

The Long Reach of Fertility Limitation: Human Capital Formation across Decades

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Several decades of scholarship demonstrate the important role that expansions in family planning and female education played in reducing family size and improving early life conditions for new birth cohorts of children. Given growing evidence about the importance of these early life conditions for trajectories of development in youth and adolescence, it is likely that such expansions have a more enduring legacy. In the present study, we test this theory using a novel longitudinal data set that facilitates the study of human capital formation in Indonesian birth cohorts from 1960-1990, a period during which total fertility fell from 5.8 births to 3.4 births per woman (Table 1). Using rich data on families and communities, we identify, in turn, the effects of family planning expansions on fertility outcomes, the effect of fertility outcomes on early-life measures of physical health, the effects of these inputs on trajectories of cognitive development and linear growth, and finally the effect of these development measures of completed education and adult height. We generate a series of macrosimulations that link these equations and introduce variation in the parameter estimates given assumptions about macroeconomic change. In doing so, we generate a plausible range of values taken by the influence of fertility decline on human capital attainment in contemporary cohorts of Indonesian adults.

BACKGROUND

The rapid, post-WWII fertility declines observed in many resource-poor populations have had far-reaching implications, particularly for maternal and child health. Much of this effect has occurred through a reduction of intra-household competition for resources among children, later initiation and longer intervals between births improving maternal restoration, and increased investment in prenatal care. Many studies demonstrate that such shifts are sufficient to produce significant decreases in maternal, infant and early childhood mortality (Palloni and Tienda, 1986, Palloni, 1989) as well as improvement in child nutritional status and their early-life physical growth (Uauy and de Andraca, 1995).

In recent years, such gains in early life health have been hailed as a potential driver of socioeconomic development at the population level. Mounting evidence demonstrates the importance of pre-, peri-, and post-natal health on early life cognitive and emotional development (Behrman and Rosenzweig, 2002, Canning et al, 2011, Fernald et al., 2008, 2009). Further, children's growth trajectories appear highly predictive of their acquisition of formal education, the quality of their performance in school, and even their adult earnings in the labor market (Currie 2007, Strauss and Thomas 2008, Martorell et al, 2010).

While both lines of research are now well-developed, several crucial elements of these long-term shifts remain unexplored. First, few studies have linked these two processes. That is, what is the net effect of fertility decline – including investments in family planning – on the cognitive skills, education, and earnings capacity in a population? Second, the effect of both fertility decline and early life health on labor market outcomes has largely ignored the rapid change in the structure of labor demand that accompanies these changes. The same processes that shift fertility shift employment to something increasingly urbanized, skill-intensive, and diversified in terms of occupations and industries. Therefore, cognitive and non-cognitive skills are individual characteristics that may carry an even larger premium in terms of expected earnings. Third, a complete understanding of the process by which fertility decline and economic development are linked must consider how macro-level changes in nutritional and work environments erode the health benefits that have historically been associated with fertility decline. Because of the combination of employment strategies that discourage the universal adoption of breastfeeding, and promote a processed-foods diet (Popkin 2004), the net effect on human capital formation in more recent periods remains ambiguous (e.g., Baum and Ford 2004).

Our research seeks to fill these gaps.

APPROACH

We combine multiple secondary data sources from Indonesia. The primary data source is composed of four waves of the longitudinal, population representative Indonesia Family Life Survey. The data have several characteristics that are advantageous for this analysis. First, the longitudinal survey has excellent retention; over 90% across the four waves. Second, the survey includes detailed information on individual and household economic indicators, cognition, education, labor, self-reported health, and detailed fertility histories, as well as a rich array of measured indicators of health, including anthropometrics. Third, the survey data are multilevel; detailed interviews with community leaders, local facilities, and service providers provide crucial information for our analysis, including the availability of contraception, schooling, and employment. Fourth, the survey is based on regional boundaries consistent with the Indonesian statistical agency (BPS); thus the data can be merged with macro-economic and macro-nutritional indicators derived from annual BPS surveys on employment and wages.

Our statistical analysis of the IFLS and BPS data proceeds in three stages. We begin by identifying the contribution of efforts to reduce fertility and to improve child and maternal health on the mechanisms linking population transitions to children's human capital trajectories (specifically, birthweight, stunting, wasting, and cognition at age 5, all of which are measured in the IFLS). These contributions are assessed by leveraging the joint temporal and spatial variation in family planning efforts in Indonesia, which can be identified both in the IFLS. In doing so, we are careful to consider concurrent changes to the macroeconomic environment. The specified regression equations (conditional logits) are well-tested and have been employed before to estimate effects of pace of childbearing and breastfeeding on child mortality (Palloni, 1989; Palloni and Millman, 1986).

Secondly, we specify a set of regressions in which children's cognitive skills, educational attainment for age, and – for older children – occupation and wages, are a function of the health outcomes in

the previous specifications. We then consider a set of circumstances related to fertility decline and use the predicted values of associated health outcomes in the second set of equations to derive the implied human capital characteristics of individuals associated with fertility decline.

In each of these specifications, our goal is to generate estimates that are plausibly causal effects. As such, we use instruments, sibling comparisons, and comparisons within communities to minimize confounding bias. Because initial results (not shown) suggest that the generated estimates vary slightly across specification strategy, we use the range of estimated values.

Finally, we introduce interactions between macroeconomic conditions and the first set of regressions—those predicting health outcomes from indicators of fertility decline. The interactions allow us to derive a set of predicted education and labor market outcomes under several types of conditions—namely those estimated in times larger families and fewer resources and those estimated in the presence of smaller families with greater resources with or without the presence of rich educational opportunities.

The approach generates estimates for (a) the net effect of fertility reduction on children's health and nutritional status and (b) the magnitude of the impact of child health and nutrition improvements on the accumulation of human capital over the life cycle of individuals. Specifying the relevant pathways linking fertility decline to second-generation adult human capital facilitates the production of estimates under different assumptions about how these pathways are linked, allowing us, for example, to specify a weaker return to smaller family size in the presence of rising body mass and processed foods (a phenomena identifiable in the data—specifically among families in Jakarta).

Crucially, the approach depends on multiple assumptions. We must assume that the parameter estimates are well-identified. Second, the regressions using measures of cognition and linear growth early in life can only be estimated for a subset of the cohorts under consideration—namely the youngest group in our sample. We must assume that the links between spacing, breastfeeding, and early-life cognition and height were similar in early cohorts. We allow these associations to vary to test the sensitivity of the results to these outcomes. Perhaps most importantly, we must assume that the processes under consideration do not produce general equilibrium effects that are not accounted for here.

These are nontrivial assumptions. Nevertheless, existing estimates explicitly linking family planning, fertility decline, and second-generation adult human capital are non-existent or specified without consideration of the relevant mechanisms. By carefully specifying the relevant assumptions and considering plausible values for the estimates given potential bias, the present approach offers an important empirical step forward to understand the implications of major transitions in demographic conditions.

Table 1. Shifts in Family Planning & Female Education, 1965-1990
Cohort Human Capital Outcomes by 2007, Indonesia

	Period				
	1965-69	1970-74	1975-79	1980-84	1985-89
TFR	5.57	5.30	4.73	4.11	3.40
Infant mortality rate (per thousand)	118	100	84	70	59
% IFLS cohort born into a community with an active family planning program	1.2	9.3	22.2	55.4	90.3
	Birth Cohorts				
	1965-69	1970-74	1975-79	1980-84	1985-89
As adults (18 and over) in 2007:					
Completed education (in years)	6.6	8.1	8.3	8.7	9.0
Average adult height (cms) (female only)	150.3	150.1	150.9	151.2	151.3
Average adult height (cms) (all adults)	155.8	155.9	156.4	156.6	156.1

Source: Badan Pusat Statistik, United Nations, and the Indonesian Family Life Survey.

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