The Role of Childhood Mortality in Fertility Transition in a Rural Sahelian District of Northern Ghana

Fred Binka, Ayaga Agula Bawah, Mian Bazle Hossain

A widely accepted hypothesis holds that mortality decline induces reproductive change. In Asia, however, childhood mortality covaries with fertility in ways that suggest volitional replacement of children is a consequence rather than a cause of demographic transition. Whether this relationship occurs in African settings where fertility regulation is dominated by child spacing rather than limitation remains unknown. This paper assesses the child replacement hypothesis with longitudinal birth and deaths data occurring to children of 43,000 women observed in the Navrongo Demographic Surveillance System over the July 1993 to June 2003 period. Cox regression is employed to assess the effect of child mortality on odds of parity progression, controlling for maternal characteristics. Results show that the death of a child has no effect on the odds of subsequent parity progression. The Navrongo experiment has no effect on replacement. Results are contrasted with an analysis from Bangladesh evincing a pronounced replacement effect.

Introduction

A widely accepted, but seldom tested, hypothesis holds that high fertility in high mortality settings is influenced by the tendency of couples to replace children who have died. This paper examines the hypothesis that the this relationship holds in a Sahelian setting of northern Ghana where longitudinal data on fertility and mortality have been compiled for a decade of prospective observation. Where fertility is controlled, and mechanisms for volitional child replacement exist, couples adjust their fertility regulation practices in response to the death of a child (Rahman 1998, Hossain and Phillips 2003). Findings suggest that has demographic transition progresses in a population, the association between child replacement and fertility increases owing to the spread and intensity of fertility regulation. Whether these relationships transfer to an African population where fertility transition has begun remains unknown, however. In 1994, the Navrongo Health Research Centre (NHRC) launched an experimental study known as the Community Health and Family Planning Project (CHFP). The Navrongo experiment has demonstrated that exposure to community health services can introduce fertility declines ranging from a half a birth to a full birth over five project exposure years. Concomitant effects of child health interventions have had pronounced late child mortality impact. These pronounced

demographic effects of the project have been introduced in a societal setting where fertility regulation is a consequence of child spacing rather than child limitation. Fertility change is indicative of a discrete project impact rather than a sustained fertility transition.

This paper posits that volitional child replacement will be not be evident in this setting. Volitional fertility regulation for child spacing is independent of childhood survival, even when contraceptive use increases and fertility is declining. To investigation this hypothesis, our analysis marshals data from the Navrongo Demographic Surveillance System that have prospectively registered the longitudinal observation of 43,000 women of reproductive age residing in four treatment zones of the CHFP. Analysis is based on the interval between a given birth (the "index birth") and the next conception, employing the strategy proposed by Hill et al. (2001) in a paper on retrospective fertility histories recording child replacement effects in Zimbabwe and Senegal. Analysis replicates an application of this approach by Hossain and Phillips 2002, using prospective surveillance data from Bangladesh.

In keeping with the Hill, et al. model, we have defined four mortality variables for each child with respect to a given mother: the death of a preceding birth of the mother prior to the birth of index child (mort_1); a death of a preceding birth of the mother during the interval (mort_2); a death of the index birth during the specified interval (mort_3); and the death of a birth in the twelve months following the end of the interval (mort_4) defining parameters of the hazard model:

$$\ln h(t/x,z) = h_0(t) + \sum_{j=1}^{J} \beta_j X_{ij} + \sum_{k=1}^{K} \gamma_k Z_{ik} + \sum_{l=1}^{3} \xi_l C_{il} + \sum_{m=1}^{4} \delta_m \cdot mort_{im} + \sum_{k=1}^{K} \sum_{m=1}^{4} \eta_{ikm} Z_{ik} \cdot mort_{im} + \sum_{k=1}^{3} \sum_{l=1}^{4} \varsigma_{ikl} C_{il} \cdot mort_{ii} \quad \textbf{(1)}$$

where t is the number of months from the onset of the index birth interval to the time of the conception that closes the interval, time to the end of the study period, or the time to loss to follow-up; and

$h(t/x,z)$ is the hazard function for conception at time t conditional on the set of maternal characteristics **X,** child characteristics **Z**;

$h_0(t)$ is a function of time representing the underlying hazard of conception;

C_{il} is the duration of exposure of individual i to treatment l

X_{ij} represents a vector of J background characteristics of individual mother i;

Z_{ij} is the birth order of the index child, sex of the index child, and year of the birth of the index child;

$mort_{im}$ represents, for individual i, the death of a preceding birth of the mother prior to the birth of index child ($mort_{i1}$), a death of a preceding birth of the mother during the interval ($mort_{i2}$), a death of the index birth during the specified interval ($mort_{i3}$), and the death of a birth in the twelve months following the end of the interval ($mort_{i4}$),

$\beta, \gamma, \delta, \eta$ are vectors of parameters to be estimated by the maximum likelihood; and

ε is an error term.

A reduced form of (1) is employed which estimates η for interactions between sex of child, year of birth, and mortality type.

Research has showed that fertility has been reduced by nearly a birth by the most intensive cell of the Navrongo experiment, relative to levels observed among women unexposed to the experiment. Interaction terms in the model assess the conditional effect of the experiment on replacement. Findings show that exposure to the experiment has had no effect on child replacement, despite the pronounced impact of the experiment on reproductive behavior. Implications for interpreting the role of child survival in demographic transition are reviewed and discussed.