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How Does Family Planning Promote Development? : Evidence from a Social Experiment in Matlab, Bangladesh, 1977 – 1996 *

Abstract

Family planning programs may have long-run consequences for families and economic development, in addition to fertility reduction, but these consequences have not been adequately assessed. Malthus foresaw that slowing population growth would increase wages. The UN 1994 Population Conference in Cairo concluded that family planning enhanced women's health and empowerment, which were also objectives of development. Evidence from a long-run social experiment in family planning and maternal and child health in Matlab, Bangladesh is examined here. The family planning program is associated with a 10-15 percent decrease in fertility and population growth for two decades, and with an increase in adult women's wages by a third, but it had no apparent effect on the wages of youth or male adults. Child survival, child schooling, and women's and daughter's health (BMI) improved relatively in program villages, and physical household assets were 25 percent larger in program villages, consistent with hypothesized intertemporal and intergenerational behavioral mechanisms.

Keywords: Family Planning, Malthusian Consequences, Women's Human Capital, Household Savings and Composition of Assets

JEL Classification: J13, J12, D13, D91

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1. Introduction

If a social welfare program reduces the private costs of assessing, adopting, and using birth control, fertility is expected to decline. But questions remain; for example: by how much will fertility decline, for how long, among which groups in the population will it be most effective, what are the wider welfare consequences of this program-induced decline in fertility for the family and for society, and finally, how does such a program-induced decline in fertility affect the inputs of labor and capital that appear critical to economic development? Answers to these questions are relevant to determining the appropriate population policies related to family planning and maternal and child health programs and how these programs should be specifically designed and targeted in different parts of the world. However, these questions have not been answered confidently by long run empirical studies, even though family planning programs have been widely recommended and subsidized as a component of the systems of social welfare programs in many countries for decades.

The rate of population growth of the low-income countries increased from about 0.5 percent per year in 1900, to 1.2 percent by 1940, and accelerated to 2.5 percent by 1960. This unprecedented rapid rate of population growth was expected to overwhelm the capacity of poor countries to accumulate the capital required to employ their populations productively (Kuznets, 1966; United Nations, 2003; Coale and Hoover, 1958; National Academy of Sciences, 1971). Reproductive biologists in the 1950s developed and clinically tested oral steroids (i.e. the pill) and improved the design of the intrauterine device (IUD), both of which were shown in the 1960s to be reliable methods for reversible birth control in high- and low-income countries. These new methods of birth control provided women with control over reproduction by means that were separated from the sexual act.

Several private foundations (e.g. Ford and Rockefeller) assigned priority to research on reproductive biology and its applications to contraception. These same foundations pioneered the diffusion of these new birth control technologies to populations in low-income countries; eventually, family planning was incorporated into many overseas development assistance programs, both bilaterally (e.g. USAID) and multilaterally (e.g. International Planned Parenthood Federation and UN Fund for Population Activities). However, nearly 50 years later, there are relatively few statistical assessments of what these family planning and reproductive health programs have

achieved. In particular, there are few randomized social experiments or statistical evaluations that compare long-term outcomes for persons offered a program with outcomes for persons in a "control" group (i.e. a comparison population group chosen in various systematic ways to hold constant other determinants of fertility and other family outcomes potentially affected by choice).

From 1960 to 2005 total fertility rates, or the number of children a women would have if she experienced current age-specific birth rates for her reproductive lifetime, declined in Latin America and Asia from 6 to 3 children (Schultz, 1997, 2008). Public and private resources to subsidize family planning have recently begun to decline. Concurrently, other challenges to development have attracted increased support (such as funding for public health initiatives related to the HIV/AIDS epidemic and infectious and parasitic diseases, such as tuberculosis and malaria). With the decrease in resources for family planning, it is important to understand what the economic and humanitarian justifications are for public assistance in family planning and reproductive health and in which contexts these programs are likely to be most valuable in reducing poverty and increasing economic growth.

First, family planning policies or programs should be shown to have achieved their initial objective of reducing fertility among those who were offered voluntary program services. In other words, local average treatment effects (LATE) of programs on *fertility* should be statistically significant and substantial relative to their social cost (i.e. public and private costs) (Imbens and Angrist, 1994). It is important to then disentangle whether helping couples reduce the number of unwanted or ill-timed births leads the couples to substitute their resources from raising more children to achieving other lifetime objectives. Some of these other family objectives may be viewed as "positive social externalities" or spillovers caused by a program. One indication that these other family objectives generate positive social externalities is that public funds are already used to encourage these outcomes, such as improvements in women's health, increases in women's productivity, and increases in the human capital of their children, as reflected in their health, nutrition, and schooling. Systematic consequences of program-induced declines in fertility may increase economic development. For example, fertility may substitute for savings and physical asset accumulation, as hypothesized by Samuelson's (1958) overlapping generations (OLG) model, or implied by some versions of Modigliani's life cycle savings framework that are extended to include children (Modigliani and Brumburg, 1954; Modigliani, 1970). If public family planning services that

induce fertility decline also generate desirable social externalities, public subsidies of these services might be justified, even when the program is not sustainable from private user fees or regular government resources (Kremer and Miguel, 2007).

Subsidies encourage households to adopt new, more productive inputs – such as improved techniques of birth control – and may hasten the pace of social learning. These processes can increase welfare over time. But even in the case of improved welfare, policy makers often intend to phase out subsidies when a majority of households learn about the productive characteristics of the new inputs and presumably use them optimally. However, continued subsidies can be justified in terms of social externalities, particularly when the costs of motivating some groups to use the input by traditional expansions in program access are more costly than targeted subsidies. Similar arguments are made in support of conditional cash transfers, or negative prices of inputs, targeted to the poor. The conditional cash transfer programs give beneficiaries a cash transfer contingent on meeting certain requirements, such as sending children to school or attending a health clinic. These programs are designed to both reduce current poverty and increase investment in the human capital of children, or disadvantaged women, for which private and social returns are thought to be high in the long run (Parker, et al. 2008).

Evaluations of family planning programs have estimated the cross sectional association between the regional intensity of program treatment and the regional level of fertility (e.g. Schultz, 1973, 1992; Rosenzweig and Schultz, 1982; Gertler and Molyneaux, 1994). Even when panel data are analyzed and fixed effects are included for regions and time, the estimated effects of program changes on fertility changes may be biased by nonrandom placement and expansion of programs associated with omitted variables (Schultz, 1973; Miller, 2004; Bleakley, 2007). If the government's placement of a program (i.e. supply) and its expenditures per beneficiary are positively correlated with regional conditions that also affect fertility (demand), the estimated (inverse) relationship between the program and fertility may not be entirely causal. Similarly, if migrants select their destinations in part because of the strength of their preferences for the locally provided social services, the relationship between program treatment and behavioral outcomes encouraged by the program will be inclined to overestimate the program's causal effect. The composition of the population with respect to its fertility preferences is no longer random in the program and control areas, due to the selective sorting of the populations by migration (Rosenzweig and Wolpin, 1986).

The most convincing method of evaluating program impact, other things being equal, often relies on randomized social experiments (Duflo et al., 2008). One of the few documented randomized experiments in the literature on family planning is the pioneering study conducted in the city of Taichung in Taiwan from 1963 to 1966 by Freedman and Takeshita (1969) (Chandrasekaran and Hermalin, 1976; United Nations, 1985). Three program components (direct mail brochures and information campaigns directed either to husbands wives) varied in intensity in a randomized treatment across 2389 neighborhoods (Lins) within the city. The effectiveness of the 12 distinct treatment packages on encouraging the adoption of modern contraceptives, such as IUDs, were compared with the Lins provided with "nothing" or no experimental treatment. In six months contraceptive adoption rates increased more in the heavily treated than in the untreated Lin.[1] At the aggregate level, total fertility rates in Taichung City after a six month program intervention, declined more rapidly than in other cities – 6.4 percent compared to 3.1 percent. However, factors other than the program could explain the earlier decline in fertility in Taichung city (p.307).

Spillovers of information about birth control methods to areas beyond the limits of the small neighborhoods and the ability of urban residents to obtain family planning services from outside their residential neighborhoods may have eroded the power of the experimental design to identify behavioral differences caused by the Taichung city program. Moreover, a National Family Planning Program was initiated in Taiwan in late 1964, which soon spread across all 361 local administrative areas of the island, making it difficult to assess the long run consequences of the earlier Taichung program's randomized social experiment. The cross sectional association between the regional (n = 361) intensity of the National Family Planning Program and fertility levels, and between the changes in the program and changes in fertility by age within these small administrative regions suggest an impact reducing fertility among older women for the first few years of the

[1] After six months of the program in March 31, 1964, 16 percent of the married women age 20-39 had adopted a contraceptive method in the Lins with all program treatments (everything), compared to 7 percent in Lins with "nothing". The new IUD that was emphasized by the program had been adopted by 10 percent in the "everything" Lins and 7 percent in the in the "nothing" Lins. After an additional 15 months the difference between the cumulative adoption rates in the" everything" and "nothing" Lins remained nearly the same, 25 and 17 percent for all methods, and 17 and 15 percent for IUDs (Freedmand and Takeshita, 1969, p. 132). The program hastened the initial adoption of birth control, but the program's consequences on fertility were not adequately documented. Those women who adopted an IUD under the program had relatively high fertility for their age prior to the program; after adopting an IUD they had relatively low fertility for their age. This post-program difference in fertility is suggestive of a program impact on fertility, but because those women who chose to use family planning were self-selected and may differ in unobserved ways from the average population, these differences in fertility by adopter status are not a satisfactory estimate of the program's effect (Freedman and Takeshita, 1969, p. 308).

program. But these estimated program effects between regions, and over time within regions, become smaller and lose statistical significance after several years (Schultz, 1973, 1992).

One possible explanation for why social experiments in family planning have not been more widely undertaken is that there was an early consensus in most countries that conventional family planning programs were needed. The high costs of a long-duration social experiment in family planning could therefore not be readily justified, economically or ethically, unless these program evaluation studies could substantially improve the design of population policies, not only in the specific country where they were initiated, but also in other countries. Given these constraints, the case for such social experimentation to evaluate and improve the design of family planning programs was implicitly rejected.

There are several limitations to the experimental design of the program in Taichung city. First, randomization of program treatment should have been implemented over larger population units to minimize the amount of spillover. These units should also have been more isolated and self-contained, such as geographically clustered groups of rural villages between which population mobility is more restrained. Furthermore, the evaluation did not include any follow up surveys. The ideal family planning program evaluation should include follow up surveys to record the longer term consequences of the program, for a decade or longer.

Macro- and micro-economic hypotheses have been advanced to explain why declines in unwanted fertility due to a family planning intervention might relieve population pressures on the land, contribute to parents substituting their lifetime resources from child care and family labor intensive activities to other purposes, and be a source of social externalities for other households in the village or nation. If parents have fewer unwanted children, growth in the labor force 10-15 years after a family planning program was implemented should slow, unless there is offsetting interregional migration. The marginal product of labor in the residential localities with the program should then be relatively higher when compared to marginal product of labor in villages without the program, other things being equal. This "Malthusian effect" of family planning raising wages after about 15 years could be reinforced if the program also fostered an increase in lifetime savings of parents.

In addition to the effects of fertility on the supply of traditional productive factors, namely, decreased labor supply and increased physical capital, the program could affect human capital

formation in two ways. If parents, who are able to have fewer unwanted births, reallocate the resources released from the additional childcare to increase the schooling of each of their children, as is widely hypothesized in the social sciences (Becker and Lewis, 1974; Blake, 1989; Zajonc, 1976), this substitution of "quality for quantity" of children would tend to raise hourly wages of their children. Second, improved control over the timing and number of births may help women coordinate and specialize in the accumulation of their own lifetime human capital and potentially extend their work outside of the family. These alternative mechanisms could connect the decline in fertility to an increase in income and the human capital of children or women, which would extend Malthus' framework.[2]

The timing of marriage and early childbearing may be affected by the availability of birth control services. However, the effects of these services on women's human capital accumulation, wages and labor supply is likely to become more salient among older women, ages 25 to 54, who space out their final births and terminate childbearing earlier. In contrast, the Malthusian pressure of population growth in the local labor market and the effect of the parents substituting child quality for quantity would be most evident on the wages of younger members of the population. The relative importance of the family planning program on the wages of adult women versus adult men is another check on the hypothesis linking family planning to women's accumulation of human capital, and the comparison of adult women's wages to those of adult males should help to distinguish between the relative importance of macro-Malthusian and micro-human capital mechanisms linking effective family planning programs to economic development.

2. A Social Experiment in Bangladesh: A Review of the Literature

I first summarize a previous study of a family planning social experiment conducted from 1977 to 1996 in rural villages in the poor agricultural district of Matlab, Bangladesh called the Family

[2] Interregional migration is another complicating factor. Migration tends to occur from low wage to high wage regions and is expected to diminish interregional wage differences, other factors equal. But because interregional migration tends to occur more frequently among better educated individuals, youth, and members of wealthier families (Schultz, 1982), average wages may not converge toward the national average under all circumstances. Transfers from out-migrants to their extended families at the origin may be equalizing at the regional level. However, because the wealthier families at the origin may be the first to invest in the out-migration of their members, remittances from out-migrants may flow disproportionately to wealthier families in poorer states and thus increase inequality among families at origin. The convergence in wages or changes in income inequality across regions will also depend on the compensating interregional movement of capital, which is expected to flow toward regions where the cost of complementary labor is lower, raising returns on this capital investments from other regions (Foster and Rosenzweig, 2008).

Planning and Maternal Child Health (FPMCH) program.[3] All married women of childbearing age living in 70 of the 141 regionally-clustered villages included in the Demographic Surveillance System (DSS) of the Matlab district were visited every two weeks by a locally recruited female health worker. The health worker supplied married women with a variety of contraceptive methods and information on their use and side effects. Married women in the other 71 villages surveyed in 1996 had access to only the regular Bangladesh government health and family planning program community clinics. These clinics have comparable birth control supplies that are also freely available, but they require a woman to come to the clinic to obtain information and supplies (Phillips, et al., 1982). Furthermore, the environment in the government clinics may be less favorable for learning about birth control techniques and obtaining regular supplies than the home visits coordinated by the FPMCH experimental program (Schuler, et al. 2001).

The Matlab district was chosen for this family planning social experiment because its population of about 180,000 was systematically registered in 1966 as part of field experiments to test the efficacy of new cholera vaccines and interviewed again by a census team in 1974 and 1982. Monthly DSS vital records were maintained on all births, deaths, marriages, and population movements in the Matlab district. Few places in rural South Asia had at this time more reliable data from which birth and death rates could be calculated, ensuring that any demographic consequences of a family planning or public health social experiment in Matlab could be inferred with considerable confidence from vital records, censuses, and sample surveys collected by the Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR, B) (Fauveau, 1994).

An important question for development policy is whether subsidies for birth control and the diffusion of information regarding alternative birth control techniques reduce fertility, and if so, whether these declines in fertility are associated with improvements in family long-term welfare and economic growth. Do the programs benefit some specific sub-populations more than others? Confirmed heterogeneity in program effectiveness might be useful for targeting the program to reach those most likely to respond positively to the program. The gender and generational distribution of

[3] The program's name has varied over time. It was initially called the family planning-health services project. It was then referred to as a family planning and maternal child health project and more recently it is called the Maternal Child Health and Family Planning Program (Phillips, et al., 1982; Fauveau, 1994).

social benefits from such a program may also affect policy priorities and could modify the preferred program design and appropriate evaluation methods (Schultz, 1992, 1997).

The social experiment in the Matlab FPMCH program has been extensively analyzed in the demographic and public health literatures (Phillips et al. 1982; Fauveau, 1994). No report was found documenting the randomization mechanism used to assign villages to regional clusters for program treatment.[4] The program focused initially on the home delivery of birth control information and supplies by local married relatively well-educated women, who were trained by the program. After a few years, these health field workers were assigned the additional responsibility of promoting "best practices" in maternal and child health, including tetanus toxoid immunization for women, measles vaccinations of children, and oral rehydration salts for diarrheal diseases (Muhuri, 1995). Some of these practices appeared to have been effective and were subsequently incorporated into the national family planning and health programs of the Bangladesh government. The door to door provision of information and services may have been especially effective in Matlab because this is a traditional Muslim rural society in which many women are restricted in their ability to travel alone beyond their homesteads (Bari) by the customary practices of purdah.[5] These cultural restrictions on women's movement may have prevented some married women from adopting birth control and obtaining regular contraceptive supplies at their local government family planning-health clinics. Consequently, the design of the Matlab program to include home visits may have reduced the coordination costs and the burden of stigma for a woman who wanted to evaluate alternatives, adopt birth control, and then obtain her own continuing birth control supplies.

Phillips, et al. (1982) found from the birth registration data (DSS) that after two years (1978/79) women in the program areas reported general fertility rates (i.e. births per woman age 15

[4] A trade-off may exist between a program design that randomizes treatments across many small communities, as with the Lin in Taichung city, and one across fewer larger contiguous clusters of communities, as was the case in Matlab. The analysis of randomized treatment of small areas is likely to understate the program effect when the program is scaled up to a regional or national level, because program induced differences in outcomes may be diluted by any effect of the program spilling over into neighboring control communities. These spillovers were later shown to exist even in Matlab. Clustering the treatment and control communities contiguously appears to reduce the number of distinct areas available for evaluation; although, the number of individuals who are generally the units of analysis in program evaluations is invariant. Administration and transportation of program personnel and supplies may also favor clustering of social experiments to reduce their per capita costs.

[5] A limitation of most social experiments is that they are not designed to indicate how programs might be improved by restructuring them at the margin, or what specific features explain their success or failure. Typically one or only

to 49) which were 25 percent lower than in the comparison villages. But changes in the timing of births and the dynamics of life cycle fertility control could lead to a larger short-run association between the introduction of the program new methods and age-specific birth rates, than would occur in a longer-run equilibrium as new cohorts of women in the program villages adjusted the timing and total number of births they would have over their lifetime. On the other hand, child mortality may also have declined due to the program, in which case the effects of the program on fertility, either age-standardized or children ever born for a birth cohort, would overstate the program's effect on population growth. Sinha (2005) estimated from the 1996 Matlab Health and Socioeconomic Survey (MHSS) (Rahman, et al., 1999) that women under the age of 57 residing in the 70 villages with the program reported 14 percent fewer children ever born than women residing in the comparison 71 villages, controlling for the mother's age and schooling, father's schooling, farmland, and distance to the district's headquarters.

Five questions related to this social experiment remain unanswered in Sinha's study and in the other analyses I have found on Matlab (e.g. Fauveau, 1994): (1) are the program and comparison areas actually comparable and balanced along critical dimensions before the program was launched, justifying the interpretation of the post-program differences between program and comparison villages as arising from a well-designed social experiment; (2) do controls for exogenous covariates reduce the uncertainty surrounded estimates of program effects or change these effects; (3) was the program treatment effect on fertility and family outcomes comparable for all married women in the sample, or were program effects heterogeneous, which would require a different program evaluation methodology; (4) what were the longer-run consequences of the program-induced declines in fertility on other evolving family outcomes: child and maternal health, women's productivity and earnings, household assets which might be affected by lifecycle savings, the woman's children's age-specific mortality rates, the nutritional/health status of surviving children and their years of schooling, and out-migration of women and their children: and (5) did migration or attrition of individual women from 1977 to 1996 differ in the program and comparison areas, calling for a correction in program evaluation methods based on the 1996 survey. Joshi and Schultz (2007) address some of these questions, and their findings are summarized in next section.

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a few "arms" of an experiment can be followed with a sufficient sized sample to evaluate the relative impact of these

3. Pre-Program and Post-Program Levels of Fertility in the Social Experiment

A 1974 Census of Matlab documents that three years before the FPMCH program was launched the differences in surviving fertility between the villages designated to receive the program in 1977 did not differ significantly from the other "comparison" villages in the DSS. Because fertility is not reported in the 1974 Census, an aggregate measure of surviving fertility, the ratio of children age 0-4 to women of childbearing age 15-49, is analyzed at the village level. The treatment villages have slightly higher surviving fertility pre-program (1974) than the control villages, but the difference is not statistically significant. These two groups of villages do not differ significantly in the mean years of educational attainment of adults (age 15 +) or children (age 7-14) in 1974 (Joshi and Schultz, 2007). In a 1982 census, land holdings of households are reported for the first time, and this measure of land owned per household, or per adult in the household, is not statistically different between the treatment and comparison villages.

A difference-in-difference analysis of changes between the program and comparison villages pre-program (1974) and post-program (1982 census) indicates that, by 1982, surviving fertility is 17 percent lower in the program areas than in the comparison areas, holding constant for their levels in 1974. During this period the demographic transition progressed rapidly in Bangladesh, and the child-woman ratio in the comparison villages declined 38 percent from 1974 to 1996. Nonetheless, the 1996 MHSS indicates that surviving fertility was 16 percent lower in program areas than in comparison villages.[6] One explanation for the impact of a family planning program on fertility is that the diffusion of information needed to adopt a new technology of birth control is accelerated by the program's information outreach effort. Because the monetary costs of continued contraceptive use is similar in both the program and control areas (free in both the government clinic or FPCMH program) the impact of the door-to-door outreach is likely to diminish over time. However, the persistence of the program's information impact after 19 years suggests that not only is the fixed cost of adoption reduced, but the variable costs associated with any stigma and time costs incurred

variations in program treatment.

[6] Two cross sections of 141 village averages of the child woman ratios (i.e. n=282) are stacked, and the village observations are weighted in the regression analysis by the village number of women age 15 to 49, normalized to the size of the cross sectional sample so as not to underweight the 1996 survey village averages compared with the 1974 or 1982 Census village averages. The Stata command "a-weight" for the OLS weighted regressions normalize the populations observed in each cross section.

by the woman coordinating trips to the clinic for contraceptive supplies are also reduced.

Cross tabulating the 1996 MHSS individual survey data on the number of children ever born per ever married woman by age confirms fertility is unconditionally lower in the program than in the comparison areas as illustrated in Figure 1, but only for women less than age 55. These older women were over the age of 37 when the program started in 1977 and had essentially completed their childbearing when the program started. Reduced-form estimates of the program's effect on individual fertility, conditional on other exogenous household and community control variables are reported in Joshi and Schultz (2007; Table 4) and summarized here in Table 1, Column 1. They reconfirm that the number of children born is, on average, 0.68 less for ever married women age 25 to 29 in the program villages than in the comparison villages in 1996, and this conditional program reduction in fertility increases to 1.51 fewer children for women age 45 to 49.

The education of women over the age of 50 is low in Matlab, on average less than one year of schooling. In recent years women are attaining greater levels of education; women age 20 to 29 attained on average 3-4 years of schooling by 1996, catching up to men's educational attainment. In reduced form estimates for children ever born, a woman with one more year of schooling has .06 fewer births on average, not a large difference but one that is statistically significant. In other studies of South East Asia and Latin America, female schooling and the local availability of family planning program services appear to operate as economic "substitutes" in achieving (producing) lower levels of fertility (Schultz, 1973, 1992). Heterogeneity in program effects is assessed by including interaction variables between a characteristic of the population, such as women's education, and program treatment. The impact of the program reducing fertility may also differ between the minority Hindus and Muslims, for which the program and comparison villages are moderately imbalanced, and more obviously by the woman's age, as illustrated in Figure 1.[7]

The demographic transition generally involves both a decline in child mortality and in

[7] A study of the roles of social networks in the transmission of contraceptive information leading to the adoption of birth control finds that within network communication is stronger within religious groups than across these networked groups (Munshi and Myaux, 2006). The more isolated minority Hindu group, representing only ten percent of the district population, may thus have had more to gain from the program's dissemination of new information about birth control than did the majority Muslims. The coefficient on the interaction variable between program treatment and Muslim is positive in the fertility equation, implying that the program reduced fertility by a larger amount among the minority Hindus.

fertility, which implies offsetting effects on the size of surviving family, or on the aggregate long run rates of population growth. The Matlab FPCMH program is associated with both fertility declines and child mortality declines. As noted above, mothers age 45-49 in 1996 had 1.51 fewer births in program areas than in comparison areas, but only .84 fewer living children. Thus, 45 percent of the programs impact on fertility in this age group is offset by reduced mortality in terms of its impact on the number of children surviving per woman. The program is associated with both a 15 to 20 percent lower levels of fertility and lower number of children surviving (Joshi and Schultz, 2007, Table 4).

Although there is no accepted way to assign an economic value to improvements in child health (or reduced numbers of unwanted births) caused by such a program, economic productive gains are nonetheless likely to follow in the long run as the health human capital of individuals who survived experience an increase in adult productive capacities. Biologists, physicians, and demographers conclude that a cohort who has experienced fewer inflammatory illnesses, better maternal health conditions, and better nutrition as a fetus and young child tend to experience fewer chronic illnesses and disabling conditions as an adult. As a consequence, the cohort tends to be more productive in the long run (Gluckman and Hanson, 2005). But these economic gains occurring at later ages have often been statistically identified in terms of improved survival only after age 50 and are expected to emerge noticeably in the context of the Matlab experiment only in the future. There is also evidence that cognitive capacities and schooling achievements are also improved as a birth cohort avoids malnutrition and acute trauma as a fetus and in early childhood. These productive gains would then be realized over a longer lifespan (Schultz, 2008).

Interregional migration can complicate the task of evaluating the impact of a family planning and health program. Public data do not allow me to identify the characteristics of women who died or of those who moved out of the Matlab district after 1977 and before 1996. Most interregional movement of women in Matlab occurs at the time of their marriage, because it is common practice for women to marry outside of their village of birth. The migration rates at which women move into the program villages from the comparison villages (or from outside of Matlab) does not differ significantly from the rates of movement for women born outside of the program villages. Nor are these movements of women between program and control areas at the time of marriage significantly

associated with their subsequent fertility or family lifetime outcomes considered from the 1996 MHSS, as might be expected if girls acquired different knowledge of, or attitudes toward, birth control because they had grown up in a program or comparison village. The age at first birth, an indicator of the timing of marriage, does not differ before 1996 in the program and comparison areas, though women in more recent birth cohorts start their childbearing a year later, on average, than those born twenty years earlier, in both program and comparison areas. The program does thus not affect the onset of childbearing, whereas it is associated with an increase in the spacing of births after the second birth (Joshi and Schultz, 2007, Table 4, col. 3-6).

The MHSS provides information on a woman's children, including those who have migrated from their parent's home, when they left, and how much schooling they have completed. The reported migration rates by gender of children and their date of birth do not indicate significant differences between program and comparison villages.[8] In sum, available MHSS information on migration between program and comparison villages does not confirm significant differences in overall rates of migration or the gender composition of migration. Nonetheless, these issues deserve more study when additional data become available.

4. Consequences of Family Planning Intervention on Local Wages and Employment

Macro consequences of the FPMCH program slowing population growth are expected to emerge in the aggregate market for labor raising relative wage rates in program areas. Micro consequences of the program could affect the level and composition of family investments in human and physical capital, depending on how these forms of capital complement or substitute for having fewer children.[9] Following Malthus, if the marginal productivity of labor is subject to diminishing returns,

[8] Heterogeneity in fertility response to the program is obvious with respect to the mother's age (Figure 1), due probably to biology but also possibly to differences in the unobserved conditions and experiences of the sequence of older birth cohorts. Heterogeneity in response to the program is also estimated with regard to religion and the mother's schooling. Program interactions with respect to mother's schooling are retained in all estimated reduced-form equations because the adoption of modern medical inputs and vaccinations does differ across educational levels of women, even though the program does not appear to have affected fertility, child mortality, or mother's BMI differentially across education groups, as checked by the estimated coefficient on the program interacted with these group characteristics (Table 1). These sources of heterogeneity in response to the program are assessed by Sinha's (2005) study, or in most earlier investigations of the surveillance data, such as reported by Phillips, et al. (1982) or Fauveau (1994). However, Muhuri (1995) documents from DSS data for the birth cohorts of 1981 and 1982 that maternal education differences in child mortality decrease in program treatment areas, confirming that in the production of child survival, maternal schooling and the program treatment operate as substitutes.

[9] Population growth in the Matlab demographic surveillance area between the censuses of 1974 and 1982 was nearly identical in the program and comparison areas at 1.4 percent per year for both males and females. From 1982 to

labor is homogeneous, and other productive factors, technology and interregional migration do not vary between regions of Matlab, wages by 1996 should be higher in the program villages. This tendency is expected to be most salient among youth, who are an imperfect substitute in production for older, more experienced workers (Welch, 1979).[10] Cultural restrictions on mobility by gender may limit women's pursuit of off-farm employment and even their independence to seek medical care or birth control supplies at a community clinic. These restrictions on women's movement lead to the expectation that interregional migration of young males would be greater than females, potentially offsetting to a greater degree the possible effects of population growth on male wages than on female wages. However, differences between the program and comparison communities in 1996 in the self-reported mobility of women are not strong or consistent in the MHSS or in a 1996 Socioeconomic Census of Matlab (Razzaque, et al., 1998, p. 28-33).

If the program helped parents avoid having more births than they wanted, and this reduction in number of children led them to substitute more of their resources on average into the schooling of their children, the school attendance would restrain further the supply of child labor in program areas, and raise wages for those who work. When children do enter the labor force, they would be better educated and expect to receive a higher wage. These micro economic effects of the program on family time allocation and schooling of children are assessed later. But any program impact on wages operating through children's labor supply and schooling should not be interpreted as a Malthusian consequence of slower population growth, but instead as a behavioral response of parents to childbearing and birth control options. The resulting intergenerational transfer from parents to children through investment in schooling may create a stronger obligation for children to

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1993 the comparison area grew at 0.9 percent per year and the program area 1.0 percent, whereas by 1993 to 1996 the population growth in comparison area had declined to 0.7 percent while the program area declined to 0.4 percent per year, with out-migration being more rapid for males than for females. From 1996, when the survey analyzed here was collected, to 2004, population growth in the program areas occurred at 0.45 percent per year, whereas it was about twice as fast or 0.93 in the comparison areas. The ICDDR,B DSS statistics indicate that by 1996 the total fertility rate (TFR) in the program area was 2.7 children per woman whereas it was 3.5 children in the comparison areas. The TFR had has more recently converged between the program and comparison areas (ICDDR,B, 2005: Table 2.1). In sum, after 20 years of the FPCMH outreach program, the total fertility rates in the treatment and control areas diverged markedly, and then began to re-converged. The program appears to have hastened the demographic transition.

[10] The elasticity of labor supply with respect to own wages is often noted to be more positive for women than for men and more positive for young males than for prime age males, in part because males age 25 to 54 tend to virtually all be in the labor force, and therefore exhibit little response to wages (Durand, 1965; Killingsworth, 1983; Schultz, 1990).

support their parents in old age, but it also increases per capita economic growth by augmenting savings and investments in human capital.

An effective family planning program also increases the time available to a mother, who is freed from the responsibility of caring for an additional unwanted birth. How this time is reallocated will depend on her employment opportunities and preferences. Less constrained in the tasks she can undertake, she may focus on accumulating vocational skills that raise her productivity in market and home production or add to her own lifetime human capital. By increasing her contribution to family income, she is likely to enhance her bargaining power over the allocation of family resources, with the consequence of increasing further household investments in the human capital of her children.

In the 1996 MHSS all persons in the household over age 14 are asked about their primary and secondary occupation, if they worked for pay, their annual earnings, and months worked in 1995. Table 2 reports the allocation of youth age 15 to 24 among categories of workers in the 1996 MHSS, according to ordinary least squares (OLS) estimates of the difference between program and comparison villages by gender: (1) "work for pay", which presumably excludes work within family enterprise; (2) "self employment", which presumably includes work in family enterprise where there is no obvious way to measure individual productivity or labor earnings; and (3) "house work", which involves home chores and activities, from which there may be no marketable product, and consequently no obvious basis for valuing the individual's productivity. If individuals do not indicate working in any of these three job categories, they are assigned to (4) "other". [11]

Younger males, age 15 -24, work in self employment (e.g. family farm) 6.5 percentage points more often in the program villages than in the comparison villages, whereas they work for wages 7.3 percentage points less often (Table 2). The percentage differences in time allocation between program and comparison villages among young females are insignificant. This reallocation of the labor of sons from wage to self-employment activities in program villages does not prevent sons from completing .40 more years of schooling (ten percent more) than in comparison areas, adjusting

[11] The survey asks for individual earnings only if the respondent works for pay, and even then some do not report earnings and months worked, perhaps because their primary occupation is a student (#33). A weakness of the MHSS data is hours worked is not reported, and relatively few individuals work for pay, and can report earnings per month worked. If an individual reports different job types for their primary and secondary occupation, they are allocated in Tables 2 and 3 to paid job if either job is paid, to self employment if their other occupation is house work or "other", and to house work if their other occupation is not specified, i.e. "other".

for the linear effect of age. The schooling gain for girls is somewhat larger at .51 years, controlling for age (Table 2, row 6). Housework is more frequent for both girls and boys in program areas, though the differences are not statistically significant. About half of the youth are not classified into a type of job. The frequency of this "other" group does not differ significantly between the youth in program and comparison villages.

The log of the monthly wage for those reporting paid employment in 1995 is regressed on whether the individual resides in a program village, controlling only for age in the sample of youth age 15 to 24 by sex in the last row of Table 2.[12] The log monthly wage does not differ significantly between program and comparison villages for young males. However, young women have log wages .363 larger in program villages, and this difference is significant at the 5 percent level, assuming the suitable criteria is a one-tailed t test for a positive value. Part of the program association with women's wage rates may be the effect of young women having one half more years of schooling in the program villages.

Table 3 shows the estimates for adults age 25 - 54 of differences between program and comparison areas in job type and log monthly wages, controlling in this age group for a quadratic in post-school years of potential experience (i.e. age-years of schooling-6), and years of completed schooling, as Mincer (1974) specified his earnings function. The only significant difference in program areas for male adults is 1.4 percentage points increase in the residual "other" category. The log wages of male adults are .052 smaller in program than comparison villages, although the difference is not significant. Women age 25-54 work less often in paid jobs in program than comparison areas, -.069, and work more often in house work, +.068. These older women report in

[12] The data on earnings from the MHSS for 1995 do not include information on hours worked. It has only months worked in the previous year for which earnings is paid. To exploit all the information in the survey on earnings in paid employment, I have combined that which is reported in both an individual's primary and secondary occupation, if any. The annual earnings in that job is divided by months worked in that job, and when two wage jobs are reported, the monthly wages in both jobs are weighted by months worked in each. In a previous draft of this paper, I did not realize that about a tenth of the wage earners reported working both jobs for twelve months in 1995, and proceeded as if they worked full time in both jobs, which implied working an unrealistic 24 months per year. Therefore, I have decided here to set a maximum work time in a year of 12 months, and attribute those who worked their two wage jobs for a total of 13 to 24 months to have actually worked the equivalent of 12 months or full time. No central conclusions in this empirical analysis changed with this recoding of the wage data, though the coefficients estimated for the quadratic in potential years of post-school experience are more stable and of the expected sign (i.e. positive and negative) with the current coding (See later Tables 4 and 5). The estimated program effects on the log earnings per month for women age 25 to 54 did not change appreciably in magnitude and remained significant with this preferred recoding.

program villages log wages that are .364 larger (44 percent greater) and this difference is significant (t = 4.94), even though for adults it is adjusted for their greater schooling in program villages.

These adjusted program/comparison differenced wage estimates suggest that less rapid population growth in the program villages is not associated with receiving higher wages for younger or adult males. In contrast, younger, and especially adult women age 25-54, report significantly higher wages in program villages, but work less often in paid jobs. With only about half of these adult women and men working for a wage, and a smaller fraction of the youth, it is possible that the productive characteristics of the wage earning sample in the program and comparison areas could differ in uncontrolled ways, and this could represent a specification error that biases these single-equation estimates of the program effect on women's and men's earnings opportunities.

A framework is then needed to account by gender for the participation of youth and adults in the wage labor force (Heckman, 1974). A sample selection model is needed to correct for potential variation in the composition of the population reporting monthly earnings, which may also be associated with the family planning program treatment. Joint maximum likelihood (ML) estimates are reported for a probit model of employment in wage work, and a log linear monthly wage equation, which assumes for the errors in the wage work and wage rate equations are normally distributed and may potentially be correlated.

To build on Heckman's (1974) framework, information is required that is expected to raise the non-wage productivity (i.e. reservation wage outside of the wage sector) of an individual and thereby reduce the likelihood that the individual works in the wage labor force.[13] However, to be valid instruments, these identifying variables excluded from the wage equation must not modify the individual's wage offer. About 70 percent of the sample households own agricultural land in 1996, and most are likely to have inherited this land for a generation. This family endowment of land is assumed to be independent of variation in the village level wage or that of the individual's unobserved productive characteristics. Households with more land per working aged adults are

[13] Fifty-one percent of the adult males report a wage, whereas 39 percent of adult females report a wage. For the youth age 15 to 24 the fraction earning a monthly wage is smaller, 18 percent for males and 8.6 percent for females. Thus, the correction for sample selection bias could be more important for youth, other things equal, but also harder to estimate with precision, given the smaller proportion of youth reporting monthly earnings outside of their parent's homestead, especially for young women, and the more frequent enrollment of youth in school.

expected to face a stronger incentive for their members to work in the family enterprise, and be less likely to work in a wage job, other things equal. An advantage of having your own children and family work your own household's land instead of hiring labor is that family members may require less monitoring than hired labor and thus be a more "profitable" source of farm labor. This rationale for family employment of its members has been proposed in the development literature (Maluccio, 1997; Bhalotra and Heady, 2003: Bharadwaj, 2009).

In a traditional Muslim community, such as Matlab, the mobility of young daughters may be restrained by custom, deterring them from working for pay away from their family homestead, due to what might be called stigma.[14] But these cultural restraints on the conditions of work for women may not be as restrictive in inhibiting daughters (and wives) from working in self-employment in family enterprise, or in housework in the company of other family members. The exception may be when women are engaged in higher status non-manual occupations, such as teaching and salaried work for the government or for an NGO.[15] The household's factor endowment of agricultural land (i.e. whether the household has any, and the value of this owned cultivable land, divided by the number of adults over age 14 who might work the land) are proposed as two variables increasing family labor productivity and reducing the likelihood that family members work in a wage job. These two endowment variables provide plausibly exogenous economic constraints identifying why male and female youth and adults are differentially selected into paid employment and may provide the needed exclusion restriction to correct for any sample selection bias embodied in single-equation estimates of the wage function.

First, in column 1 and 3 of Table 4 single-equation (OLS) estimates of the log wage equation are reported for men and women age 15 to 24, controlling for the conventional human capital variables of years of schooling and potential experience after school. Second, in column 2

[14] According to the 1996 MHSS, the great majority of women report they require their husband's permission to leave their village or go to the medical center, or use public transportation, and in many of these cases they must be accompanied by a family member (author's own tabulations). See also Razzaque, et al., 1999.

[15] The wage returns to women's schooling may be higher when they work as teachers, nurses, and staff in government and NGO institutions, such as in medical care and microcredit. Out-migration of women from Matlab is less common than for men. It is possible that the primary educated women migrate for employment to urban labor markets such as Dhaka, and are earnings significantly higher wages according to the number of years of primary school they have completed. Unfortunately, the MHSS does not ask parents to report the earnings or wage rates for children who have left home.

and 4, joint maximum likelihood (ML) estimates of the sample selection correction model are identified on the basis of inclusion in the wage work probit equation of the two land endowment variables, and their exclusion from the market wage function.

The "landed" and "household agricultural land value per adult" variables are both significant in reducing male participation in the paid labor force, as hypothesized, providing a credible economic basis for the identification of the selection correction. The ML estimated-effect of the program on young male wages is still not significantly different from zero, corrected now for potential sample selection bias. The households which own agricultural land are also less likely to have young women work for wages outside of the homestead, though in the case of women, the household value of land per adult does not apparently add to the explanation of the wage employment outcome.[16] The estimated effect of the program on young women's wages is insignificant. According to these sample selection corrected estimates, Malthusian population pressure reduced by the program is not associated with higher wages of youth in the program versus comparison villages, and the significant OLS estimates of the program effect on young women's wages is no longer significant.

Private wage returns to schooling are commonly estimated by the coefficient on the years of schooling completed by the worker in log wage equations, assuming implicitly that schooling is exogenous (Mincer, 1974). Young men's wages are about 7.8 percent higher on average with an additional year of schooling, according to the OLS estimates, and when corrected for sample selection, these private wage returns increase to 8.4 percent. For young women the OLS estimates of returns to schooling decline slightly from the OLS estimates of 9.4 percent, to the ML estimates of 9.0 percent, when corrected for sample selection, and are no longer statistically significant in this sample of 190 women wage earners.

Table 5 presents ML estimates in column 2 of the selection-corrected wage equation for adult men age 25 to 54, which shows that men in landowning households are also less likely to work for pay outside of their household. Male log monthly wages are .097 lower in program than in the comparison villages, and this difference is statistically significant. Both the single-equation (OLS)

[16] The landed and value of land variables are, however, always jointly statistically significant at the 5 percent level, and over identification tests indicate both variables are, not surprisingly, identifying similar estimates of the effects

and the joint sample selection model (ML) estimates imply adult women receive wages fully one-third higher in program villages, and these differences are statistically significant. This could be due to their accumulation of productive experience other than child rearing, or savings in the form of assets that add to their productivity in non-wage activities in the program villages, raising the reservation value of a their time in housework, self employment, family enterprise, or simply leisure.[17] Other hypotheses for this regularity are explored in the next section.

Eleven percentage points fewer adult women are in paid employment in the program villages than in the comparison villages (Table 5, column 4, panel 2), and Table 3 suggests this is associated with their increased involvement in housework. The reduced supply of adult female labor to the inter-household wage labor market may contribute to raising the wages for adult women. Private wage returns on schooling remain unchanged at 6.2 percent for adult males, when the OLS estimates of the wage function are corrected by ML for sample selection. The comparable estimates of wage returns to schooling for adult women are 13.9 percent in both the OLS and ML estimates, twice as large a proportionate wage effect as for adult males, although women's wages start at a lower level than men's. The higher wage returns to schooling for adult women than for adult men could be a factor motivating the recent rapid increase in female schooling attainments in Matlab and in Bangladesh more widely, at both the primary and secondary school levels (Shafig, 2007; Asadullah and Chaudhury, 2006).

In summary, the aggregate effects of population growth, which Malthus assumed would diminish the marginal product of labor and depress wages, are not evident in Matlab between program and comparison villages, possibly because the diminishing returns to labor are relatively modest in Matlab. Evidence of systematic migration from comparison to program villages is not observed in the movements of women or the children of women sampled in the MHSS. Children

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of the excluded land variable on participation in wage employment. See test statistics in bottom row in Tables 4 and 5.

[17] For example, NGO micro credit organizations in Bangladesh have often targeted poor women who lack collateral to secure a formal sector loan that might then establish themselves in self employment, e.g. for the purchase of livestock (e.g. ducks and goats) and materials for handicraft production. Approximately half of the program and half of the comparison villages in Matlab thana report in 1996 having a BRAC microcredit organization in the village. Reduced form regressions for fertility and other family outcomes include a control for the presence of this rural NGO in the village, which is significantly associated with women participating more often in loan, savings, and work groups, having lower fertility (-.14), and increased schooling of sons and daughters (Joshi and Schultz, 2007, Tables 6 and 9).

and adults are less likely to be working for wages and reporting earnings per month in villages with the program, perhaps because these households have fewer children and therefore require more child labor from each of their children, as well as women, on family farms and enterprises. Parents in program areas may have also accumulated more lifetime assets, as they reduced their fertility; these household assets, such as orchards and ponds, could differentially raise the productivity of family versus hired labor. The portfolio of assets held by the household may also respond over time to the program-induced change in the composition of family labor, perhaps to compensate for the diminished supply of child labor. This possibility is explored in section 8 of this paper.

5. What Causes Adult Women to Receive Higher Wages in Program Villages?

Given the significance and magnitude of the estimated effect of the Matlab program on the wages of women age 25 to 54, this empirical regularity warrants more study to characterize the mechanism through which the program operates. One approach is to determine if the effect of the program treatment on wages operates differentially with respect to various productive endowments and observable exogenous characteristics of the individual woman. The program treatment effect on wages is first allowed to vary with these characteristics by adding to the wage functions in Tables 4 and 5 an interaction between the worker characteristic and the program treatment. The third row in the top panel of Table 6 reports the coefficient on the program*schooling interaction, which is significantly different from zero for adult women (t = 4.31). The difference in log wages associated with a year of schooling is roughly twice as large in the program villages as in the comparison villages, or .182 (i.e. .0816 +.100) and .0816, respectively. Including this interaction variable reduces the unexplained program effect by about three-fifths among women 25-54, evaluated for those with no schooling, or from .332 (in Table 5) to .132 (in row 1, Table 6). The program's benefit for a woman who on average has avoided an unwanted child appears to increase her productivity proportionately more if the woman has more schooling.

Another strategy for decomposing the premium in adult women's wages in program villages is to measure the effects of the program on the woman's other observed productive endowments. Some gains in schooling attainment may have accrued to women age 15-24 because their mothers were able to have fewer children as a result of the program, which helped their children stay in school longer (Table 2). This mechanism should be less common in the case of women 25-54 (Table

3). Schooling, however, is already controlled for in the wage functions estimated in Tables 4 and 5, which is expected to bias downward the estimated program effect on wages, because other things are not equal.

Increases in body mass index (BMI) toward internationally accepted standards are frequently associated with workers receiving higher wages in poor, malnourished populations, especially at levels below 25-30 (Strauss and Thomas, 1995). The average BMI of married women in Matlab comparison villages is only 18.4 in the 1996 MHSS, which is 1.0 to 1.5 units lower than comparable women in the program treatment villages (Joshi and Schultz, 2007: Tables 5 and A). But including BMI in the wage function, as reported in the second panel of Table 6, does not reveal a relationship between BMI and the wages of adult women or youth of either gender in Matlab. Only men age 25-54 exhibit log wages that are .057 larger for those with a unit more BMI. Thus, the program's effect on adult women's BMI does not appear to be a source of the wage gains they receive in program villages.[18] Future work might seek ways to treat schooling and BMI as endogenous and responding to the program, and yet also be separately identified arguments in the wage function.[19] To estimate this specification would require more information to identify program-induced variation in schooling and BMI that is independent of the error in the wage function.

Finally, the structure of wages in these traditional Muslim areas may be affected by the ability of males to migrate to higher wage areas, whereas women have less mobility. Regional differences in male wages that would otherwise be attributable to the program effect on population growth could be arbitraged away through male migration.[20] This hypothesis would imply, however,

[18] The wage function may also take a more complex functional form that is not captured in this estimation that is additive in log wages. Estimating a generalized quadratic form (i.e. Taylor series approximation), which includes squared terms in schooling, BMI and a complete set of interactions, does not uncover significant additional variables, nor does this generalized second-order specification pass a joint test for incremental power to explain log wages.

[19] Early childhood nutritional conditions, inflammatory infections, and health are thought to affect height, which would have been largely determined before the onset of the program for women over the age of 24 in 1996. Height of adult women can therefore be treated as exogenous from the perspective of evaluating this FPCMH program. Although adult height is often found to be positively associated with wages in relatively large samples (Strauss and Thomas, 1995), height is not a statistically significant variable when added as an exogenous determinant to the log wage equations estimated from the 1996 MHSS for either males or females within the age groups 25-54 (Tables 4 and 5). For youth age 15 to 24, height may be increasing with age and the program could stimulate an earlier onset of the adolescent growth spurt, and increase height for age, which makes it more difficult to interpret height as a determinant of wages among the maturing youth.

[20] In 2003 when migration data are tabulated from the surveillance area by sex and age for the program and comparison regions, net out migration from the district is more than twice as large for males as females. However,

that young women in program areas would also receive higher wages, whereas they do not in Table 4 column 4. The MHSS indicates that boys and girls born to residents in the program areas are just as likely to migrate out of the village, or out of the district, as children born to residents in the comparison areas. Differential migration between program and comparison areas is thus not clearly linked to the differences between their structure of wages by age and sex.[21]

6. Life Cycle Trade-offs between Number of Children and other Family Objectives

With the social experiment in Matlab, the 1996 MHSS provides a benchmark on a variety of long term family outcomes that may diverge between program and comparison areas after the elapse of nearly two decades, 1977-1996, which could clarify possible pathways by which the program has affected family welfare and socioeconomic development. The same controls are maintained as in the previously discussed reduced-form study of the woman's fertility that is summarized in column 1 of Table 1 and unconditional program-comparison differences in Figure 1 (Joshi and Schultz, 2007).[22]

The death rate of a woman's children before their fifth birthday tends to be lower in program villages among women of all ages, and is statistically significant at the 5 percent level among women age 35-39, 45-49, and 50-54 (Table 1, column 2). As already noted, the adult women residing in program villages in 1996 are healthier, measured by their body mass index (BMI)(Table 1, column 3). DSS data confirms adult women with greater BMI experience over time lower mortality in Matlab (Menken, et al. 2003). Another study finds that maternal mortality is lower in

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the rates of out migration from the program and comparison areas are similar in 2003 (ICDDR.B, 2005: Tables 2.1, A-13 to A-15). Out migration rates from the district for children of women resident in 1996 in the program and comparison areas are also similar, according to the authors calculations.

[21] With a single survey collected in 1996, it is not possible to estimate rates of in-migration, except to calculate the fraction born outside of the district. Families who entirely left the district between 1974 and 1996 or died cannot be distinguished, nor are adjustments feasible for attrition due to differential mortality between the program and comparison areas. All of these processes, if impacting differentially in the program and comparison villages from 1977 to 1996, could potentially modify the estimated effect of the program.

[22] Controls are included directly for the woman's age, schooling, and religion, as well as interacted with the program treatment, allowing for the response to the program to be heterogeneous along these three dimensions. Other controls are included as additive effects in the form of a quadratic in husband's age, his years of schooling, household marital type, whether a control village shared a boundary with a program village and hence could have had greater opportunity to learn through geographically defined social networks about the program services, and five characteristics of infrastructure in the village: the distance to the community family planning-health clinic, whether there is a secondary schools in the village or an adjacent village, a paved (Pucca) road, village motor boat transportation, and a BRAC microcredit program in the village.

program areas than in comparison areas from 1982 to 2002 (Rahman et al., 2009). Daughters of these women age 9-14 and 15-29 completed .35 and .22 standard deviations more years of schooling (measured as a Z score) for their age (and sex) in the program areas than in the comparison areas, whereas the sons obtained .54 and .43 standard deviations more schooling in these two age groups of children (Table 1, Columns 4-7). The estimated program effects on the son's schooling are statistically significant at the five percent level, whereas the schooling effects for daughters are significant by conventional standards only in the older age group, 15-29.[23] Even though the levels of schooling achieved by girls converged to that of boys in Matlab in the 1990s, as it did more widely in Bangladesh, the FPCMH program does not appear to have reinforced this gender convergence in schooling achievement. On the other hand, daughters age 1-14 are reported to have a significantly higher body mass index Z scores in the program villages, normalized for age and sex, whereas there is no significant difference in BMI Z scores for sons (Table 1, columns 8-9).24

7. Family Planning as a Female-Specific form of Human Capital Investment

The coefficients on the variable defined as the product of education and program treatment in the reduced form equations for fertility, child mortality, and women's BMI (Table 1, columns 1 – 3), are insignificant, implying that heterogeneity in response to the program along these outcomes is not evident. Avoiding one unwanted birth is approximately the program's impact for women age 25 to 54 (Table 1, column 1), and this impact is equivalent to an investment in a woman's human capital for which the wage returns to her over her remaining lifetime, is estimated to be .33 log points per year. Given the estimated wage return to a year of schooling is 14 percent (Table 5, col.4), or the fertility effect of the program is equivalent to the wage return on 2.4 more years of schooling . i.e. .33/.14 . A robustness check on this interpretation of the effect of a family planning program is the

[23] Enrollment of youth in school did not differ between the program and comparison areas, as reported by Sinha's (2005). However, survey measures of "school enrollment" are expected to be a noisier measure of school investment in children than " years of schooling completed", both because enrollment does not capture variation in attendance or time invested and the cumulative investment also depends on when the child started school and her progression rates, as well as age. Therefore, years of schooling completed is a preferred measure here and is expressed as a normalized Z score within age and sex subgroups of youth.

[24] Chaudhuri (2008) reports in samples based on the child as the unit of observation, rather than the mother, that height-for-age is greater for boys and girls in the program villages than in the comparison villages, but these differences are not evident in estimates of Joshi and Schultz (2007).

lack of a significant wage return from the family planning program for adult men or males or females age 15-24 (in Tables 4 and 5), corrected for sample selection of wageworkers. Only the wage productivity of adult women is enhanced by the Matlab FPMCH program, and such a clearly effective program in reducing fertility and child mortality may therefore be interpreted as an investment in women's human capital equivalent to 2 to 3 years of schooling, plus any positive intergenerational benefits for her children, in terms of human capital.[25]

8. How is Family Planning Associated with The Portfolio of Household Assets?

Parents may view their children as a partial substitute for the accumulation of physical assets over their life cycle, because both children and assets could meet their consumption requirements in old age and provide a form of precautionary insurance for their care, should their health and productivity fail. If a family planning program helps parents avoid unwanted births, it may foster an increase in parent lifecycle savings in the form of physical capital. The asset value of children to parents is difficult to appraise, but might be roughly in proportion to the parent's own lifetime wealth in either human capital or physical capital. A program-assisted reduction of one child in family size might then be linearly related to an estimated change in the log of household assets per adult. This relationship has not been empirically studied in a framework where fertility and family savings are determined simultaneously. It would be preferable to analyze changes in assets in a panel survey of families with exogenous variation in family planning or reproductive health services. But only a single cross sectional survey with data on wealth is available for the Matlab social experiment from 1996. Can a single cross sectional survey offer insights as to the savings and investment responses of parents to the Matlab program intervention?

The 1996 MHSS reports wealth holdings in some detail, though it is more difficult to

[25] One way to think about the magnitude of the woman's wage return to the program is to imagine that an extra child occupies her mother for the equivalent of X years of full time child care that she could otherwise invest in on-the-job training without a birth. With the program effect on adult women's wages estimated as .33 log points for about a one birth reduction, this effect could be divided by X to obtain an annual percentage wage return to policies which avoid one unwanted birth per woman. Imagine that a marginal additional birth occupied a mothers time for three additional years, and then the annual private wage return, using Mincer's (1974) framework, would be on the order of 11 percent (.33/3). But the marginal birth avoided by the program might occur when the woman is about age 30, which leaves her with only 30 or so years remaining in her life to recover the investment through her earnings. This is a much shorter pay back period than deciding whether to attend school as a child. According to this illustrative example, the private wage return to the Matlab program intervention would be about 8 percent, and does not allow for recovery of the public costs of the program, but only the private opportunity cost of three years of the mother's time, evaluated at the age when she would want to have her last child.

construct comprehensive indicators of household income or consumption from this survey that does not value home production or the services of consumer durables. Individuals identify their own personal assets in a few categories, but the ownership of most major assets is attributed only at the household level. Table 7 summarizes by asset categories based on the author's calculations derived from various modules in the MHSS for strata 1 and 2 sample households (the representative sample), first for all married woman in column (1), which is the unit of observation underlying Table 1, and then for the representative sample of households (including households with more than one married woman) in column (2). Column (3) converts column (2) into the percentage share of total household assets accounted for by each asset category, and thereby avoids "double counting" when two married women are sampled from the same household in column (1). The major assets are 1A-agricultural cultivated land, equal to 42 percent; 1B-ponds and orchards, 3.9 percent; 2A-housing, 41 percent; 2B+2C- jewelry and financial assets, 2.9 percent; 2D through K- consumer durables, 2.4 percent; 3-livestock, 2.0 percent; and 4-nonfarm business assets, 4.4 percent. Household assets in the program villages average 238,402 taka (or 47,505 more than in the comparison villages, or 25 percent more ((program-comparison)/comparison), as shown in the next to last row in columns 4, 5, 6 and 8 in Table 7. This program-comparison unconditional difference is statistically significant, with a t = 4.71 (Column 7). Because the program and comparison region's households were similar in terms of their education in 1974, and in terms of the area of land owned per household in a 1982 census, it is assumed that the value of physical assets per household did not differ before the program started in 1977 between the program and comparison villages. In that case, developments evolved on a different course in the two regions possibly because of the provision of the FPCMH program's services. Under these working assumptions, the 1996 survey data on asset ownership and their values for the program and comparison villages are consistent with the behavioral hypothesis that parents treated their number of children as a substitutes for physical assets over their life cycle. The differences in the portfolio of assets held by parents in program and comparison villages can shed further light on which assets are viewed by parents as more complementary with their (diminished) supply of child labor, and which assets are better substitutes for the support and care parents expect to receive from their children.

One area of household production where child labor is thought to be relatively important is in

tending livestock (row 3, Table 7). Total livestock assets are 23 percent *lower* in program village households than in comparison village households, with a significant t = 4.60, even though the value of sheep and goats is slightly larger in program households and thus offsets to some degree the sharply reduced value of cows and buffalos in program areas.[26] A second activity in which children assist parents is fishing, and the value of boats is 36 percent lower in program than in comparison villages.[27] Family labor is important in agriculture, notably in the cultivation of annual crops in this delta region. The value of household assets held in the form of agricultural cultivated land is 8 percent larger in program villages relative to comparison villages, but this small difference is not significant, and contrasts with the previously noted larger and more significant increase of one quarter in total household wealth.[28] Households in program villages invest their savings differently? They hold 44 percent more assets in the form of housing and 33 percent more assets in the form of consumer durables than do households in comparison villages (Table 7, row D-K, column 8). These large increases in consumer assets may be due to above-average income elasticities of household demand for the consumption of the services of housing and consumer durables, combined with income gains associated with the reduction in unwanted births. The advancement of women's earnings in program areas may encourage their households to use more consumer durables and housing as a substitute for the more valuable time of wives. The services of housing and consumer durables may also have greater value among the elderly or as a means of precautionary savings.[29] In the case of financial savings and jewelry, these more liquid assets are 56

[26] The 1974 Census reports information on the number of cows owned by households in the census. There is no significant difference in number of cows per household between the program and comparison villages in 1974. Although the number of cows per household has declined in the entire Matlab district as reflected in the 1996 MHSS, but it has declined more sharply in the program than in the comparison villages.

[27] Because fishing is predominantly an occupation of Hindus, and the fraction of Hindus is lower in the program villages than in the comparison villages in 1977 and 1996, this religious difference could account for the difference in fishing assets. The 1977 and 1982 Census asks how many boats the household owns (without valuations), and the difference in number of boats between program and comparison areas was smaller in these earlier years (1974, 1982) than the difference in the value of boats in 1996.

[28] It was assumed earlier that the marginal product of child labor increases with the household's value of agricultural land, and to the extent that the program contributes exogenously to accumulation of agricultural land, as a form of life cycle savings substituting for children, this additional land could also reduce the cost of additional children and encourage greater fertility. Clearly this program effect is of secondary importance, given the net effect of the program reducing fertility.

[29] The value of TVs in the household is 2.5 times larger in program households than in comparison households. It is also likely that the relative prices of consumer durables has declined relative to other assets and thus provided in this period increased returns to justify the holdings. One might infer from these asset differences across villages that buildings and shops in non farm business assets and ponds and orchards in farm business assets are assets classes

percent larger in the program than in the comparison households, consistent with these assets also being a good substitute for children over the life cycle and a preferred form of retirement and precautionary savings. Jewelry is also one of a handful of household assets that is generally attributed to individuals, and women own the dominant share of the jewelry assets. However, jewelry represents only 1.4 percent of household assets. Estimating program-comparison differences in the total value of household assets, as in Table 7, it is possible to express total household assets in logarithmic form and obtain a similar estimate that the program is associated with .23 log points more assets, and the program effects do not appear to differ by women's education when assets are expressed in logarithms. Because many households do not hold any assets in a specific asset category, analyses of the logged value of assets can only be performed for the total assets or housing assets without sacrificing sample size and representativeness. Consequently, to retain the full distribution of asset categories in Table 7, assets are expressed in arithmetic terms that can then be aggregated over all households.

9. Recapitulation

A single case study of the long-run consequences of the impact of a family planning program on fertility is not a basis for generalizations about what similar programs may have achieved in other parts of the world. Nonetheless, evidence from Matlab suggests that in this poor rural region of Bangladesh, where women are culturally restricted in their movement outside of their homestead, a concerted outreach program delivering birth control information and supplies to married women in their homes every two weeks was instrumental in a significant decline in fertility and sustained lower (by 16 percent) levels of fertility and child mortality for two decades. This was accomplished during a period when fertility was falling rapidly. Fertility declined in the comparison villages (in the MHSS 1996 Survey) from about 6 to 3.5 children per woman, which received only the regular government program of family planning and health services extended through community clinics

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which did not strongly complement child labor, given their substantial positive associations with program treatment, 55 and 66 percent, respectively (Table 7). Another dimension of household assets is having a tube well within the family homestead or Bari, which is increasing in this period more in program villages than in comparison villages, raising family welfare and presumably improving health and hygiene. The convenience of these water sources adjacent to the household also saves the time of women and children, who are traditionally responsible for fetching water (Joshi and Schultz, 2007, Table 7). Unfortunately, the introduction of tube wells, though they undoubtedly contributed to reducing pathogens in water supplies and thus to the decline in child mortality and morbidity in this

(Fauveau, 1994; ICDDR,B, 2005). The additional reduction in fertility and allied improvement in child and maternal health associated with the Matlab FPCMH program is also associated with sons receiving significantly more schooling, daughters having a better nutritional status as measured by their BMI, and for better educated women having proportionately higher wage rates and living in households with proportionately greater assets. Households in program villages reported a fourth more assets per adult, and held a smaller shares of household assets in forms which complement child labor, such as livestock and fishing or even land for agricultural annual cultivation. They held a larger share of their assets in financial savings, jewelry, orchards and ponds, housing, and consumer durables, which may be assets that are better substitutes for old age support provided traditionally by children.

The widely accepted Malthusian model of development predicts that population growth is an important factor depressing agricultural wages in countries such as Bangladesh. It implies that the wage rates of youth age 15 to 24 should be higher in program villages where population growth has been reduced by the program and the size of surviving family is 15 to 20 percent smaller by 1996. But there is no evidence of youth monthly earnings in the program villages being any higher than in the comparison villages, when maximum likelihood estimates of employment in wage jobs and log wage equations are jointly estimated, to correct for potential sample selection bias. Monthly earnings of adult males, age 25 to 54, are in fact somewhat lower in the program than comparison villages when corrected for selection bias into the wage-earning sample. Patterns of in and out migration from the two adjacent areas are also similar for children residing in program and comparison villages in Matlab in 1996, suggesting interregional migration is not operating to conceal the program's effect on the local wages. However, adult women age 25 to 54 in program areas are less likely to work in wage employment. When they do work in a paid job, they receive wages that are more than one-third larger (Table 5), related mostly to the higher returns women receive from their schooling in program villages (Table 6, panel A). This regularity is not readily explained by the Malthusian framework, but is consistent with the hypothesis that avoiding unwanted births allowed women to improve their health, increase their wage returns from their schooling, and accumulate more experience in the labor market, all of which add to the value of their

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period, also tapped shallow aquifers in the Matlab region that have recently been shown to often contain toxic level

human capital and raise their reservation wage.

Whether these estimates of the effects of family planning and child and maternal health policy are relevant for other parts of the world remains an open issue because other social experiments or long term statistical matching evaluation studies of population programs have not, to my knowledge, been implemented or suitably analyzed.[30] Future research might address whether the consequences of the Matlab program on fertility, child survival, and child schooling is due to special features of gender relations in these poor Muslim rural areas or if such a program would have a similar effect on fertility and family outcomes in other equally poor rural areas of the developing world, especially where gender inequality is comparable?

10. Conclusions and Directions for Research

The long run consequences for women, children, and men of the voluntary decline in fertility facilitated by public programs and policies that reduce the monetary and psychic costs of birth control have not been adequately evaluated. One research strategy to explore this question is to specify instrumental variables that are causally responsible for a decline (or increase) in fertility where the source of this variation can be viewed as outside the control of the household, i.e. exogenous to lifecycle resource allocations, and otherwise uncorrelated with parent preferences and the long-term outcomes of the family. The well-designed FPCMH social experiment implemented in half of the villages of Matlab thana provides the social scientist with an unusual opportunity to evaluate directly the long run consequences of such an intensive outreach program in a poor isolated rural area of South Asia. An alternative research strategy is to specify an instrument for fertility which represents a "natural experiment", such as having twins, which may under some conditions simulate the consequences of a shock to fertility that may arguably be independent of parent preferences, family endowments, and prices that might otherwise modify family opportunities and behavior (Schultz, 2008). The effect of twins on fertility and subsequent family outcomes may be

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of arsenic.

[30] A literature has studied the family consequences of legalizing abortion in the United States, which concludes that legalization by state and time period reduced birth rates, especially among poorer groups in the population, and there were improvements in average child health and schooling. And after 20 years, a reduction in crime associated with youth can be detected and linked to the earlier reforms reducing unwanted childbearing (Gruber, et al.,1999; Donohue and Levitt, 2001). Other studies have tried to isolate the policy induced effect of increasing women's schooling on fertility, child health and schooling (Currie and Moretti, 2003, Black et al., 2005a, 2005b; Osili and Long, 2008).

viewed as a estimate of the long term effect of a fertility change, with of course the sign reversed from that expected from an effective family planning program. But even in this case, the biological "quality" of twins is not equal to singleton births, and the timing of fertility is altered as well by twins, leaving those who are credit constrained at a particular disadvantage in making compensating investments in their children simultaneously due to having twins. Family planning should improve the timing of births, an elusive component of reproductive behavior, but not necessarily one that is analogous to avoiding twins.

The implications of alternative economic opportunities and constraints on the determination of fertility have been studied, but largely guided by the unified models of household production and consumption (Becker, 1981; Schultz 1981, 1997). However, husbands and wives may have different preferences over fertility and women's work outside of the family and therefore bargain over fertility, the allocation of household resources, and their labor supplies (McElroy and Horney, 1981; Chiappori, 1992; Haddad, et al. 1997; Quisumbing and Maluccio, 2003; Rasul, 2008; Thomas, 1990, 1994). Several directions for research on these issues are promising and deserve more attention. Associated with the decline in fertility, women supply more of their lifetime labor to household production other than childcare and to market labor force activities (Schultz, 1990, 2008). Available measures of women's work in the home, in unpaid family work, in self-employment, as well as in the wage employment, are not always comparable across countries, or even over time within countries, especially in low-income agricultural settings (Durand, 1975; Schultz, 1990). As fertility declines in many countries in South and West Asia, the prevailing culture may not encourage women in rural areas to reallocate their time to work in occupations outside of their home. In these circumstances, how will women realize their productive potential and capture the opportunity value of their time? If women are constrained to allocate their time among traditional home making activities or household production, as they reduce their rearing of children, how large is the efficiency loss, and how does the different working environment for women affect their bargaining power over resources in the household? Can women in Matlab who have avoided having one or two unwanted births readily enter paid employment and earn the higher wages observed in program villages? How might public programs assist women in reallocating their time to realize these increased productive opportunities? Perhaps the welfare gains of women and their children

associated with the demographic transition are not diminished substantially by women choosing to work more at home, as in Matlab, or for that matter in West Bengal following the Green Revolution (Mukhopadhyay, 1994).

One way to assess whether women benefit disproportionately from engaging in work outside of their home is to analyze how households allocate their resources to "private goods" that benefit only certain individuals in the household. Variation in private good consumption can help to identify the implicit "sharing rule" guiding a rational (Pareto efficient) household's joint labor supply and consumption choices, including public goods (Chiappori, 1992; Browning and Chiappori, 1998; Haddad et al, 1997; Blundell, et al., 2005). This requires the specification of a "private good" that provides utility only to the woman (or man) in the household. It has been argued that leisure, if it could be unambiguously measured for a mother, might represent such a private good (Schultz, 1990). A more readily measured private good would be investment in women's own human capital, such as for health (e.g. BMI > 19, Cf. Fogel, 2004), schooling, or vocational skills that raise her wage, although even in these cases altruism between spouses could undermine the validity of some "private goods". A private good for children could be their human capital for which returns are socially attractive. But to assume that one spouse values these forms of child human capital more than the other spouse remains controversial, and to make children public goods to deduce implications from the collective household model may also be restrictive and unrealistic in some settings.

Is the magnitude and persistence of the effects of the family planning program in Matlab on fertility due to the frequency of the field worker's home visits, or the low incomes and education of the population, or the local Muslim/Hindu customs which restrict the geographic movement of women, and limit their independence to obtain birth control? Regional variation in expansions of family planning programs in a number of countries suggest there may be a relatively short period when the program's initial intensity contributes to a substantial and significant decline in births rates (Freedman and Takeshita, 1969; Schultz, 1973, 1992; Gertler and Molyneaux, 1994; Frankenberg, et al., 2003; Miller, 2004). This would imply the long run demand for contraceptive use and resulting fertility is relatively inelastic with respect to price subsidies for contraception, after the early phase of introducing knowledge of new technologies of birth control and modifying social norms. This

does not appear to have been the case in Matlab, and it is important to know why the Matlab experiment is different. More analysis of the sources of the decline in cohort fertility would be useful before drawing any conclusions about the share of the international decline in fertility that is attributable to a past and current organized family planning activity. Future analyses should address how these interventions have improved outcomes critical to enabling future generations to escape poverty such as decreased fertility, increased wage opportunities for women, changes in private household savings rates, changes in the composition of household wealth, and finally improvements in early childhood survival, health, nutrition, and schooling.

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Table 1: Reduced Form Estimates of the Matlab Program's Treatment Effect on Fertility and the Family Outcomes [1]

Selected Explanatory Variables:	Children Ever Born (1)	Fraction Children Died by Age five (2)	Women's Body Mass Index (3)	Children's Years of Schooling Z Score				Children's Body Mass Index Z Score	
				Age 9 – 14		Age 15 – 29		Age 1 - 14	
				Daughter (4)	Son (5)	Daughter (6)	Son (7)	Daughter (8)	Son (9)
Treatment * Age under 25	- .517 (.213)	- .038 (.032)	.380 (.385)						
Treatment * Age 25 to 29	- .681 (.208)	.010 (0.24)	.839 (.379)						
Treatment * Age 30 to 34	- 1.07 (.232)	- .038 (.025)	.945 (.346)						
Treatment * Age 35 to 39	- 1.02 (.245)	- .049 (.025)	1.14 (.347)						
Treatment * Age 40 to 44	- 1.26 (.270)	- .025 (.027)	1.40 (.385)	.352 [2] (.257)	.541 (.194)	.221 (.211)	.430 (.185)	.424 (.185)	- .047 (.259)
Treatment * Age 45 to 49	- 1.51 (.296)	- .056 (.025)	1.19 (.358)						
Treatment * Age 50 to 54	- 1.11 (.259)	- .056 (.026)	1.02 (.390)						
Treatment * Age 55 to 59	- .303 (.308)	-.038 (.028)	.957 (.425)						
Treatment * Age 60 to 64	- .404 (832)	- .007 (.029)	.716 (.405)						
Treatment * Age 65 or more	- .255 (.324)	- .051 (.027)	.999 (.383)						
Treatment * Women's Schooling	.0017 (.018)	.001 (.002)	.049 (.051)	.018 (.017)	.005 (.016)	.026 (.014)	- .011 (.015)	.013 (.016)	.028 (.018)
Treatment * Muslim	.310 (.177)	.023 (.019)	- .426 (.285)	- .277 (.232)	- .283 (.182)	- .404 (.193)	.469 (.160)	- .246 (.155)	.148 (.256)

Women's Years Schooling	- .064 (.014)	- .004 (.002)	.049 (.021)	.093 (.014)	.088 (.015)	.098 (.013)	.092 (.013)	.005 (.015)	- .022 (.014)
Muslim	.252 (.149)	-.020 (.017)	.102 (.189)	.409 (199)	.062 (.146)	.475 (.168)	.456 .140)	.066 (.132)	- .203 (.235)
Boundary to Program*									
Age 15 to 34	- .223 (.121)	.020 (.011)	.192 (.238)	.064 [2] (.078)	.071 (.107)	.003 (.083)	- .010 (.077)	.208 (.091)	.123 (.104)
Age 35 to 54	-.390 (.160)	.003 (.013)	.323 (.299)						
Age 55 or more	-.216 (.190)	.015 (.022)	.153 (.309)						
Husband's Years of Schooling	- .005 (.010)	-.002 (.001)	.095 (.015)	.093 (.014)	.088 (.015)	.078 (.007)	.071 (.008)	.003 (.009)	.007 (.007)
Sample Size	5379	5127	4703	1338	1416	1717	2235	1716	1741
R^2	.571	.072	.123	.305	.263	.312	.259	.031	.048

Notes:

[1] Robust standard errors reported in parentheses beneath regression coefficients. Other variables included in regression but not reported here are women's age dummies, husbands age and age squared, female heads of household married, female heads of household widowed or divorced, female not head and husband absent, variable for missing age or education of husband, five village infrastructure characteristics: Pucca road, distance to sub– hospital/clinic, secondary school in village or next village, BRAC office in village, village has motor boat.

[2] Treatment interaction with woman's age collapsed to only a single treatment for all women with children averaged in specified age groups per woman.

Source: Columns 1-9 from Tables 4, 5, 9, and 10 in Joshi and Schultz (2007).

Table 2: Program Effects on Characteristics of Youth Age 15 to 24*

Type of Occupation or Characteristic	Male Sample Size	Male Program Effect	Female Sample Size	Female Program Effect
1. Work for Pay	1159	-.073 (2.56)	1190	-.021 (.93)
2. Self Employment	1159	.065 (2.81)	1190	-.014 (1.62)
3. House Work	1159	.018 (1.72)	1190	.019 (.77)
4. Other (1.0-1-2-3)	1159	-.011 (.39)	1190	.016 (.56)
5. Student Enrolled	2514	.033 (1.73)	2222	.029 (1.54)
6. Years of Schooling	2222	.400 (2.65)	2514	.510 (3.38)
7. Ln Monthly Earnings	452	.0275 (.29)	190	.364 (1.77)

* Beneath regression coefficient in parentheses is the absolute value of its robust t statistic, adjusted for clustering at the village level. In the regression the only control included is for the linear effect of age. Because the program appears to have reduced fertility and contributed to the increase in child schooling and also thereby affected post school potential experience, it is inappropriate to control for schooling or experience when estimating the total effect of the program on type of occupation or wage outcomes for youth.

Table 3: Program Effects on Characteristics of Adults Age 25 to 54, by Sex

Type of Occupation or Characteristic	Male Sample Size	Male Program Effect	Female Sample Size	Female Program Effect
1. Work for Pay	2545	-.0049 (.28)	3632	-.0692 (4.19)
2. Self Employment	2545	.0174 (1.01)	3632	-.0009 (.15)
3. House Work	2545	.0018 (.73)	3632	.0678 (4.50)
4. Other (1.0 -1-2-3)	2545	-.0143 (2.40)	3632	.0024 (.19)
5. Student (#33)	3525	-.0045 (.92)	4092	.0010 (.35)
6. Years of Schooling	3525	.584 (4.63)	4092	.285 (3.76)
7. Ln Monthly Earnings	1794	-.0518 (1.18)	1597	.364 (4.94)

* Beneath regression coefficient in parentheses is the absolute value of its robust t statistic adjusted for clustering at the village level. Regressions also include controls in this age group of a quadratic in post schooling years of potential experience and years of completed schooling, except for predicting schooling, which is estimated without a collinear control for schooling.

Table 4: Matlab, Bangladesh 1996 Estimates of Wage and Wage Employment Functions for Youth age 15-24, by Gender: Alternative Estimates
(Beneath regression coefficients in parentheses are the absolute values of associated robust t statistics)

1. Dependent and Explanatory Variables	Male OLS	Male ML Selection Corrected	Female OLS	Female ML Selection Corrected
Log Monthly Earnings	(1)	(2)	(3)	(4)
Program Village	.0609 (.65)	.0693 (.69)	.343 (1.68)	.160 (.62)
Years of Schooling	.0783 (3.66)	.084 (2.71)	.0942 (1.97)	.0897 (1.50)
Years of Post-School Potential Experience	.165 (2.61)	.146 (1.42)	-.0066 (.06)	.250 (1.81)
Experiences Squared ($x10^{-2}$)	-.198 (.73)	-.121 (.29)	.121 (.25)	-.119 (.20)
Constant	5.02 (12.5)	5.23 (15.4)	3.74 (4.87)	-3.44 (2.95)
2. Selection into Sample with Monthly Earnings (derivatives at sample mean)		**Male ML Selection Corrected**		**Female ML Selection Corrected**
Program Village		-.0781 (1.23)		-.0774 (.94)
Years of Schooling		-.0503 (3.72)		.024 (1.29)
Years of Post-School Potential Experience		.253 (7.18)		.142 (3.48)
Experience Squared ($x10^{-2}$)		-1.00 (7.12)		-.236 (1.26)
Agricultural Land Owner (0/1)		-.192 (3.31)		-.148 (2.42)
Value of Agricultural land (1000s of Takas per Adult)		-.0016 (1.78)		-.00083 (.79)
Constant		-1.66 (7.89)		-2.38 (8.94)
Rho (Standard. Error)		-.903 (.026)		.976 (.011)
n (sample size)	452	452 / 2504	190	190 / 2212
P > F or Chi-Squared Wald test of Chi-Squared fit test (P Value) land	.0000	.0000 26.3(.0000)	.037	.0001 12.67(.0018)

Table 5: Matlab, Bangladesh 1996 Estimates of Wage and Wage Employment Functions for Adults age 25-54, by Gender: Alternative Estimates
(Beneath regression coefficients in parentheses are the absolute values of associated robust t statistics)

1. Dependent and Explanatory Variables	**Male OLS**	**Male ML Selection Corrected**	**Female OLS**	**Female ML Selection Corrected**
Log Monthly Earnings	(1)	(2)	(3)	(4)
Program Village	-.0946 (2.24)	-.0972 (2.27)	.329 (4.62)	.332 (4.33)
Years of Schooling	.0622 (11.5)	.0619 (11.4)	.139 (9.36)	.139 (9.37)
Years of Post-School Potential Experience	.0221 (1.67)	.0259 (1.58)	.0311 (1.17)	.0283 (.73)
Experiences Squared ($x10^{-2}$)	-.0340 (1.57)	-.0392 (1.55)	-.0335 (.81)	-.0292 (.48)
Constant	6.90 (33.9)	6.81 (22.2)	3.32 (7.92)	3.39 (3.97)
2. Selection into Sample with Monthly Earnings (derivatives at sample mean)		**Male ML Selection Corrected**		**Female ML Selection Corrected**
Selection into Sample with Monthly Earnings (expressed as derivatives at sample means)		-.0712 (1.61)		-.112 (2.78)
Program Village		.0075 (1.23)		.0049 (.58)
Years of Schooling		.125 (10.3)		.114 (8.33)
Years of Post-School Potential Experience		-.162 (7.90)		-.179 (8.31)
Experience Squared ($x10^{-2}$)		-.369 (6.92)		-.0698 (1.41)
Agricultural Land Owner (0/1)		-.0024 (3.59)		-.0007 (1.32)
Value of Agricultural Land (1000s of Takas per Adult)		-1.71 (9.31)		-1.79 (8.36)
Constant		.0466 (.119)		-.0239 (.253)
Rho (standard error)		-.0712 (1.61)		-.112 (2.78)
n (sample size)	1794	1794/3514	1597	1597/4080
P > F or Chi-Squared Wald test of Chi-Squared fit test (P value) land	.0000	.0000 94.8 (.0000)	.0000	.0000 6.70(.0350)

Table 6: Joint Maximum Likelihood Estimates of Wage Participation and Wage Functions with Alternative Specifications to Assess Underlying Mechanisms for Women's Wage Effects

Heckman ML Model[1]				
Hypothesis 1: Wage Returns to Schooling are affected by Program Treatment				
Ln Monthly Earnings Coefficient (t)	**Age 15-24**		**Ages 25-54**	
	Male	**Female**	**Male**	**Female**
Program Village	.165 (1.18)	-.0694 (.19)	**-.125** **(2.26)**	.132 (1.50)
Years of Schooling	**.0971** **(2.97)**	.0570 (.80)	.0577 (7.56)	.0816 (4.10)
Schooling* Program[2]	-.0312 (1.09)	.0624 (.85)	.0078 (.80)	**.100** **(4.31)**
Hypothesis 2: BMI affects wages and affected by Program Treatment				
Body Mass Index[3] (Indicator of Good Health)	.0220 (.76)	.0938 (1.41)	**.0568** **(5.44)**	.0072 (.38)

[1] Estimates of log monthly earnings equations coefficients selectively reported, whereas other variables are included as shown in column 2 and 4 of Tables 4 and 5. Hypothesis 1 adds to the basic model in Tables 4 and 5 the interaction between the individual's years of schooling and resident in a treatment village. Hypothesis 2 adds to Hypothesis 1 the individual's body mass index (Kg/Ht^2). Adult women have a larger and healthier level of BMI in treatment villages as estimated in reduced form equations in Table 1, column 3, presumably due to the program's provision of birth control methods and health inputs and health information (Joshi and Schultz, 2007, Table 5).

[2] Variable added to earnings function and also included in the wage employment probit equation as reported in columns 2 and 4 of Tables 4 and 5.

[3] BMI is defined as weight in Kilogram divided by height in Meters squared. It is expressed as a Z score or the individual's deviation from the sample median as estimated for a well fed population by CDC divided by the standard deviation of BMI in the population, and evaluated as an indicator of health and nutrition in various WHO publications.

Table 7: Average Value of Assets of Households in Matlab 1996 MHSS by Average in Program and Comparison Villages and Their Differences

Categories of Household Assets	Married Women Sample Means (1)	House-hold Sample Total Means (2)	Percent of Total House-hold Wealth (3)	Program Treated Villages Means (4)	Comparison Villages Means (5)	Treatment Differences Program-Comparison (6)	*t* Statistic of Program Effect (7)	Treatment Difference (6) ÷ Comparison Mean (5)*(8)
1. Farm Business Assets	113,001	99,260	46.2	104,819	93,612	11,207	2.45	.12*
A. Agricultural Land	102,716	90,271	42.0	93,739	86,748	6,991	1.64*	.081
B. Ponds and Orchards	9,393	8,301	3.9	10,334	6,236	4,098	5.94	.66*
C. Equipment	645	512	0.2	601	422	179	1.48*	.42
D. Plows	22	18	0.0	17	18	-.63	-0.28*	-.04
E. Other Farm Bus. Assets	225	158	0.1	128	188	-.60	-0.69*	-.32
2. Housing, Liquid Assets and Consumer Durables	114,341	99,387	46.3	117,261	81,225	36,036	5.73	.44*
A. Housing or Homestead	101,309	87,954	40.9	103,741	71,914	31,827	5.40	.44*
B. Jewelry	3,759	3,084	1.4	3,533	2,629	904	4.40	.34*
C. Savings Financial Assets Liquid Assets (B + C)	3,407 7,166	3,108 6,192	1.4 2.9	4,005 7,538	2,196 4,825	1,809 2,713	2.53 3.38	.82* .56*
D. TV	340	307	0.1	476	136	340	5.74	2.50*
E. Radio	3.26	280	0.1	310	249	61.1	2.30	.25*
F. Clock/Watch	484	399	0.2	416	382	34.4	1.28*	.09
G. Fan - Electric	180	163	0.1	242	82.6	160	5.68	1.94*
H. Cycle	80	86	0.0	1.24	47.1	77.3	2.70	1.64*

I. Furniture	3,205	2,879	1.3	3,115	2,639	476	2.93	.18*
J. Quilt	1,106	973	0.5	1,086	858	227	4.83	.26*
K. Other Consumer Goods	143	153	0.1	213	92	120	2.67*	.56*
L. Total Consumer Durables (D - K)	5,865	5,240	2.4	5,982	4,486	1,496	5.07*	.33*
3. Livestock Total	4,825	4,258	2.0	3,718	4,807	-1,089	- 4.60*	- .23*
A. Cows and Buffalos	4,091	3,570	1.7	3,023	4,126	- 1,103	- 4.78*	- .27*
B. Goats and Sheep	303	288	0.1	303	271	32.3	1.70	.12*
C. Fowl	411	383	0.2	378	388	- 9.83	- 0.75	- .03
D. Other Livestock	20	18	0.0	14	22	- 8.84	- 3.20*	- .40*
4. Non-Farm Business Assets Total	14,210	11,933	5.6	12,603	11,252	1,351	0.41	.12
A. Buildings and Shops	11,121	9,434	4.4	11,437	7,399	4,038	1.82	.55
B. Rickshaw	95	101	0.1	100	102	- 1.74	- 0.07	- .02
C. Boats	720	651	0.3	510	795	- 286	- 3.20*	- .36*
D. Carts	14	14	0.0	11	176	- 6.51	- 0.88	- .37
E. Fishing Nets	279	253	0.1	240	267	- 27.1	- 0.51	- .10
F. Spinning Looms	0.2	0.2	0.0	0.2	.4	- .43	- 0.97	- 1.0
G. Other	1,979	1,478	0.7	305	2,671	- 2,366	- 1.06	- .89
Total Assets	246,377	214,838	100	238,402	190,897	47,505	4.71*	.25*

Figure 1. Number of Children Ever Born per Ever Married Woman by Five-Year Age Groups in Matlab Health and Socioeconomic Survey 1996, by resident in Program and Comparison Villages