Increasing female education, stagnating female labor force participation, and gains from marriage: the case of rural Bangladesh

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Abstract

In spite of the considerable achievement of gender equality in education in the country, Bangladesh has experienced stagnant female labor force participation (FLFP) since the 1990s. Assuming that increased women's education affects various life-time outcomes beyond the formal labor market, we examine the impact of female schooling not only on FLFP but also on gains from marriage and household welfare. Adopting a quasi-experimental design and using the nationwide female secondary school stipend program, implemented in 1994, as an instrument variable, we find statistically significant negative causal impact of women's education on FLFP. In contrast, there are positive and significant effects of wife's education on husband's schooling, household income particularly from non-farm activities, and husband's foreign migration. Our results suggest that an extra year of wife's schooling increases husband's schooling by 1.0 year and per capita household income by 18 percent. This study also investigates the causal effect on other household welfare variables and finds that wife's years of schooling has positive and significant impact on sanitary control and children's health. These findings indicate that female schooling enhances women's well-being not through their own market activities but through marriage and household non-market activities.

JEL Classification Codes: I25; I31; J12; J13; J16; J21; O10

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I. INTRODUCTION

Gender equality in education has been globally acknowledged as an important goal for international development. One of the UN Millennium Development Goals (MDGs) is to 'promote gender equality and empower women,' and an ongoing effort to 'achieve gender equality and empower all women and girls' is encouraged in the UN Sustainable Development Goals (SDGs). Empowerment of women, particularly by promoting girls' education and encouraging active female labor force participation (FLFP), has an importance more than its intrinsic value. The World Development Report (WDR) 2012 (World Bank, 2012) argues that gender equality matters for sustainable development as well as in its own right. Since women now represent 40 % of the global labor force (World Bank, 2012), enhancing women's productivity by improving their ability and opportunities in the labor market is indispensable for a country to achieve further development. Meanwhile, significant returns to women's schooling are to be found in the household sector, where the schooling of women has important effects on the human capital of future generations (World Bank, 1991; United Nations Development Program, 1996).

A number of existing studies claim that Bangladesh has achieved substantial gender equality in education for the last few decades (Asadullah and Chaudhury, 2009; United Nations, 2014; World Bank, 2012). According to the MDG Report 2014 (United Nations, 2014), the regional achievement of gender parity in primary and secondary education in South Asia has been largely attributed to changes in Bangladesh and Nepal, which have favored girls' schooling. Bangladesh has increased its school enrollment ratio among girls aged between 5 and 19 from 33% in 1991 to 56% in 2005 (World Bank, 2012). The country has also experienced a reversed gender gap in secondary education

where girls are more likely to attend secondary school than boys (Asadullah and Chaudhury, 2009). In contrast to the country's great achievement in gender equality in education, however, the FLFP rate in Bangladesh has been stagnant at a low level (34-43%) and has slightly decreased since 1990.[1] Although newly developed industries such as the garment sector have provided employment opportunities for women who used to be out of the formal labor market in the country (Heath and Mobarak, 2015), those opportunities are still limited in urban areas near the capital city, Dhaka,[2] and the majority of women in rural villages, represented in our data, still choose to be housewives and prefer not to be employed in formal jobs.

This puzzling situation of Bangladesh, in which the increase in female education has not been associated with an expansion of FLFP, is not unique. Indeed, existing studies on the impact of female education on FLFP have reported mixed results. De Paoli (2009) shows the positive relationship between women's education and labor market participation in Ecuador, while no impact of female schooling on market activities is found in Uganda, Israel, and Kenya (Keats, 2016; Lavy and Zablotsky, 2015; Ozier, 2015). Klasen and Pieters (2015) observe that India has experienced the stagnation of FLFP (at

[1]Regarding labor force participation rate, both national and ILO estimates are available in the DataBank at the World Bank. In both estimates, the definition of labor force participation is stated as "the proportion of the population ages 15 and older that is economically active: all people who supply labor for the production of goods and services during a specified period." According to the Population and Household Census 2011 by the Bangladesh Bureau of Statistics, the definition of economically active population has been modified in every census (in 1974, 1981, 1991, 2001, and 2011). For example, the 1991 census defines economically active population as persons aged 10 years and above, who were either employed or unemployed and unpaid family helpers who spent at least 20 hours during the last week for gainful economic activity.

[2]There are large clusters of garment factories in Dhaka and Gazipur, particularly in the Tongi area. We can find a number of women working at factories as paid labor. They often commute from a nearby village or stay in a special apartment (dorm), which is often provided and organized by a factory. See the article by Heath and Mobarak (2015) for a more detailed story of positive impacts of garment jobs on female schooling and FLFP, which uses data covering urban villages in Dhaka and Gazipur.

18% since the 1980s) despite the fact that the country has achieved expansion of education and great improvement in gender equality in education. Their findings suggest a strong conditional U-shaped relationship between education of women and FLFP, suggesting that women who have low or very high education are more likely to participate in the labor market, while those who gain moderate education (those at the bottom of the U shape) are less likely to do so due to social stigma against low-skilled jobs. A decision of labor force participation of married women is also negatively affected by household income and husband's education due to the strong income effect (Klasen and Pieters, 2015; Goldin, 1995; Mammen and Paxson, 2000; Blau and Kahn, 2007).

A question arises as to why women are keen to invest in high education despite their low expectation of entering the formal labor market. Goldin (1997)'s study that describes rational responses of American women during the 1950s to labor and marriage markets provides us a potential answer to this question. At that time, the majority of college women chose to get married rather than to be employed in formal jobs. For them, according to her, attending a college is an educational investment for future marriage gains because it enables them to marry a college man whose expected future income is high. Indeed, education has its significant value as an investment in marriage market (Foster and Rosenzweig, 2001; Lafortune, 2013), and previous studies suggest the importance of marriage through which women's education could enhance their well-being (Goldin, 1995; Klasen and Pieters, 2015; Lefgren and McIntyre, 2006). The existence of positive assortative mating has been explained by a variety of theories (Becker, 1973; 1991), indicating that educated women are more likely to marry educated men. Empirically, Behrman, Rosenzweig, and Taubman (1994) and Behrman and Rosenzweig (2002) show that an extra year of female schooling increases the partner's

education by 0.3 year by using twin data to deal with the endogeneity of education. Lefgren and McIntyre (2006) find, using the quarter of birth as instrumental variables, that husband's earning is increased by $4,000 with an additional year of wife's schooling in the US.

Women's educational attainment matters even after the marriage particularly for issues related to children such as fertility and children's human capital. As for fertility, wife's education is found to have strong negative effects on the number of births (Breierova and Duflo, 2004; Chicoine, 2012; Ozier 2015; Tequame and Tirivayi, 2015). Increase in female schooling also improves child health and child health investment (Breierova and Duflo, 2004; Keats, 2016; Güneş, 2015; Currie and Moretti, 2003). Masuda and Yamauchi (2017) discuss several channels through which an increase in female schooling leads to a fertility decline and child health improvement. For example, an increase in human capital of women raises opportunity cost of early marriage and childbearing, which induces less incidence of early pregnancy and higher probability of being in the labor force (Becker, 1981; Baird et al., 2010). Changed fertility preference affects the number of children as well as investment in human capital of each child within a household (Becker and Lewis, 1974). Improved knowledge of women on health also changes their children's health outcomes by using appropriate health services (Keats, 2016; Lavy and Zablotsky, 2015; Mocan and Cannonier, 2012; Thomas et al., 1991; Glewwe, 1999). In addition to health, maternal education has significant and positive impact on child schooling (Behrman and Rosenzweig, 2002; Lam and Duryea, 1999; Duflo, 2012). In India, Behrman, Foster, Rosenzweig, and Vashishtha (1999) stress the importance of women's education in the productivity of home teaching, where better-

educated mothers are superior teachers at home. Therefore, investments in women's human capital directly influence children's schooling outcomes.

Expanding the effect of women's education beyond the labor market, this paper aims to examine the impact of increased female schooling on various life-time outcomes related to women in rural Bangladesh. While existing studies have assessed the effects of women's education on several life-time choices such as work, marriage, and the number of children separately, our study is the first attempt to capture the comprehensive picture of women's life-time choices by looking at the causal impact of female schooling on them. To deal with the endogeneity of education, we adopt a quasi-experimental design using the nationwide female secondary school stipend program in Bangladesh as an external shock. Our results show negative and significant causal impact of female education on FLFP, which is consistent with the current stagnation of FLFP in the country. We also find that an additional year of wife's schooling increases husband's schooling by 1.0 year and household per capita income by 18%, indicating the positive gains from marriage by increased education of women. Wife's education has a positive impact on the probability of having healthy children and the probability of using clean latrine in a household, suggesting that improved knowledge on sanitation enhances children's health status.

The rest of the paper is composed as follows. In section two, we outline the female secondary stipend program in Bangladesh, which is used for a quasi-experimental design in our analyses. Section three describes the data used in this study. Empirical strategy and estimated results are presented in sections four and five, respectively. Section six is conclusion.

II. GENDER DISPARITY IN SCHOOLING AND THE FEMALE SECONDARY SCHOOL STIPEND PROGRAM IN BANGLADESH

The schooling system (grades 1-12) in Bangladesh is categorized into four different types of schools: grades 1-5 are called "primary;" grades 6-8, "junior secondary;" grades 9-10, "secondary;" and grades 11-12 "higher secondary."[3]The academic year in primary and secondary schools begins in January and ends in December. Officially, the school starting age is 6, but, according to our data in 1988, 47% of children aged 8 in a primary school were either in grade 1 or still illiterate, meaning that delayed entry and grade repetition are common.

Gender Disparity in Schooling before the Stipend Program

Low educational achievement among girls and women in Bangladesh has been recognized by international organizations and the Government of Bangladesh at least since the early 1990s. For example, the World Bank reports that literacy rate among women was only 22%, while that of the total population was 35% (World Bank, 1992). According to our data in 1988, there was clear gender disparity in both school enrollment rate and years of education prior to the introduction of the stipend program in 1994. Figure 1 shows the ratio of girls and boys, by age group, who were enrolled in a school in 1988, 2000, and 2014. In 1988, school enrollment rate of girls was lower than that of boys at all ages. The gap between girls and boys was particularly pronounced at secondary school ages (ages 11-15). Girls' enrollment rate dropped from 70% to less than 40% from age

[3] Associated with the different levels of education, Bangladesh has four different terminal exams, starting at the primary level (Primary Education Completion Exam, PCSE), followed by junior secondary level (Junior School Certification, JSC), secondary level (Secondary School Certification, SSC), and higher secondary level (Higher Secondary Certification, HSC).

11 to age 15, while that of boys changed from 80% to more than 50%. Figure 2 presents the years of schooling of women and men, by age group. Overall, women reported lower educational achievement than men at all ages. The years of schooling at ages 15-19 were 3 years and 5 years for women and men, respectively. This 2-year gap in years of school achievement between women and men is even persistent among the population aged above 19 (2 years and 4 years for women and men, respectively).

The Female Secondary School Stipend Program

In response to gender disparity at the secondary school level in Bangladesh, a nationwide female secondary school stipend program was implemented in 1994 with the aim of raising school enrollment among rural girls.[4] Program objectives include (1) improving secondary school attainment among women and girls; (2) promoting female employment and labor force participation; and (3) reducing early marriage and avoiding early pregnancy. The program combines four uniform projects under different donors: Female Secondary School Project by the Government of Bangladesh (GOB), Female Secondary School Assistant Project by the World Bank and GOB, Secondary Education Development Project by the Asian Development Bank and GOB, and Female Secondary Education Project by the Norwegian Government. These four differently named projects share the same stipend scheme (including stipend amount and eligibility criteria) and the same project objectives, so that they can be regarded as a single uniform stipend program. As the program targets rural areas, 30 metropolitan *thanas* in Khulna, Dhaka, Chittagong, and Rajshahi were excluded (Schurmann, 2009). Thus, the project covered 460 out of all

[4]In the same line with this program, a similar pilot project has been implemented in a narrow part of the country since 1982. Meanwhile, free tuition policy was introduced to grades 6-8 in 1990 in rural thanas.

the 490 thanas in the country. The program was officially introduced in January 1994 in all 460 thanas, and 98% of all rural secondary schools where girls enrolled were part of this program by 1998 (Khandker et al., 2003).[5]

The targeted population of the female secondary school stipend program is girls in grades 6 to 10 (aged 11 to 15). All girls attending a secondary school in rural areas who meet the following criteria are eligible to receive stipend and tuition subsidy: (1) attend at least 75 % of school days; (2) attain at least 45% mark in the annual examination; and (3) remain unmarried. According to Khandker et al. (2003), only 6% of secondary school girls have failed to satisfy the criteria. The stipend covered as much as 50% of the costs of needed items such as textbooks, uniforms, and stationery, and other expenses such as transportation and exam fees (approximately 25-60 *taka* per month). Moreover, the program subsidizes full tuition cost, ranging from 10 to 20 taka per month, depending on a grade (Fuwa, 2001).[6]The stipend was directly paid to an account in the girl's name at the nearest Agrani Bank, a state bank with branches all over the country.

Immediate changes after the stipend program in school enrollment rate and years of schooling are observed from Figures 1 and 2, respectively. In 2000, school enrollment rate at primary school ages (ages 6-10) was nearly 90% for both girls and boys, and that of secondary school ages was higher among girls than boys. Girls at age 15 reported 75% school enrollment rate, while boys at the same age reported less than 55%. Likewise, both

[5]Although official implementation of the program was in January 1994, there was a delay in some schools—the program started in either 1995 or 1996 (Fuwa, 2001; Khandker et al., 2003).

[6]In addition to the stipend and tuition subsidy, the program also offered technical assistance to improve the quality of schools such as curriculum reforms, instructional material development, teacher training, recruitment of female teachers, improvement of school infrastructure, community awareness programs, and institutional capacity building. Unlike the stipend and tuition subsidy, however, these technical support differed, depending on the donor (GOB, World Bank, Asian Development Bank, and the Norwegian Government) (Fuwa, 2001).

girls and boys aged 10-14 mark on average 4 years of schooling in 2000; the achievement was slightly higher for girls than for boys at ages 15-19. In 2014, the gap in educational achievement between women and men completely disappeared among younger cohorts (ages 15-19, 20-24, and 25-29) who are likely to have benefited from the stipend program.

Several studies have already reported positive results of the female secondary school stipend program. Using data at the early stage of its implementation, Fuwa (2001) and Khandker et al. (2003) show that the immediate impact of the program is to raise school enrollment rate among targeted girls, while it has reduced that among boys. Reversed gender gap of secondary school enrollment rate between rural boys and girls has been also examined by Asadullah and Chaudhury (2009) using the difference-in-difference (DID) methodology with both rural and urban data. They argue that rural boys at the secondary school have been disadvantaged partially due to the female-favored stipend program. Moreover, recent studies have examined long-term impacts of the program on women's livelihood. Using a data set covering both rural and metropolitan areas, Hong and Sarr (2012) employed both DID and regression discontinuity methodologies and found that the program has contributed to raising women's years of education by 1.6–2.0 years and increasing the marriage age of women by 1.4–2.3 years. They also provided evidence that an additional year of schooling led by the program has enhanced FLFP by 2.4–5.3%. Using data set covering both rural and metropolitan areas, Shamsuddin (2015) also employed DID and showed an increase in women's years of education by 0.36–1.08 years and FLFP by 2.2–6.6 percentage points due to the program, while he reported a decrease in female earnings by 5.8–17.0 %. In addition to the positive impact on education and labor force participation, the study argues that the program has

enhanced women's incentive to work in the service industry and engage in self-employment.

III. DATA

The present study uses the latest round of a household panel data set "Livelihood System of Rural Households Panel Data" collected by Dr. Mahabub Hossain of the Bangladesh Rural Advancement Committee (BRAC). It covers 62 out of a total 64 districts in the country and consists of 62 rural villages—i.e., one village represents each district. A multi-stage random sampling method was adopted for sample selection of 62 villages for the benchmark survey in 1988 (Nargis and Hossain, 2004; Hossain et al., 2009). All the villages were under the targeted thanas of the female secondary school stipend program. Approximately 20 households in each village were randomly chosen originally as the sample households, whereas the sample size has been expanded as the survey round proceeded. The repeated panel household survey was conducted in 2000, 2004, and 2008, and the latest survey was conducted in 2014 in collaboration with the National Graduate Institute for Policy Studies. The 2014 data covered 2,846 randomly selected households. The data contained both household information (e.g., amount of owned land, use of fertilizer, and investments in family businesses) and individual information (e.g., age, gender, education, and occupation).

Apart from the household data, a village survey was conducted in the sample villages in 2014. It provided village information such as land condition and access to infrastructure (e.g. bus stop, bank branch, school, and district head quarter). One of the strengths of our data set is its coverage of temporary migrants because active migration is one of the particular features in rural Bangladesh (Kikkawa and Otsuka, 2016). Since

the initial survey round in 1988, the sample households have been asked whether they have family members who are temporally absent due to migration. The information on individual migrants covered age, gender, relationship with household head, education, and purpose (e.g., for work and education), place, and duration of migration. This information enabled us to analyze households in which husband or wife was absent due to migration.

From the total of 2,846 households, we selected 2,565 households for this study in which both wife and husband were recorded. Households in which either wife or husband is missing due to divorce or death of the partner consisted of 9.8 % of the total. Table 1 shows summary statistics for these selected couples. Columns 1-2 are for all 2,565 samples and columns 3-4 are for subsamples in which wife's age is between 25 and 36. This subsample was mainly used for our analyses. Details about the subsample will be explained in the next section. In column 3, the average age of the wife in the subsample was 30.7 years, while that of the husband was 38.2 years. Wives were slightly more educated than husbands; the former with 5.56 years of schooling and the latter, 5.40 years. In contrast, the average marriage age was substantially different; wives get married at the age of 17, while husbands get married at the age of 21. Only 9% of the women were in the labor force, implying that majority were housewives. Average household per capita income was 32,733 taka, to which wife is less likely to contribute due to the low FLFP.

IV. ESTIMATION STRATEGY

The purpose of this study is to examine the causal effects of women's education on their various life-time outcomes. Unlike existing studies, however, our sample covered only rural areas where the female secondary school stipend program was actually implemented.

Thus, the DID methodology, which uses sample from metropolitan areas as a comparison group, cannot be applied to the case under study. The OLS estimate is likely to be biased due to measurement errors and unobserved factors (such as individual "ability"), which affect both educational attainment and outcomes of interest (Lefgren and McIntyre, 2006). Instead, we employed a fuzzy regression discontinuity design to explore the causal impact of women's education on various outcomes. In our application, we utilized the timing of the introduction of the stipend program and divided our sample into 'treatment,' who were exposed to the stipend program, and 'control,' who did not benefit from the stipend program based on the year when the program was first implemented. As treatment status was assigned based on an observed forcing variable, age, we assumed that whether an individual is treated or not is completely random.

Table 2 provides details about the eligibility for the stipend program of each birth cohort. To summarize, girls born before 1980 (women aged above 34 in 2014) were not covered by the program and girls born between 1980 and 1982 (women aged between 31 and 34) were partially covered by the program because when the program was first introduced in 1994, the program entry grade is fixed with either grade 6 or 9. In other words, girls in grades 7 and 8 in 1994 and girls in grade 8 in 1995 were not covered by the program, as indicated by the non-highlighted parts in the table, as they had to wait until grade 9 to receive the program benefit. All girls who were born after 1983 (women aged 30 or younger) fully benefited from the stipend program. As the stipend program was only available for eligible girls who were in a secondary school at the time of implementation (in other words, for compliers), our design is a fuzzy regression

discontinuity (Imbens and Lemieux, 2008). As girls who were born after 1983 were fully exposed to the stipend program, we set the age cutoff point at age 30 in 2014.[7]

Figures 3(a) and 3(b) plot average years of education by each age group and fitted line for the plots for wives and husbands, respectively. A drawn vertical line indicates the age cutoff point at age 30. Not surprisingly, there was the sharp upward jump (discontinuity) for wives at the age cutoff point, which indicates the causal effect of the stipend program on the years of education for women near the cutoff. At the cutoff, women exposed to the stipend program attained on average nearly 1 additional year of schooling. However, such upward jump cannot be observed for husbands at the same age cutoff. Although there was large heterogeneity in the average years of education among husbands aged below 30 (left hand side of the cutoff), the fitted line indicates the decrease in education, which is consistent with findings from previous studies that the stipend program has led to reversed gender disparity in the secondary level of education (Fuwa, 2001; Khandker et al., 2003; Asadullah and Chaudhury, 2009). Likewise, Figures 3(c) and 3(d) describe scatter plots of years of education, by age, with the bin size 3. Again, the sharp discontinuity at the cutoff was observed for wives but not for husbands.

Given the sharp discontinuity in wife's years of education at the age cutoff point, we restricted the analysis to sample near the cutoff and applied the fuzzy regression discontinuity setting. This assumes that the age cohorts near the age cutoff point are similar in most characteristics, so that any difference in outcomes can be attributed to the stipend program. Let Y be the outcome of interest; *Educ*, the educational attainment of

[7]We also analyzed separate impacts of the stipend program on grades 6-8 and 9-10 in later analysis.

women; *x*, the age; and *c*, the cutoff. Following Imbens and Lemieux (2008), the causal effect of an additional year of schooling in the fuzzy setting τ is defined as

$$\tau = \frac{\lim_{x \to -c} E[Y|Age = x] - \lim_{x \to +c} E[Y|Age = x]}{\lim_{x \to -c} E[Educ|Age = x] - \lim_{x \to +c} E[Educ|Age = x]} \quad (1)$$

where the limits from the left and right are taken for the range $c - h < x < c + h$ with some bandwidths *h*. As suggested by Hahn et al. (2001), the treatment effect in this setting should be estimated by two-stage least-squares (2SLS):

$$Y_{js} = \alpha + \beta \widehat{Educ_i} + f(Age_i - c) + X_s \delta_Y + v_i \quad (2)$$

$$Educ_i = \gamma + Treat \times \left(\pi + g(Age_i - c)\right) + g(Age_i - c) + X_s \delta_{Educ} + \epsilon_i \,, \quad (3)$$

where Y_{js} represents the outcome of interest of a household *j* in village *s*. $Educ_i$ is years of education of wife *i* in a household *j* in village *s*; Age_i is the age of wife; and village dummies X_s are also included to capture difference in the characteristics of the marriage market in each village. $Treat = 1[Age_i \leq 30]$, and $f(\cdot)$ and $g(\cdot)$ are some functions of the order of polynomials. Here, we employed the first order polynomial as none of the higher order of polynomials was significant. The interaction term between $Treat$ and $g(\cdot)$ was included to allow the regression function to differ on both sides of the cutoff point (Lee and Lemieux, 2010). Moreover, $Age_i - c$ instead of Age_i was used to allow the intercepts of the two regressions to be different at both sides of the cutoff. v_i and ϵ_i are random error terms. Following Imbens and Lemieux (2008) and Lee and Lemieux (2010), standard errors were computed using the robust 2SLS standard errors and clustered at cohort (age) level. In this framework, β represents the causal effect of an additional year of wife's education on outcomes. The treatment effect is a local average treatment effect.

To select optimal bandwidths, h, we used the cross-validation methods (Imbens and Lemieux, 2008) and several bandwidth selection procedures by Calonico et al. (2014, 2017). Figure A1 shows the results of the cross-validation procedure. The cross-validation function sharply declined once we included 3 age cohorts from left-hand and right-hand sides of the cutoff, and it increased rapidly after including 6 age cohorts from each side. Meanwhile, estimated bandwidths by several procedures varied from 2 to 7 and from 2 to 15 for left-hand and right-hand side of the cutoff, respectively. Based on these results, we employed the bandwidths with 3 to 6 in our analysis. The order of the polynomials and the bandwidth were the same at both first and second stages.

Figure 4 shows the estimation framework of this study. We assumed that both market and non-market activities within a household are determined directly by wife's education and indirectly by husband's education, which is affected by wife's education due to assortative mating. Solid lines indicate the causal relationships between wife's education and outcomes: husband's education, market activities, and non-market activities, which are examined in this study. We also assumed that, although the similar causal relationships between husband's education and market and non-market activities may exist, which is shown by dotted lines, they are not explicitly explored in this study. In each regression, we excluded husband's education due to the strong correlation between wife's and husband's schooling levels. Among various outcomes shown in this figure, we assumed that husband's education, occupation, and household income represent pecuniary gains from marriage, while fertility, sanitation control, children's health and education represent non-pecuniary household welfare gains.

V. RESULTS

Internal validity test

Before moving to our main results, we present three standard validity checks following Imbens and Lemieux (2008). First, as was discussed in the previous section, we argue that treatment status is randomly assigned as it is determined based on individual age. An important assumption here is that any individual cannot manipulate the treatment status so that we can use the stipend program as a natural experiment, which solely affects female school attainment. To ensure this assumption, we examine whether there is any discontinuity in the forcing variable, age, at the cutoff by using McCrary density test (McCrary, 2008). Figures 5(a) and 5(b) show the results of the test for the sample in 2000 and 2014, respectively. Neither figure reveals any discontinuity around the cutoff.

There is, however, still a possibility of manipulation of the treatment status. For example, if parents of girls, whose age was not eligible for the treatment, anticipated the stipend program, they would intentionally delay daughter's school entry year or have grade repetition to enable daughters to remain in an eligible grade when the stipend program was introduced. As we discussed in the previous section, delayed entry and grade repetition are common in our sample, but if they are systematically correlated with the timing of the stipend program, the assignment of the treatment status is no longer random. To check whether there is any discontinuity in probability of delayed entry and grade repetition, we create a dummy variable that takes one if a schooling child is in a lower grade than the grade she/he is supposed to be according to her/his age. Figure 5(c) presents the result. Although there is a slight jump between age 15 and 16 at the cutoff, this may be because of the terminal exam after grade 10 (at ages 15-16) called Secondary School Certification (SSC). As an individual who fails to pass the exam cannot proceed to the next grade, a number of grade repeaters are likely to increase at this age. In fact,

another jump is observed at around age 18 when students face another terminal exam called Higher Secondary Certification (HSC).

Second, to ensure that outcomes of interest are solely affected by the change in female schooling derived from the stipend program, we examine whether covariates that affect both the educational attainment and outcomes of interest show discontinuity at the cutoff. Figures 6(a)-6(d) present pre-marital household characteristics of children in 2000: mother's years of schooling, father's years of schooling, amount of owned land, and log of non-land fixed asset, which could affect both women's schooling and their post-marital outcomes. Note that our data are not individually paneled, rather it is paneled at the household level. Therefore, we cannot track pre-marital household characteristics of exactly our study sample women in 2014. Instead, we use our data of children in 2000, assuming that they share similar trend in household characteristics with the study sample women in 2014.[8] In Figures 6(a)-6(d), all four covariates vary smoothly around the cutoff without discontinuity.

Third, to ensure that the stipend program only affects women's school attainment and that no change in men's education is induced, we examine equation (3) by using men in our sample in 2014. Results are presented in Table A1. The coefficients of the treatment status are not significant and F-statistics for the joint hypothesis of the treatment status and the interaction term is small. Thus, we conclude no impact of the stipend program on male school attainment.

Other potential concerns regarding our estimations are derived from analyzing married women (Lefgren and McIntyre, 2006). The first issue is selection bias. Since

[8]We also do not know whether women are originally from the same sample village or move from a non-sample village due to marriage.

husband's education and household income are observed only for those women who choose to marry, and it is possible that those who choose not to marry have potentially lower expected gains from marriage than those who choose to marry, ignoring single persons would cause selection bias. This becomes a serious issue in a country where marriage probability is low, even among adults. In rural Bangladesh, however, marriage is universal. Only 2.1% of women aged above 20 years old remain unmarried in our sample. Thus, our estimation is largely free from such selection bias. Second, the issue of timing bias becomes a problem if educational investments occur before and after marriage. In our sample, only 1.9% of women aged above 20 remain in a school, indicating that educational investment after marriage is very rare in rural Bangladesh. Therefore, the timing bias does not have to be considered in our context.

Correlation between the stipend program and educational attainment

Table 3 documents the results of the first-stage regression, which shows the relationship between the stipend program and educational attainment of wives in our sample. The exposure to the female secondary school stipend program has significantly increased women's education, which is consistent with the aim of this program. The F-statistics exceeds 2. The results suggest that a woman eligible to the program obtains about 1.2 years more schooling than one not exposed to the program, which is equivalent to 24% increase relative to women on the right of the cutoff. Compared with findings from existing studies that the program increases women's years of education by 0.36–2.0 years (Hong and Sarr, 2012; Shamsuddin, 2015), our results seem reasonable.

Table 4 presents the disaggregated impact of the stipend program. As we discussed in the previous section, the stipend program covering grades 6-8 was available

for women aged 30 or below, whereas the one covering grades 9-10 was offered to women aged 34 or below (see Table 2). Utilizing the difference in grades covered by the program among cohorts, we create another treatment dummy variable that takes one if wife's age is 34 or below and include two different treatment dummies to see whether there is any difference in the impact on female schooling. According to Table 4, while the treatment status in grades 6-8 has positive and statistically significant impact on wife's years of schooling, the coefficients of the treatment status in grades 9-10 are positive but not statistically significant. These findings indicate a larger effect of the stipend program for the lower grades.

To examine heterogeneity of impacts of the program among women having different levels of education, we divide our sample into less educated women and highly educated women. Table 5 presents the results. The stipend program greatly contributed to increased educational attainment among women who have primary level of education (Panel A), whereas it has negative or little impact on women having secondary (or above) level of schooling (Panel B). The second finding seems puzzling as the primary objective of the stipend program is to encourage girls to obtain secondary level of education. To find out a reason, we looked at the distribution of sample women by educational attainment. Figures A2(a) and A2(b) show the density of women, by years of education for control and treatment groups, respectively. Three features can be observed from the figure. First, the density of treatment women shifted right compared with that of control women, indicating that the stipend program increases overall educational attainment (Table 3). Second, at years of education 0-5, the highest density moved from 0 in control women to 5 in treatment women, meaning that the stipend program boosts schooling among less educated women (Table 5). Third, at years of schooling above 5, however, the highest

density shifted from 10 in control women to 6 in treatment women, suggesting that the distribution of highly educated treatment women is more concentrated at lower secondary level than that of highly educated control women. The observed negative and little impact of the stipend program among highly educated women is attributed to this distributional change.

The change in distribution can be explained by selection bias of schooling (Klasen and Pieters, 2015). Thanks to the stipend program, girls having low "ability" or being less motivated, who would not proceed to secondary education without the stipend program, are now attending a secondary school, while girls with high "ability" or high motivation, who used to attend a secondary school even before the program was introduced, are not affected. As a result of the lack of or weakened selection, average performance among secondary school girls is likely to decline. In fact, the majority of women having above primary level of education stop their schooling before they reach grade 10, at which they can obtain SCC (see density of treatment women at years of education above 5). Thus, the stipend program decreases the average educational attainment of women conditional on having secondary or above level of schooling by mitigating selection bias. In other words, the program has a great contribution to equality in education as it improves schooling of girls at the bottom.

Estimate of the effect of education on marriage age and FLFP

Having shown that the stipend program is significantly correlated to the wife's educational attainment, we now look at the causal effect of women's education on marriage age and FLFP. Table 6 presents the estimation results. One of the dependent variables, a FLFP dummy, takes one if wife's primary or secondary occupation is related

to any economic activity such as a farm or non-farm job rather than as a housewife. Somewhat, surprisingly, our estimation results showed no impact on marriage age and negative impact on FLFP. Regarding marriage age, the coefficients of wife's years of education in columns (1)-(4) of Panel A were mostly positive but not statistically significant. The same coefficients in OLS estimation shown in columns (5)-(8) were positive and statistically significant, suggesting that women's years of education and marriage age are positively correlated. Meanwhile, the effects of the same variable on FLFP shown in columns (1)-(4) of Panel B were negative and statistically significant with some bandwidths. According to the coefficient in column (4) of Panel B, an additional year of schooling reduces the probability of FLFP by roughly 7 percentage points. OLS results in columns (5)-(8) showed positive association between female schooling and FLFP, although the magnitude of the coefficients was small. Note that education is endogenous to both marriage and labor force participation, and we deal with this endogeneity by employing 2SLS. Thus, our estimation results clearly indicate that neither FLFP nor age of marriage is induced to increase by an additional year of female schooling in our sample. For robustness check, we regressed FLFP on years of schooling using a full sample of women rather than restricting only to wives. The results of the first-stage and second-stage regressions are shown in Table A2. The estimated coefficients were negative but not statistically significant.

These results are inconsistent with the findings from the existing literature, which reports that the increased women's educational attainment induced by the stipend program has positive and statistically significant impact on FLFP and marriage age (Hong and Sarr, 2012; Shamsuddin, 2015). One of the possible reasons for this inconsistency might be derived from the difference in methodologies used and the coverage of the data

set, since both Hong and Sarr (2012) and Shamsuddin (2015) employed DID estimation with data covering both rural and metropolitan areas; the latter was not covered by the stipend program.

Our finding is highly relevant to policies empowering women because one of the objectives of the stipend program is to promote women's labor market activities through enhancing girls' human capital. As we discussed in the earlier section, there are a number of explanations on the relationship between female schooling and labor force participation. Among them, Goldin (1997) argues the importance of two factors that enable notable increase in FLFP—i.e., the emergence of highly educated women and the development of white-collar jobs for women. In our context in rural Bangladesh, both factors are hardly in place. Female school attainment in tertiary education is still far behind that of male attainment (United Nations, 2014). Moreover, available employment opportunities for women in rural villages are restricted to blue-collar and self-employment jobs (e.g., maid servant and tailoring). Some limited options for educated women are employment as a school teacher and NGO worker, but these fields are highly competitive. In addition to Goldin's two factors, as we will see in the next subsection, the strong income effect may be another dominant factor in rural Bangladesh as a result of assortative mating and a substantial wage gap between men and women.

Estimates of the effect of education on gains from marriage

We now proceed to the analysis of another important return to female education—i.e., gains from marriage. Columns (1)-(4) of Panel A in Table 7 show the linear effect of wife's education on husband's years of schooling. The results suggest that an additional year of education of the wife is associated with an increase in the husband's education by

almost 1.0 year. As the average years of education of husbands in this subsample were 5.05, a 1.0-year increase is equivalent to a 19.8% increase in husband's schooling. The coefficients in OLS estimates in columns (5)-(8) show similar results with 2SLS.The positive impact of wife's education on household per capita income is observed from columns (1)-(4) of Panel B. Note that household income can be directly affected by the stipend program if an educated wife contributes to family income by participating in the labor force and generating her own income. To avoid endogeneity between household income and wife's labor force participation, we restricted our sample to wives who are out of the labor market (92% of the total sample) in Table 7. By doing so, we can remove a potential direct effect of the stipend program on household income generated by wives. Thus, the observed impact discussed below is an increase in household income, which is earned by other family members. The results indicate that an extra year of education of the wife leads to an increase in per capita household income by 5382.5–8403.0 taka. The magnitude of this impact is equal to an 18–26% increase. OLS estimates in columns (5)-(8) also indicate a positive relationship between wife's schooling and household income.

We decomposed the household income into farm (such as crop, rice, forestry, fish, and farm wage income) and non-farm incomes (such as remittance, business, service, industry, and non-farm wage income). According to the estimation results in columns (1)-(4) of Panels A and B in Table 8, wife's education increases non-farm income significantly, while no impact is observed on farm income. Thus, the increased household income is mainly attributed to the increase in non-farm activities of the husband.

As our estimation removed the wives' direct income contribution, two channels are assumed through which female schooling affects household income. First, education would enable women to marry men who have potential in earning high income. As we

observe in Panel A of Table 7, there is a positive impact of wives' schooling on husbands' educational attainment. If education is one of the signals of income-generating ability of husbands, wives' education would increase household income through assortative mating. Second, women's education would increase household income indirectly through better household resource allocation. As the majority of the wives in our sample are housewives, their education may enhance the productivity of the rest of the household members by assisting their activities. However, we found no impact of women's schooling on decision-making on market and non-market activities within a household such as investment in family business and farm activities, loan, expenditure, daily commodity purchase, and issues related to children.

To supplement our findings, we looked at the effect of wife's education on husband's decision on foreign migration because the absence of a husband leaves great freedom and responsibility for household issues to a wife. Our foreign migration dummy captures both current foreign migrants and returnees (who have ever migrated and already returned). According to column (2) of Panel C in Table 8, the husband's probability of being a foreign migrant is increased by 6 percentage points with an additional schooling year of the wife. This impact is equal to an 83% increase relative to household on the right of the cutoff, so that the magnitude of the effect is large, though the coefficient is statistically significant only in the estimation with bandwidth 4.

In our rural sample, the majority of foreign migrants are temporal migrants. They often migrate to countries in Asia and the Middle East and are away from home for several years due to high placement cost (Kikkawa and Otsuka, 2016). In such a household in which a husband spends most of his time in foreign countries, his wife must assume the role of the household head on behalf of the husband. Moreover, a migrant husband often

has to rely on his wife on the use of remittance that he sends home. Because of this background surrounding foreign migration, it is not surprising to find evidence that the wife's educational attainment is one of the important factors affecting the husband's decision on foreign migration. Thus, women's education could contribute to household income indirectly through their high capability to manage the household. This can be another reason for men to choose highly educated women to be their wives.

Estimates of the effect of education on household welfare

In this subsection, we will shift to explore consequences on household welfare such as fertility, children's schooling, sanitation control, and children's health. We have examined a number of available variables in our data set representing outcomes on health, education, sanitation, nutrition, expenditure, and decision-making authority among household family members. From all the results, we obtained suggestive evidence particularly in fertility, sanitation control, and children's health.

The result of wife's education on fertility is shown in columns (1)-(4) of Panel A in Table 9. Our dependent variable is the number of children aged 15 or below per wife. The coefficient of the variable of our interest was -0.32, and it was statistically significant at the 5% level with bandwidth 4. As the average number of children was 2.27 with this bandwidth, our estimation results indicate that an increase in wife's years of schooling by 1 year induces a decline in fertility by 14%. The results of OLS estimates shown in columns (5)-(8) also confirm the negative association between wives' education and fertility, although the magnitude of the coefficients was small compared with 2SLS estimates. Note that in the previous subsection, we found no positive effect of schooling on both marriage age and FLFP (see Table 6), suggesting that the negative impact of

wives' education on fertility is not attributed to the increased opportunity cost of childbearing. Although further investigation on channels of the fertility decline is beyond the scope of our study, our finding on child health suggests the change in women's preference in favor of quality of children over quantity.

Columns (1)-(4) of Panel B report the causal effect of wife's education on young family member's schooling dummy, which takes 1 if 'any' family member aged between 15 and 22 attends a school and zero, otherwise. Because 'any' family members are included in this estimation sample, they are not necessarily the biological child of a wife and are possibly relatives such as sisters or brothers-in-law. We did not restrict the sample to 'biological children' because of the age of wives in our subsample. As we set the bandwidths 3-6 in this estimation, the coverage of the age of treatment wives was limited to 25-30 years old, implying that the age of their own biological children in this treatment group was also limited to 0-10 years old, which does not cover our targeted age population whose age is between 15 and 22 years old (equivalent to those going to higher secondary or tertiary school). As a compromise, we expanded the sample of children from 'biological children' to any family members whose age is between 15 and 22, who live in the same household. The estimation results shown in the columns (1)-(4) of Panel B present a mixed impact of women's education on 'any' children's schooling. The sign of the coefficients varied across different bandwidths, from which we cannot conclude the actual impact on the dependent variable. Moreover, OLS results in columns (5)-(8) showed no correlation between wives' schooling and young family members' school

enrollment. It may well be that the impact of women's education is limited to their own 'biological' children.[9]

Columns (1)-(4) of Panel C show the causal effect of wife's years of education on the use of latrine with water seal. In our sample villages, an automatic flush toilet is rarely available. Some households still use open toilets or hanging latrines nearby a river or lake, and they hardly clean up the sanitary station after use. On the other hand, other households make an effort to keep a latrine tidy by cleaning up the sanitary station by water after use. No special facility is needed to maintain a clean toilet since water used for the cleaning comes from a nearby water well. What family members have to do is to bring some water before they use a toilet and use it to clean the bath room afterward. Thus, the level of sanitation highly depends on household members' awareness of the issue. Our finding indicates that 1 additional year of education of the wife has improved the probability of using a toilet with water seal by 16 percentage points. Since 57% of subsample households use this type of latrine, this impact is equivalent to a 28% increase in use.

Let us now move on to the next analysis on children's health. To capture the health status of children, we created a dummy variable that takes 1 if a child reports "sometimes sick" or "hardly ever sick" and zero if she/he reports "almost always sick." In our subsample, nearly 90% of the children report that they are healthy. Columns (1)-(4) of Panel D present the causal effect of wife's education (mother's education) on the children's health dummy, which was positive and statistically significant. The estimated coefficients suggest that if mother's education increases by 1 year, children's probability of being healthy increases by 14 percentage points. For both a husband and parents-in-

[9]To examine association (not causal effect) between wife's education and children's schooling, we also regressed OLS with wives aged above 40 years old whose children are old enough, and we obtained significant positive association between the two.

law, having healthy (grand) children has great importance. If they are aware of the positive causality between wife's education and children's health, men would prefer to have a highly educated woman as their future wife.

Our findings on sanitation control and children's health are consistent with the results of household expenditure and its use. Table 10 presents the impact of wives' education on different weekly expenditures. The total household expenditure shown in columns (1)-(4) of Panel A increased by 765.7 taka with an extra year of schooling. We also disaggregated total expenditure according to its use. For example, weekly expenditure on nutritious food items comprises all expenditure on highly nutritious food such as vegetables, fruits, meat, and eggs. Expenditure on sanitation items includes spending on soap, detergent, and related items. Medical expenditure covers the cost of medical care and medicine. From columns (1)-(4) of Panels B-D, we found that women's education significantly increased all three expenditures. Although no impact of schooling on wife's decision-making authority on household expenditure was observed, it is less likely that a husband decides every single purchase such as daily food and sanitary items because most household tasks such as cooking and laundry are carried out by women. Therefore, the findings on expenditure confirm the contribution of women's schooling to improvement in household welfare such as sanitary control and children's health.

VI. CONCLUSIONS

In this study, we examined the causal effect of women's educational attainment on various life-time outcomes related to women beyond the formal labor market. To deal with potential endogeneity and unobserved heterogeneity of education, we adopted a quasi-experimental design to approximate real randomization. Using the nationwide

female secondary school stipend program introduced in 1994 as an instrument variable, we obtained evidence on the effects of women's schooling on FLFP, gains from marriage, and household welfare. In the context of the long stagnation of FLFP in Bangladesh, negative and statistically significant impact of women's education on FLFP was observed. In contrast, the significantly positive effects of wife's schooling on husband's education and household income were found, which were attributed to the increase in non-farm activities, including husband's foreign migration. Our findings indicate that husband's educational attainment is increased by 1.0 year with an extra year of wife's education and that household income is raised by 18-26% if a wife attains 1 additional year of education. This study further investigated the causal impact of wife's education on household welfare such as sanitation control and children's human capital. Results suggest that wife's education has positive effect on the household's probability of using clean latrine and the biological children's probability of being healthy, while it has no effect on the any young family member's probability of being at a school. These findings indicate that female schooling enhances women's well-being not through their own market activities but through various channels such as marriage and non-market household activities.

The study suggests two important implications regarding female education and its returns. First, modest increase in female education is a necessary but not sufficient condition for promoting FLFP. We cast doubt on one of the objectives of the stipend program, which is to promote women's labor market activities though enhancing girls' human capital. This is based on the assumption that an increase in female schooling should be followed by an increase in FLFP, which would eventually contribute to further development of the country. What we found in this study, however, is that the improved women's education rarely enhances their labor market activities in rural Bangladesh,

although it enhances their well-being through other channels such as marriage and non-market household activities. Second, despite negative impact of women's schooling on FLFP, investing in female education is still important in a sense to improve women's well-being as we observed its positive effects on husbands' education, household income, and children's health. Although it is still too early to observe its impact on future generations (as their children are still young), as the previous literature indicates, we can expect inter-generational benefits from the stipend program such as schooling and labor outcomes in the future.

Based on our results on FLFP, we conjecture that there are other determining factors to promote FLFP apart from the modest increase in female education so far achieved by the policy means. Although we cannot identify such factors, our study provides the comprehensive assessment of the impacts of the stipend programs on women's life-time choices as well as their limitation in promoting FLFP. For policymakers, particularly those who believe or expect significant monetary returns to investment in female secondary schooling accrued from women's labor market activities rather than marriage and non-market household activities, our findings must be helpful to properly understand the current situation. In all likelihood, in order to promote FLFP, a broader analytical framework, which encompasses both supply and demand factors of female labor force, is required to deepen our understanding of the key determinants of FLFP in developing countries in general and in Bangladesh in particular.

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TABLE 1. Summary statistics of selected variables

	(1)	(2)	(3)	(4)
	All sample		Subsample (24<wife's age<37)	
	Mean	Standard deviation	Mean	Standard deviation
Wife's age	39.59	12.53	30.70	3.59
Wife's years of education	4.28	3.86	5.56	3.79
Wife's marriage age	16.87	2.64	17.33	2.66
Wife's working status (=1 if working)	0.07	0.26	0.09	0.28
Number of children aged≤15	1.26	1.17	2.05	0.99
Husband's age	47.42	13.70	38.21	5.99
Husband's years of education	4.80	4.70	5.40	4.74
Husband's marriage age	22.06	7.27	21.00	8.67
1= if Muslim	0.92	0.27	0.91	0.29
Owned land of household (ha)	0.40	0.72	0.27	0.63
Log of non-land fixed asset	8.91	1.68	8.78	1.61
1= if access to electricity	0.73	0.44	0.73	0.45
Household per capita income (100 Tk)	362.79	321.37	327.33	282.19
Observations (no.)	2565	2565	933	933

TABLE 2. Eligibility of cohort for the female secondary stipend program

Year	Birth year									
	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
1990	8	7	6	5	4	3	2	1		
1991		8	7	6	5	4	3	2	1	
1992		9	8	7	6	5	4	3	2	1
1993		10	9	8	7	6	5	4	3	2
1994			10	9	8	7	6	5	4	3
1995				10	9	8	7	6	5	4
1996					10	9	8	7	6	5
1997						10	9	8	7	6
1998							10	9	8	7
								10	9	8
									10	9
										10
Age in 2014	36-37	35-36	34-35	33-34	33-32	32-31	31-30	30-29	29-28	28-27

Notes: Highlighted parts indicate the eligible grade covered by the stipend program.

TABLE 3. The impact of the female secondary stipend program on wife's years of education: results of first-stage regression

	(1) BW3	(2) BW4	(3) BW5	(4) BW6
Treatment = 1	1.240**	1.173**	0.852*	0.837**
	(0.467)	(0.390)	(0.429)	(0.359)
Treat*(Age-30)	-0.312	-0.299	-0.012	0.024
	(0.222)	(0.176)	(0.115)	(0.081)
(Age-30)	0.144	0.067	-0.118	-0.150**
	(0.143)	(0.117)	(0.106)	(0.053)
Constant	2.932	3.002*	3.114***	3.033***
	(1.562)	(1.427)	(0.876)	(0.670)
F-statistics	7.84	5.48	2.04	2.73
Mean of dep. var. in right if the cutoff	5.09	5.06	5.01	4.85
Observations (no.)	455	573	724	933

Notes: Standard errors in parentheses. Standard errors clustered at cohort level, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

TABLE 4. The disaggregate impact of the female secondary stipend program on wife's years of education

	(3) BW5	(4) BW6	(5) BW7	(6) BW8
Treatment in grades 6-8	0.864*	0.894**	0.967**	1.209***
	(0.427)	(0.375)	(0.365)	(0.383)
Treatment in grades 9-10	0.066	0.189	0.164	0.113
	(0.233)	(0.253)	(0.271)	(0.329)
(Age-30)	-0.116	-0.115**	-0.103**	-0.062
	(0.067)	(0.049)	(0.046)	(0.054)
Constant	3.068***	2.818***	2.877***	2.961***
	(0.885)	(0.668)	(0.623)	(0.587)
Observations (no.)	724	933	1018	1141

Notes: Standard errors in parentheses. Standard errors clustered at cohort level, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

TABLE 5. The heterogeneity impact of the female secondary stipend program on wife's years of education

	(1) BW3	(2) BW4	(3) BW5	(4) BW6
Panel A: Women whose years of education are 5 or below (primary level)				
Treatment = 1	1.757***	1.262***	1.083**	0.826*
	(0.185)	(0.342)	(0.424)	(0.414)
Treat*(Age-30)	0.128	0.168	0.079	0.252**
	(0.212)	(0.250)	(0.124)	(0.099)
(Age-30)	0.446**	0.072	0.029	-0.130
	(0.149)	(0.140)	(0.083)	(0.075)
Constant	0.734	1.099	0.980**	1.572***
	(0.650)	(0.591)	(0.322)	(0.430)
Observations (no.)	228	287	359	473
Panel B: Women whose years of education are above 5 (above primary level)				
Treatment = 1	-0.629*	-0.597**	-0.151	0.019
	(0.274)	(0.230)	(0.203)	(0.278)
Treat*(Age-30)	0.217	-0.066	0.107	0.035
	(0.191)	(0.163)	(0.123)	(0.076)
(Age-30)	-0.286	-0.194**	-0.112	-0.034
	(0.162)	(0.068)	(0.086)	(0.056)
Constant	10.674***	10.329***	9.686***	9.207***
	(0.420)	(0.226)	(0.398)	(0.404)
Observations (no.)	227	286	365	460

Notes: Standard errors in parentheses. Standard errors clustered at cohort level, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

TABLE 6. The impact of wife's years of education on marriage age and FLFP: results of second-stage regression

	(1) BW3	(2) BW4	(3) BW5	(4) BW6	(5) BW3	(6) BW4	(7) BW5	(8) BW6
	2SLS				OLS			
	Panel A: Marriage age							
Years of education	0.120	-0.042	0.222	0.305	0.241***	0.209***	0.202***	0.187***
	(0.283)	(0.131)	(0.510)	(0.462)	(0.023)	(0.029)	(0.026)	(0.025)
(Age - 30)	-0.015	-0.089*	0.046	0.037	0.022	-0.009	0.041	0.007
	(0.117)	(0.047)	(0.161)	(0.131)	(0.081)	(0.050)	(0.056)	(0.037)
Husband's age	0.016	0.009	-0.013	0.007	0.017	-0.000	-0.013	0.009
	(0.038)	(0.035)	(0.039)	(0.029)	(0.049)	(0.043)	(0.036)	(0.026)
Constant	17.224***	18.183***	17.012***	15.389***	16.670***	17.422***	17.071***	15.734***
	(1.239)	(1.377)	(1.338)	(1.387)	(1.567)	(1.472)	(1.173)	(1.097)
Observations (no.)	453	569	720	929	453	569	720	929
Mean of dep. var. in right if the cutoff	17.18	17.11	17.10	17.20	17.18	17.11	17.10	17.20
	Panel B: 1 = FLFP							
Years of education	-0.037**	-0.004	-0.064	-0.076**	0.006	0.006	0.007**	0.007**
	(0.019)	(0.029)	(0.050)	(0.036)	(0.003)	(0.004)	(0.003)	(0.002)
(Age - 30)	0.007	0.006	-0.011	-0.015*	0.020***	0.009	0.008**	0.006***
	(0.006)	(0.011)	(0.014)	(0.008)	(0.003)	(0.007)	(0.003)	(0.002)
Husband's age	-0.000	0.002	0.001	0.000	0.000	0.002	-0.000	-0.001
	(0.001)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Constant	0.506**	0.305*	0.405	0.404**	0.323	0.279	0.207	0.173*
	(0.201)	(0.178)	(0.271)	(0.201)	(0.164)	(0.155)	(0.126)	(0.084)
Observations (no.)	455	573	724	932	455	573	724	932
Mean of dep. var. in right if the cutoff	0.11	0.11	0.11	0.10	0.11	0.11	0.11	0.10

Notes: Standard errors in parentheses. Standard errors clustered at cohort level, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

TABLE 7. The impact of wife's years of education on husband's education and per capita household income: results of second-stage regression

	(1) BW3	(2) BW4	(3) BW5	(4) BW6	(5) BW3	(6) BW4	(7) BW5	(8) BW6
	2SLS				OLS			
Panel A: Husband's years of education								
Years of education	0.681***	0.809***	0.693***	1.021***	0.802***	0.839***	0.792***	0.809***
	(0.151)	(0.126)	(0.187)	(0.324)	(0.032)	(0.049)	(0.049)	(0.038)
(Age - 30)	-0.133*	-0.065	-0.099	0.027	-0.097*	-0.057	-0.069	-0.032
	(0.071)	(0.063)	(0.069)	(0.087)	(0.044)	(0.054)	(0.045)	(0.026)
Constant	-2.705	-2.645	-2.966*	-4.030***	-2.966	-2.670	-3.145	-3.630**
	(2.570)	(2.298)	(1.768)	(1.531)	(2.862)	(2.555)	(1.735)	(1.192)
Observations (no.)	418	519	660	853	418	519	660	853
Mean of dep. var. in right if the cutoff	4.93	4.98	4.97	5.05	4.93	4.98	4.97	5.05
Panel B: Per capita household income (100 Tk)								
Years of education	56.317***	53.825***	79.071*	84.030**	19.201***	19.448***	18.623***	22.298***
	(21.451)	(15.296)	(43.824)	(41.519)	(4.395)	(3.701)	(3.271)	(3.119)
(Age - 30)	4.979	6.277	17.909	19.813	-6.379	-3.961	-1.037	2.162
	(5.899)	(4.397)	(14.169)	(12.236)	(6.166)	(4.071)	(4.228)	(3.708)
Constant	11.909	28.122	-3.155	-86.550	79.786	39.386	64.452	17.033
	(146.088)	(130.815)	(104.506)	(86.103)	(141.823)	(137.842)	(104.228)	(79.547)
Observations (no.)	418	519	660	853	418	519	660	853
Mean of dep. var. in right if the cutoff	288.61	306.64	304.31	325.71	288.61	306.64	304.31	325.71

Notes: Standard errors in parentheses. Standard errors clustered at cohort level, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.Number of working age members (15<age<60) within a household is controlled in panels B-D. Husband's age is included in panels A-D.

TABLE 8. The impact of wife's years of education on husband's migration, electrification, and assortative mating: results of second-stage regression

	(1) BW3	(2) BW4	(3) BW5	(4) BW6	(5) BW3	(6) BW4	(7) BW5	(8) BW6
	2SLS				OLS			
Panel A: Per capita household farm income (100 Tk)								
Years of education	3.965	15.426	12.669	14.623	4.717*	5.998**	5.446***	4.633***
	(13.590)	(10.495)	(17.790)	(20.432)	(2.248)	(1.890)	(1.621)	(1.477)
(Age - 30)	-2.694	2.590	0.594	2.740	-2.464	-0.217	-1.670	-0.117
	(6.891)	(3.726)	(5.945)	(5.716)	(4.717)	(2.664)	(2.710)	(1.763)
Constant	-35.908	-93.365	-93.419	-55.324	-37.284	-90.276	-85.340	-38.560
	(95.091)	(100.626)	(71.361)	(67.884)	(128.233)	(119.747)	(81.653)	(63.147)
Observations (no.)	418	519	660	853	418	519	660	853
Mean of dep. var. in right if the cutoff	109.88	120.75	124.33	127.63	109.88	120.75	124.33	127.63
Panel B: Per capita household non-farm income (100 Tk)								
Years of education	52.352***	38.399**	66.402	69.406*	14.484**	13.449***	13.178***	17.666***
	(19.037)	(19.269)	(43.497)	(37.976)	(3.851)	(3.136)	(2.922)	(3.462)
(Age - 30)	7.673	3.687	17.315	17.073	-3.915	-3.743	0.633	2.278
	(5.611)	(4.621)	(13.689)	(10.912)	(5.974)	(3.635)	(4.367)	(3.720)
Constant	47.817	121.486	90.264	-31.226	117.070	129.662	149.793	55.593
	(132.616)	(121.020)	(122.698)	(97.272)	(140.425)	(122.771)	(88.995)	(83.919)
Observations (no.)	418	519	660	853	418	519	660	853
Mean of dep. var. in right if the cutoff	178.73	185.89	179.99	198.08	178.73	185.89	179.99	198.08
Panel C: 1 = if husband is a foreign migrant								
Years of education	0.061	0.058*	0.047	0.055	0.010***	0.011***	0.010***	0.011***
	(0.048)	(0.033)	(0.035)	(0.041)	(0.003)	(0.002)	(0.002)	(0.002)
(Age - 30)	0.018	0.019	0.012	0.018	-0.002	0.002	0.001	0.004
	(0.019)	(0.016)	(0.011)	(0.012)	(0.007)	(0.007)	(0.004)	(0.003)
Constant	0.298*	0.367***	0.311***	0.302**	0.442***	0.448***	0.378***	0.380***
	(0.164)	(0.120)	(0.116)	(0.117)	(0.084)	(0.094)	(0.084)	(0.066)
Observations (no.)	449	565	715	922	449	565	715	922
Mean of dep. var. in right if the cutoff	0.06	0.07	0.06	0.07	0.06	0.07	0.06	0.07

Notes: Standard errors in parentheses. Standard errors clustered at cohort level, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. % of non-farm village labor force and number of working age members (15<age<60) within a household are included in Panel A. Husband's age is included in panels A-B.

TABLE 9. The impact of wife's years of education on fertility, children's schooling, sanitation control, and children's health: results of second-stage regression

	(1) BW3	(2) BW4	(3) BW5	(4) BW6	(5) BW3	(6) BW4	(7) BW5	(8) BW6
	2SLS				OLS			
Panel A: Number of children aged 15 or below								
Years of education	-0.153	-0.324**	-0.343	-0.357	-0.036**	-0.037***	-0.033***	-0.026*
	(0.121)	(0.159)	(0.236)	(0.275)	(0.009)	(0.008)	(0.010)	(0.012)
(Age - 30)	0.057	-0.038	-0.025	-0.038	0.092***	0.052*	0.061**	0.047***
	(0.038)	(0.060)	(0.070)	(0.072)	(0.018)	(0.024)	(0.020)	(0.014)
Constant	4.730***	4.811***	4.460***	4.436***	4.233***	4.042***	3.596***	3.499***
	(0.401)	(0.485)	(0.834)	(1.005)	(0.645)	(0.678)	(0.532)	(0.406)
Observations (no.)	455	573	724	933	455	573	724	933
Mean of dep. var. in right if the cutoff	2.34	2.27	2.22	2.17	2.34	2.27	2.22	2.17
Panel B: 1 = if any family member aged between 15 and 22 is in schooling								
Years of education	0.010	0.051**	-0.012	0.030	0.024	0.006	0.021	0.008
	(0.033)	(0.021)	(0.031)	(0.046)	(0.048)	(0.023)	(0.016)	(0.010)
(Age - 30)	0.004	0.076**	0.021	0.039*	0.013	0.048	0.031	0.032
	(0.044)	(0.031)	(0.034)	(0.020)	(0.075)	(0.040)	(0.045)	(0.019)
Constant	-1.285***	-0.825	-0.442	-0.742***	-1.107	-1.159*	-0.423	-0.648*
	(0.445)	(0.513)	(0.433)	(0.158)	(0.835)	(0.572)	(0.675)	(0.295)
Observations (no.)	71	108	147	282	71	108	147	282
Mean of dep. var. in right if the cutoff	0.57	0.67	0.69	0.67	0.57	0.67	0.69	0.67
Panel C: 1 = if using latrine with water seal								
Years of education	0.109***	0.161***	0.101**	0.097	0.033**	0.029***	0.027***	0.028***
	(0.021)	(0.040)	(0.050)	(0.062)	(0.008)	(0.006)	(0.004)	(0.004)
(Age - 30)	0.012	0.041*	0.019	0.020	-0.012	0.004	-0.000	0.004
	(0.017)	(0.021)	(0.012)	(0.013)	(0.014)	(0.014)	(0.009)	(0.004)
Constant	-0.025	-0.228	-0.004	-0.017	0.261	0.269	0.257	0.217*
	(0.155)	(0.251)	(0.276)	(0.263)	(0.218)	(0.217)	(0.147)	(0.105)
Observations (no.)	455	573	724	933	455	573	724	933
Mean of dep. var. in right if the cutoff	0.51	0.57	0.56	0.56	0.51	0.57	0.56	0.56
Panel D: 1 = if child aged between 0 and 5 is healthy								
Years of education	0.106*	0.058	0.139**	0.089**	0.009**	0.010**	0.007**	0.007**
	(0.063)	(0.047)	(0.066)	(0.043)	(0.003)	(0.004)	(0.002)	(0.002)
(Age - 30)	0.017	0.014	0.038*	0.017*	-0.013	-0.005	-0.012	-0.004
	(0.032)	(0.026)	(0.023)	(0.010)	(0.014)	(0.007)	(0.008)	(0.005)
Constant	0.150	0.707***	0.481	0.712***	0.967***	0.983***	0.925***	0.949***
	(0.508)	(0.225)	(0.383)	(0.254)	(0.112)	(0.094)	(0.118)	(0.112)
Observations (no.)	294	347	465	583	294	347	465	583
Mean of dep. var. in right if the cutoff	0.91	0.90	0.89	0.91	0.91	0.90	0.89	0.91

Notes: Standard errors in parentheses. Standard errors clustered at cohort level, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Number of siblings aged 0-5 and number of siblings aged 6-18 are included in Panel B. Husband's age is included in panels A, B, and D. Age dummies of children are included in panels B and D.

TABLE 10. The impact of wife's years of education on weekly expenditure: results of second-stage regression

	(1) BW3	(2) BW4	(3) BW5	(4) BW6	(5) BW3	(6) BW4	(7) BW5	(8) BW6
	2SLS				OLS			
Panel A: Weekly total expenditure								
Years of education	232.470***	765.663**	533.609*	437.918	105.064**	140.568***	133.875***	159.264***
	(86.656)	(319.580)	(300.313)	(325.089)	(32.403)	(30.426)	(27.690)	(27.644)
(Age - 30)	-38.832**	208.005*	54.769	57.412	-76.534***	9.367	-59.077	-14.791
	(17.426)	(123.587)	(127.132)	(98.262)	(18.571)	(42.827)	(68.240)	(50.208)
Constant	-1.4e+03**	-4.3e+03***	-4.5e+03***	-3.6e+03***	-821.511	-2.8e+03*	-3.6e+03**	-2.9e+03**
	(560.254)	(1661.025)	(1273.482)	(1084.494)	(579.115)	(1456.855)	(1429.933)	(1111.826)
Observations (no.)	455	573	724	933	455	573	724	933
Mean of dep. var. in right if the cutoff	2999.03	3204.05	3177.43	3360.01	2999.03	3204.05	3177.43	3360.01
Panel B: Weekly expenditure on nutritious food items								
Years of education	85.584***	128.627***	121.786***	118.701***	31.286***	37.373***	34.411***	39.667***
	(23.421)	(42.856)	(29.367)	(34.738)	(6.112)	(6.797)	(5.425)	(5.145)
(Age - 30)	18.640**	33.741**	28.454***	17.879*	2.572	4.743	3.569	-2.599
	(8.733)	(13.115)	(8.087)	(10.815)	(6.283)	(5.930)	(3.801)	(5.689)
Constant	113.215	-245.926	-204.190	-487.872**	351.341	-28.461	-1.306	-277.557
	(252.555)	(353.627)	(242.468)	(202.297)	(189.631)	(333.051)	(245.796)	(235.991)
Observations (no.)	455	573	724	933	455	573	724	933
Mean of dep. var. in right if the cutoff	655.03	687.62	679.99	706.88	655.03	687.62	679.99	706.88
Panel C: Weekly expenditure on sanitation items								
Years of education	5.878***	6.954***	6.944***	5.319	2.234***	2.438***	2.588***	2.635***
	(1.565)	(1.597)	(2.554)	(3.979)	(0.492)	(0.377)	(0.381)	(0.314)
(Age - 30)	1.949**	2.146***	1.898**	1.172	0.870	0.711*	0.657**	0.477
	(0.867)	(0.515)	(0.740)	(1.155)	(0.697)	(0.336)	(0.282)	(0.345)
Constant	-17.274	-25.393**	-23.703*	-22.822*	-1.292	-14.632	-13.589	-15.681**
	(13.838)	(12.425)	(12.654)	(13.080)	(6.987)	(11.733)	(10.703)	(6.781)
Observations (no.)	455	573	724	933	455	573	724	933
Mean of dep. var. in right if the cutoff	60.03	61.87	62.10	64.59	60.03	61.87	62.10	64.59
Panel D: Weekly expenditure on medical care								
Years of education	77.948**	139.460**	102.081	49.688	6.778*	16.580**	18.084**	20.476**
	(36.975)	(67.825)	(93.782)	(79.094)	(3.144)	(6.875)	(5.719)	(6.963)
(Age - 30)	11.298	34.174*	9.771	5.072	-9.763	-4.874*	-14.152	-2.497
	(15.525)	(19.916)	(36.096)	(22.484)	(6.363)	(2.085)	(14.528)	(9.027)
Constant	-568.171**	-1.2e+03**	-1.0e+03**	-590.630	-256.054**	-934.198	-849.869*	-512.895
	(281.199)	(536.616)	(407.368)	(393.118)	(85.695)	(514.016)	(382.355)	(315.102)
Observations (no.)	455	573	724	933	455	573	724	933
Mean of dep. var. in right if the cutoff	155.01	184.79	193.12	212.85	155.01	184.79	193.12	212.85

Notes: Standard errors in parentheses. Standard errors clustered at cohort level, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The number of family members in a household and husband's age are included in panels A-D.

TABLE A1. The impact of the female secondary stipend program on husband's years of education: results of first-stage regression

	(1) BW3	(2) BW4	(3) BW5	(4) BW6
Treatment = 1	0.420	0.555	-0.022	-0.020
	(0.578)	(0.531)	(0.636)	(0.534)
Treat*(Age - 30)	-0.262	-0.160	0.255	0.333*
	(0.375)	(0.181)	(0.237)	(0.168)
(Age - 30)	0.098	0.169*	-0.097	-0.167***
	(0.278)	(0.075)	(0.143)	(0.049)
Constant	3.107**	2.632**	2.724**	3.519***
	(1.121)	(1.074)	(0.968)	(0.874)
F statistics	0.34	2.81	0.59	2.91
Observations (no.)	338	426	517	643

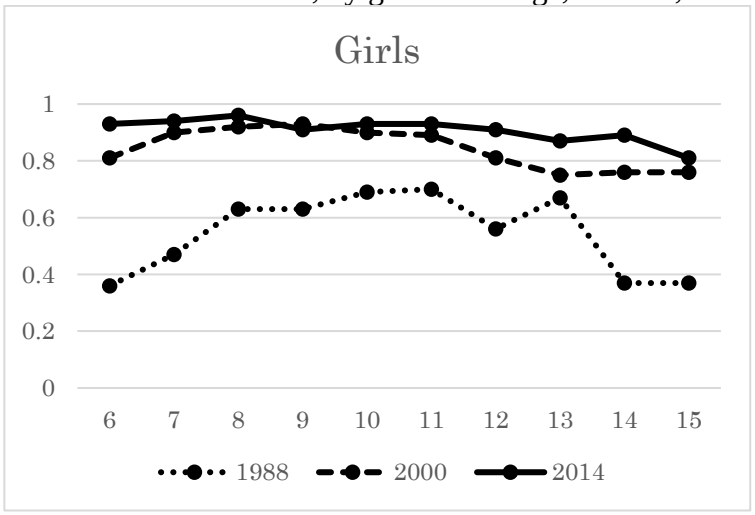
Notes: Standard errors in parentheses. Standard errors clustered at cohort level, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

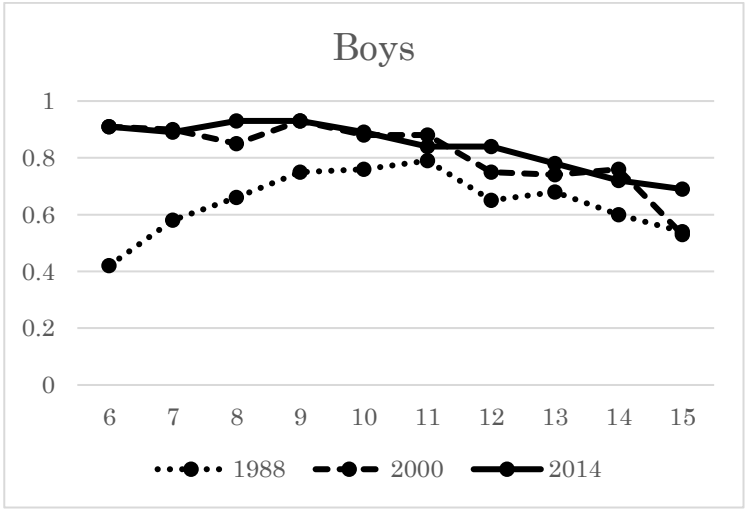
TABLE A2. The impact of women's years of schooling on FLFP: all women

	(1) BW3	(2) BW4	(3) BW5	(4) BW6	(5) BW7	(6) BW8	(7) BW9	(8) BW10
Panel A: The impact of the stipend program on years of schooling: First-stage results								
Treatment = 1	1.116*	0.912*	1.056**	1.029**	1.125**	1.315***	1.313***	1.137***
	(0.513)	(0.401)	(0.390)	(0.397)	(0.408)	(0.377)	(0.366)	(0.358)
Treat*(Age - 30)	-0.301	-0.311*	-0.120	-0.024	0.015	-0.094	-0.058	-0.007
	(0.248)	(0.145)	(0.095)	(0.091)	(0.088)	(0.084)	(0.074)	(0.068)
(Age - 30)	0.024	-0.098	-0.101	-0.153**	-0.146**	-0.066	-0.087	-0.137**
	(0.280)	(0.119)	(0.079)	(0.069)	(0.066)	(0.071)	(0.065)	(0.062)
Constant	3.853*	4.607**	3.587**	3.437***	3.485***	3.342***	3.493***	3.736***
	(1.882)	(1.731)	(1.119)	(0.848)	(0.811)	(0.630)	(0.608)	(0.609)
Observations (no.)	643	800	1048	1367	1531	1720	1898	2070
Panel B: The impact of years of schooling on FLFP: Second-stage results								
Years of education	-0.019	-0.013	-0.031	-0.036	-0.016	-0.022	-0.007	0.006
	(0.020)	(0.018)	(0.024)	(0.028)	(0.025)	(0.020)	(0.026)	(0.027)
(Age - 30)	-0.004	-0.009*	-0.009	-0.013	-0.006	-0.007	-0.002	0.000
	(0.010)	(0.005)	(0.008)	(0.008)	(0.006)	(0.005)	(0.007)	(0.007)
Age of head	0.008***	0.008***	0.008***	0.008***	0.007***	0.007***	0.006***	0.005***
	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)	(0.002)
Constant	0.086	0.026	0.039	0.011	-0.020	-0.031	-0.053	-0.057
	(0.127)	(0.124)	(0.103)	(0.086)	(0.081)	(0.071)	(0.081)	(0.087)
Observations (no.)	640	796	1044	1359	1522	1710	1886	2056

Notes: Standard errors in parentheses. Standard errors clustered at cohort level, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

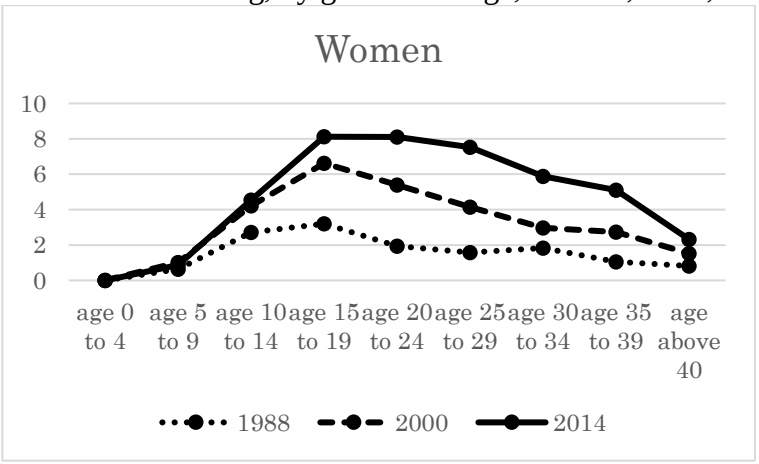
FIGURE 1. School enrollment rate, by gender and age, in 1988, 2000, and 2014

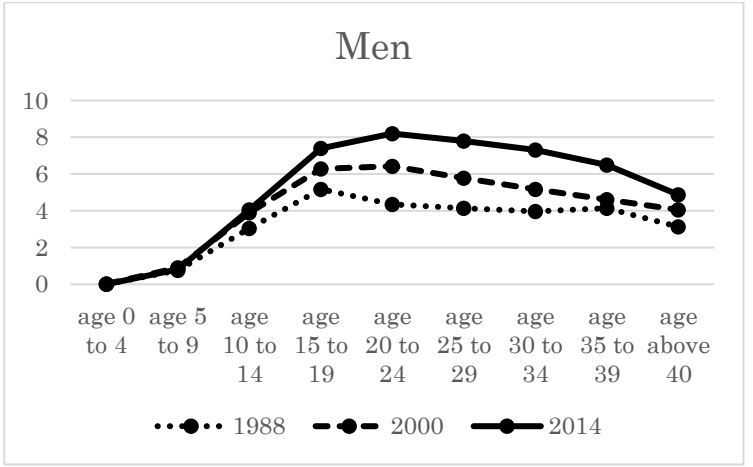




Source: Livelihood System of Rural Households Panel Data in 1988 and 2000
Note: X axis shows age; Y axis shows school enrollment rate

FIGURE 2. Years of schooling, by gender and age, in 1988, 2000, and 2014

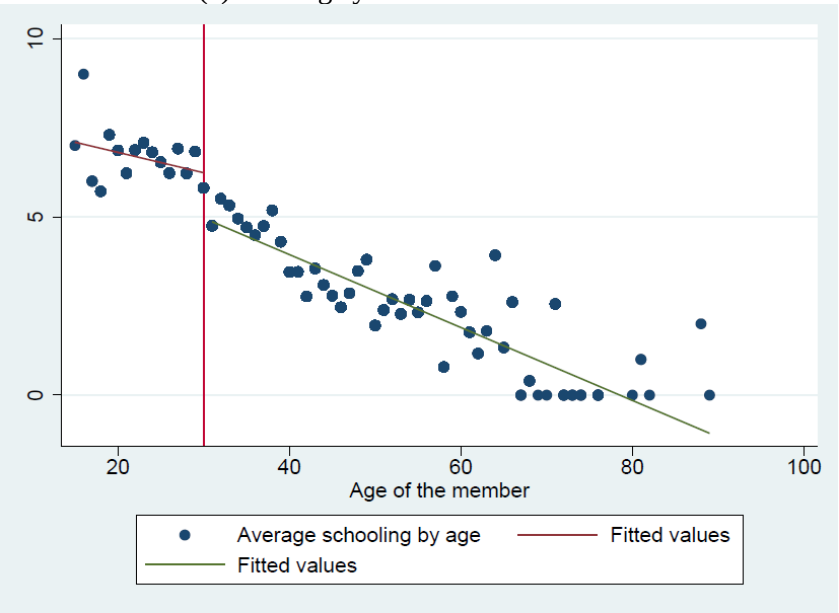




Source: Livelihood System of Rural Households Panel Data in 1988, 2000, and 2014
Note: X axis shows age group; Y axis shows years of schooling

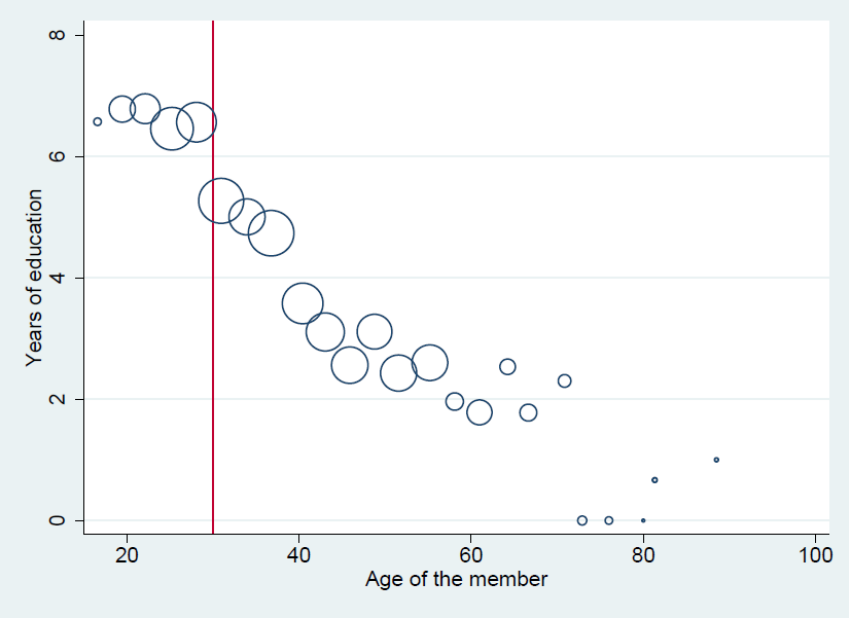
FIGURE 3. Average and scatter plots of years of education, by age

(a) Average years of education: Wife



(b) Average years of education: Husband

(c) Scatter plots of years of education: Wife



(d) Scatter plots of years of education: Husband

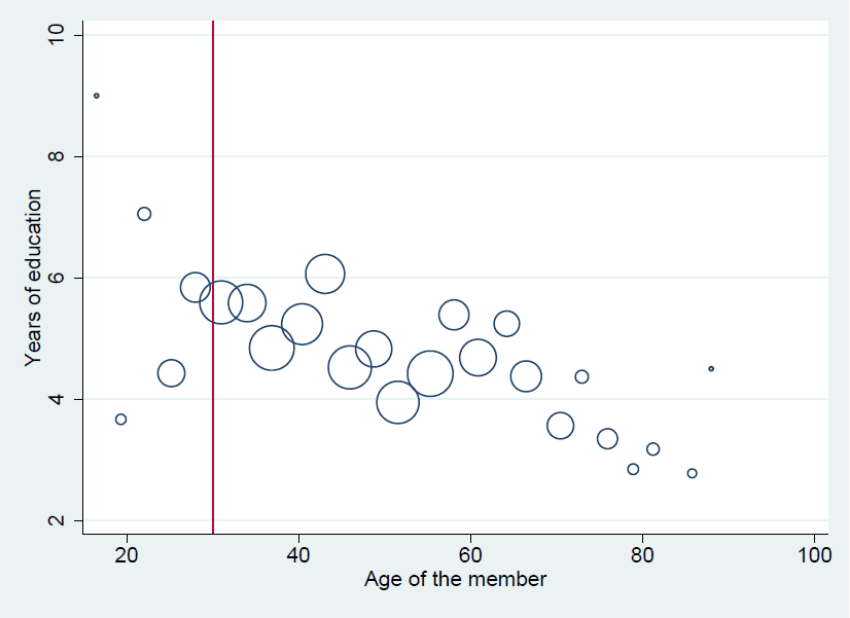


FIGURE 4. Estimation framework

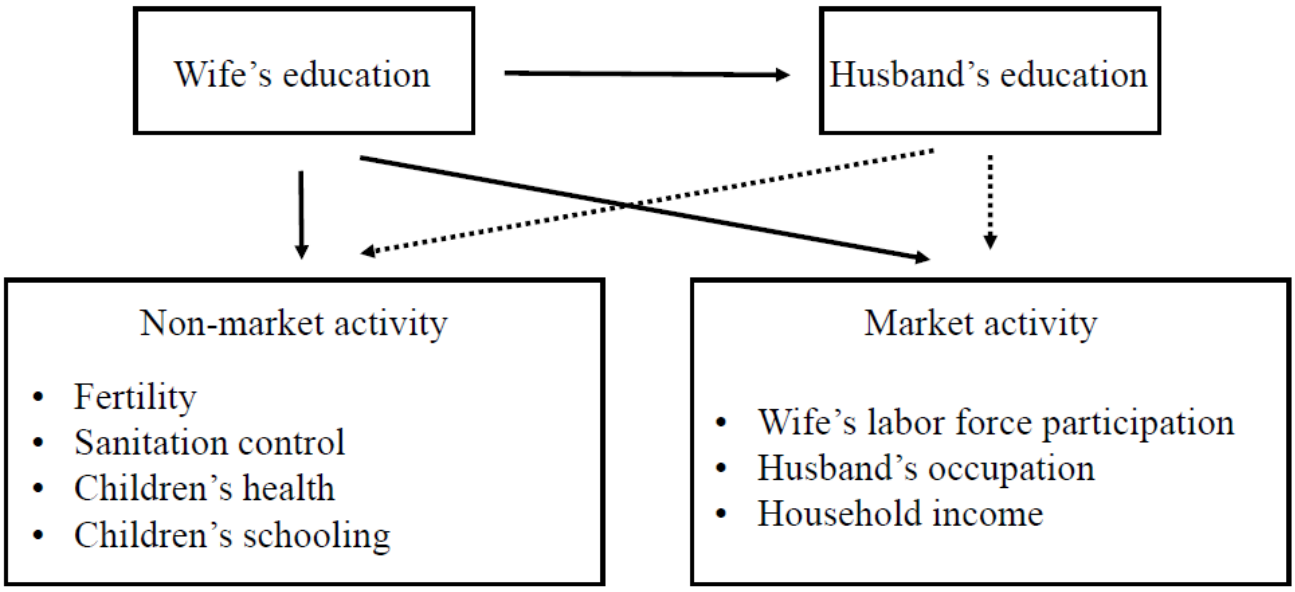
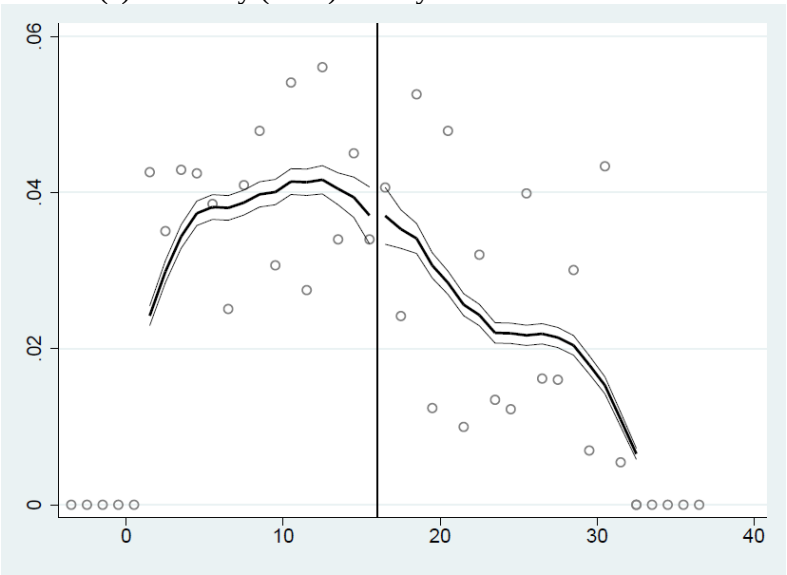
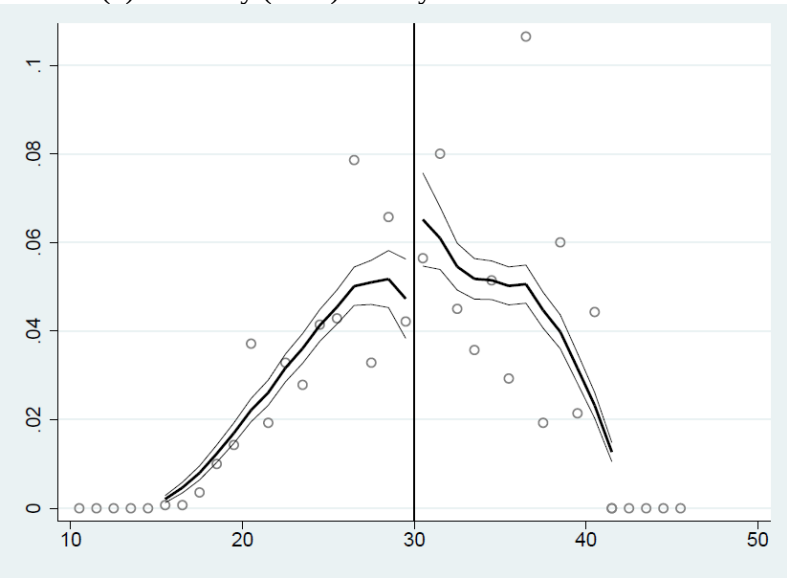


FIGURE 5. Density check in forcing variable: McCrary (2008) density test and discontinuity check in grade repetition and delayed entry

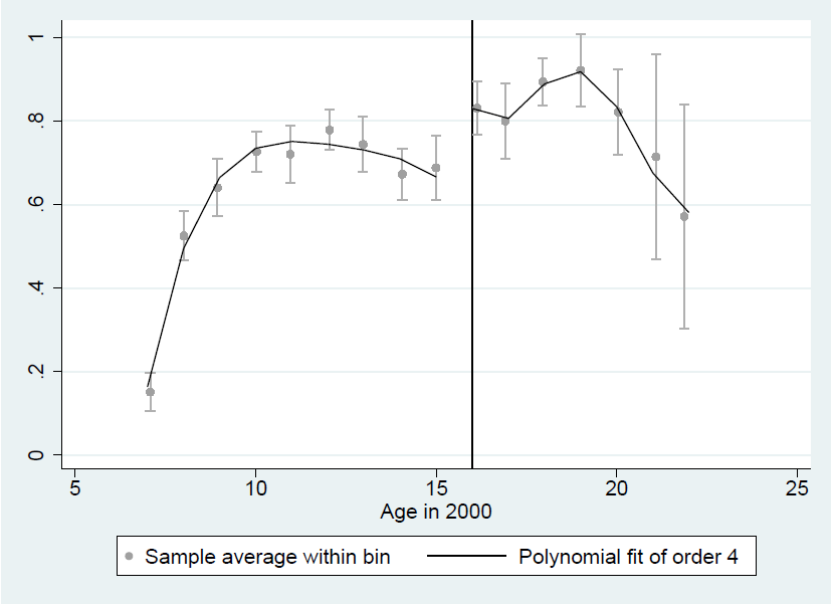
(a) McCrary (2008) density test with data in 2000



(b) McCrary (2008) density test with data in 2014



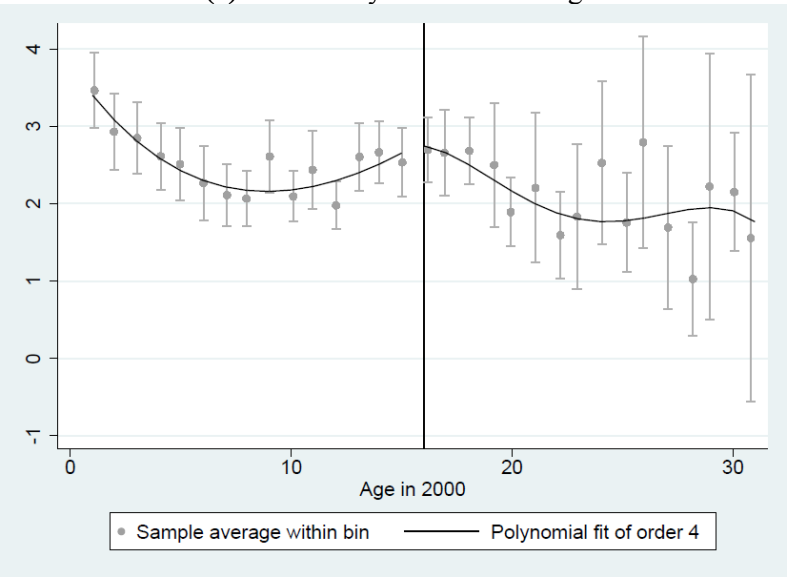
(c) Discontinuity check in grade repetition and delayed entry in 2000



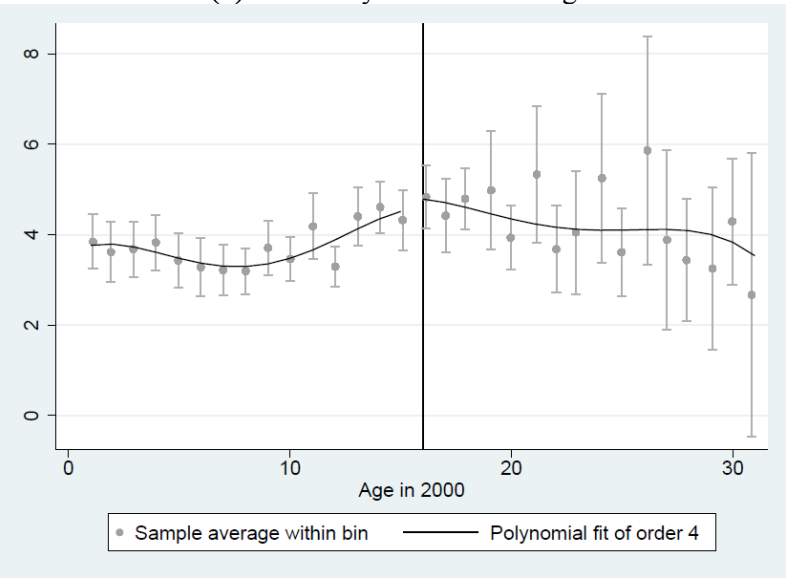
Note: X axis shows age. Vertical lines indicate the cutoff at ages 16 and 30 in 2000 and 2014, respectively.

FIGURE 6. Discontinuity check in other covariates: pre-marital household characteristics in 2000

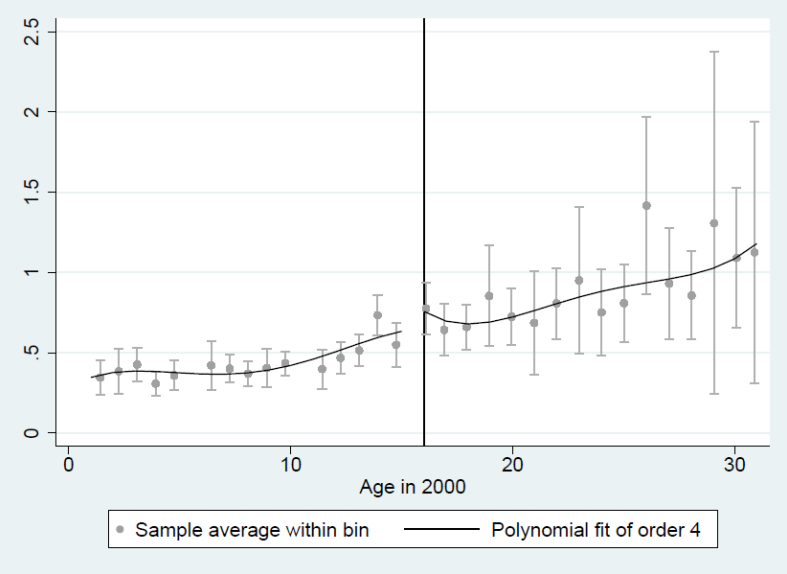
(a) Mother's years of schooling



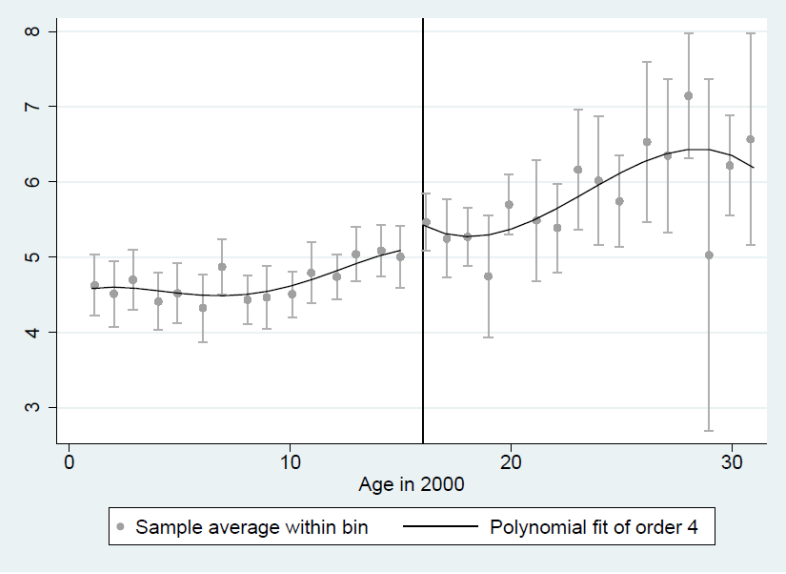
(b) Father's years of schooling



(c) Amount of owned land (ha)

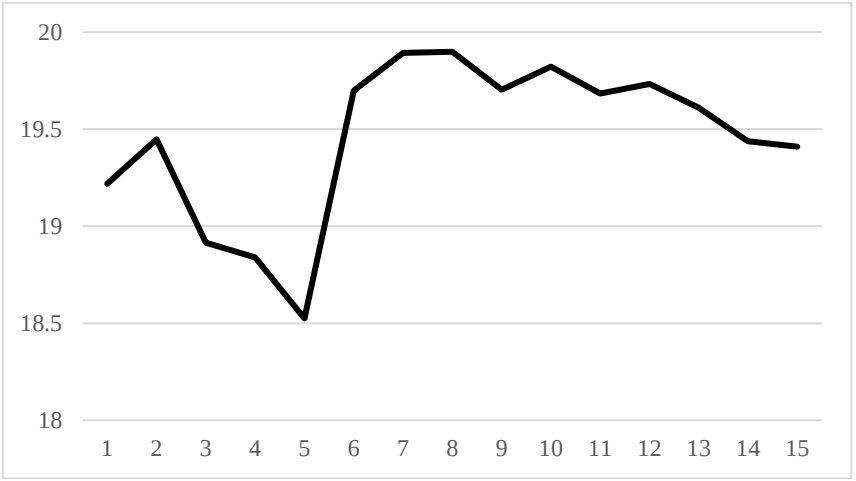


(d) Log of non-land fixed asset



Note: Vertical lines indicate the cutoff at age 16.

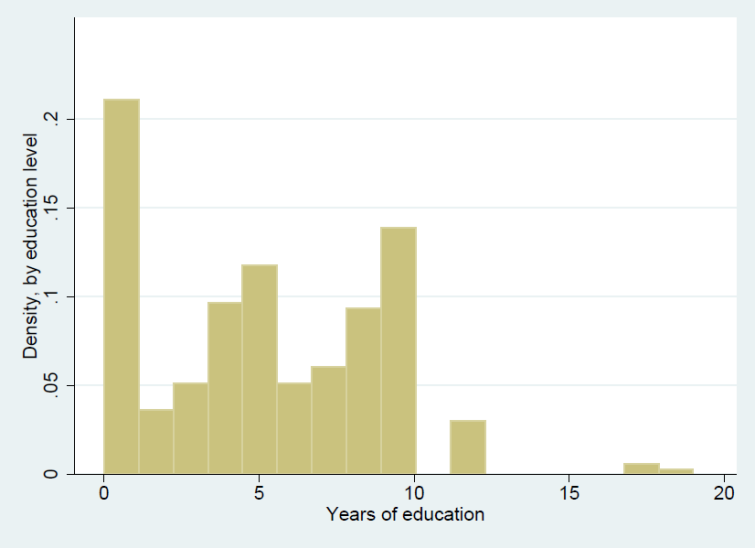
FIGURE A1. Bandwidth selection: Cross-validation function



Note: X axis shows the bandwidth.

FIGURE A2. Distribution of sample women, by years of education: Bandwidth 4

(a) Women: Treatment = 0



(b) Women: Treatment = 1