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DETERMINANTS OF FERTILITY DECLINE: EVIDENCE FROM ASIA, 1975-2008

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Fertility has declined in the past 50 years, but the debate continues about what explains these declines across countries. We explore the association of socioeconomic factors with fertility outcomes in Asia. Fertility trends are analyzed for Bangladesh, Indonesia, Nepal, Pakistan, and Philippines in 25 WFS and DHS from 1975 to 2008 using multilevel random effects logistic models to identify the primary determinants of fertility and estimate their effects. We find that family planning use in a community and female education are associated with a lower likelihood of giving birth. Women experiencing the death of a previous child or living in a community with a higher proportion of children dead are more likely to give birth. Decomposition analysis results indicate that education does not account for much of the fertility declines across countries. Family planning in a community is the main contributor in explaining fertility decline, particularly in Bangladesh and Indonesia.

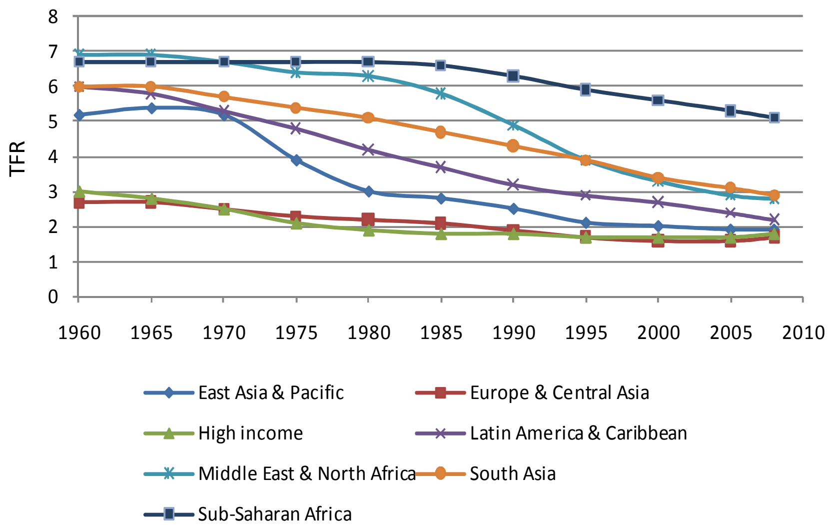
1 INTRODUCTION

A large literature has investigated the consequences as well as determinants of fertility. Historically, the motivation was the concern that high fertility rates would result in excessive population growth and depletion of resources (Malthus 1798; Ehrlich 1968). Subsequently, another school of thought emerged which promoted population optimism – that population growth could promote economic growth because of the non-linear nature of food production and people's capacity to adapt behaviors (Simon 1981). Then, population neutralism claimed that population growth neither hinders nor promotes economic growth in isolation of other factors and polices (Working Group on Population Growth and Economic Development et al. 1986; Kelley and Schmidt 2001). However, changes in fertility have significant implications not only for the size of a population but also for its age structure. The size and structure of populations have macroeconomic implications, and declining fertility levels, when accompanied by appropriate education and labor policies, can stimulate economic growth via the demographic dividend (Bloom and Canning 2004, 2008; Bloom et al. 2007, 2008a). Furthermore, at the household level, having fewer children implies that families can save and invest more in each child for education and training, thus enhancing the physical and human capital of a society. Despite these various impacts, attention has shifted away from fertility due to inattention to demography as well as growing interest in other areas of health.

In the past 50 years, the total fertility rate (TFR)[1] has declined in both high-income countries and in developing regions, and the declines have been more rapid than many demographers had expected (World Bank 2001; United Nations 2011). However, the rates of decline vary considerably, and countries in some regions (primarily sub-Saharan Africa) continue to experience high levels of fertility (Figure 2.1). Despite much research on the determinants of fertility, the question of what explains the fertility declines across countries remains. This chapter seeks to explain the fertility declines in South and Southeast Asia by exploring the socioeconomic factors associated with fertility outcomes at the individual level. Several studies suggest improvements in female education, reductions in child mortality, or the introduction of family planning programs as the primary motivators of fertility decline (Joshi and Schultz 2007; Schultz 2009; Hossain et al. 2007; Schultz 2007; Cleland et al. 1994), and I explore the relative importance of these explanatory factors to fertility decline in Asia. Identifying the factors that affect fertility trends can assist in shaping relevant policies aimed at reducing fertility and establishing small family norms.

[1] TFR is the number of children a woman can expect to have over the course of her reproductive life (age 15-49 or 15-44) assuming current patterns of fertility remain constant.

Figure 1. Trends in Total Fertility Rate (TFR) by Region, 1960-2005



Source: United Nations, 2011

2 BACKGROUND: FERTILITY DECLINE

2.1 Theories of Fertility Decline

The various theories that have been put forth to explain fertility decline can be broadly categorized into three groups: demand theories, ideational and diffusion theories, and composite theories. Demand theories, including classic demographic transition theory, suggest that the fertility transition is driven by the reduced demand for children resulting from the combination of income, prices, and preferences. According to Becker's seminal work (1960), higher incomes lead to a shift in parental preferences from quantity to quality, and thus to smaller families as incomes increase. Caldwell (1976) further attempted to explain fertility decline through an intergenerational wealth flows lens by stating that the demand for children is a function of the utilities and costs of alternate family sizes. Assuming economic rationality of societies, the overall premise of Caldwell's model is that as families modernize and nucleate, flows of wealth reverse, having been from children to parents to being from parents to children.

Classic demographic transition theory (DTT) states that the transition from an initial equilibrium with high fertility and high mortality to a new equilibrium characterized by low fertility and low mortality occurs as a result of modernization (Kirk 1996). One mechanism of DTT is a lagged fertility decline following declining child mortality. The process of modernization, however, is not clearly defined and in the original statement, no claim exists about the causal factors (Notestein 1953). Rather, it was simply that fertility was kept high in pre-modern countries due to social codes and high mortality levels, and urbanization and industrialization was followed by a shift toward smaller families. While no major fertility declines have taken place in the absence of mortality decline, there are cases where fertility decline appears to have predated mortality decline (Coale and Watkins 1986), suggesting that fertility decline brought about mortality decline via reduced maternal mortality and increased birth spacing. Evidence exists of simultaneous declines in fertility and mortality in some European countries, though this pattern does not extend as much to currently developing countries (other than perhaps Bangladesh). Thus, while this has been a useful description of population changes, the theory has been relatively weak on explanation. Several recent economic explanations for fertility transitions have focused on the role of returns to schooling, especially for women: when women's wages increase, the opportunity cost (in addition to monetary cost) of having children increases (Schultz 2001). However, it seems that demand theory cannot account for the rapidity of fertility declines in places like Bangladesh and (in the early 20th century) Bulgaria.

Ideational and diffusion theories have stated that changes in fertility are linked to cultural and linguistic factors; the diffusion of ideas and knowledge about fertility control to members of a social system through interpersonal communication (and other channels) is an important factor in the fertility transition (Casterline et al. 2001; Cleland and Wilson 1987; Cleland 2001). Diffusion theory as it pertains to fertility is the application of the more general diffusion theory which posits that diffusion is a "process in which an innovation is communicated through certain channels over time among the members of a social system" (Rogers 2003). As Coale and Watkins (1986) point out, historical Europe provides some support for ideational and diffusion theories. First, the onset of fertility decline was associated with language groups, suggesting interpersonal communication as a mechanism. Second, marital fertility fell because individuals in Europe were regulating their fertility within marriage, which was an innovation of the late 19th century. Second, the decline of marital age-specific fertility rates demonstrated that parity-specific control became more common in Europe between 1880 and 1930. Third, the fertility decline occurred concurrently in Western Europe and overseas European colonies despite large differences in macroeconomic conditions and population density between these areas. Moreover, in England, children left home early to go into service and did not send money back to parents; although they were a net economic loss, levels of natural fertility predominated prior to the fertility transition. Finally, France was the forerunner of fertility decline which started in the 1800s yet it was rather behind with respect to industrialization and urbanization. The decline swept across most of Europe between 1880 and 1930, incorporating even poor, agrarian societies such as Bulgaria (Cleland and Wilson 1987). More recent analysis of the World Fertility Surveys provides further evidence that language or other cultural factors (religion) influenced the onset of fertility decline and indicates a rapid spread of birth control practices from urban to rural areas (Cleland 2001). However, despite some evidence, this theory does not explain *why* someone would change behavior unless there is some advantage to it, which then directs one toward the demand theories above.

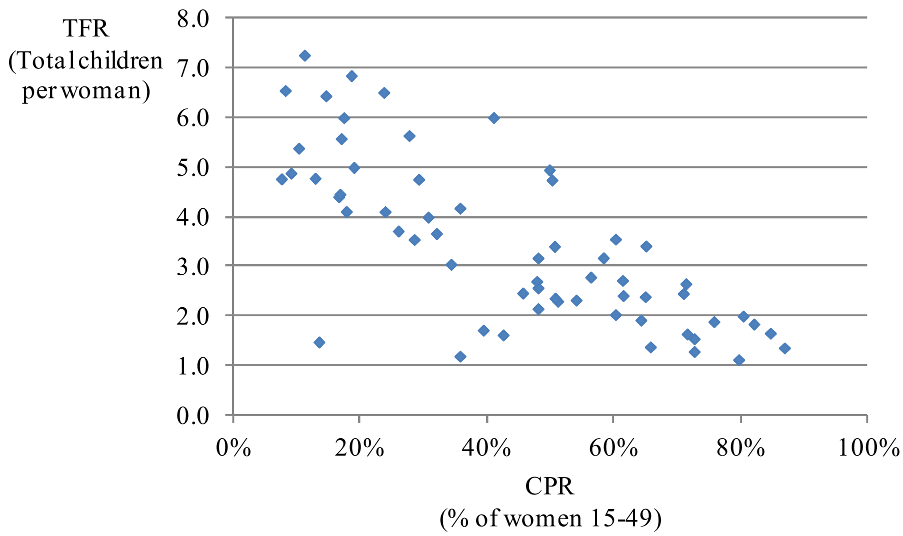
As Hirschman (1994) argues, neither demand theories nor ideational and diffusion theories alone adequately account for the fertility declines that have occurred in various countries and regions. Another branch of theory – composite theory – has attempted to combine economic and sociological theories to explain fertility declines. The main elements of composite theory include (a) the demand for surviving children, (b) supply limited by natural fertility and supply of children, and (c) the costs of fertility regulation. The first two of these elements are directly related to the economic theories while the third element incorporates the diffusion and ideational theories discussed above. Easterlin (1978) broadened the economic model of demand, supply and costs of fertility to include cultural elements to capture the diffusion of ideas. It was further posited that diffusion occurs faster later in transition because (a) more advanced health technology is available, (b) economic and social development is occurring faster, (c) cheaper and more effective contraceptives become increasingly available, and (d) more communication and political control exists resulting from higher degree of social integration (Retherford 1985).

Thus, fertility declines occur when the combination of conditions – economic, social, and cultural – is sufficient to promote behavior change. Given the large number of factors highlighted in the literature, I argue that composite theory is the most comprehensive as it addresses both the economic and sociological concerns of the other theories and has the fewest gaps. Therefore, this study is based on the principles of composite theory of fertility decline, and in the following section, I review the literature on the determinants of fertility decline and how each fits into the framework of composite theory.

2.2 Fertility Determinants: Mechanisms

The literature on the determinants of fertility has traditionally distinguished between proximate and distal determinants. As first introduced by Davis and Blake (1956), proximate determinants are the set of biological and behavioral factors through which all social, cultural, and economic factors can operate to affect fertility. Bongaarts (1982) simplified the 11 variables proposed by Davis and Blake to four (marriage, contraception, induced abortion, and postpartum infecundability) and provided a quantitative method of assessing the relative contributions of these factors to fertility outcomes. Figure 2.2 illustrates the strong correlation between fertility and contraception, one of the primary proximate determinants of fertility decline, for a selection of countries in 2006. Distal determinants of fertility are socioeconomic factors that affect the proximate determinants, which then results in fertility outcomes. Analyses of the distal factors, summarized below, have included education, modernization (e.g. child mortality, economic development, female labor force participation, urbanization), family planning programs, and religion.

Figure 2. Relationship between TFR and CPR, 2006



Data Source: World Bank World Development Indicators

2.2.1 Education and Fertility

Education is probably the most frequently studied distal factor. Female education affects fertility through a number of mechanisms: (a) greater opportunity cost in child rearing (schooling is taken as a proxy for females' potential wage), (b) lowered risk of child mortality, and (c) better ability to decipher and adopt contraceptive methods. Studies in Asia and Africa have found women's education to be one of the strongest determinants of fertility declines (Murthi 2002; Kirk and Pillet 1998). Bongaarts (2003) found that in 57 least developed countries, educational composition is a key predictor of declining fertility.

Evidence from micro-level studies suggests that education increases female labor force participation, resulting in a higher opportunity cost of child rearing which leads to lower fertility (Schultz, 2001). When parents are educated, they receive higher salaries and are more productive and healthier and in turn educate their children. With rising education costs, this results in a quantity-quality trade off and a lower demand for number of children and smaller family sizes (Becker 1960). Education leads to a skilled workforce, and a negative relationship exists between fertility and the share of skilled workers in the labor force (Kimura and Yasui 2007). Thus, higher education and economic opportunities for women can result in lower fertility (Gertler and Molyneaux 1994; Dreze and Murthi 2001). Macro-level studies have also provided evidence of the relationship between education and fertility. In Asia, macro-level changes such as female education rates, female labor force participation, and the demand for skilled labor raised the costs of bearing children and catalyzed the fertility transition (Rammohan 2004).

Previous evidence from cross-country studies also suggests a significant effect of maternal education on child health (Caldwell and McDonald 1982; Cleland and van Ginneken 1988). Micro-level data after World War II indicate that an additional year of mother's schooling is linearly associated with 5-10% lower child mortality rates (Schultz 1981, 1997). Another study conducted in 33 countries by Cochrane and colleagues (1980) indicated that a 20% reduction in infant mortality was associated with mother's completion of 4-6 years of school. Female education lowers the risk for child mortality which results in a higher proportion of surviving children, thus potentially decreasing fertility by decreasing the number of births 'needed' to achieve a given family size objective (Schultz 2001).

Educated women also generally use modern contraceptive methods more, suggesting that an educated woman is better able to achieve her fertility desires (Schultz 2001; Cleland and Jejeebhoy 1995). This appears consistent with a study by Gertler and Molyneaux (1994) in Indonesia which suggests that the majority of the fertility decline in the 1980s can be attributed to contraceptive use which was primarily induced by increases in female education at the micro level and economic development at the macro level. Furthermore, Bloom and colleagues (2008b) have recently shown that a woman's education, in conjunction with child mortality experience, has a significant negative impact on her social group's fertility outcomes. This approach to education and fertility – via social group interactions –falls under the diffusion/ideational theory framework.

2.2.2 Modernization and Fertility

With respect to the literature on fertility, modernization is a broad concept and can be thought of as having a number of specific components. Among them are reductions in child mortality, economic development, female labor force participation, and urbanization, as discussed below.

2.2.2.1 Child Mortality

The empirical literature on the relationship between child mortality and fertility has focused on two main pathways through which child mortality can affect fertility: replacement (child replacement hypothesis) and insurance/hoarding (child survival hypothesis) (Hossain et al. 2007; Preston 1978; Taylor et al. 1976;

LeGrand and Sandberg 2006; Montgomery and Cohen 1998; Hill et al. 2001). Replacement is the idea that the death of a child results in a subsequent change in reproductive behavior to replace the lost child. This can be further decomposed into biological replacement and behavioral replacement. Biological replacement reflects the truncation of breastfeeding (lactational amenorrhea) due to infant death. The shorter breastfeeding period speeds the return of fecundability, and thus the *biological* probability of conception. Behavioral replacement results from the decision of a couple to have an additional child soon after the death of another one. Since the focus is on the *decision* to replace, this is termed *behavioral* replacement. The hoarding (or insurance) effect of child mortality is based on the notion that parents have an ideal "final" number of children and adjust the actual number of births according to perceived mortality risks. Couples *anticipate* mortality risks based on prior child death experience of their own or of others and form their reproductive plans accordingly. Thus, hoarding fits within demand theory.

Based on DHS data and qualitative surveys in Benin, Capo-chichi and Juarez (2001) have suggested that decreasing child mortality (combined with increases in female education) motivates couples to reduce their fertility, with contraception as the proximate determinant of choice. Rahman (1998) demonstrated that the death of a child increases the likelihood of a subsequent pregnancy in Bangladesh. Furthermore, the replacement hypothesis appears to have more empirical support than the hoarding hypothesis (Hossain et al. 2007). Evidence from sub-Saharan Africa also lends support to the replacement hypothesis (Gyimah 2002).

2.2.2.2 Economic Development

At the macro-level, a clear cross-sectional negative association exists between GDP per capita and TFR (World Bank 2011). As discussed in the previous section, several authors have highlighted the negative presumed effect of income on fertility: the quantity-quality tradeoff leads to investing more in fewer children rather than investing less in more children, resulting in lower fertility (Becker 1960; Becker et al. 1990). In developing countries, children have traditionally been seen by theorists as assets for labor supply and old-age security, leading to higher fertility. However, with rising incomes, this economic dependence may decline, resulting in smaller families (Dreze and Murthi 2001). On a macro level, economic development and a departure from agriculture has been shown to be associated with lower fertility (Caldwell et al. 1999; Caldwell and Barkat-e-Khuda 2000).

2.2.2.3 Female Labor Force Participation

Female labor force participation can impact fertility as noted above in the education discussion. The option to get paid employment makes staying home for child-care relatively more expensive (Schultz

2001). Analyses in Asia have found the combination of female education, demand for skilled labor, and economic opportunities for women to be the strongest determinants of fertility decline by creating a demand for family planning (Rammohan 2004; Kimura and Yasui 2007; Gertler and Molyneaux 1994). Female employment and labor force participation, especially as mediated by education, have been examined within a demand theory framework in the literature.

2.2.2.4 Urbanization

The mechanisms through which urbanization could impact fertility include: (a) urban areas have better access to health services and information, including contraceptives, (b) urban areas have better access to education, (c) urban areas tend to be better off economically, (d) women in urban areas are more likely to be employed and (e) women in urban areas are more exposed to new ideas. Empirically, there is no consensus on the issue of urban and rural residence. Some evidence from sub-Saharan Africa and Asia indicates that urban residence is negatively associated with fertility (Capo-chichi and Juarez 2001; Caldwell and Barkat-e-Khuda 2000; Rammohan 2004). However, others indicate that urbanization has no significant association with fertility after adjusting for other factors (Dreze and Murthi 2001). An increase in household assets (e.g. electricity, piped water, toilets, radios, televisions, etc.) has been shown to be negatively associated with fertility (Blacker et al. 2005). Finally, the relationship between child mortality and fertility as discussed above indicates that improvements in child mortality would lead to lower fertility.

2.2.3 Family Planning Programs and Fertility

Family planning programs have been lauded as a success in many countries, including Bangladesh. Many analyses attribute fertility decline to an increased supply of and reduced barriers to contraception through family planning programs (Debpuur and al 2002; Caldwell 1994; Cohen 1998; Lucas 1992; Campbell et al. 2006). Others posit that it was not family planning alone, but rather family planning in the context of overall economic development that brought down fertility (Caldwell et al. 1999; Caldwell and Barkat-e-Khuda 2000). Evidence from Pakistan suggests that client-oriented family-planning programs, coupled with a few years of female schooling, can have an effect on fertility even in the short-run (Alam et al. 2003). However, other studies have concluded that family planning programs have very little effect on fertility decline (Soomro 2000; Moultrie and Timaeus 2003). The mechanisms through which family planning programs affect fertility are reduced financial and social costs, within the demand theory framework, and in changing ideas and norms, in which case they are a component of the ideational framework. Because of this combined contribution, family planning programs fit well within the composite theory framework.

2.2.4 *Religion and Fertility*

Although religion can inhibit fertility decline via restrictions on use of contraception or abortion to regulate fertility, evidence also indicates that after controlling for other factors, religion is not generally a driving factor. An analysis of fertility differentials by religion in Kerala found that socioeconomic settings drive fertility decisions; couples belonging to the same religion make different decisions if from different socioeconomic classes, and couples from different religions make similar decisions if from similar socioeconomic classes (Alagarajan 2003). Cultural norms resulting from religious affiliation that impact fertility decisions and behaviors are an example of diffusion/ideational theory explanations for fertility decline.

Through the mechanisms described above, socioeconomic variables can affect fertility outcomes. This chapter explores the socioeconomic and cultural determinants of fertility in Asia to ascertain (i) which are most strongly associated with fertility outcomes, and (ii) within each country setting, which factors are relatively more responsible for explaining the fertility declines of the past few decades. The selection of countries reflects a range of socioeconomic development and diversity in both fertility declines as well as of social and cultural norms. The aim of this chapter is to shed light on the controversies in the literature as discussed above and draw conclusions about the key determinants of fertility decline. The theoretical framework for this study of distal determinants is the composite theory of fertility decline as this framework, as discussed above, is the most comprehensive and addresses gaps in the others. The choice of variables as well as the levels at which they operate – individual *and* community – make this an application of composite theory as it incorporates elements of both economic and social theories. I expect education and family planning programs to be negatively associated with fertility and child mortality to be positively associated with fertility. The magnitudes of effect will likely vary between countries.

3 EMPIRICAL STRATEGY

The primary outcome measure in the analysis is whether a woman has given birth in the year prior to the survey date. I assess the impact of education, household wealth, child mortality, religion, and use of family planning on the odds of giving birth. To identify the potential determinants of fertility and estimate the effect of each of these factors on fertility, I use the following multilevel random effects logistic model:

$$(1) \qquad Log_e\left[\frac{p(birth_{i,j,t}=1)}{p(birth_{i,j,t}=0)}\right] = \alpha + \boldsymbol{X}_{i,j,t}\beta + \boldsymbol{Z}_{j,t}\gamma + \boldsymbol{\delta}_t + u_{i,t} + \varepsilon_{i,j,t}$$

where $birth_{i,j,t}$ is a binary indicator variable which equals 1 if woman i in cluster j gave birth in the year prior to the survey at year t, and equals 0 otherwise. $\boldsymbol{X_{i,j,t}}$ represents individual-level characteristics and $\boldsymbol{Z_{j,t}}$ represents community-level characteristics at time t (Table 2.1). $\boldsymbol{\delta_t}$ is a vector of survey fixed effects, $u_{j,t}$ is the cluster-specific random effect and $\varepsilon_{i,j,t}$ is the individual-specific error. While $u_{j,t}$ measures the difference between the average birth outcome in cluster j and the average birth outcome in the entire country, $\varepsilon_{i,j,t}$ measures the deviation in birth outcome for woman i and the average birth outcome for the j-th cluster. A random effects model is chosen to allow for community-level effects. Stata/IC 10.0 is used for the regression analyses. The data are pooled for all years in any given country and the regressions are run specific to each country. The results of the pooled data analysis are expected to yield average effects in each country over the entire period.

Table 1. Individual- and Community-level variables

$\boldsymbol{X_{i,j,t}}$: individual-level characteristics	$\boldsymbol{Z_{j,t}}$: community-level characteristics
• Respondent's level of education completed • Respondent's child mortality experience • Respondent's age • Respondent's religion	• Neighboring women's current use of family planning • Neighboring women's years of education completed • Neighboring women's child mortality experience • Neighboring women's religious distribution

4 Data

4.1 Data Sources

The main objective of this study is to analyze the determinants of fertility in South and Southeast Asia. Since fertility change tends to happen gradually over time, the analysis is restricted to countries where individual level demographic data are available for at least 30 years. The World Fertility Surveys (WFS), administered between 1973 and 1984, covered 43 countries with internationally-comparable core instruments, which include both a household questionnaire and a more detailed questionnaire administered primarily to ever-married women. However, some surveys include all women of reproductive age. The woman questionnaire includes marriage and pregnancy histories as well as sections on socioeconomic background, fertility preferences, contraception, and breastfeeding. The successor of the WFS is the Demographic and Health Surveys (DHS)[2], which have been administered in over 80 countries. WFS *and* DHS are only available for five countries in South and Southeast Asia: Bangladesh, Indonesia, Nepal, Pakistan and the Philippines.

A total of 25 surveys from the WFS and DHS are included in this analysis, covering a period of over 30 years from 1975 to 2008. In Bangladesh, Nepal, Pakistan, and Indonesia, the surveys were administered to ever-married women of reproductive age. In the Philippines, the WFS was limited to ever-married women, but subsequent DHS data include all women of reproductive age. Given the marital sampling and the fact that few births occur outside of marriage in the sample, the analysis is limited to 197,497 currently married women age 25-44. A minimum age of 25 is chosen to ensure that all the women in the sample had already completed their education. Thus, the results are reflective of fertility for married women age 25-44 – and in sum will represent the total marital fertility rate (TMFR) for women 25-44. After applying the age and marital status restrictions and dropping observations with missing values, the resulting sample represents about 60% of the original WFS and DHS datasets. This sub-sample is no longer representative of the original sample of women; therefore, sample weights are not applied in the regression analysis.

4.2 Variables

4.2.1 Dependent Variable

This chapter is about declines in period fertility – or a cross-section of fertility at a given time and location. In order to closely match fertility outcomes to observed determinants, the analysis focuses on fertility over the twelve months prior to the survey date as primary outcome variable. I am interested in the effects of a number of variables on period fertility, including both individual- and community-level characteristics. Although period fertility measures are more subject to distortions due to changes in the

[2] The DHS are nationally-representative household surveys that provide data built around a core of a full birth history for a wide range of indicators in the areas of health, population, and nutrition. They are also generally representative at the residence level (urban-rural) and region level (states/divisions). Standard DHS surveys have relatively large sample sizes (about 5,000 to 30,000 households per survey) and are conducted approximately every five years, enabling comparisons over time. Women age 15-49 in the sampled households are also included for the women's questionnaire, and in some countries eligibility is limited to ever-married women of reproductive age.

time distribution of births than lifetime (or cohort) fertility measures, they provide current information which can be more useful for policymaking. The one-year time interval for birth also allows exploration of both biological and behavioral components of child mortality effects on fertility (discussed in detail in the next section).

Table 2.2 presents the fertility summary statistics for each country for the first and last survey periods. Column A shows the TFR as reported in WFS and DHS reports. These are the average number of births per woman age 15-44. (In ever-married samples, marital status information is obtained from the household questionnaire.)

Column B shows the estimated TMFR for women age 15-44 for the year prior to the survey, which is the sum of the age-specific marital fertility rates calculated as the number of births per currently-married woman at each age 15-44:

(2) $$TMFR_{15-44} = \sum_{i=15}^{44} \frac{\#\ births\ to\ married\ women\ in\ age_i}{\#\ married\ women\ in\ age_i}$$

Column C contains the estimated TMFR for women age 25-44 for the year prior to the survey, calculated in the same way for each age 25-44:

(3) $$TMFR_{25-44} = \sum_{i=25}^{44} \frac{\#\ births\ to\ married\ women\ in\ age_i}{\#\ married\ women\ in\ age_i}$$

The TMFRs calculated in Column B are not directly comparable to published TFRs as the rates in Column B are for the year before the survey and are for currently-married women age 15-44 only rather than all women of reproductive age. Column C employs an additional restriction for age and includes only married women age 25-44. This sub-sample of women is chosen to restrict the empirical analysis to women who have completed all their schooling in order to reduce the impact of potential future schooling for younger women. The marital fertility trends for the 25-44 samples are also illustrated in the appendix (Figure A2.1).

The overall pattern of marital fertility indicates that TMFRs have declined in all five countries over the past few decades. As a percentage of TMFR in the earliest survey period for women 25-44, Nepal has experienced the greatest decline (65%) with Bangladesh (57%) following. The Philippines have seen a

42% decline while Indonesia and Pakistan have had the least decline (27% and 26%, respectively). In absolute terms, Nepal has seen the greatest decline in the TMFR over the study period (about 3 births per married woman) with Bangladesh and the Philippines experiencing a decline of about 2 births per married woman. Pakistan and Indonesia have had the smallest declines in both absolute and relative terms.

Table 2. Fertility summary statistics for currently-married women by country for first and last surveys

	Year	(A) Survey TFR (age 15-44)	(B) $TMFR_{15-44}$	(C) $TMFR_{25-44}$
Bangladesh	1975	6.2	6.4	3.4
	2007	2.7	3.6	1.5
Indonesia	1976	5.1	6.6	3.3
	2007	2.6	5.2	2.4
Nepal	1976	6.2	7.3	4.9
	2006	3.1	4.0	1.7
Pakistan	1975	6.2	8.3	5.1
	2006	4.0	6.7	3.8
Philippines	1978	5.1	9.1	4.8
	2008	3.2	6.0	2.8

Notes: Column A displays official TFRs as reported in WFS and DHS reports, for five years and three years preceding the survey, respectively. Column B displays TMFR for women 15-44 as calculated by authors for births in the year preceding the survey. I would expect these rates to be higher than TFRs since the sample is restricted to married women. Column C displays TMFR for women 25-44, the sub-sample of women after they have completed their education. I would expect these rates to be lower than the TMFRs in Column B since they exclude women age 15-24.

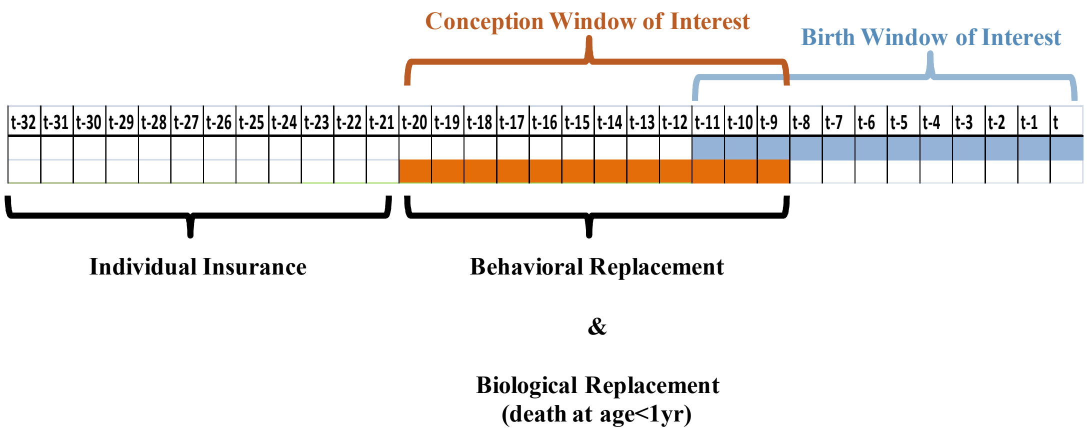
4.2.2 Coding of Key Explanatory Variables

The variable for level of education completed for each woman is directly available from the DHS but had to be imputed from the years of education completed for some of the WFS. The levels of education are recoded to establish consistency between WFS and DHS surveys across countries and then divided into four categories: no education, primary education, secondary education, and higher education (>12 years). The reference category in the regressions is no education. Education at the community level is constructed as the self-excluded average years of education within the woman's cluster (i.e. the average years of education in the cluster was calculated excluding the individual woman's own years of education – thus it is the average years of education of other women around her).

For family planning programs, I use a measure to reflect the ideational and the supply-side effects of family planning programs: the contraceptive use of neighboring women. This would reflect what is happening in the community with respect to ideas about and availability of family planning. Thus, instead of using an individual's current use of a modern method, a cluster-level variable is constructed to represent the self-excluded mean current use of modern contraceptives for each woman (i.e. the proportion of women currently using modern contraception in the cluster is calculated excluding the individual woman's own use of contraception.

A key innovation of this analysis is the treatment of replacement effects for child mortality. The main dependent variable is birth in the 12 months prior to survey. I refer to this 12-month period as the birth window of interest. The conception period corresponding to these births is nine months prior to the start and end, respectively, of the birth window. The conceptualization of the birth and conception windows is important for understanding the construction of the various child mortality variables, which is a modification of the strategy followed by Hill, Hossain and colleagues (Hill et al. 2001; Hossain et al. 2007). Three individual-level variables and one community-level variable capture the effect of child mortality on fertility. (See Figure 2.3 for an illustration of the birth and conception windows as well as the various child mortality variables.) At the individual level, I include the effects of previous child deaths occurring at different time intervals. At the community level, I include the proportion of children dying to women in a cluster as a measure of child mortality.

Figure 3. Schematic of the child mortality variables in relation to the birth and conception windows of interest



Note: *t* is the time of the survey (interview with woman), with *t-1* indicating one month prior to the survey, *t-2* indicating two months prior to the survey, etc. The birth window of interest is 12 months prior to the survey, and the corresponding conception window nine months prior to the birth window.

First, I consider the death of a child who was of an age to be breastfed – death of this child would result in the truncation of breastfeeding and thus of lactational amenorrhea, which would expose the mother to conception of a subsequent child. (This biological variable captures the effect of the proximate determinant postpartum infecundability.) I assume one full year of breastfeeding and I code this variable linearly as the number of months of fecundability reinstated due to the death of a child under the age of one year occurring during the conception window.[3] In the regression analysis, if there is a positive association between this variable and the outcome – birth – I can conclude that there is evidence of biological replacement behavior – i.e. a birth resulting from the death of a child under the age of one during the conception window. If, on the other hand, there is no association or negative association between this variable and the probability of having a subsequent birth, I can conclude that there is no evidence of biological replacement.

Second, I consider the death of a child of any age occurring during the conception window. Because this variable is not restricted to children under the age of 1, it captures an overall measure of "behavioral replacement" – or the decision of a couple to have an additional child to replace one that has recently died. In the regression analysis, if there is a positive association between this child mortality variable and the outcome, I can conclude that there is evidence of behavioral replacement behavior – i.e. a birth resulting from the death of a child of any age during the conception window. If, on the other hand, there is no association or a negative association between this variable and the probability of having a subsequent birth, I can conclude that there is no evidence of behavioral replacement. .

Next, I consider the hoarding component of child mortality – or the idea that couples anticipate mortality risks and form their reproductive plans accordingly. The stimulus to hoard is driven by two experiences – the couple's own experience of child deaths and their perception of child mortality from the experience of deaths in their community. The third child mortality variable captures the effect of the couple's prior child mortality experience on fertility behavior – i.e. the death of a child of any age occurring before the conception window. Thus, past deaths (though not in the very recent past and prior to the conception window) would lead a couple to plan on having additional children with the expectation that some of them may die. In the regression analysis, if there is a positive association between this child mortality variable and the outcome, I can conclude that there is evidence of hoarding behavior at the individual level. If, on the other hand, there is no association or a negative association between this variable and birth, I can conclude that there is no evidence of hoarding behavior. (Please refer to Figure 2.3 for an illustration of these three individual-level child mortality variables.)

Finally, I consider child deaths within a woman's community. This fourth child mortality variable represents the effect of the community's child mortality experience on an individual woman's fertility

[3] Refer to Figure A2.2 in the appendix for a schematic illustrating the construction of the "biological replacement" variable of months reinstated based on a few examples of date of birth, age at death, months of breastfeeding (i.e. interruption of conception during the conception window), and months reinstated due to death of a child under the age of one year.

behavior. This cluster-level hoarding variable is constructed as the respondent-excluded mean proportion of children born in the past ten years who have died in the cluster (i.e. the proportion of children who have died to women in that cluster was calculated excluding the individual woman's own proportion of children who had died).

The religion variable is challenging as numerous religions and belief systems are present in the various countries, and these groupings have been inconsistent over time within countries. Thus, to establish consistency across countries and surveys, religion is recoded into three categories: Christian, Muslim, and other. The reference group is "other" and has differing interpretations in each of the settings. For example, "other" includes but is not limited to the Hindu population in the South Asian countries and the Buddhist population in the South East Asian countries.

4.2.3 Coding of Control Variables

To control for the relationship between age and fertility outcomes, four age categories are defined: 25-29, 30-34, 35-39, 40-44. Categorical community-level age variables which represent the proportion of women in each five-year age category within the cluster are also created. This control variable is intended to capture age-related openness to ideas and innovations. In addition, control variables are included for the distribution of religion in each cluster. Furthermore, the analysis controls for the number of months of the conception window that are blocked from conception due to breastfeeding of a prior child (assuming 12 months of breastfeeding). Finally, fixed effects for each survey are included to reflect survey-specific differences.

5 RESULTS

5.1 Descriptive Analysis

Table 2.3 displays characteristics of surveyed women before the age and marital status restrictions are applied with adjustments for sample design. In the earliest survey, women on average had 0.19 (Indonesia) to 0.26 (Pakistan) births in the year before the survey, which reduced to about half in the most recent survey, except in Pakistan. The total number of children ever-born has decreased in all countries with the highest in Pakistan in 2006. In the most recent round of surveys, women in the Philippines are the most educated with the average woman completing nearly 11 years of school in 2008. Contraceptive use also increased since the earliest survey in each country. Indonesia had the highest proportion of women using a modern contraceptive method in the latest survey (54%). Pakistan had the lowest proportion of women using a modern method – 21% on average in 2006, an increase from 4% in 1975. While Bangladesh had similarly low usage in 1975, by 2007 this figure increased to 44%. During the study period, women's education increased on average in every country. Pakistan has experienced the least improvement with 65% of women still with no education in 2006. The proportion of women reporting residence in urban areas also increased during the study period across all countries.

Table 3. Country-specific characteristics of surveyed women in the first and last surveys

Bangladesh	1975 (n=6488)		2007 (n=10996)	
	Mean	Std. Dev.	Mean	Std. Dev.
Age	28.14	9.81	30.44	9.35
Births in past year	0.20	0.40	0.11	0.32
Births in past 5 years	0.99	0.91	0.55	0.69
Children ever-born	3.96	3.10	2.77	2.02
Children alive	2.97	2.39	2.42	1.70
Proportion currently using FP	0.04	0.20	0.44	0.50
No education	0.76	0.43	0.34	0.47
Primary school	0.18	0.39	0.30	0.46
Secondary school	0.05	0.21	0.30	0.46
Higher education	0.01	0.08	0.06	0.24
Proportion Urban	0.08	0.27	0.23	0.42
Proportion Muslim	0.83	0.38	0.91	0.29
Proportion Christian	0.00	0.06	0.00	0.05

Indonesia	1976 (*n*=9101)		2007 (*n* =32895)	
	Mean	Std. Dev.	Mean	Std. Dev.
Age	31.23	9.32	34.19	8.44
Births in past year	0.19	0.39	0.12	0.32
Births in past 5 years	0.84	0.90	0.50	0.64
Children ever-born	3.45	2.80	2.46	1.80
Children alive	2.76	2.23	2.26	1.57
Proportion currently using FP	0.20	0.40	0.54	0.50
No education	0.62	0.49	0.07	0.25
Primary school	0.33	0.47	0.48	0.50
Secondary school	0.05	0.22	0.39	0.49
Higher education	0.00	0.07	0.07	0.25
Proportion Urban	0.16	0.36	0.42	0.49
Proportion Muslim			0.89	0.32
Proportion Christian			0.09	0.29

Table 3 Continued

Nepal	1976 (*n* =5567)		2006 (*n* =10793)	
	Mean	Std. Dev.	Mean	Std. Dev.
Age	29.22	8.86	28.76	9.86
Births in past year	0.24	0.43	0.10	0.31
Births in past 5 years	1.02	0.96	0.51	0.74
Children ever-born	3.09	2.60	2.44	2.30
Children alive	2.34	2.00	2.13	1.92
Proportion currently using FP	0.02	0.15	0.34	0.48
No education	0.95	0.21	0.53	0.50
Primary school	0.03	0.17	0.18	0.38
Secondary school	0.01	0.11	0.25	0.43
Higher education	0.00	0.07	0.04	0.20
Proportion Urban	0.02	0.15	0.16	0.36
Proportion Muslim	0.04	0.20	0.04	0.19
Proportion Christian	0.00	0.00	0.01	0.09

Pakistan	1975 (*n*=4952)		2006 (*n*=10023)	
	Mean	Std. Dev.	Mean	Std. Dev.
Age	30.73	9.33	32.38	8.68
Births in past year	0.26	0.44	0.21	0.41
Births in past 5 years	1.12	1.03	0.91	0.96
Children ever-born	4.17	3.18	3.87	2.85
Children alive	3.19	2.48	3.45	2.54
Proportion currently using FP	0.04	0.18	0.21	0.41
No education	0.87	0.33	0.65	0.48
Primary school	0.07	0.25	0.14	0.35
Secondary school	0.04	0.19	0.14	0.35
Higher education	0.00	0.05	0.06	0.25
Proportion Urban	0.27	0.44	0.33	0.47
Proportion Muslim			1.00	0.00
Proportion Christian			0.00	0.00

Philippines	1978 (*n*=9222)		2008 (*n*=13594)	
	Mean	Std. Dev.	Mean	Std. Dev.
Age	33.60	8.36	29.90	10.05
Births in past year	0.26	0.44	0.10	0.30
Births in past 5 years	1.18	1.02	0.47	0.74
Children ever-born	4.56	3.02	2.02	2.31
Children alive	4.10	2.66	1.92	2.16
Proportion currently using FP	0.15	0.36	0.22	0.41
No education	0.06	0.23	0.01	0.11
Primary school	0.24	0.43	0.20	0.40
Secondary school	0.58	0.49	0.47	0.50
Higher education	0.13	0.33	0.33	0.47
Proportion Urban	0.32	0.47	0.56	0.50
Proportion Muslim	0.02	0.15	0.05	0.22
Proportion Christian	0.95	0.23	0.88	0.33

Note: Summary statistics presented are for the sample of ever-married women surveyed before restrictions are applied for age or marital status and are adjusted for sample weighting. The exception is the Philippines DHS which includes all women.

5.2 Regression Analysis: Cross-Country Trends

Table 2.4 displays the odds ratios of having a birth in the 12 months before the survey estimated using the model in Equation (1), for the respondent's level of education, years of education in her cluster, use of modern contraception in her cluster, the four child mortality variables – months of conception reinstated by the death of a child under age one in the conception window, death of a child of any age in the conception window, death of a child occurring before the conception window, the proportion of children dead in the cluster – and the respondent's religion.

Across countries there is diversity in the effects of education level, but in general, completion of primary school is negatively associated with birth when compared to the reference group of women with no education (odds ratio < 1). For example, in Nepal, a woman who has completed primary school has 0.74 times the odds of giving birth as compared to a woman with no education. In Pakistan, a woman who has completed primary school has 15% lower odds of giving birth compared to a woman with no education.

A similar pattern is evident for completion of secondary school. The effect is the greatest in the Philippines where women with secondary education have 0.71 times the odds of giving birth compared to women with no education. The relationship between secondary education and birth is different in Indonesia where those completing secondary school have about 23% higher odds of giving birth compared to those with no education.

The relationship between higher education and birth is not as clear. In Bangladesh, Indonesia and Nepal, women with higher education have higher odds of giving birth than those with no education (40%, 78%, and 64% higher odds, respectively). In contrast, women with higher education in Pakistan and the Philippines have lower odds of giving birth than those with no education (about 30% lower odds). These results indicate that in the 25-44 age range, women with higher education are more likely to have births (other things being held constant) than those with no education in Bangladesh, Indonesia and Nepal – these women have likely delayed childbearing until completing their education, thus at older ages, they have higher fertility than those who have had children at younger ages (i.e. those with no education). The education results are reflective of the fertility profiles by age and level of education illustrated in the appendix (Figure A2.3).

Table 4. Multilevel random effects logistic modeling of birth in the year prior to survey, currently married women age 25-44

	Birth in the year prior to survey (1 = Birth, 0 = No Birth)				
	Bangladesh	Indonesia	Nepal	Pakistan	Philippines
Survey 1	1975	1976	1976	1975	1978
Survey 2†	0.761***	0.737***	0.803**	0.718***	1.018
	(0.632 - 0.916)	(0.650 - 0.836)	(0.675 - 0.955)	(0.625 - 0.824)	(0.762 - 1.361)
Survey 3†	0.896	0.868**	0.845*	0.709***	0.966
	(0.749 - 1.072)	(0.778 - 0.969)	(0.697 - 1.025)	(0.617 - 0.816)	(0.721 - 1.293)
Survey 4†	1.010	0.858***	0.651***		0.891
	(0.841 - 1.213)	(0.769 - 0.957)	(0.528 - 0.803)		(0.667 - 1.192)
Survey 5†	0.890	0.849***			0.857
	(0.736 - 1.077)	(0.759 - 0.949)			(0.639 - 1.148)
Survey 6†	0.889	0.797***			
	(0.729 - 1.084)	(0.710 - 0.895)			
Survey 7†		0.872**			
		(0.776 - 0.980)			
Education (ref = no education)					
Primary education	0.949	1.050	0.744***	0.848**	0.887
	(0.864 - 1.042)	(0.984 - 1.122)	(0.627 - 0.882)	(0.728 - 0.987)	(0.715 - 1.100)
Secondary education	0.871**	1.233***	0.814**	0.874*	0.713***
	(0.770 - 0.984)	(1.142 - 1.331)	(0.665 - 0.996)	(0.746 - 1.023)	(0.575 - 0.886)
Higher education	1.396***	1.782***	1.644**	0.736**	0.716***
	(1.156 - 1.687)	(1.601 - 1.984)	(1.113 - 2.427)	(0.570 - 0.950)	(0.573 - 0.894)
Years of education in cluster	0.946***	1.005	0.874***	0.957***	0.950***
	(0.920 - 0.973)	(0.995 - 1.016)	(0.838 - 0.911)	(0.934 - 0.980)	(0.930 - 0.971)
Family Planning Program Proxy					
Use of modern contraception in cluster	0.117***	0.284***	0.158***	0.947	0.582***
	(0.0889 - 0.155)	(0.254 - 0.318)	(0.106 - 0.237)	(0.651 - 1.376)	(0.436 - 0.777)
Child Mortality					
Months of conception reinstated by death of child (<age 1) in conception window	1.072***	1.174***	1.082***	1.011	1.051**
	(1.025 - 1.122)	(1.144 - 1.204)	(1.035 - 1.131)	(0.969 - 1.055)	(1.008 - 1.095)
Death of a child in conception window (ref = no)	2.962***	2.774***	3.662***	2.824***	3.134***
	(2.240 - 3.916)	(2.353 - 3.272)	(2.689 - 4.986)	(2.100 - 3.798)	(2.343 - 4.191)
Death of a child prior to conception window (ref = no)	1.392***	1.191***	1.281***	1.147**	1.240***
	(1.277 - 1.516)	(1.130 - 1.256)	(1.159 - 1.415)	(1.032 - 1.274)	(1.127 - 1.364)
Proportion of children dead in cluster	1.833	2.290***	1.520	2.274***	0.990
	(0.862 - 3.900)	(1.649 - 3.179)	(0.614 - 3.762)	(1.287 - 4.017)	(0.503 - 1.950)
Religion (ref = other)					
Muslim	1.254***		1.284		1.167
	(1.066 - 1.475)		(0.946 - 1.743)		(0.861 - 1.581)
Christian	1.239		1.340		1.087
	(0.878 - 1.748)		(0.674 - 2.664)		(0.937 - 1.261)
Constant	0.552***	0.545***	0.756*	0.872	0.545**
	(0.398 - 0.766)	(0.476 - 0.625)	(0.555 - 1.029)	(0.709 - 1.072)	(0.311 - 0.956)
Observations	30227	105496	17760	13471	30543
Number of cluster	580	5994	331	1373	1070

Notes: Odds ratios reported, 95% confidence intervals in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All models additionally control for: age (5-year age groups, proportion of women in each 5-year age group within cluster) and proportion of women in each religious group within cluster, not shown.

†Survey fixed effects for each country refer to the following years:
Bangladesh – 1993, 1996, 1999, 2004, 2007; Indonesia – 1987, 1991, 1994, 1997, 2002, 2007; Nepal – 1996, 2001, 2006; Pakistan – 1990, 2006; Philippines: 1993, 1998, 2003, 2008.

In general, the average number of years of education in a woman's cluster is negatively associated with her giving birth prior to the survey. The effect is greatest in Nepal where every additional year of education in the cluster on average is associated with 13% lower odds of the woman having a birth. The magnitude of effect is smaller – though in the same direction – for Bangladesh, Pakistan, and the Philippines. In Indonesia, there was no significant association. Estimates for this variable are likely biased to some extent; since it is a cluster-level variable, it may be overestimating the effect of education due to omitted variables at the cluster-level that are correlated with education.

With respect to use of modern contraception in the cluster, there is an overall negative trend across all countries although there is diversity of effect size between countries. The effect is largest in Bangladesh and Nepal – an increase in modern contraception use within the cluster from 0% to 100% is associated with 88% and 84%, respectively, lower odds of having a birth. In Pakistan, however, there is no significant association between use of modern contraception in the cluster and birth.

The results provide evidence of biological replacement. For every additional month of conception reinstated by a death of a child under age one in the conception window, there are increased odds of having a birth ranging from an odds ratio of 1.05 in the Philippines to 1.17 in Indonesia, though it is not statistically significant for Pakistan. The stability of the parameter estimates across countries for this variable is noteworthy. This finding is reassuring since the variable is essentially a biological factor that should not vary a great deal across women in different countries. There is also evidence of behavioral replacement – the death of a child of any age in the conception window is associated with higher odds of having a birth. The large effect sizes are statistically significant in all five countries with odds ratios ranging from 2.8 to 3.7. There is additional evidence of hoarding behavior at the individual level in each of the countries in the sample. Death of a child occurring prior to the conception window is positively associated with a subsequent birth, with odds ratios ranging from 1.1 in Pakistan to 1.4 in Bangladesh. There appears to be additional support for hoarding behavior based on the experience of child deaths of other women in her cluster in Indonesia and Pakistan, where the odds ratios were 2.3, but there was no significant association in the other three countries.

Religion does not play prominently in this analysis. Adjusting for the other factors discussed above, women who identified themselves as either Muslim or Christian did not have any different odds of a birth than those who were categorized as "Other." The exception is Bangladesh where Muslim women have 1.3 times the odds of having a birth compared to others. Distribution of religious affiliation within a cluster did not have any effect on birth (estimates not shown).

Thus, the multilevel regression results indicate that women's primary and secondary education, her community's average years of education, and her community's use of modern contraception are generally negatively associated with marital fertility in the 25-44 age range. Higher education, death of a previous child, and her community's experience with child mortality are positively associated with fertility. Other than in Bangladesh, neither the individual's religion nor her community's religious composition appears to have an effect on fertility.

5.3 Decomposition Analysis: Country-Specific Results

The effects of the various individual- and cluster-level factors over the study period can best be understood through a decomposition analysis for each country. The purpose of the decomposition analysis is to identify the portion of decline in births over the survey period in each country that is accounted for by each independent variable. There are three components to this decomposition: (1) the effect of each independent variable as estimated by the regression parameter, (2) the change in the independent variable over the course of the study period, and (3) the change in the dependent variable over the study period. The calculation for the percent explained by each independent variable, *x*, is as follows:

(4) $$\%\ explained\ by\ x = \frac{\hat{\beta}_x \ * \ \Delta\bar{x}}{\Delta\bar{y}} * 100$$

where $\Delta\bar{x}$ is the change in independent variable *x* between the first and last surveys, $\hat{\beta}_x$ is the estimated parameter for *x*, and $\Delta\bar{y}$ is the change in the dependent variable (probability of birth) between the first and last surveys. According to the following equation, upper and lower bounds for the percent explained were also calculated to get a sense of the accuracy of the estimate:

(5) $$\%\ explained\ by\ x = \frac{[\hat{\beta}_x \pm (1.96 * se_x)] \ * \ \Delta\bar{x}}{\Delta\bar{y}} * 100$$

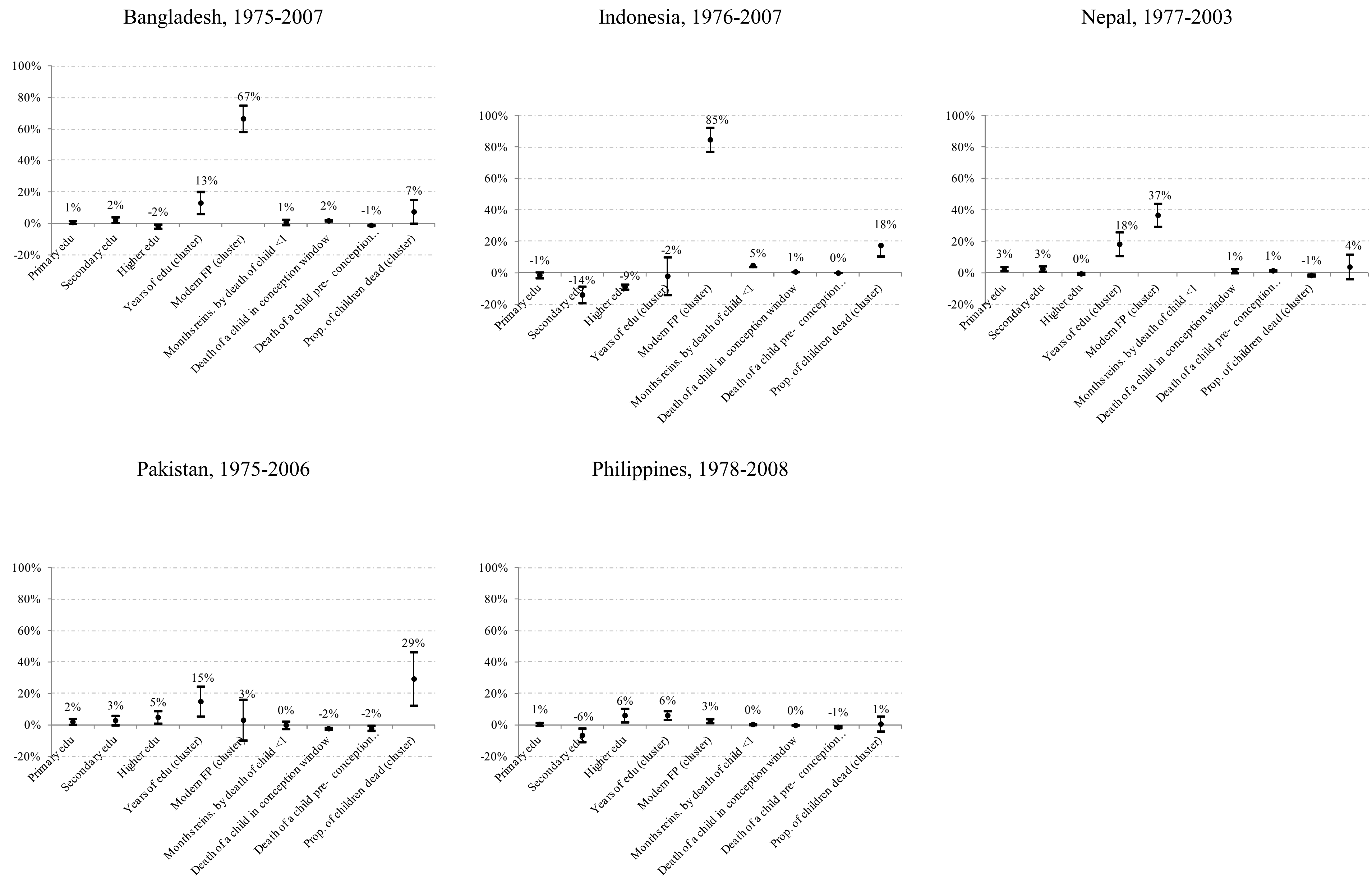
Decomposition analyses are more easily carried out within a linear regression framework. Thus, I re-estimated the models shown in Table 2.4 using multilevel linear regression., which had minimal effect on the coefficients. Overall, the changes in the explanatory factors included in the model are able to explain the declines in fertility by amounts ranging from 73% on the high end to 10% on the low end. (See Tables A2.1-A2.5 in the appendix for calculations.) In two countries (Bangladesh and Indonesia), I am able to explain the majority of the decline, whereas in Nepal I am able to explain about half of the decline with the independent variables included in the model. In Pakistan, about one-third of the decline is explained, but in the Philippines, very little is explained.

As reported in Table A2.1, changes in the explanatory factors explain 75% of the decline in births between 1975 and 2007 in Bangladesh, where the percentage of currently-married women 25-44 having a birth in the year prior to survey decreased from 19% to 8%. In the same period, the average percentage of women currently using a modern contraceptive method within each cluster increased from 6% to 46% on average, and the years of education for other women in the cluster increased from 1.4 years to nearly 5 years of school. The majority of the fertility decline is explained by modern contraception use in the cluster (67%) with some contribution of education of other women in cluster (13%). (Figure 2.4) Surprisingly, an individual's education does not appear to explain much of the decline. The child mortality variables, though associated in the direction hypothesized, do not explain much of the decline in fertility either. Thus, the substantial increase in contraceptive use appears to be driving the fertility decline in Bangladesh to a far greater degree than the increases in education or improvements in child mortality.

In Indonesia, there was a decrease in the percentage of women 25-44 having a birth between 1976 and 2007 – from 18% to 12%, respectively. The changes in explanatory variables explain 72% of the decline in births during this period. Use of modern contraception in the cluster increased from 22% to 56% and is the overwhelming contributor to the decline in fertility, accounting for 85% of the decline. The percentage of children dead in the cluster decreased from 17% to 7% and adds a relatively smaller share in explaining the reduction in births. In the same period, the proportions of women in each education category increased – but the improvements in education did not have any role in the fertility decline because education is positively associated with fertility for women age 25-44. This emphasizes that once educated women complete their schooling, they have higher fertility at older ages than women with no education who started childbearing earlier (while the other women were still in school).

In Nepal, 56% of the decline in births, which reduced from 27% women 25-44 having a birth in 1977 to 10% in 2003, is explained. Use of modern contraception at the cluster-level, which increased from 2% to 32%, accounts for 37% of the decline. Years of education of other women in the cluster explains an additional 18%, reflecting the improvement in education from less than a year to over three years of schooling in the cluster on average. As in the case of Bangladesh, a woman's own level of education does

Figure 4. Decomposition Analysis by Country: Percent of Decline in Births Explained by Explanatory Variables



not appear to explain much of the decline. Similarly, the child mortality variables do not contribute much to the explanation either.

In Pakistan, the percentage of women with a birth decreased from 28% to 21%, and the model explains 34% of this decline. Of the independent variables, child mortality and education of other women in the cluster are most predictive. The decline in the proportion of children born in the past ten years who have died in the cluster (22% to 10%) explains 29% of the decline in births. Education in the cluster, which increased from one to three years, accounts for an additional 15% of the reduction in births. In Pakistan, the increase in the use of modern contraception in the cluster from 4% to 21% hardly explains any of the decline.

The percentage of women having a birth in the Philippines declined from 25% in 1978 to 14% in 2008 – one of the more substantial declines in marital fertility over the study period. However, the changes in explanatory factors in the model are able to explain very little of this decline – only 10%, most of which is accounted for by improvements in education and use of modern contraception in the cluster. The Philippines is the only country in this analysis where women on average completed secondary education in the most recent survey, yet since level of education was high even in the earliest survey period, the relatively small increase in level of education did not have much impact on fertility. These findings imply that other unidentified events or changes were occurring that are strongly associated with the considerable decline in fertility over the study period in the Philippines.

6 ROBUSTNESS CHECKS

Initial robustness checks were carried out by running regressions that included regional classifications specific to each country and age using the xi command in Stata. However, including regional fixed effects neither had an impact on the other parameter estimates, nor did it substantially affect the R^2 when dropped from the model. Similarly, I had included a dummy indicator for urban residence which exhibited neither an effect of its own nor an impact on the other parameter estimates. Thus, I excluded both region and urban residence from the final model. I compared regressions with age as an indicator variable to those with a linear and quadratic form of age as well as to models with age as 5-year categories. The differences in estimates of the other parameters and in the R^2 were minimal; thus, I chose the simpler specification and used categorical age in the final model.

I was concerned about the effect of wealth on fertility as well as about omitted-variable bias and its effect on the parameter estimates for other variables. While household wealth information was not available in the WFS, the DHS contains household asset information, which is used to create an asset index that is a composite of asset information that is available consistently for all of the DHS surveys in each country. The asset index, a continuous variable, incorporates information on source of drinking water; type of toilet facility; floor, wall and roof materials; presence of electricity in the home; and possession of a television; and possession of a car. Each of the assets is assigned a score based on the quality and/or prevalence within the household. These scores are then summed to produce the final asset index. Source of drinking water is categorized as surface (0), open/well (1) or surface (2). Type of toilet is categorized as no facility (0), pit/latrine (1) or flush (2). Floor, wall and roof materials are categorized as natural (0), rudimentary (1) or finished (3). The wealth index in each country was a composite of asset information that was available consistently for all of that country's DHS surveys.[4] The maximum possible value for the final asset index is 12 in Bangladesh; 8 in Nepal, Pakistan and the Philippines and 6 in Nepal. I included two wealth variables – one that captured the woman's household assets and one that was the average of the other households in her cluster – and ran the regressions on just the DHS surveys to look at the effect of wealth on fertility and its impact on the other explanatory variables. While wealth of the cluster did not have any significant association with births (except in Pakistan), an individual's household asset score was associated with lower odds of birth in all the countries with the largest effect in Nepal and the Philippines (OR = 0.9). (Appendix Tables A2.6-A2.10) In the other three countries, the effects were even smaller. Of more concern to the analysis, however, was the impact on the other variables, as I was concerned with omitted variable bias. Inclusion of both wealth variables reduced the effect of the family planning program proxy by 4% in Indonesia (from an OR of 0.28 to 0.29) and 8% in Nepal (from an OR of 0.15 to 0.16). However, in Bangladesh and the Philippines, the effect of contraception use in the cluster became stronger upon inclusion of wealth. The greatest impact in terms of percentage change in odds ratios is seen in the individual education effect – inclusion of wealth resulted in up to 16% change in the odds ratio for education levels. However, this effect was not systematic. For example, the greatest impact is seen in Nepal and the Philippines – in Nepal, inclusion of wealth resulted in a 16% increase in the odds ratio for higher education, while in the Philippines, the result was 16% attenuation in the odds ratio for higher education. The other independent variables were not very much affected by the inclusion

[4] The asset index in each country included the following:
Bangladesh: source of drinking water; type of toilet facility; floor, wall, and roof materials; electricity; and television.
Indonesia: source of drinking water; floor material; electricity; and television.
Nepal: source of drinking water; type of toilet facility; floor material; electricity; and television.
Pakistan: source of drinking water; type of toilet facility; roof material; electricity; and television.
Philippines: source of drinking water; type of toilet facility; floor material; electricity; and car.

of the wealth variables, with no more than 10% impact on the odds ratios. This leads me to conclude that assuming the same relationships in the WFS survey period, exclusion of wealth in the main regressions may result in some small amount of bias for the education and contraception variables, but the direction of bias is not consistent across countries.

7 CONCLUSIONS AND DISCUSSION

The analysis presented has yielded the following main results. First, a woman's completion of primary school and the years of education completed by other women around her are negatively associated with fertility. Completion of secondary school or higher education does not have consistent relationships with birth across countries. Child mortality is positively associated with the odds of birth. In this dataset, there is evidence of biological replacement, behavioral replacement, and hoarding behavior (at both individual and cluster levels) in all countries. Use of modern contraception in a woman's cluster – a proxy for family planning programs – is negatively associated with birth as hypothesized. Neither religion nor urban residence has any general impact on fertility, confirming previous findings that have found these to have no effect after adjusting for other factors such as education or socioeconomic status.

In terms of the overall contribution of these factors, the results of the decomposition analysis suggest that changes in the explanatory variables included in the model are able to explain half of the fertility declines on average across these countries and up to three-fourths (in Bangladesh). Contrary to much of the existing literature, education at the individual-level does not appear to account for much of the fertility declines across countries. Although a woman's education is associated negatively with birth, it does not explain much of the reduction in fertility over time. Education at the cluster-level has a relatively larger role. This effect, however, is likely an overestimate since it is a cluster-level variable and may be reflecting some unobserved cluster-level effects such as wealth as discussed above. Overall, women's education – while certainly important for women's decision-making, autonomy, and economic opportunities – appears to have surprisingly small effects in the fertility declines. Use of modern contraception by other women in the cluster – the proxy for family planning programs – explains much more of the fertility declines, and even after controlling for wealth in a sub-sample of surveys, it tends to be the main contributor in explaining the declines in this set of countries. An additional notable finding is the stability of the individual-level child mortality variables. The odds ratios for biological (particularly) and behavioral replacement as well as hoarding are relatively stable across countries. Even though these variables do not account for a great deal of the fertility declines, they exhibit stable predictive power.

.While the results of this study show some consistent patterns across countries, they also highlight the high degree of heterogeneity across countries. While the family planning program proxy appears to explain much of the fertility declines in Bangladesh, Indonesia, and Nepal, it does not have much influence in Pakistan or the Philippines. The findings of Bangladesh, Indonesia, and Nepal suggest that increases in the use of modern contraception – even with only minimal improvements in education, household wealth, and child mortality – is associated with reduced fertility. While this result is suggestive of assertions by Cleland and colleagues (1994) that a strong family program is responsible for the fertility decline in Bangladesh, the findings on family planning and household wealth are contrary to Caldwell and colleagues' (1999; 2000) assertion that overall economic development is the main driver of fertility decline in Bangladesh. The sub-analysis of the DHS surveys indicates that improvements in household wealth do not explain much of the fertility declines over the time period analyzed.

The findings from Indonesia are generally consistent with earlier work that showed the importance of increases in contraceptive use – induced primarily by a strong family planning program, economic development and education opportunities for women – in the fertility decline in Indonesia (Gertler and Molyneaux 1994). The role of family planning as proxied by contraceptive use in the cluster and lack of explanation by education in the fertility decline in Nepal provide support for previous studies that claim education has been neglected while family planning programs have been effective (Jones and Leete 2002; Thapa 1989).

Overall, the findings from this study lend support for the composite theory of fertility decline. If education, household wealth, and child mortality had been the primary distal determinants, there would have been support for demand theories of fertility decline. If family planning programs had been the only contributor to explaining the declines, ideational and diffusion theory of fertility decline would have been supported. However, since there is contribution of both – though more for family planning programs – the results of this study seem to indicate that composite theory is the most appropriate for explaining the fertility declines in these countries. While the focus of this study is South and Southeast Asia, the results may be useful to other countries that still have high fertility rates and relatively low levels of economic development, many of which are concentrated in Africa. One of the policy implications of these findings is that investments to improve access to and uptake of family planning have the potential to lower fertility, even in settings without substantial improvements in income or education.

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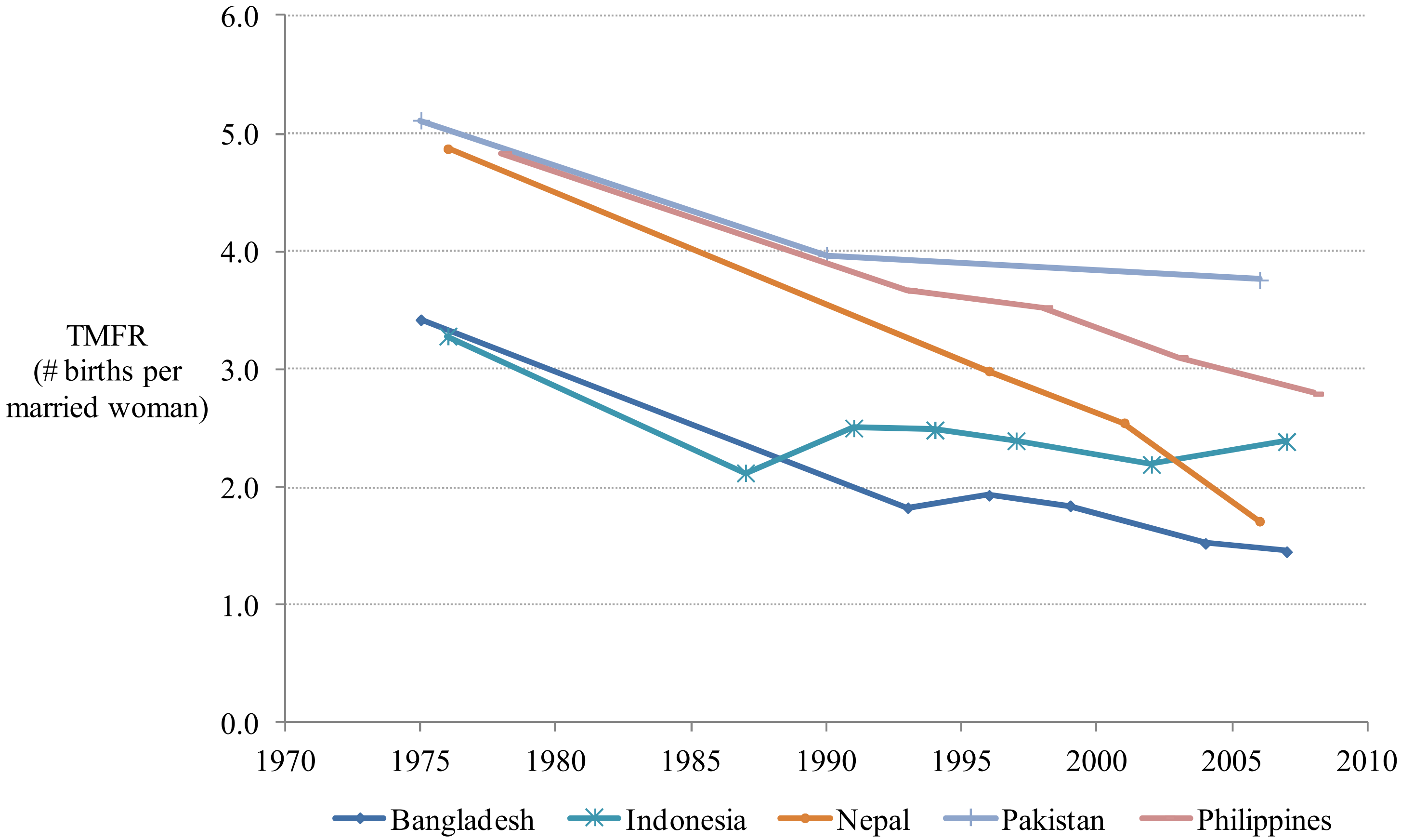
9 APPENDIX

Figure A1. Total marital fertility rate for women 25-44 by country, 1975-2008



Data Source: WFS and DHS, 1975-2008

Figure A2. Schematic for the construction of the biological replacement variable

Birth-date	Months intrpted. Preg.	Months intrpted. BF	Age at death (months)	Months reinstated BF due to "premature death"
t-31	0	1	12	0
	0	1	11	1
	0	1	10	1
	0	1	9	1
	0	1	8	1
	0	1	7	1
	0	1	6	1
	0	1	5	1
	0	1	4	1
	0	1	3	1
	0	1	2	1
	0	1	1	1
	0	1	0	1
t-30	0	2	12	0
	0	2	11	1
	0	2	10	2
	0	2	9	2
	0	2	8	2
	0	2	7	2
	0	2	6	2
	0	2	5	2
	0	2	4	2
	0	2	3	2
	0	2	2	2
	0	2	1	2
	0	2	0	2
t-29	0	3	12	0
	0	3	11	1
	0	3	10	2
	0	3	9	3
	0	3	8	3
	0	3	7	3
	0	3	6	3
	0	3	5	3
	0	3	4	3
	0	3	3	3
	0	3	2	3
	0	3	1	3
	0	3	0	3

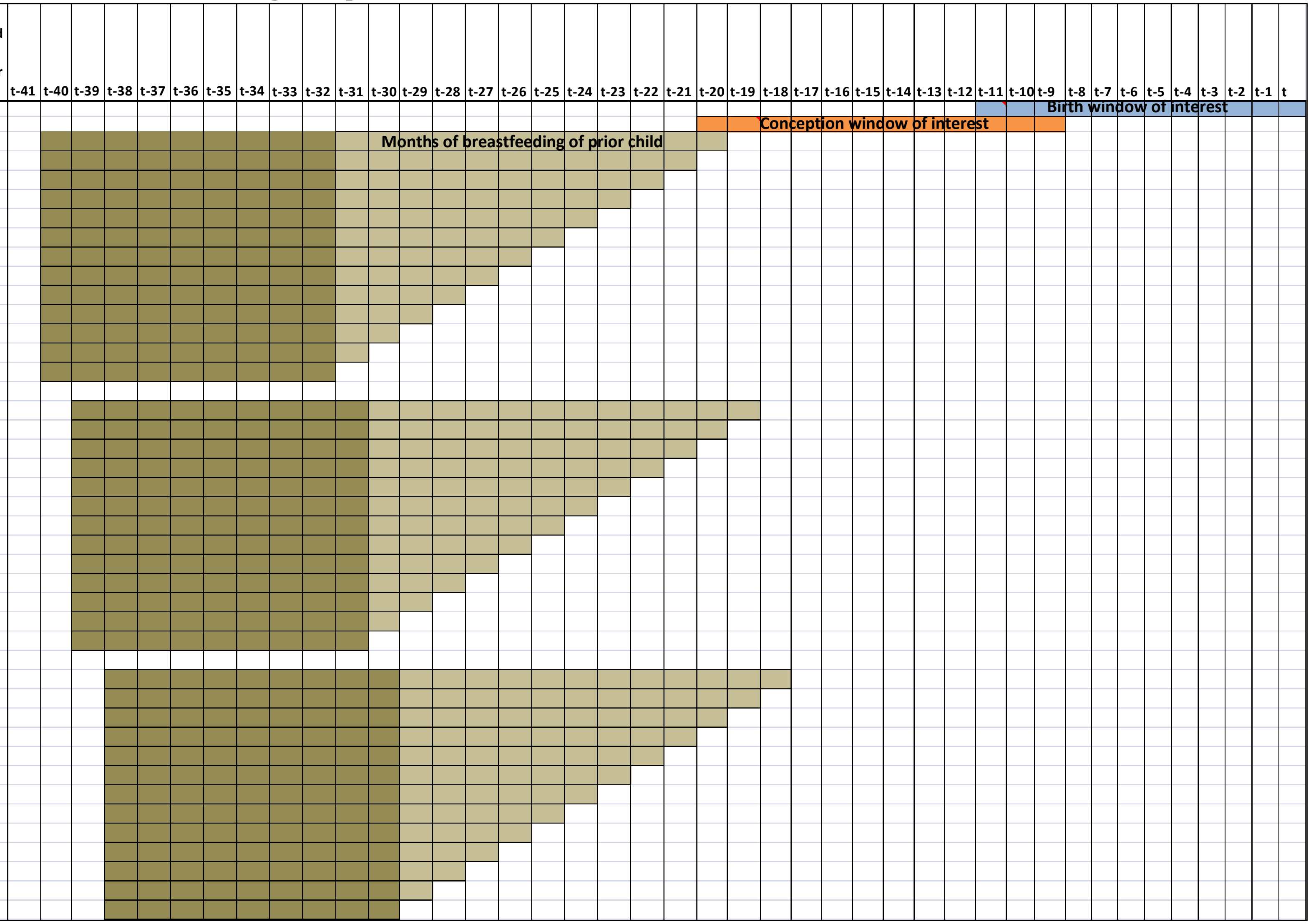
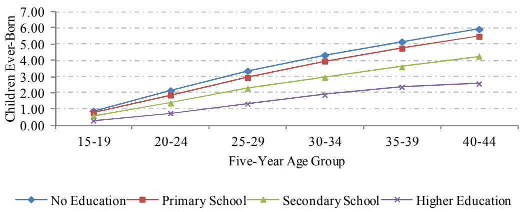
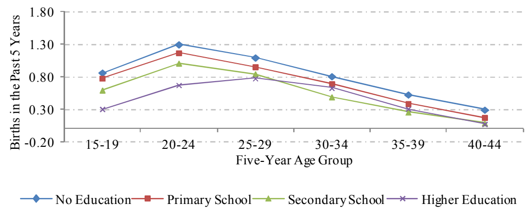


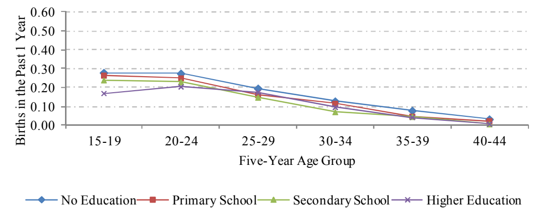
Figure A3. Fertility profiles by country, age, & education level for currently married women 15-44

Children Ever Born | Births in 5 Years Prior to Survey | Birth in Year Prior to Survey

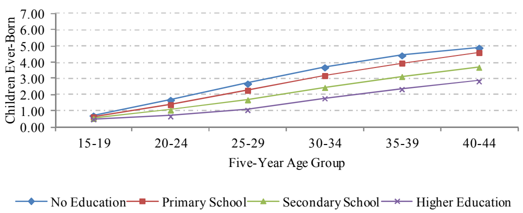
Bangladesh

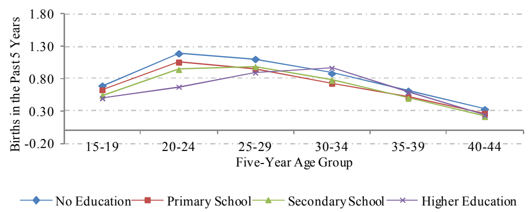


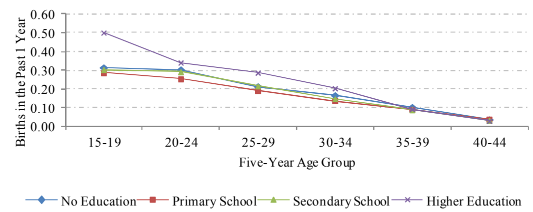




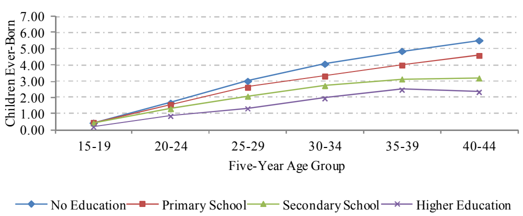
Indonesia

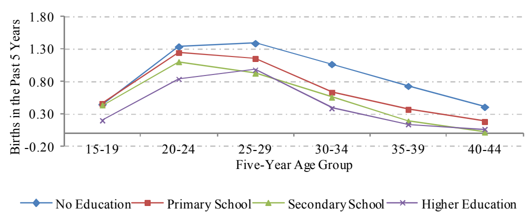


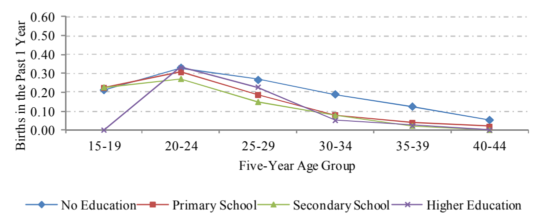




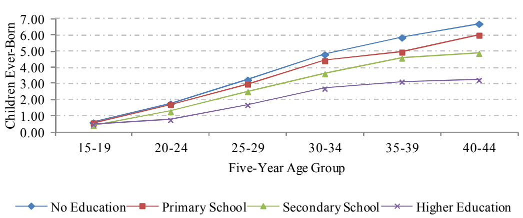
Nepal

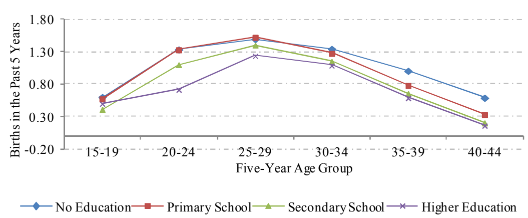






Pakistan





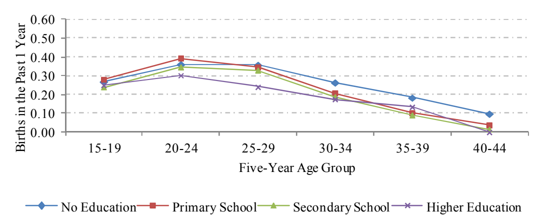


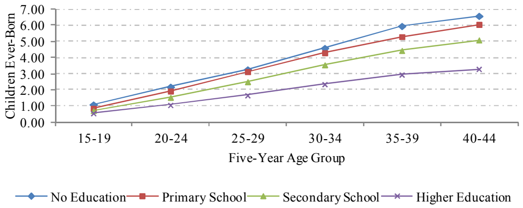
Figure A3 Continued

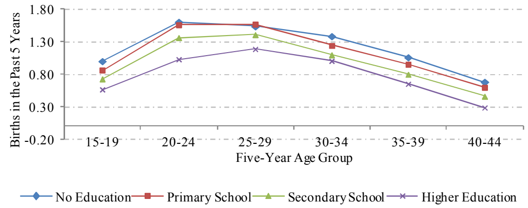
Children Ever Born

Births in 5 Years Prior to Survey

Birth in Year Prior to Survey

Philippines





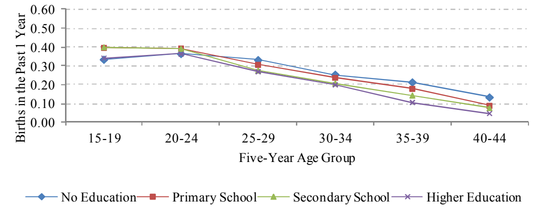


Table A1. Decomposition analysis for Bangladesh: percent of the fertility decline explained by independent variables

Bangladesh

	(1) 1975	(2) 2007	(3) 1975-2007 Change	(4) Coefficient	(5) s.e.	(6) % explained in decline in births	(7) Lower bound	(8) Upper bound
Birth	0.19	0.08	-0.11					
Primary edu	0.18	0.30	0.12	-0.0065	-0.0042	1%	0%	2%
Secondary edu	0.04	0.24	0.19	-0.0128	-0.0053	2%	0%	4%
Higher edu	0.01	0.10	0.09	0.0255	-0.0087	-2%	-3%	-1%
Years of edu (cluster)	1.40	4.88	3.48	-0.0042	-0.0012	13%	6%	20%
Modern FP (cluster)	0.06	0.46	0.40	-0.1900	-0.0122	67%	58%	75%
Months conception interrupted by BF	2.42	1.02	-1.39	-0.0143	-0.0006	-18%	-19%	-16%
Months reins. by death of child <1	0.47	0.03	-0.44	0.0019	-0.0023	1%	-1%	2%
Death of a child in conception window	0.02	0.00	-0.01	0.1570	-0.0174	2%	1%	2%
Death of a child pre-conception window	0.22	0.27	0.05	0.0287	-0.0039	-1%	-2%	-1%
Prop. of children dead (cluster)	0.19	0.06	-0.13	0.0651	-0.0338	7%	0%	15%
Muslim	0.83	0.90	0.07	0.0198	-0.0071	-1%	-2%	0%
Prop. Muslim (cluster)	0.83	0.90	0.07	-0.0076	-0.0117	0%	-1%	2%
Christian	0.00	0.00	0.00	0.0177	-0.0153	0%	0%	0%
Prop. Christian (cluster)	0.00	0.00	0.00	-0.0008	-0.0270	0%	0%	0%
Age 30-34	0.25	0.26	0.01	-0.0716	-0.0045	1%	1%	1%
Age 35-39	0.20	0.25	0.04	-0.1330	-0.0049	5%	5%	6%
Age 40-44	0.17	0.18	0.01	-0.1780	-0.0055	1%	1%	1%
Age 30-34 (cluster)	0.14	0.17	0.03	0.0102	-0.0255	0%	-2%	1%
Age 35-39 (cluster)	0.12	0.17	0.05	0.0657	-0.0274	-3%	-5%	-1%
Age 40-44 (cluster)	0.11	0.12	0.02	-0.0232	-0.0303	0%	-1%	1%
Total						75%	36%	113%

The first two columns display the mean of the respective variables in the first and last survey years. The third column shows the difference of the means in the first and last survey periods. The fourth column contains the estimated regression coefficients. The fifth column indicates the components as a percentage of the total decline in births. The calculation for the fifth column is as follows:

$$Column\ 6 = \frac{(Column\ 3 * Column\ 4)}{(Change\ in\ \text{Birth})} * 100$$

Table A2. Decomposition analysis for Indonesia: percent of the fertility decline explained by independent variables

Indonesia

	(1) 1976	(2) 2007	(3) 1976-2007 Change	(4) Coefficient	(5) s.e.	(6) % explained in decline in births	(7) Lower bound	(8) Upper bound
Birth	0.18	0.12	-0.05					
Primary Edu	0.28	0.42	0.15	0.0049	-0.0034	-1%	-3%	0%
Secondary Edu	0.10	0.44	0.35	0.0206	-0.0040	-14%	-19%	-9%
Higher Edu	0.01	0.09	0.07	0.0639	-0.0059	-9%	-10%	-7%
Cluster Edu Yrs	2.56	8.21	5.65	0.0002	-0.0006	-2%	-14%	10%
Cluster FP	0.22	0.56	0.34	-0.1310	-0.0060	85%	77%	92%
Months interrupted_BF	1.77	1.27	-0.50	-0.0137	-0.0003	-13%	-14%	-13%
Months reinstated	0.17	0.03	-0.14	0.0186	-0.0017	5%	4%	6%
Behavioral Replacement	0.01	0.01	0.00	0.1510	-0.0114	1%	1%	1%
Hoarding	0.14	0.13	0.00	0.0165	-0.0027	0%	0%	0%
Cluster Proportion Children Dead	0.17	0.07	-0.10	0.0880	-0.0180	18%	11%	25%
Muslim								
Cluster Muslim								
Christian								
Cluster Christian								
Age 30-34	0.26	0.27	0.01	-0.0651	-0.0028	1%	1%	1%
Age 35-39	0.26	0.25	-0.01	-0.1250	-0.0029	-2%	-2%	-2%
Age 40-44	0.20	0.21	0.01	-0.1880	-0.0032	3%	3%	3%
Cluster Age 30-34	0.19	0.23	0.04	0.0008	-0.0120	0%	-2%	2%
Cluster Age 35-39	0.18	0.21	0.03	-0.0143	-0.0120	1%	0%	2%
Cluster Age 40-44	0.15	0.18	0.03	-0.0056	-0.0129	0%	-1%	2%
Total						72%	31%	114%

Table A3. Decomposition analysis for Nepal: percent of the fertility decline explained by independent variables

Nepal

	(1) 1977	(2) 2003	(3) 1977-2003 Change	(4) Coefficient	(5) s.e.	(6) % explained in decline in births	(7) Lower bound	(8) Upper bound
Birth	0.27	0.10	-0.17					
Primary Edu	0.02	0.14	0.12	-0.0361	-0.0091	3%	1%	4%
Secondary Edu	0.01	0.15	0.14	-0.0324	-0.0104	3%	1%	4%
Higher Edu	0.00	0.03	0.03	0.0285	-0.0215	0%	-1%	0%
Cluster Edu Yrs	0.25	3.35	3.10	-0.0101	-0.0020	18%	11%	26%
Cluster FP	0.02	0.32	0.30	-0.2080	-0.0210	37%	29%	44%
Months interrupted_BF	2.56	1.27	-1.30	-0.0197	-0.0008	-15%	-16%	-14%
Months reinstated	0.41	0.04	-0.38	0.0054	-0.0030	1%	0%	3%
Behavioral Replacement	0.02	0.01	-0.01	0.2150	-0.0230	1%	1%	2%
Hoarding	0.20	0.28	0.09	0.0294	-0.0059	-1%	-2%	-1%
Cluster Proportion Children Dead	0.24	0.11	-0.13	0.0783	-0.0533	4%	-4%	12%
Muslim	0.04	0.03	-0.01	0.0322	-0.0196	0%	0%	0%
Cluster Muslim	0.04	0.03	-0.01	-0.0099	-0.0276	0%	0%	0%
Christian	0.00	0.01	0.01	0.0299	-0.0387	0%	-1%	0%
Cluster Christian	0.00	0.01	0.01	0.0709	-0.0755	0%	-1%	0%
Age 30-34	0.26	0.25	-0.01	-0.0937	-0.0069	-1%	-1%	-1%
Age 35-39	0.20	0.23	0.03	-0.1630	-0.0074	3%	3%	3%
Age 40-44	0.18	0.19	0.02	-0.2380	-0.0081	2%	2%	3%
Cluster Age 30-34	0.16	0.14	-0.03	0.0417	-0.0438	1%	-1%	2%
Cluster Age 35-39	0.13	0.13	0.00	0.1220	-0.0456	0%	0%	0%
Cluster Age 40-44	0.12	0.11	-0.01	0.0664	-0.0493	0%	0%	1%
Total						56%	22%	90%

Table A4. Decomposition analysis for Pakistan: percent of the fertility decline explained by independent variables

Pakistan

	(1) 1975	(2) 2006	(3) 1975-2006 Change	(4) Coefficient	(5) s.e.	(6) % explained in decline in births	(7) Lower bound	(8) Upper bound
Birth	0.28	0.21	-0.07					
Primary Edu	0.08	0.13	0.05	-0.0275	-0.0119	2%	0%	4%
Secondary Edu	0.05	0.14	0.09	-0.0246	-0.0124	3%	0%	6%
Higher Edu	0.01	0.08	0.07	-0.0484	-0.0191	5%	1%	9%
Cluster Edu Yrs	1.10	2.98	1.89	-0.0061	-0.0018	15%	6%	24%
Cluster FP	0.04	0.21	0.16	-0.0141	-0.0284	3%	-10%	16%
Months interrupted_BF	2.60	2.01	-0.60	-0.0194	-0.0010	-16%	-18%	-15%
Months reinstated	0.39	0.14	-0.25	-0.0003	-0.0033	0%	-2%	2%
Behavioral Replacement	0.01	0.02	0.01	0.1940	-0.0266	-2%	-3%	-2%
Hoarding	0.18	0.25	0.07	0.0208	-0.0083	-2%	-4%	0%
Cluster Proportion Children Dead	0.22	0.10	-0.12	0.1310	-0.0455	29%	12%	46%
Muslim								
Cluster Muslim								
Christian								
Cluster Christian								
Age 30-34	0.28	0.26	-0.02	-0.1100	-0.0095	-3%	-3%	-2%
Age 35-39	0.21	0.24	0.04	-0.2110	-0.0100	11%	10%	12%
Age 40-44	0.20	0.19	-0.01	-0.3090	-0.0110	-6%	-6%	-5%
Cluster Age 30-34	0.19	0.20	0.01	0.0017	-0.0322	0%	-1%	1%
Cluster Age 35-39	0.15	0.20	0.05	0.0755	-0.0344	-5%	-10%	0%
Cluster Age 40-44	0.14	0.15	0.01	0.0305	-0.0373	0%	-1%	1%
Total						34%	-29%	97%

Table A5. Decomposition analysis for Philippines: percent of the fertility decline explained by independent variables

Philippines

	(1) 1978	(2) 2008	(3) 1978-2008 Change	(4) Coefficient	(5) s.e.	(6) % explained in decline in births	(7) Lower bound	(8) Upper bound
Birth	0.25	0.14	-0.11					
Primary Edu	0.21	0.24	0.03	-0.0182	-0.0158	1%	0%	1%
Secondary Edu	0.58	0.44	-0.15	-0.0488	-0.0159	-6%	-11%	-2%
Higher Edu	0.17	0.31	0.14	-0.0476	-0.0163	6%	2%	10%
Cluster Edu Yrs	9.58	10.59	1.01	-0.0066	-0.0015	6%	3%	9%
Cluster FP	0.20	0.24	0.04	-0.0784	-0.0195	3%	1%	4%
Months interrupted_BF	2.58	1.61	-0.97	-0.0109	-0.0006	-10%	-11%	-9%
Months reinstated	0.10	0.04	-0.06	0.0072	-0.0035	0%	0%	1%
Behavioral Replacement	0.01	0.01	0.00	0.2120	-0.0253	0%	0%	0%
Hoarding	0.05	0.10	0.05	0.0285	-0.0067	-1%	-2%	-1%
Cluster Proportion Children Dead	0.09	0.04	-0.05	0.0023	-0.0471	1%	-4%	6%
Muslim	0.02	0.02	0.00	0.0227	-0.0218	0%	0%	0%
Cluster Muslim	0.02	0.02	0.00	-0.0105	-0.0359	0%	0%	0%
Christian	0.96	0.90	-0.06	0.0100	-0.0101	1%	-1%	2%
Cluster Christian	0.95	0.90	-0.06	0.0558	-0.0262	3%	0%	6%
Age 30-34	0.26	0.27	0.00	-0.0771	-0.0061	0%	0%	0%
Age 35-39	0.25	0.26	0.00	-0.1480	-0.0063	0%	0%	0%
Age 40-44	0.21	0.22	0.01	-0.2210	-0.0068	2%	2%	2%
Cluster Age 30-34	0.21	0.16	-0.05	0.0598	-0.0281	3%	0%	6%
Cluster Age 35-39	0.21	0.16	-0.05	0.0302	-0.0286	1%	-2%	4%
Cluster Age 40-44	0.18	0.13	-0.05	0.0139	-0.0318	0%	-2%	3%
Total						10%	-24%	43%

Table A6. Bangladesh: Multilevel random effects logistic modeling of birth in the year prior to survey, currently married women 25-44, 1993-2007 (DHS)

Bangladesh	Birth in the year prior to survey (1 = Birth, 0 = No Birth)		
	(1)	(2)	(3)
Primary education[a]	0.894**	0.902*	0.907*
	(0.808 - 0.990)	(0.811 - 1.002)	(0.815 - 1.009)
Secondary education[a]	0.853**	0.878*	0.889
	(0.751 - 0.969)	(0.764 - 1.010)	(0.771 - 1.024)
Higher education[a]	1.384***	1.419***	1.440***
	(1.140 - 1.679)	(1.140 - 1.766)	(1.154 - 1.797)
Years of education in cluster	0.945***	0.954***	0.945***
	(0.917 - 0.973)	(0.924 - 0.986)	(0.908 - 0.984)
Use of modern contraception in cluster	0.114***	0.111***	0.111***
	(0.0861 - 0.151)	(0.0831 - 0.148)	(0.0833 - 0.148)
Months of conception reinstated by premature death	1.197***	1.216***	1.216***
	(1.132 - 1.266)	(1.149 - 1.287)	(1.148 - 1.287)
Death of a child in conception window[b]	2.805***	2.577***	2.576***
	(2.053 - 3.832)	(1.869 - 3.553)	(1.868 - 3.551)
Death of a child prior to conception window[c]	1.428***	1.437***	1.435***
	(1.302 - 1.565)	(1.306 - 1.580)	(1.305 - 1.579)
Proportion of children dead in cluster	1.576	1.567	1.604
	(0.686 - 3.621)	(0.659 - 3.724)	(0.674 - 3.819)
Muslim	1.319***	1.280**	1.280**
	(1.086 - 1.601)	(1.048 - 1.563)	(1.048 - 1.563)
Christian	1.31	1.218	1.216
	(0.912 - 1.881)	(0.827 - 1.795)	(0.825 - 1.792)
Household asset score		0.984	0.978*
		(0.964 - 1.004)	(0.954 - 1.003)
Household asset score in cluster			1.017
			(0.977 - 1.058)
Constant	0.435***	0.406***	0.405***
	(0.296 - 0.640)	(0.273 - 0.606)	(0.272 - 0.604)
Observations	27447	25859	25859
Number of cluster	580	580	580

Table A7. Indonesia: Multilevel random effects logistic modeling of birth in the year prior to survey, currently married women 25-44, 1987-2007 (DHS)

Indonesia	Birth in the year prior to survey (1 = Birth, 0 = No Birth)		
	(1)	(2)	(3)
Primary education[a]	1.039	1.06	1.062
	(0.968 - 1.116)	(0.987 - 1.138)	(0.988 - 1.140)
Secondary education[a]	1.224***	1.300***	1.303***
	(1.128 - 1.328)	(1.196 - 1.413)	(1.199 - 1.417)
Higher education[a]	1.792***	1.907***	1.914***
	(1.603 - 2.003)	(1.702 - 2.138)	(1.708 - 2.146)
Years of education in cluster	1.007	1.023***	1.020***
	(0.996 - 1.018)	(1.011 - 1.035)	(1.007 - 1.034)
Use of modern contraception in cluster	0.279***	0.291***	0.289***
	(0.249 - 0.313)	(0.259 - 0.327)	(0.257 - 0.325)
Months of conception reinstated by premature death	1.202***	1.199***	1.199***
	(1.169 - 1.236)	(1.166 - 1.233)	(1.166 - 1.233)
Death of a child in conception window[b]	2.675***	2.653***	2.652***
	(2.253 - 3.177)	(2.230 - 3.156)	(2.229 - 3.154)
Death of a child prior to conception window[c]	1.212***	1.203***	1.203***
	(1.149 - 1.280)	(1.140 - 1.270)	(1.139 - 1.270)
Proportion of children dead in cluster	2.257***	2.265***	2.270***
	(1.599 - 3.186)	(1.603 - 3.201)	(1.606 - 3.208)
Household asset score		0.935***	0.929***
		(0.921 - 0.950)	(0.911 - 0.948)
Household asset score in cluster			1.015
			(0.986 - 1.045)
Constant	0.389***	0.414***	0.411***
	(0.334 - 0.452)	(0.356 - 0.482)	(0.353 - 0.478)
Observations	100527	98841	98841
Number of cluster	5619	5618	5618

Table A8. Nepal: Multilevel random effects logistic modeling of birth in the year prior to survey, currently married women 25-44, 1996-2006 (DHS)

Nepal	Birth in the year prior to survey (1 = Birth, 0 = No Birth)		
	(1)	(2)	(3)
Primary education[a]	0.708***	0.731***	0.736***
	(0.592 - 0.848)	(0.608 - 0.880)	(0.611 - 0.886)
Secondary education[a]	0.774**	0.802*	0.814*
	(0.628 - 0.952)	(0.641 - 1.005)	(0.649 - 1.020)
Higher education[a]	1.660**	1.906***	1.932***
	(1.115 - 2.471)	(1.229 - 2.956)	(1.246 - 2.995)
Years of education in cluster	0.871***	0.904***	0.883***
	(0.833 - 0.911)	(0.860 - 0.951)	(0.833 - 0.937)
Use of modern contraception in cluster	0.145***	0.168***	0.157***
	(0.0956 - 0.219)	(0.109 - 0.259)	(0.101 - 0.243)
Months of conception reinstated by premature death	1.231***	1.215***	1.216***
	(1.153 - 1.313)	(1.137 - 1.298)	(1.137 - 1.299)
Death of a child in conception window[b]	2.948***	3.009***	2.996***
	(2.003 - 4.338)	(2.033 - 4.455)	(2.024 - 4.436)
Death of a child prior to conception window[c]	1.368***	1.353***	1.350***
	(1.222 - 1.532)	(1.206 - 1.519)	(1.203 - 1.515)
Proportion of children dead in cluster	1.178	1.289	1.275
	(0.432 - 3.212)	(0.461 - 3.609)	(0.458 - 3.551)
Muslim	1.401*	1.429*	1.419*
	(0.952 - 2.061)	(0.961 - 2.124)	(0.955 - 2.107)
Christian	1.366	1.424	1.411
	(0.682 - 2.733)	(0.704 - 2.879)	(0.698 - 2.856)
Household asset score		0.913***	0.893***
		(0.878 - 0.950)	(0.849 - 0.939)
Household asset score in cluster			1.058
			(0.981 - 1.141)
Constant	0.650**	0.682**	0.685**
	(0.464 - 0.909)	(0.483 - 0.963)	(0.486 - 0.966)
Observations	14823	14363	14363
Number of cluster	287	287	287

Table A9. Pakistan: Multilevel random effects logistic modeling of birth in the year prior to survey, currently married women 25-44, 1990-2006 (DHS)

Pakistan	Birth in the year prior to survey (1 = Birth, 0 = No Birth)		
	(1)	(2)	(3)
Primary education[a]	0.865*	0.901	0.898
	(0.731 - 1.023)	(0.757 - 1.072)	(0.755 - 1.069)
Secondary education[a]	0.906	0.933	0.939
	(0.766 - 1.072)	(0.782 - 1.113)	(0.787 - 1.120)
Higher education[a]	0.773*	0.796	0.812
	(0.595 - 1.005)	(0.605 - 1.048)	(0.617 - 1.069)
Years of education in cluster	0.956***	0.961***	0.948***
	(0.932 - 0.981)	(0.935 - 0.987)	(0.920 - 0.977)
Use of modern contraception in cluster	0.958	0.967	0.875
	(0.650 - 1.410)	(0.648 - 1.444)	(0.580 - 1.319)
Months of conception reinstated by premature death	1.058**	1.066**	1.067**
	(1.002 - 1.118)	(1.008 - 1.128)	(1.009 - 1.129)
Death of a child in conception window[b]	2.446***	2.391***	2.391***
	(1.745 - 3.428)	(1.686 - 3.391)	(1.687 - 3.390)
Death of a child prior to conception window[c]	1.175***	1.167**	1.161**
	(1.046 - 1.321)	(1.036 - 1.315)	(1.031 - 1.308)
Proportion of children dead in cluster	3.271***	3.101***	3.158***
	(1.593 - 6.719)	(1.497 - 6.427)	(1.526 - 6.537)
Household asset score		0.984	0.965**
		(0.963 - 1.005)	(0.938 - 0.993)
Household asset score in cluster			1.043**
			(1.003 - 1.084)
Constant	0.573***	0.601***	0.551***
	(0.463 - 0.710)	(0.476 - 0.758)	(0.431 - 0.704)
Observations	10748	10306	10306
Number of cluster	1373	1373	1373

Table A10. Philippines: Multilevel random effects logistic modeling of birth in the year prior to survey, currently married women 25-44, 1993-2008 (DHS)

Philippines	Birth in the year prior to survey (1 = Birth, 0 = No Birth)		
	(1)	(2)	(3)
Primary education[a]	0.857	0.873	0.876
	(0.656 - 1.118)	(0.667 - 1.143)	(0.669 - 1.146)
Secondary education[a]	0.675***	0.737**	0.739**
	(0.515 - 0.887)	(0.559 - 0.971)	(0.561 - 0.975)
Higher education[a]	0.742**	0.856	0.861
	(0.562 - 0.980)	(0.644 - 1.137)	(0.648 - 1.145)
Years of education in cluster	0.950***	0.982	0.971**
	(0.930 - 0.971)	(0.959 - 1.005)	(0.944 - 0.999)
Use of modern contraception in cluster	0.490***	0.497***	0.494***
	(0.367 - 0.654)	(0.370 - 0.666)	(0.368 - 0.662)
Months of conception reinstated by premature death	1.055**	1.065**	1.064**
	(1.000 - 1.112)	(1.009 - 1.124)	(1.009 - 1.123)
Death of a child in conception window[b]	3.198***	2.958***	2.948***
	(2.302 - 4.441)	(2.122 - 4.124)	(2.114 - 4.110)
Death of a child prior to conception window[c]	1.265***	1.227***	1.228***
	(1.142 - 1.400)	(1.106 - 1.361)	(1.107 - 1.362)
Proportion of children dead in cluster	1.109	0.889	0.919
	(0.543 - 2.262)	(0.428 - 1.845)	(0.442 - 1.913)
Muslim	1.262	1.189	1.185
	(0.872 - 1.828)	(0.813 - 1.739)	(0.810 - 1.732)
Christian	1.106	1.091	1.09
	(0.944 - 1.295)	(0.930 - 1.281)	(0.928 - 1.279)
Household asset score		0.905***	0.898***
		(0.883 - 0.928)	(0.873 - 0.923)
Household asset score in cluster			1.03
			(0.983 - 1.080)
Constant	0.570**	0.657*	0.639*
	(0.359 - 0.906)	(0.411 - 1.051)	(0.399 - 1.025)
Observations	24248	23482	23482
Number of cluster	1070	1067	1067

Notes: Odds ratios reported, 95% confidence intervals in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All models additionally control for: survey year, age (5-year age groups, proportion of women in each 5-year age group within cluster), proportion of women in each religious group within cluster, and prior birth in the conception window, not shown.

[a] Reference category is no education.

[b] Reference category is no death of a child in the conception window

[c] Reference category is no death of a child prior to the conception window