practices attributed to differences in religious institutions.

5. CONCLUSION

Most evidence on child survival in low-income countries comes from estimation of child health, child survival or child mortality functions. However, child health is closely related to household decisions in birth spacing, especially if households are resource constrained. In this context, this paper determines child survival and birth spacing as a correlated process and attempts to re-examine the results relating to sibling composition, parental education and household resource constraint in explaining child survival in low-income countries.

Results obtained from the analysis of households in the Indian and Pakistani Punjab provinces suggest some similarities as well as differences in the role of these variables in the two provinces. These also highlight the differences in the role of the state and the religion in these two neighbouring countries. First, the duration between children has a negative and significant effect on child mortality. Our results imply that the greater the duration between successive children, the lower is sibling competition for limited resources and the lower is the likelihood the child dies. There is some indirect evidence of son preference and significant and rather similar evidence of inequality among siblings in both the samples. The hazard of child mortality is lower if the spacing with the subsequent child is longer, if the child is male and has more elder sisters. In addition, the hazard of birth spacing is lower if there are more girls in the family at the time of birth of the current child, thus suggesting some aversion to the likelihood of having further girls when parents already have more girls. We interpret these results as reflecting competition for limited household resources in societies characterised by borrowing constraints and son preference. Second, the results for household resources are interesting. For the Indian sample, household resource does not have a significant effect on the duration to the subsequent child. Household resources however significantly increase the hazard of the child surviving (by increasing the number of days the child is alive). The results are however quite different for the Pakistan sample. The hazard of subsequent birth is lower for women belonging to richer households, but household resources do not have a significant effect on the hazard of child survival. This difference in results relating to the household resources can partly be explained by differences in the role of the state in the two countries. Finally, Maternal education seems to have a weak and unfavourable impact on child survival while the effect of paternal education is more favourable, though the significance level is low among the Pakistani households. Among the Indian households neither the father's age nor education is significant but maternal age tends to have a favourable effect on child spacing and thus some indirect evidence in favour of child survival. In other words, there are interesting differences in the relative role of father and mother in the Indian and Pakistani Punjab, perhaps signifying the cultural practices in these two states, partly attributed to the religious differences.

In terms of policy implications, our results suggest the importance of family planning measures to affect birth spacing and sibling composition and public health measures to affect hospital delivery as well as vaccination at birth. Other measures may include policies to improve relative returns and employment prospects of girls in these countries. However, the success of these measures would, to a large extent, depend on the nature of the state and also the religion that has been emphasized by the differences in the results from India and Pakistan.

Table 1: Nonparametric Description of the Duration Data, All Children, Indian Punjab

	Birth spacing NEXT		Child Survival SURV	
Time	**Hazard rate**	**Survival rate**	**Hazard rate**	**Survival rate**
0	0.0655	1.0000	0.0552	1.0000
1	0.1116	0.9366	0.0092	0.9463
2	0.1124	0.8376	0.0031	0.9376
3	0.0941	0.7485	0.0031	0.9347
4	0.0848	0.6812	0.0008	0.9318
5	0.2301	0.6258	0.0018	0.9311
6	0.2429	0.4967	0.0011	0.9294
7	0.2487	0.3891	0.0007	0.9284
8	0.3870	0.3030	0.0010	0.9277
9	1.9704	0.2048	0.0000	0.9268

Table 2: Nonparametric Description of the Duration Data, All Children, Pakistani Punjab

	Birth Spacing NEXT		Child Survival SURV	
Time	**Hazard Rate**	**Survival Rate**	**Hazard Rate**	**Survival Rate**
0	0.0000	1.0000	0.0067	1.0000
1	0.0000	1.0000	0.045	0.9927
2	0.0009	1.0000	0.107	0.9447
3	0.0159	0.9991	0.1377	0.8397
4	0.068	0.9833	0.1764	0.7214
5	0.0468	0.9187	0.1875	0.5938
6	0.1805	0.8767	0.2405	0.4828
7	0.189	0.7315	0.291	0.37
8	0.1527	0.6052	0.412	0.2679
9	1.8843	0.5193	1.8162	0.1689

Table 3: Selected Descriptive Statistics on Educational Attainment of Parents, Indian Punjab

VARIABLE	N	Mean	Std Dev
LITFATH	2708	0.64	0.48
LITMOTH	2708	0.02	0.16
EDUCM1	2708	0.178	0.38
EDUCM2	2708	0.08	0.28
EDUCM3	2708	0.136	0.34
EDUCM4	2708	0.04	0.19

Note: LITFATH: 1 if the father is literate; LITMOTH: 1 if mother can read and write. EDUCM1: 1 if mother has primary schooling; EDUCM2: 1 if mother has middle schooling; EDUCM3: 1 if the mother has gone to high schools; EDUCM4: 1 if the mother has some university education.

Table 4: Selected Descriptive Statistics on Educational Attainment of Parents, Pakistani Punjab

VARIABLE	N	Mean	Std Dev
LITFATH	1566	0.4867079	0.4998619
LITMOTH	1566	0.1644513	0.3707133
EDUCM1	1566	0.1204019	0.325456
EDUCM2	1566	0.0697063	0.2546711
EDUCM3	1566	0.0171561	0.1298629

Note: LITFATH: 1 if the father is literate; LITMOTH: 1 if mother can read and write. EDUCM1: 1 if mother has primary schooling; EDUCM2: 1 if mother has middle schooling; EDUCM3: 1 if the mother has gone to high schools.

Table 5: Simultaneous Hazard Estimates, All Children, India

	$\rho = 0^{*}$	$\rho_{\neq 0}{}^{*}$	$\rho = 0^{**}$	$\rho_{\neq 0}{}^{**}$
	Duration to Next Birth			
CONS_1	-6.4053 ***	-5.3136 ***	-6.4053 ***	-5.3136 ***
	(1.4134)	(1.0885)	(1.4134)	(1.0828)
HINDU	-0.5147 **	0.2406 **	-0.5147 **	0.2406 **
	(0.2511)	(0.0937)	(0.2511)	(0.0939)
SIKH	-0.5726 **	-0.3105	-0.5726 **	-0.3105
	(0.2457)	(0.2042)	(0.2457)	(0.2032)
PCASSET	-0.3508 ***	-0.3195	-0.3508 ***	-0.3195
	(0.0656)	(0.2022)	(0.0656)	(0.2011)
AGEM1	0.0157	-0.2491 ***	0.0157	-0.2491 ***
	(0.0552)	(0.0529)	(0.0552)	(0.0529)
AGEM2	0.1405 **	0.0358	0.1405 **	0.0358
	(0.0707)	(0.0423)	(0.0707)	(0.0425)
AGEM3	-0.1085 ***	0.0761	-0.1085 ***	0.0761
	(0.0351)	(0.0561)	(0.0351)	(0.0558)
AGEF1	-0.0263	-0.0821 ***	-0.0263	-0.0821 ***
	(0.0409)	(0.0276)	(0.0409)	(0.0275)
AGEF2	0.0499	-0.0211	0.0499	-0.0211
	(0.036)	(0.0319)	(0.036)	(0.0316)
AGEF3	-0.023	0.0251	-0.023	0.0251
	(0.017)	(0.0291)	(0.017)	(0.029)
LITFATH	-0.0222	-0.0179	-0.0222	-0.0179
	(0.1185)	(0.0149)	(0.1185)	(0.0143)
LITPRIMW	0.202	-0.0474	0.202	-0.0474
	(0.1355)	(0.0945)	(0.1355)	(0.0944)
HIEDW	-0.0894	0.1381	-0.0894	0.1381
	(0.1599)	(0.1072)	(0.1599)	(0.1074)
BOY	-0.6756 ***	-0.0626	-0.6756 ***	-0.0626
	(0.0893)	(0.1251)	(0.0893)	(0.1255)
POLDF	-0.4798 ***	-0.5282 ***	-0.4798 ***	-0.5282 ***
	(0.1196)	(0.0778)	(0.1196)	(0.0778)
REPPROB	-0.1054	-0.3769 ***	-0.1054	-0.3769 ***
	(0.118)	(0.0989)	(0.118)	(0.0986)
EVERUSE	0.1641	-0.0466	0.1641	-0.0466
	(0.1095)	(0.0954)	(0.1095)	(0.0954)
RURAL	0.2991 **	0.1594 *	0.2991 **	0.1594 *
	(0.1181)	(0.0878)	(0.1181)	(0.0879)
Duration 0-3 years	2.3840 ***	1.7270 ***	0.3840 ***	0.7270 ***
	(0.1189)	(0.1098)	(0.1189)	(0.11)
Duration 3-5 years	-0.2767 ***	-0.5968 ***	-0.2767 ***	-0.5968 ***
	(0.0844)	(0.1046)	(0.0844)	(0.1047)
Duration above 5	-0.3470 ***	-0.2924 ***	-0.3470 ***	-0.2924 ***

	(0.069)	(0.0697)	(0.069)	(0.0696)
ln-L	-5410.14		-5410.14	
		Child Survival		
CONS_1	-1.5457	-1.4652	-1.2491	-1.2628
	(1.6623)	(246.4126)	(1.6292)	(79.461)
HINDU	0.0662	0.0562	0.1317	0.1205
	(0.3894)	(0.3947)	(0.3834)	(0.3835)
SIKH	-0.2048	-0.2177	-0.1423	-0.1537
	(0.3834)	(0.3892)	(0.3778)	(0.3783)
PCASSET	-0.3848 ***	-0.3860 ***	-0.3314 ***	-0.3226 ***
	(0.0959)	(0.0972)	(0.0938)	(0.0942)
AGEM1	-0.0144	-0.0179	0.0022	0.0053
	(0.0767)	(0.0778)	(0.0749)	(0.0755)
AGEM2	0.1919 *	0.1958 *	0.1798 *	0.1765 *
	(0.1069)	(0.1086)	(0.1049)	(0.106)
AGEM3	-0.0344	-0.0361	-0.0183	-0.0146
	(0.0554)	(0.0566)	(0.0554)	(0.0561)
AGEF1	-0.0403	-0.0403	-0.0404	-0.0411
	(0.0518)	(0.0541)	(0.0501)	(0.0508)
AGEF2	-0.0229	-0.0223	-0.0239	-0.0248
	(0.0527)	(0.0546)	(0.0522)	(0.0534)
AGEF3	-0.0224	-0.0236	-0.0211	-0.0213
	(0.0235)	(0.0286)	(0.0236)	(0.0271)
LITFATH	0.0173	0.0164	0.0521	0.0496
	(0.1687)	(0.1716)	(0.164)	(0.1657)
LITPRIMW	0.1668	0.1717	0.1617	0.1504
	(0.2151)	(0.2227)	(0.2089)	(0.2147)
HIEDW	-0.0509	-0.0594	-0.0109	-0.0248
	(0.2538)	(0.2576)	(0.2478)	(0.2522)
BOY	0.2563	0.2613	0.2751 *	0.2843 *
	(0.1618)	(0.1672)	(0.1619)	(0.1685)
NOLDF	-0.0007	0.0066	-0.0989	-0.096
	(0.1123)	(0.1144)	(0.1094)	(0.1108)
IBOYOLDF	-0.4264 ***	-0.4294 ***	-0.3262 **	-0.3339 **
	(0.1578)	(0.1599)	(0.1552)	(0.1574)
BIRORDER	0.0354	0.0314	0.1588 ***	0.1603 ***
	(0.0593)	(0.0614)	(0.0599)	(0.0607)
NEXT			-0.2739 ***	-0.2738 ***
			(0.035)	(0.0354)
PRENAT	0.9742 ***	0.9782 ***	0.6114 ***	0.6074 ***
	(0.159)	(0.1607)	(0.1633)	(0.1642)
VACCN	-1.6405 ***	-1.6585 ***	-1.5895 ***	-1.5799 ***
	(0.2651)	(0.2669)	(0.2652)	(0.2665)
RURAL	0.3083 *	0.3019 *	0.2215	0.2152
	(0.1788)	(0.1811)	(0.1782)	(0.1799)

Duration 0-1 years	-2.4841 ***	-2.4816 ***	-2.3969 ***	-2.4023 ***
	(0.331)	(0.3345)	(0.3332)	(0.3393)
Duration 1-5 years	-0.5750 ***	-0.5806 ***	-0.5828 ***	-0.5809 ***
	(0.1316)	(0.1331)	(0.1315)	(0.1337)
Duration above 5	-0.0214	-0.0212	-0.0229	-0.018
	(0.269)	(0.2712)	(0.2699)	(0.2719)
ln-L	-1184.23	-6605.14	-1152.53	-6573.56
Heterogeneity and correlation terms				
σ_ε	2.0782 ***	1.2725 ***	2.0782 ***	1.2725 ***
	0.1273	0.1585	0.1273	0.159
σ_u	0.8482 ***	0.8488**	0.6995 ***	0.6775 ***
	0.1637	0.2119	0.1816	0.2139
$\rho_{\varepsilon u}$		0.8401**		0.686***
		0.378		0.0933
NOBS	4271	4271	4271	4271

Notes:

*: With *NEXT* in the survival equation

**: Without *NEXT* in the survival equation

Asymptotic standard errors in parentheses;

Significance: '*'=10%; '**'=5%; '***'=1%.

Table 6: Pakistan Sample: All Children

	$\rho = 0^*$	$\rho \neq 0^*$	$\rho = 0^*$	$\rho \neq 0^*$
	Duration to Next Birth			
Duration 0 – 2	2.2742 ***	2.2761 ***	2.2742 ***	2.2772 ***
	(0.0373)	(0.0379)	(0.0373)	(0.038)
Duration 2 – 5	0.2328 ***	0.2246 ***	0.2328 ***	0.2291 ***
	(0.0231)	(0.0232)	(0.0231)	(0.0233)
Duration 5 +	-0.2540 ***	-0.2422 ***	-0.2540 ***	-0.2430 ***
	(0.0312)	(0.0312)	(0.0312)	(0.0313)
CONSTANT	-2.1958 ***	-2.2316 ***	-2.1958 ***	-2.1619 ***
	(0.4051)	(0.407)	(0.4051)	(0.4114)
BOY	-0.0409	-0.0336	-0.0409	-0.031
	(0.0268)	(0.0269)	(0.0268)	(0.027)
POLDF	-0.1187 **	-0.1295 ***	-0.1187 **	-0.1283 ***
	(0.0489)	(0.0488)	(0.0489)	(0.0491)
AGEM1	-0.0159	-0.0181	-0.0159	-0.0189
	(0.0138)	(0.0136)	(0.0138)	(0.0138)
AGEM2	0.0084	0.0043	0.0084	0.0072
	(0.008)	(0.0079)	(0.008)	(0.008)
AGEM3	0.0291 ***	0.0358 ***	0.0291 ***	0.0317 ***
	(0.0074)	(0.0073)	(0.0074)	(0.0074)
AGEF1	-0.0184 *	-0.013	-0.0184 *	-0.0149
	(0.0106)	(0.0104)	(0.0106)	(0.0107)
AGEF2	-0.0366 ***	-0.0337 ***	-0.0366 ***	-0.0358 ***
	(0.0074)	(0.0072)	(0.0074)	(0.0074)
AGEF3	0.0026	0.0029	0.0026	0.0034
	(0.0049)	(0.0048)	(0.0049)	(0.0049)
MOTHLIT	-0.1925 **	-0.0791	-0.1925 **	-0.1136
	(0.0842)	(0.083)	(0.0842)	(0.0832)
EDUCM1	0.0143	-0.0896	0.0143	-0.0521
	(0.0739)	(0.0725)	(0.0739)	(0.0728)
EDUCM2	0.0476	-0.0254	0.0476	-0.0024
	(0.112)	(0.1106)	(0.112)	(0.1113)
EDUCM3	0.2183	0.0895	0.2183	0.1443
	(0.1565)	(0.1564)	(0.1565)	(0.1567)
FATHLIT	0.072	0.0759	0.072	0.0826 *
	(0.0504)	(0.0494)	(0.0504)	(0.0502)
RURAL	0.0146	0.039	0.0146	0.0258
	(0.0523)	(0.0516)	(0.0523)	(0.0524)
LNHHEXP	-0.1562 ***	-0.1706 ***	-0.1562 ***	-0.1687 ***
	(0.0374)	(0.0376)	(0.0374)	(0.038)
PCASSET	-0.0541 *	-0.0598 *	-0.0541 *	-0.0535 *
	(0.0311)	(0.0306)	(0.0311)	(0.0311)
EVERUSE	0.0858 *	0.0879 *	0.0858 *	0.0794
	(0.0515)	(0.0505)	(0.0515)	(0.0513)

	Child Survival			
Duration 0 – 1	-2.3668 ***	-2.3741 ***	-2.3399 ***	-2.3815 ***
	(0.2498)	(0.2589)	(0.2586)	(0.2531)
Duration 1 – 2	-0.5607 **	-0.5154 *	-0.5240 **	-0.5072 *
	(0.2536)	(0.266)	(0.2601)	(0.2603)
Duration 2 – 5	-0.5501 ***	-0.5584 ***	-0.5454 ***	-0.5506 ***
	(0.0952)	(0.1002)	(0.0975)	(0.0993)
Duration 5 +	0.0288	0.0178	0.001	0.0013
	(0.1038)	(0.1065)	(0.1046)	(0.1086)
CONSTANT	-1.0871	0.1272	0.5314	1.2753
	(1.0414)	(0.8258)	(0.8038)	(0.8394)
BOY	0.1766 *	0.3545 ***	0.3072 ***	0.3108 ***
	(0.099)	(0.1004)	(0.0969)	(0.0998)
NEXT			-0.5782 ***	-0.4698 ***
			(0.0243)	(0.0267)
NOLDF	0.1578 ***	0.1758 ***	0.1503 ***	0.2212 ***
	(0.0376)	(0.0436)	(0.0419)	(0.0454)
IBOYOLDF	-0.0652 *	-0.1646 ***	-0.1261 ***	-0.1443 ***
	(0.0366)	(0.0413)	(0.0367)	(0.039)
AGEM1	-0.1500 ***	-0.1879 ***	-0.1326 ***	-0.1595 ***
	(0.0322)	(0.0328)	(0.0312)	(0.0355)
AGEM2	-0.0621 ***	-0.0495 **	-0.0701 ***	-0.0619 ***
	(0.0193)	(0.0213)	(0.0204)	(0.0211)
AGEM3	0.0423 ***	0.0016	-0.0458 ***	-0.0810 ***
	(0.0159)	(0.0196)	(0.0175)	(0.0189)
AGEF1	0.0106	0.0234	0.0107	-0.0001
	(0.023)	(0.0248)	(0.0209)	(0.0278)
AGEF2	-0.0443 ***	-0.0423 **	-0.0602 ***	-0.0600 ***
	(0.0159)	(0.0174)	(0.0167)	(0.0179)
AGEF3	0.0071	0.0142	0.0277 **	0.0327 ***
	(0.0114)	(0.0123)	(0.0113)	(0.0114)
BIRORDR	0.1035 ***	0.1093 ***	0.2049 ***	0.1452 ***
	(0.0268)	(0.0308)	(0.0323)	(0.0323)
LITMOTH	0.3588 *	0.1655	0.6242 ***	0.4415 **
	(0.188)	(0.2254)	(0.2295)	(0.2228)
EDUCM1	0.0691	0.3561 *	0.4228 **	0.5564 ***
	(0.159)	(0.1957)	(0.1869)	(0.1777)
EDUCM2	-0.4480 *	0.017	-0.1645	0.0275
	(0.2422)	(0.2971)	(0.2873)	(0.2931)
EDUCM3	-1.7314 **	-0.6676	-0.8861	-0.542
	(0.7909)	(0.5418)	(0.5574)	(0.4892)
LITFATH	-0.3409 ***	-0.2957 ***	-0.5762 ***	-0.3062 ***
	(0.0878)	(0.1031)	(0.1000)	(0.103)
RURAL	0.1724	0.4832 ***	0.4628 ***	0.5637 ***

	(0.1053)	(0.117)	(0.1149)	(0.1286)
LNHHEXP	0.0128	-0.0642	0.0101	-0.0995
	(0.0678)	(0.0722)	(0.0687)	(0.0723)
PCASSET	-0.014	-0.0659	0.0217	0.0536
	(0.0588)	(0.0695)	(0.0662)	(0.074)
PRENAT1	0.1959 *	0.2678 **	0.4569 ***	0.4334 ***
	(0.1055)	(0.1151)	(0.1127)	(0.1193)
WHERBRTH	0.0299	-0.01	0.0278	0.041
	(0.1348)	(0.138)	(0.1347)	(0.1373)
Heterogeneity and Correlation Terms				
σ_{ε}	1.0524 ***	1.0457 ***	1.0524 ***	1.0496 ***
	(0.0203)	(0.0206)	(0.0203)	(0.0206)
σ_{u}	3.6626 ***	2.2432 ***	2.1211 ***	1.9906 ***
	(0.9182)	(0.0962)	(0.0765)	(0.0739)
$\rho_{\varepsilon u}$		0.2894 ***		0.1689 ***
		(0.0188)		(0.0258)
Log Likelihood		-11609.4		-11566.7

Notes:

*: With *NEXT* in the survival equation

**: Without *NEXT* in the survival equation

Asymptotic standard errors in parentheses;

Significance: '*'=10%; '**'=5%; '***'=1%.

APPENDIX

Definition of regression variables

HINDU: 1 if comes from Hindu family (India only)
SIKH: 1 if comes from Sikh family (India only)
PCASSET: composite indicator of household assets
AGEMUM1, AGEMUM2, AGEMUM3: age splines of the mother at the birth of the first child
AGEDAD1, AGEDAD2, AGEDAD3 : age splines of the father at the birth of the first child
LITMOTH: 1 if the mother can read/write
LITFATH: 1 if the father can read and write
LITPRIMW: if the mother is literate and/or has primary education (India only)
HIEDW: 1 if the mother has middle and higher schooling (school grade 6-11 and higher) (India only)
EDUCM1: if the mother has primary education (Pakistan only)
EDUCM2: if the mother has middle education (Pakistan only)
EDUCM3 : if the mother has higher schooling (Pakistan only)
BOY: 1 if the current child is male
BIRORDER: birth-order of the child
NOLDF: number of older sisters at the birth of the child
IBOYOLDF: an interaction between BOY and OLDF
POLDF: NOLDF/(BIRORDER-1) if BIRORDER>1 and is zero if BIRORDER=1
NEXT: time to the birth of the next sibling
REPPROB: 1 if the mother had any reproductive problems including still birth or delivery complications (India only)
EVERUSE: 1 if the couple had ever used contraception (Pakistan only)
VACCN: 1 if the child has been vaccinated after birth (India only)
PRENAT: 1 if had antenatal check-up before the birth of the baby (Pakistan only)
RURAL: 1 if comes from rural area
WHERBRTH: 1 if the child is delivered in a hospital (Pakistan only)

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