The Effect of Female Education on Health Knowledge and Fertility Behavior: Evidence from Primary Schooling Reform in Ethiopia*

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Abstract

Policy makers promote female education as one of the means to reduce child mortality in developing countries. With the aim of identifying the channels of influence, this paper examines the effect of female education on various measures of health knowledge and fertility behavior. To tackle the endogeneity of education, I use a schooling reform that, in 1994, introduced mother tongue instruction in Ethiopia's primary schools and abolished a central exit exam at the end of primary education. Results based on the 2011 Demographic and Health Survey data show an increase in female years of education of about 0.50 to 0.69 as a result of the reform. Secondary education improves females′ knowledge on the mother-to-child transmission and prevention of HIV/AIDS and Tuberculosis. However, an improvement in fertility behavior as measured by desired number of children, the use of contraception, early marriage and pregnancy vanishes when taking into account the endogeniety of education. Estimation results indicate that wealth status seems to matter more than education per se for improving the fertility behavior of women in Ethiopia.

Keywords: Child Health, Female Education, Instrumental Variable, Ethiopia

JEL classification: I12, I21, I28, J13

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1 Introduction

The fourth millennium development goal (MGD 4) set by the United Nations aims at reducing child mortality by two third between 1990 and 2015 (UN, 2013). In a recent review of the literature on child health in developing countries, Currie and Vogl (2013) show the sever consequences of adverse health shocks in childhood. They attribute this to the presence and interaction of multiple shocks and the limited mitigating health infrastructures available in most developing countries. In such an environment, parental education especially maternal education could play a significant role in improving child health. With the aim of reaching MDG 4 and following the results of empirical studies, female education is one of the policy instrument promoted by policy makers to reduce child malnutrition in most developing countries.

There is a substantial but mixed evidence on the causal effect of maternal education on child health. In the context of developed countries, maternal education is found to decrease the probability of low birth weights and preterm birth in the US (Currie and Moretti, 2003). On the other hand, studies such as McCrary and Royer (2011) and Lindeboom et al. (2009) find little evidence on the positive effect of either maternal or paternal education. The evidence in the context of developing countries seem to confirm a positive effect of education in improving child health. For instance, Chou et al. (2010) find a positive effect of female education in reducing infant mortality in Taiwan whereas Breierova and Duflo (2004) show female education to be as important as male education in reducing child mortality in Indonesia. Furthermore, using adopted and non-adopted children in China, Chen and Li (2009) find the effect of maternal education to be mainly due to nurturing rather than genetic factors.

Female education influence child health through several channels. Based on the pioneering work of Becker (1965)′s theory of the allocation of time, Grossman (1972) set up a model for health demand. In this model, maternal education has direct and indirect effects on the production of child health. The direct effect comes through an improved productive and allocative efficiency in the production process. Productive efficiency results when educated women can obtain a larger child health output given the same amounts of inputs as less-educated women. Allocative efficiency pertains to a situation in which women with high education choose better combinations of inputs to produce a given child health output compared to less educated women. The indirect effect of education comes through its effect on wage and non-labour income. As human capital theory and assorting mating indicates, women with high education are likely to have high paying jobs and/or high quality spouses.

Building up on the conceptual framework of Mosley and Chen (1984), various studies identify additional channels linking female education to child health (Glewwe, 1999; Frost et al., 2005). First, formal education by itself may transfer health related information and enhances healthy behaviors by the mother. Second, education also influences a shift in attitude

from traditional beliefs towards modern attitude and improves the use of health care services. Third, literacy and numeracy skills acquired through education enables females to read and accurately follow health care information. Fourth, educated women also prefer to have fewer and healthy children due to the quantity-quality trade off. Finally, education also improves a female's autonomy thereby giving her the power to take part in the household′s decision making process.

Quantifying the influence of the different channels that link female education to child health is crucial to design effective policy instruments to improve child health. However, the literature that examines the causality of these pathways is very scarce especially in developing countries. Currie and Moretti (2003) identify prenatal care use, lower fertility and lower probability of smoking during pregnancy as the mechanisms behind the maternal education-child health link in the US. On the contrary, McCrary and Royer (2011) find no evidence that maternal education affects fertility, prenatal care use and risky maternal behavior such as smoking, drinking and sexually transmitted disease. They instead find a positive effect of female education on the quality of partner measured by his age and level of education.

In the context of developing countries, Frost et al. (2005) uses a logistic regression and finds a substantial effect of education that works through socioeconomic status and modern attitude but not through improved health care knowledge. To the contrary, using the number of radios and televisions in the household and the availability of local newspapers as instruments for health knowledge, Glewwe (1999) identify health knowledge on vaccinations, treating infections, polio, diarrhea and safe drinking water as crucial mechanisms that education affects child health. Furthermore, Osili and Long (2008) find a 0.26 births reduction for an additional year of education using a primary school reform in Nigeria.

In this paper, I extend the literature that identifies the channels that female education influences child health. Specifically, I look at the causal relationship between education and a female's knowledge regarding the mother-to-child transmission and prevention of HIV/AIDS and Tuberculosis (TB). I focus on these health outcomes since HIV/AIDS and TB are among the ten major causes of under five mortality in most sub-Sarahan African countries (Liu et al., 2012). Furthermore, halting the incidences of HIV/AIDS and TB along with Malaria by 2015 make up the sixth millennium development goal set by the United Nations (UN, 2013). Preventing the mother-to-child transmission of these diseases is one crucial means to reduce their incidence. In addition, I use the number of children a woman desires, the actual use or the intention to use contraception and females′ knowledge of the fertility period as measures of fertility behavior. Marriage and pregnancy that occurs before the age of 20 are also used to measure fertility behavior. These outcomes are not only hypothesized to reduce child mortality but also work towards achieving the fifth millennium development goal which aims to improve a woman's reproductive health (UN, 2013).

Difference in parental background, tastes and values are likely to affect females′ years of

education on the one hand and health knowledge and fertility behavior on the other. The inability to observe these variables renders female education to be endogenous and leads to biased estimates. To deal with this, I follow a difference-in-difference and instrumental variable approach using a primary schooling reform in Ethiopia. In 1994, the government introduced mother-tongue instruction in primary schools and abolished a central exit exam to enter upper-primary education. Prior to 1994, Amharic, which is the official language in the country, was used as medium of instruction in primary schools. Amharic was also used as the language of the central exit exam at the end of grade six.

The use of mother tongue as medium of instruction is likely to increase the level of schooling of the non-Amharic mother tongue speakers without having any effect on Amharic language speakers. On the other hand, abolishing the central exit exam could potential increase level of education independently of mother-tongue. However, the benefit to the non-Amharic mother tongue speakers is likely to be higher to the extent that the use of Amharic language as the medium of examination was disadvantageous for them. This implies that the intensity of the reform differed by birth cohort and mother-tongue group. Because the use of mother tongue as medium of instruction was not implemented through out the country, an individual's treatment status also various across regions of residence. I use the exogenous variation in exposure to the policy instrument by birth cohort, mother-tongue group and region of residence to instrument female years of secondary education.

Results based on data from 2011 Demographic and Health Survey show that the primary schooling reform increased female education by about 0.50 to 0.69. Using a similar approach, Ramachandran (2012) finds an increase of 0.80 to 1.18 year of secondary education for both males and females. Comparing the two results, the effect of the reform on female education appears to be lower than that of males. An extra year of secondary schooling induced by the reform increase females$'$ knowledge on the mother-to-child transmission and prevention of HIV/AIDS and Tuberculosis by about eight percent. Furthermore, the effect of education on fertility behavior is found to be heterogeneous. Additional year of education increases the probability of knowledge regarding the fertility period by 6.5 percent. However, it has no significant effect on the number of children females desire. The actual use or the intention to use contraception decreases with education whereas marriage and pregnancy before the age of 20 increases with education. The estimation results also indicate that wealth status seems to matter more than education per se for the fertility behavior of women in Ethiopia.

The paper is structured as follows. Section II gives a brief description of the reform and the data. In section III, the estimation strategy is discussed. Estimation results are presented and discussed in Section IV while concluding remarks are given in Section V.

2 The Reform and Data Description

2.1 The 1994 Education Reform

Prior to the early 1990s, Ethiopia was ruled by a monarchy system and later by a communist party which used Amharic for administrative and educational purposes. Amharic, which is the language of the Amhara ethnic group, was used as the language of instruction and examination in primary education and English was used in secondary and higher education. Ethiopia is a diversified country with more than 80 ethnic groups and most of these ethnic groups have their own language. Given this diversity, using Amharic as the medium of instruction and examination resulted in a large educational inequality across language groups. For instance, the difference in mean Science achievement score between Amharic mother tongue speaker and non-Amharic speakers in first and second grade were 10.10 and 9.82 respectively in 1987 (Heugh et al., 2007).

With the aim of reaching universal primary education, the Ethiopian People′s Revolutionary Democratic Front (EPRDF) undertook a major education reform in 1994. The education system was decentralized and regional governments were given the responsibility to administer the education system of their respective regions while the national government remains in charge of providing finance, curriculum content and national examinations (MOE, 1994). Prior to 1994, the education system consists of primary education (grades 1-6), junior secondary education (grades 7-8) and senior secondary education (grades 9-12). The current education system is divided into general primary education (grades 1-8), general secondary education (grades 9-10) and preparatory secondary education (grades 11-12). In the old and new system, national examinations were given on completion of each level. In the new education system, students that did not successfully pass the national examination have the option to join technical vocational training programs (MOE, 1994).

The two major parts of the reform were the introduction of mother tongue instruction in primary education and the abolishment of the central primary school exit examination. Whereas the junior secondary school entrance examination is abolished in all regions, the use of mother tongue instruction in primary education various across regions. Heugh et al. (2007) reports that the mother tongue instruction is fully implemented from grade 1 to 8 in Oromia, Tigray and Somali regions, from grade 1 to 6 in Amhara, Dire Dawa and Harari regions and from grade 1 to 4 in Gambela and SNNPR regions. Amharic continue to be used as medium of instruction in Addis Ababa and Afar region irrespective of mother tongue due to population diversity and resource constraint respectively.

Various government reports and studies show a substantial increase in primary education enrollment and achievement as a result of the reform. The gross enrollment rate in primary education was 26.6 percent in 1994 and has increased to 57.4 percent in 2000. The gap in the percentage of school-age children attending primary school across regions also narrowed

(MOE, 2002). Heugh et al. (2007) specifically looks at the effect of using mother tongue instruction (MTI) and finds a lower achievement score in maths and science in regions that did not introduced MTI compared to regions that introduced MTI. Similarly, using the variation in the length of exposure to MTI, Heugh et al. (2012) also find an improvement in science and maths test scores for students with eight years of MTI compare to those with fewer years.

2.2 The Data

The empirical analysis in this paper is based on data from the Ethiopian Demographic and Heath Survey (EDHS). EDHS is a national representative survey of around 20,000 households and their members. The survey started in 2000 and it is undertaken every five years. It contains detailed information on various socio-economic characteristics of men and women such as education, health status and wealth. One of the main aim of the survey is to collect detailed information on various measures of health status, health knowledge, family planning and fertility history of women aged 15-49 and the health status of children under the age of five. In this paper, I use the 2011 wave and restrict the sample to females.

The language of the respondent, region of residence and birth year are the variables that I use to identify the treatment status of respondents to the primary schooling reform. Even though the use of mother tongue instruction from grade 1 to 8 was a nation-wide reform, it was not fully implemented in all regions. Hence, I restrict the individuals affected by the reform to Afan Oromo mother tongue speakers in the region of Oromia, Amhara, Harare and Dire Dawa. Amharic language speakers in the regions of Oromia, Amhara, Harari and Dire Dawa make up the control group. The policy was also fully implemented for Tigirigna language speakers in Tigray region. However, the absence of Amharic language speakers in Tigray region makes it difficult to construct a plausible comparable group.

The 1994 education reform also involved changes in upper secondary education and higher education. For instance, a central exit exam was introduced at the end of general secondary education. In addition, the years of higher education required for obtaining first degree was also reduced. These changes do not bias the primary schooling reform effect as long as they affect Amhara and Afan Oromo language speakers in a similar way. However, this is not guaranteed since, for example, the central exit exam includes Amharic language examination which is likely to be disadvantageous for Afan Oromo language speakers. Hence, I use the years spent in primary education and the years spend in general secondary education as the two measure of female education.

[Figure 1 about here]

Figure 1 show the mean years of education for females born between 1960 and 1994. The mean years of secondary education has increased from 1 to 5 years between the cohort born

in 1961 and 1994. There a jump in the years of secondary education with the birth cohort that started school in 1994, indicating a plausible positive influence of the reform. In order to clearly see the evolution of years of secondary education depending on the intensity of the treatment, Figure 2 shows the trend in years of secondary education separately for Amharic and Afan Oromo language groups. On average, Amharic mother tongue speakers have 2.3 higher years of education than Afan Oromo monther tongue speakers (see also Table 1). The jump in the years of secondary education with the birth cohort that started school in 1994 is larger for the Afan Oromo mother tongue speakers compared to the Amharic speakers. This is because they are affected by the abolished central exit examination and the introduction of mother tongue instruction whereas the Amharic language group is only affected by the former.

[Figure 2 about here]

I examine health knowledge and fertility behavior as the major mechanisms via which female education is likely to affect child health. In Ethiopia and most Sub-Saharan African countries, HIV/AIDS and Acute Respiratory Infections remain among the ten major causes of child mortality (Liu et al., 2012). Education can improve a woman′s knowledge of the various ways in which HIV/AIDS can be transmitted from mother-to-child. To measure this, I use three binary variables which indicate whether the woman knows if HIV/AIDS can be transmitted from mother to child during pregnancy and delivery. I also measure prevention knowledge as an indicator variable taking the value one if the woman knows mother-to-child transmission of HIV/AIDS can be prevented by using antiretroviral drugs during pregnancy. Similarly, I use two binary indicators for a female′s knowledge on the symptoms and mother-to-child transmission of the tuberculosis.

Due to the quality-quantity trade off, the fertility preferences and behavior of women is another mechanism that education influence child health. I measure fertility preference by using a woman′s desired number of children, an indicator variable for using or the intention to use contraception and her knowledge of the fertility period. Two indicator variables for marriage and pregnancy before the age of 20 are used to measure fertility behavior. Early marriage and pregnancy are known to be major causes of neonatal mortality in developing countries (Liu et al., 2012).

[Table 1 about here]

Table 1 presents the descriptive statistics of the variables by mother tongue group. The health knowledge and fertility behavior of females is much higher among Amharic mother tongue speakers. A female′s health knowledge regarding the mother-to-child transmission of HIV and its intervention ranges between 75 to 88 percent among Amharic language speakers

whereas it is on average 20 percentage point lower for Afan Oromo language speakers. Irrespective of mother tongue, a female′s knowledge regarding the mother-to-child transmission of Tuberculosis is very low in Ethiopia. Finally, Amharic language speaking females desire fewer number of children, are more likely to use contraception and to know the fertility period.

3 Estimation Strategy

To estimate the effect of the reform on female's years of schooling and the subsequent effect on health knowledge and fertility behavior, I follow a difference-in-difference (DD) and instrumental variable estimation strategies respectively. Such approach is applied in studies that uses schooling reform to identify the causal effect of education on wages (Duflo, 2001), child health (Currie and Moretti, 2003; Breierova and Duflo, 2004; Lindeboom et al., 2009; Chou et al., 2010; McCrary and Royer, 2011) and fertility (Osili and Long, 2008). Ramachandran (2012) follows a difference-in-difference approach to identify the effect of the mother tongue instruction on years of schooling.In this paper, I build up on the results of Ramachandran (2012) and focus on the effect of the reform on female years of education and the subsequent effect on health knowledge and fertility behavior.

The primary schooling reform involved abolishment of junior secondary school entrance examination and the introduction of mother tongue instruction with the cohort that started primary education in 1994. This implies that the intensity of the reform differed by birth cohort and mother-tongue group. Because the use of mother tongue as medium of instruction was not implemented through out the country, an individual's treatment status also various across regions of residence.

The reform was implemented with the cohort that started primary education in 1994. Assuming that primary school starting age is 6, individual aged between 2 to 8 in 1994 forms the treated cohort. Those who already started primary school in 1994 could potential be used as a control group. However, due to the high prevalence of late enrollment in primary education in Ethiopia, I use the age group 13 to 20 as the control group. This age group is likely to be out of primary school by the time the reform was put in place. The difference in years of education between those aged 2-8 and those aged 13-20 in 1994 comprises the first difference in the DD framework.

The second difference in the DD framework depends on the mother tongue group that individuals belong to. The Afan oromo speakers living in the regions of Oromia, Amhara, Harae and Dire Dawa comprise the treated group whereas the Amharic language speakers in the four regions make up the control group. The use of mother tongue as medium of instruction is likely to increase the level of schooling of the Afan Oromo speakers without having any effect on Amharic language speakers. On the other hand, abolishing the national examination at the end of grade six could potential increase the level of education independent

of an individual's mother-tongue. However, the benefit to the Afan Oromo language speakers is likely to be higher to the extent that the use of Amharic language as the medium of the national examination was disadvantageous for them.

I use the following specification to estimate the effect of the reform on female years of schooling.

$$S_{ijk} = \alpha_0 + \alpha_1 After_j + \alpha_2 LANtreat_{ik} + \alpha_3 After_{jk} * LANtreat_{ik} + \alpha_4 X_{ijk} + \epsilon_{ijk} \quad (1)$$

where S_{ijk} is years of schooling of individual i of birth cohort j in region k. $LANtreat_{ik}$ a dummy variable taking the value one for Afan oromo language group in region k and zero for Amharic speakers in region k. $After_{jk}$ is an indicator for the birth cohort aged 2-8 in 1994 and zero if aged 13-20 in 1994. X_{ijk} includes controls for various measures of background characteristics.

Difference in parental background, tastes and values are likely to affect females$'$ years of education on the one hand and health knowledge and fertility behavior on the other. The inability to observe these variables renders female education to be endogenous in equation (1). Hence, I apply an instrumental variable estimation strategy to identify the causal effect of years of female schooling on health knowledge and fertility behavior. In this two-stage approach, equation 1 makes up the first stage estimation. In the second stage, the outcome variables that measure health knowledge and fertility behavior are estimated using the following specification:

$$Y_{ijk} = \beta_0 + \beta_1 Shat_{ijk} + \beta_2 X_{ijk} + \mu_{ijk} \quad (2)$$

Y_{ijk} is the various observed measures of health knowledge and fertility behavior of individual i of birth cohort j in region k. It includes knowledge of mother-to-child transmission and prevention of HIV/AIDS, Tuberculosis, knowledge of the fertility period, desired number of children, use of contraception, early marriage and pregnancy. $Shat_{ijk}$ is the predicted female education from the first stage regression in equation (1).

Most of the measures of health knowledge and fertility behavior are binary variables. Hence, I use the following specification and apply a conditional maximum likelihood estimation method[1].

$$Y^*_{ijk} = \beta_0 + \beta_1 S_{ijk} + \beta_2 X_{ijk} + \nu_{ijk} \quad (3)$$

$$Y_{ijk} = 1[Y^*_{ijk} > 0] \quad (4)$$

In the maximum likelihood estimation, the outcome equation (2) and the equation for female schooling (1) are estimated jointly. μ_{ijk} and ν_{ijk} are assumed to have zero mean, bivariate normal distribution and independent of the explanatory variables. The variance

[1]This part is based on Wooldridge (2002).

of the error term in equation (3) is normalized to one for identification. The endogeneity of female education implies that μ_{ijk} and ν_{ijk} are correlated. Furthermore, average partial effects are calculated in order to interpret the magnitude of the maximum likelihood estimates.

4 Estimation Results

4.1 The Effect of the Reform on Female Schooling

Table 2 presents estimation results from OLS regression of equation 1. In column (1), the reform effect on female years of primary education is estimated without controlling for differences in observed characteristics. The treated cohort, those aged 2-7 in 1994, have on average 1.5 higher years of primary education compared to those aged 13-20 in 1994. In addition, Afan Oromo language speakers have, on average, 1.8 less years of primary schooling compared to Amharic language speakers.

[Table 2 about here]

The interaction between the treated cohort and the treated language group indicates the effect of the reform on female years of schooling. The reform increased years of primary education by about 0.68. Controlling for background characteristics such as age, age square, urban residence, region of residence and religion in column (2) does not alter the result. The estimated effect of the reform reduces to 0.57 year after controlling for difference in marital status, labor market participation and wealth of the household[2].

In column (4)-(6), the effect of the reform on years of secondary education is shown. The estimates lie between 0.50 and 0.63 year increase in secondary education and it is significant at 1 percent level. Following similar approach, Ramachandran (2012) estimates the effect of the reform on years of secondary education for both males and females. He finds an increase of 0.80 to 1.18 years in secondary education. Comparing these results indicates that the reform has a larger effect on the years of secondary education of males compared to females.

Ramachandran (2012) undertakes various robustness checks to verify the causality of the reform effect on years of schooling. Two of the main robustness tests are a placebo test using an artificially step up treated group and a broad definition of the treated language group by including non-Amharic language speakers. I also check the robustness of the result in the female sampling following similar approach. The estimation results for the placebo test are shown in Table 3. In this placebo test, those aged 13-20 in 1994 are used as the treated cohort and those aged 21-28 in 1994 make up the control cohort. The interaction term is not significant in any of the specifications.

[2]The coefficients on marital status, labor market participation and wealth status should be interpreted with caution because of their simultaneous relation with female education.

[Table 3 about here]

The 1994 education reform was not fully implemented for all language groups. This implies that using non-Amharic language speakers as the treated language group gives a lower bound estimate of the reform effect. The estimation results are shown in Table 4. As expected, the effect of the reform is smaller for non-Amharic speakers compared to Afan Oromo speakers. It increased female years of primary education and years of secondary education by about 0.45.

[Table 4 about here]

4.2 The Effect of Female Education on Health Knowledge

Given the significant effect of the reform on female years of secondary education, in the following I examine the subsequent effect on female health knowledge. Females′ health knowledge is measured in five dimensions. These are three binary indicators for a mother-to-child transmission and prevention of HIV/AIDS and two binary indicators on knowledge on the symptom and transmission of Tuberculosis. Table 5 shows maximum likelihood estimation results using equation (1)and (3). Average marginal effects are presented in the table in order to easily interpret the magnitude of the estimates from the probit model.

[Table 5 about here]

In Column (1) to (4), the correlation between secondary years of education and females′ knowledge regarding mother-to-child transmission of HIV/AIDS during pregnancy and delivery are shown. Column (5) and (6) shows the effect on knowledge regarding the prevention of mother-to-child transmission of HIV/AIDS during pregnancy. Column (7) to (10) presents the result for females′ knowledge on the symptom and transmission of Tuberculosis. Over all, the estimated coefficients on years of secondary schooling indicates an increase on probability of health knowledge by about two to three percent. These estimates remain robust even after taking into account differences in household characteristics such as wealth, marital status and labor market participation.

Interesting results also emerge from the effect of the individual and household characteristics controlled in the model. Age seems to matter for females′ knowledge on the transmission of Tuberculosis but not on HIV/AIDS. Household wealth status is positively correlated with health knowledge especially regarding HIV/AIDS transmission and prevention. Related to that, the labor market participation of women also has a positive effect on HIV/AIDS knowledge but less so on Tuberculosis. Furthermore, residing in Oromia region compared to Amhara region decrease knowledge on HIV/AID but increase that of Tuberculosis. Compared to Islam and traditional religions, being Christian is positively correlated with knowledge

on HIV/AID but negatively correlated with knowledge on Tuberculosis. Finally, residing in urban areas is positively correlated with the knowledge of the transmission and prevention of both HIV/AID and TB.

Controlling for various individual and household observed characteristics does not guarantee a causal interpretation of the results. The estimated effect of secondary schooling is likely to be biased due to omitted variables. Differences in preference, taste and value are likely to affect both years of schooling and health knowledge. In the absence of good proxy for these characteristics, there omission from the regression lead to biased estimates. In Table 6, estimation results that take the endogeneity of years of education into account are presented. For ease of interpretation, average marginal effects are reported.

[Table 6 about here]

The effect of years of education on HIV/AIDS and TB transmission and prevention knowledge remains positive. Compared to the results from the simple Probit model, the magnitude of the education effect is higher when endogeneity is taken into account albeit at lower significance level. Additional years of education increases the knowledge on mother-to-child transmission of HIV/AID and TB by about seven to eight percent. This is almost twice the estimates obtained from the Probit model. However, the education effect on females′ HIV/AIDS prevention knowledge remains about the same size as the Probit model although it is insignificant.

4.3 The Effect of Female Education on Fertility Behavior

The effect of education on fertility behavior is one mechanism that educating females could improve child health. This channel works due to the quantity-quality trade-off which imply that educated women lower their fertility in order to improve the health outcomes of their existing children. Table 7 shows the estimation results for the effect of female secondary education on various measures of fertility behavior.

[Table 7 about here]

Estimation results are presented for five measures of fertility behavior in Column (1) to (10). These are knowledge on the fertility period, the ideal number of children, the use or intention to use contraception, marriage and pregnancy before the age of 20. Results show that education is positively related with females′ knowledge of the fertility period and the intention to use or the actual use of contraception. I also find that the number of children a woman desires decreases with her education level. Further more, educated women are less likely to get married before age 20 and they are also less likely to get pregnant before the age

of 20. All the results remain robust after controlling for individual, household and regional characteristics.

Unlike the effect on health knowledge, females′ age, wealth status and residency in urban area do not seems to matter for fertility behavior. Similarly, residence of Oromia regions have better fertility behavior compared to those in Amhara region. Further more, Christian females desire significantly lower number of children and they have eight percent higher probability to use contraception compared to Muslims and traditional religion followers.

Table 8 presents estimation results that take into account the endogeneity of education. Similar to the argument for health knowledge, differences in preference, taste and value are some of the omitted variables that are likely to lead to biased estimates.

[Table 8 about here]

Once the endogeneity of education is taken into account, the effect of secondary education on fertility behavior gives very heterogeneous results. Its effect on the knowledge of the fertility period remains significant and positive as indicated in column (1) and (2). Additional years of education increase a awareness of the fertility period by 6.5 percent. The magnitude of the education effect is twice that of the estimate obtained from a simple probit model. On the other hand, column (3) and (4) show that the negative effect of education on the number of desired children turns positive and insignificant.

Column (5) to (10) show results which are in contradict with the quality-quantity trade-off hypothesis. Extra year of education decreases the actual use or the intention to use contraception by eight percent. Similarly, additional years of education increases the probability of marriage and pregnancy before the age of 20 by nine percent and ten percent respectively.

5 Conclusion

Increasing females and girls education is one of the policy instrument used to improve the health outcome of children. In the theoretical and empirical literature, various mechanism that links female education to child health are identified. This includes an improvement in health knowledge, change in attitude from tradition to modern values, female autonomy, increase in higher income, better quality spouse, among others.

Building upon these literature, I examine the effect of female education on health knowledge and fertility behavior. I specifically measure health knowledge using female awareness of the mother-to-child transmission and prevention of HIV/AIDS and Tuberculosis. Even though HIV/AIDS and Tuberculosis are the among the top ten cause of child mortality, as to my knowledge, the causal effect of education on females' knowledge of these specific diseases have not been studied. Furthermore, I examine the causal effect of education on fertility behavior

as measured by females′ ideal number of children, the actual or the intention to use contraception, knowledge of the fertility period, and the probability of marriage and pregnancy before the age of 20.

The main empirical challenge is to disentangle the true effect of education from unobservable factors that affect health knowledge and fertility behavior. Unobserved variables such as parental background, preferences and tastes are likely to be correlated with both years of education and the outcome variable of interest. To tackle the endogeneity of education that results from omitted variable, I use a primary schooling reform that the Ethiopian government introduced in 1994. The policy reform includes the introduction of mother tongue instruction in primary schools and abolishing the central exit exam at the end of primary education. Using the variation in exposure to the policy change by mother tongue language group and birth cohort, a difference in difference estimation result shows an improvement 0.50 to 0.69 year in female years of secondary education.

More importantly, an extra year of secondary schooling induced by the reform increase females′ knowledge on the mother-to-child transmission and prevention of HIV/AIDS and Tuberculosis by about eight percent. Furthermore, the effect of education on fertility behavior is found to be heterogeneous. Additional year of education increases the probability of knowledge regarding the fertility period by 6.5 percent but it has no significant effect on the number of children females desire.

Surprisingly, the actual use or the intention to use contraception decreases with education. At the same time, the probability of marriage and pregnancy before the age of 20 increases with education. Further research is required to exactly understand the reasons behind these relationships. In addition, I find wealth status to be positively correlated with female′ fertility behavior but not with health knowledge. This indicates that the household wealth might matter more than education per se for the fertility behavior of women in Ethiopia. However, in order to draw firm conclusion, further research that examines the causality of the link between wealth and fertility behavior is needed. Furthermore, for the purpose of designing policy instruments, it is also crucial to understand the exact mechanism behind the relationship between wealth and fertility behavior.

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Appendix

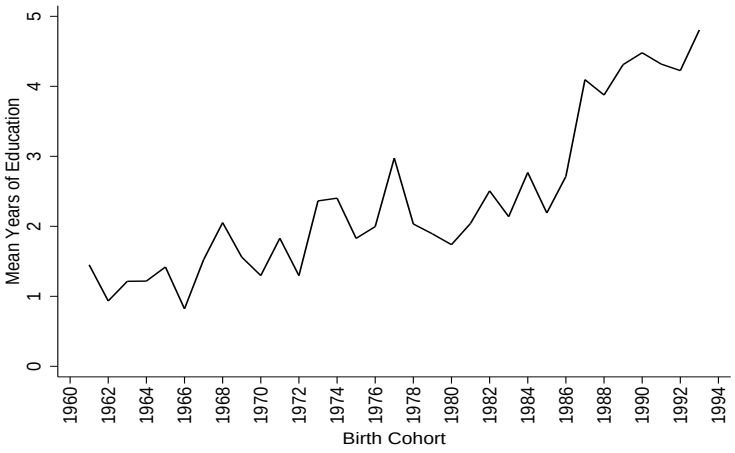
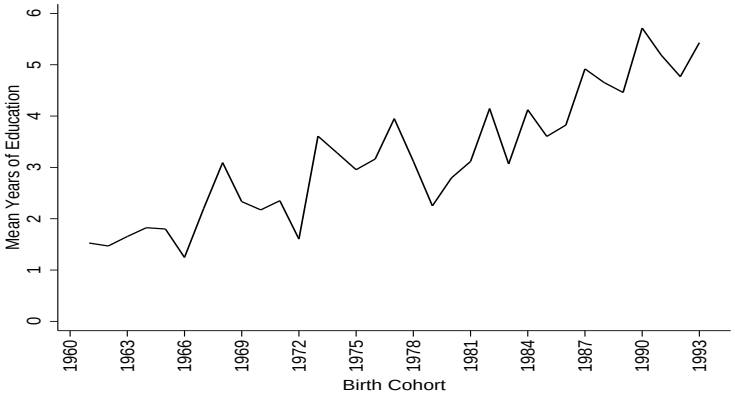
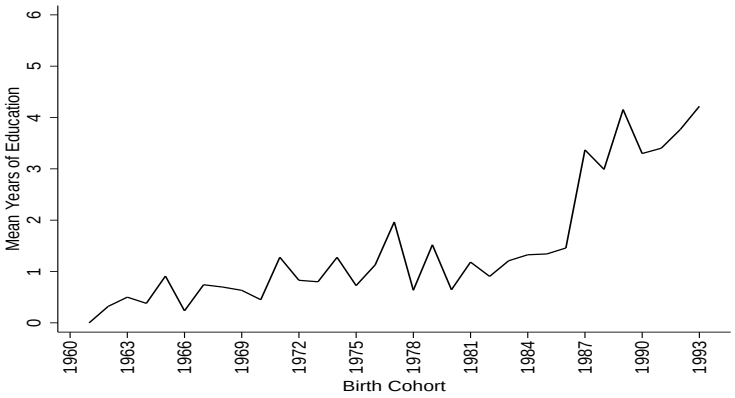


Figure 1: Mean years of secondary education for females born between 1960 and 1994.



(a) Amharic Language Group



(b) Afan Oromo Language Group

Figure 2: Mean years of secondary education for females born between 1960 and 1994 by language group.

Table 1: Descriptive Statistics

	Amharic Group	Afan Oromo Group	Country Average
Years of primary education	3.428 (3.627)	1.189 (3.030)	2.518 (3.275)
Years of secondary education	3.940 (4.310)	2.046 (3.218)	2.802 (3.782)
Years of education	4.610 (5.383)	2.223 (3.728)	3.125 (4.492)
Socio-economic characteristics			
Age	27.488 (5.571)	27.646 (5.637)	29.43 (8.578)
Married	0.591 (0.492)	0.751 (0.433)	0.643 (0.479)
Urban	0.421 (0.494)	0.185 (0.389)	0.326 (0.469)
Christian	0.848 (0.360)	0.272 (0.445)	0.616 (0.486)
Have paid job	0.412 (0.492)	0.364 (0.387)	0.378 (0.485)
Wealth index			
Poorest	0.122	0.129	0.225
Poorer	0.144	0.186	0.146
Middle	0.156	0.206	0.137
Richer	0.136	0.224	0.147
Richest	0.442	0.255	0.345
Health knowledge			
HIV transmission (Pregnancy)	0.663 (0.473)	0.567 (0.496)	0.644 (0.479)
HIV transmission (Delivery)	0.705 (0.456)	0.603 (0.490)	0.666 (0.472)
HIV prevention (Drug)	0.695 (0.461)	0.549 (0.498)	0.613 (0.487)
TB symptoms (Coughing)	0.686 (0.464)	0.723 (0.448)	0.701 (0.458)
TB transmission (Coughing)	0.544 (0.498)	0.530 (0.499)	0.529 (0.499)
Fertility behavior			
Fertility period	0.298 (0.458)	0.213 (0.409)	0.206 (0.404)
Ideal number of children	4.366 (2.713)	5.427 (3.236)	5.576 (3.331)
Intention or use of contraception	0.804 (0.397)	0.678 (0.467)	0.589 (0.492)
Early marriage	0.577 (0.499)	0.520 (0.500)	0.521 (0.500)
Early pregnancy	0.338 (0.473)	0.312 (0.464)	0.305 (0.461)
Number of observations	1,108	1,154	14,417

Standard Deviation are in parenthesis. Data source: Ethiopian Demographic and Health Survey (DHS) 2011

Table 2: The Effect of the Reform on Female Years of Education.

	Years of primary education			Years of secondary education		
	(1)	(2)	(3)	(4)	(5)	(6)
Treated Cohort	1.447***	0.915***	0.914***	1.730***	1.235***	1.233***
	(0.217)	(0.401)	(0.365)	(0.258)	(0.469)	(0.426)
Treated Language	−1.808***	−0.487***	−0.437***	−2.141***	−0.571***	−0.513***
	(0.162)	(0.161)	(0.153)	(0.187)	(0.183)	(0.174)
TC*TL interaction	0.678**	0.660***	0.568***	0.625*	0.603***	0.499***
	(0.275)	(0.227)	(0.211)	(0.322)	(0.262)	(0.244)
Age		−0.146	−0.096		−0.055	0.002
		(0.206)	(0.189)		(0.237)	(0.217)
Age square		0.002	0.002		0.000	−0.000
		(0.003)	(0.003)		(0.004)	(0.004)
Urban		3.622***	1.269***		4.287***	1.547***
		(0.168)	(0.253)		(0.199)	(0.292)
Region		0.054***	0.013		0.068***	0.020
		(0.013)	(0.013)		(0.015)	(0.015)
Christian		0.982***	0.762***		1.180***	0.921***
		(0.147)	(0.138)		(0.167)	(0.156)
Married			−1.008***			−1.158***
			(0.140)			(0.162)
Wealth index: Poorer			0.402***			0.439***
			(0.139)			(0.151)
Wealth index: Middle			0.469***			0.508***
			(0.139)			(0.150)
Wealth index: Richer			0.962***			0.996***
			(0.158)			(0.171)
Wealth index: Richest			3.106***			3.566***
			(0.249)			(0.283)
Have paid work			0.085			0.140
			(0.110)			(0.127)
Constant	2.805***	2.726	2.128	3.195***	1.304	0.658
	(0.140)	(3.215)	(2.940)	(0.164)	(3.715)	(3.381)
F-statistics	6.07	8.46	7.24	3.78	5.29	4.19
Partial R-Square	0.003	0.004	0.003	0.002	0.003	0.002
R-square	0.125	0.418	0.487	0.127	0.432	0.500
Observations	2260	2260	2260	2260	2260	2260

Treated cohort are those age 2-7 in 1994 while those aged 13-20 in 1994 make up the control cohort. Afan Oromo language speakers are the treated language group and Amharic language speakers are in the control language group. Robust standard errors are in parentheses. Significance stars indicate *** p<0.01, ** p<0.05, * p<0.1. Data source: Ethiopian Demographic and Health Survey (DHS) 2011

Table 3: Estimation Results from Placebo Test.

	Years of primary education			Years of secondary education		
	(1)	(2)	(3)	(4)	(5)	(6)
Treated Cohort	0.326	0.058	0.087	0.445*	0.158	0.194
	(0.219)	(0.233)	(0.225)	(0.258)	(0.272)	(0.263)
Treated Language	−1.630***	−0.548***	−0.546***	−1.903***	−0.640***	−0.639***
	(0.165)	(0.163)	(0.156)	(0.188)	(0.183)	(0.175)
TC*TL Interaction	−0.153	−0.070	−0.068	−0.247	−0.151	−0.152
	(0.256)	(0.198)	(0.192)	(0.296)	(0.227)	(0.219)
Age		0.078	0.170		0.068	0.166
		(0.233)	(0.223)		(0.273)	(0.261)
Age square		−0.001	−0.003		−0.001	−0.003
		(0.003)	(0.003)		(0.004)	(0.004)
Urban		3.345***	1.658***		3.885***	1.995***
		(0.182)	(0.260)		(0.212)	(0.289)
Region		0.102***	0.075***		0.122***	0.092***
		(0.013)	(0.013)		(0.016)	(0.016)
Christian		0.981***	0.880***		1.162***	1.045***
		(0.135)	(0.130)		(0.150)	(0.145)
Married			−0.130			−0.109
			(0.137)			(0.158)
Wealth index: Poorer			0.039			0.033
			(0.095)			(0.101)
Wealth index: Middle			0.180*			0.177
			(0.107)			(0.112)
Wealth index: Richer			0.525***			0.493***
			(0.126)			(0.132)
Wealth index: Richest			2.179***			2.398***
			(0.241)			(0.263)
Have paid work			0.397***			0.512***
			(0.104)			(0.117)
Constant	2.494***	−1.137	−3.025	2.804***	−1.139	−3.184
	(0.141)	(4.308)	(4.126)	(0.164)	(5.036)	(4.828)
F-statistics	0.36	0.13	0.13	0.70	0.44	0.48
Partial R-square	0.0002	0.0001	0.0001	0.0004	0.0002	0.0002
R-square	0.084	0.454	0.494	0.089	0.467	0.505
Observations	1990	1990	1990	1990	1990	1990

Treated cohort are those age 13-20 in 1994 while those aged 21-28 in 1994 make up the control cohort. Afan Oromo language speakers are the treated language group and Amharic language speakers are in the control language group. Robust standard errors are in parentheses. Significance stars indicate *** p<0.01, ** p<0.05, * p<0.1. Data source: Ethiopian Demographic and Health Survey (DHS) 2011

Table 4: The Effect of the Reform on Female Years of Education.

	Years of primary education			Years of secondary education		
	(1)	(2)	(3)	(4)	(5)	(6)
Treated Cohort	1.353***	1.321***	1.167***	1.541***	1.710***	1.528***
	(0.164)	(0.249)	(0.235)	(0.197)	(0.293)	(0.276)
Treated Language	−2.447***	−0.928***	−0.723***	−2.951***	−1.173***	−0.941***
	(0.124)	(0.097)	(0.094)	(0.147)	(0.113)	(0.110)
TC*TL interaction	0.464**	0.468***	0.437***	0.461**	0.471***	0.440***
	(0.187)	(0.150)	(0.143)	(0.222)	(0.178)	(0.169)
Age		0.151	0.175		0.295**	0.324**
		(0.125)	(0.118)		(0.145)	(0.136)
Age square		−0.003	−0.003		−0.005**	−0.005**
		(0.002)	(0.002)		(0.002)	(0.002)
Urban		2.949***	0.925***		3.514***	1.140***
		(0.099)	(0.153)		(0.116)	(0.176)
Region		0.116***	0.083***		0.132***	0.094***
		(0.009)	(0.009)		(0.011)	(0.011)
Christian		1.016***	0.865***		1.137***	0.957***
		(0.068)	(0.067)		(0.077)	(0.076)
Married			−0.714***			−0.851***
			(0.082)			(0.095)
Wealth index: Poorer			0.129			0.105
			(0.082)			(0.088)
Wealth index: Middle			0.356***			0.318***
			(0.088)			(0.094)
Wealth index: Richer			0.856***			0.879***
			(0.100)			(0.111)
Wealth index: Richest			2.643***			3.030***
			(0.156)			(0.178)
Have paid work			0.187***			0.251***
			(0.069)			(0.080)
Constant	3.582***	−1.921	−2.123	4.165***	−4.157*	−4.332**
	(0.114)	(1.957)	(1.843)	(0.137)	(2.264)	(2.128)
F-statistics	6.10	9.65	9.21	4.26	6.98	6.67
Partial R-square	0.001	0.002	0.002	0.001	0.001	0.001
R-square	0.167	0.419	0.469	0.172	0.428	0.478
Observations	6014	6014	6014	6014	6014	6014

Treated cohort are those age 2-7 in 1994 while those aged 13-20 in 1994 make up the control cohort. Non-Amharic language speakers are the treated language group and Amharic language speakers are in the control language group. Robust standard errors are in parentheses. Significance stars indicate *** p<0.01, ** p<0.05, * p<0.1. Data source: Ethiopian Demographic and Health Survey (DHS) 2011

Table 5: Probit Estimation Results for the Effect of Secondary Education on Health Knowledge.

	HIV Transm. Pregnancy		HIV Transm. Delivery		HIV Preven. Drug		TB Symptom Coughing		TB Transm. Coughing	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Secondary Education	0.024***	0.021***	0.031***	0.029***	0.040***	0.031***	0.036***	0.034***	0.034***	0.032***
	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)
Age	−0.003	−0.010	0.001	−0.005	0.033	0.016	0.076***	0.070***	0.077***	0.074***
	(0.026)	(0.026)	(0.025)	(0.025)	(0.026)	(0.025)	(0.023)	(0.023)	(0.025)	(0.025)
Age Square	0.000	0.000	0.000	0.000	−0.001	−0.000	−0.001***	−0.001***	−0.001***	−0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Urban	0.088***	0.043	0.053*	0.005	0.270***	0.075*	0.064**	−0.011	0.144***	0.089**
	(0.030)	(0.040)	(0.029)	(0.040)	(0.029)	(0.042)	(0.028)	(0.040)	(0.029)	(0.039)
Region	−0.007***	−0.008***	−0.001	−0.002	−0.003	−0.007***	0.008***	0.007***	0.004*	0.003
	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
Christian	0.060***	0.059***	0.050**	0.048**	−0.013	−0.015	−0.083***	−0.079***	−0.077***	−0.075***
	(0.023)	(0.023)	(0.022)	(0.022)	(0.023)	(0.023)	(0.021)	(0.021)	(0.023)	(0.023)
Married		−0.009		0.003		−0.011		0.030		0.011
		(0.024)		(0.023)		(0.024)		(0.022)		(0.024)
Wealth Index: Poorer		0.088**		0.102***		0.024		0.023		0.049
		(0.036)		(0.034)		(0.034)		(0.031)		(0.036)
Wealth Index: Middle		0.045		0.046		0.062*		0.012		0.022
		(0.035)		(0.033)		(0.034)		(0.030)		(0.035)
Wealth Index: Richer		0.122***		0.084**		0.083**		0.038		0.046
		(0.035)		(0.034)		(0.034)		(0.031)		(0.035)
Wealth Index: Richest		0.125***		0.122***		0.319***		0.131***		0.114**
		(0.046)		(0.045)		(0.045)		(0.044)		(0.046)
Have Paid Work		0.036*		0.050**		0.028		−0.000		−0.004
		(0.021)		(0.020)		(0.021)		(0.019)		(0.021)
Observations	2260	2260	2260	2260	1729	1729	2260	2260	2260	2260

Average Marginal Effects are reported. Standard errors are obtained through the delta method and they are shown in parentheses. Significance stars indicate *** p<0.01, ** p<0.05, * p<0.1.
Data source: Ethiopian Demographic and Health Survey (DHS) 2011

Table 6: Instrumental Variable Estimation Results for the Effect of Secondary Education on Health Knowledge.

	HIV Transm. Pregnancy		HIV Transm. Delivery		HIV Preven. Drug		TB Symptom Coughing		TB Transm. Coughing	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Secondary Education	0.071**	0.070*	0.073**	0.071	0.051	0.032	0.074**	0.074*	0.077***	0.080***
	(0.032)	(0.043)	(0.032)	(0.044)	(0.037)	(0.052)	(0.031)	(0.042)	(0.023)	(0.029)
Treated Cohort	−0.160**	−0.157**	−0.098	−0.088	−0.059	−0.030	−0.061	−0.054	−0.052	−0.052
	(0.064)	(0.071)	(0.078)	(0.093)	(0.098)	(0.107)	(0.083)	(0.097)	(0.080)	(0.089)
Treated Language	0.039*	0.033	0.009	0.001	−0.017	−0.025	0.055***	0.054***	0.048**	0.048**
	(0.022)	(0.024)	(0.026)	(0.031)	(0.031)	(0.032)	(0.020)	(0.021)	(0.020)	(0.020)
Age	−0.029	−0.036	−0.005	−0.011	0.018	0.005	0.068**	0.065*	0.070*	0.066*
	(0.034)	(0.034)	(0.031)	(0.031)	(0.035)	(0.035)	(0.033)	(0.036)	(0.037)	(0.041)
Age Square	0.000	0.001	0.000	0.000	−0.000	−0.000	−0.001**	−0.001*	−0.001*	−0.001*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Urban	−0.144	−0.042	−0.164	−0.070	0.205	0.067	−0.125	−0.068	−0.110	−0.013
	(0.196)	(0.098)	(0.189)	(0.089)	(0.227)	(0.091)	(0.195)	(0.088)	(0.185)	(0.098)
Region	−0.009***	−0.008***	−0.004	−0.003	−0.004	−0.007**	0.003	0.004	−0.001	0.001
	(0.002)	(0.003)	(0.003)	(0.002)	(0.003)	(0.003)	(0.005)	(0.003)	(0.004)	(0.002)
Christian	−0.001	0.009	−0.019	−0.009	−0.037	−0.028	−0.102***	−0.089**	−0.104***	−0.093***
	(0.072)	(0.073)	(0.066)	(0.066)	(0.057)	(0.057)	(0.039)	(0.039)	(0.031)	(0.029)
Married		0.052		0.057		−0.008		0.074		0.071
		(0.064)		(0.064)		(0.066)		(0.056)		(0.048)
Wealth Index: Poorer		0.047		0.065		0.023		−0.001		0.010
		(0.059)		(0.064)		(0.050)		(0.041)		(0.044)
Wealth Index: Middle		0.008		0.015		0.060		−0.013		−0.013
		(0.050)		(0.052)		(0.054)		(0.041)		(0.039)
Wealth Index: Richer		0.045		0.025		0.084		−0.015		−0.025
		(0.095)		(0.086)		(0.083)		(0.069)		(0.061)
Wealth Index: Richest		−0.088		−0.064		0.312		−0.045		−0.118
		(0.223)		(0.234)		(0.238)		(0.228)		(0.185)
Have Paid Work		0.021		0.037		0.030		−0.010		−0.013
		(0.026)		(0.030)		(0.021)		(0.019)		(0.017)
Observations	2260	2260	2260	2260	1729	1729	2260	2260	2260	2260

Average Marginal Effects are reported. Standard errors are obtained through the delta method and they are shown in parentheses. Significance stars indicate *** p<0.01, ** p<0.05, * p<0.1.
Data source: Ethiopian Demographic and Health Survey (DHS) 2011

Table 7: Probit Estimation Results for the Effect of Secondary Education on Fertility Behavior.

	Fertility Period		Ideal No. of Children		Contraception Use		Early Marriage		Early Pregnancy	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Secondary Education	0.032***	0.030***	−0.144***	−0.129***	0.014***	0.015***	−0.044***	−0.039***	−0.031***	−0.026***
	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Age	0.033	0.029	0.028	0.042	0.014	−0.000	0.048*	0.030	0.037	0.025
	(0.022)	(0.022)	(0.153)	(0.154)	(0.023)	(0.023)	(0.024)	(0.024)	(0.024)	(0.024)
Age Square	−0.001	−0.001	0.001	0.001	−0.000	−0.000	−0.001*	−0.000	−0.001	−0.000
	(0.000)	(0.000)	(0.003)	(0.003)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Urban	0.046*	0.012	−0.260	−0.230	0.075***	0.046	−0.006	−0.004	0.002	0.024
	(0.024)	(0.032)	(0.177)	(0.238)	(0.028)	(0.036)	(0.028)	(0.037)	(0.028)	(0.039)
Region	0.008***	0.008***	−0.018	−0.017	−0.011***	−0.011***	−0.011***	−0.009***	−0.011***	−0.009***
	(0.002)	(0.002)	(0.014)	(0.015)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Christian	0.008	0.010	−1.183***	−1.110***	0.068***	0.077***	0.024	0.054**	−0.003	0.020
	(0.019)	(0.019)	(0.136)	(0.137)	(0.020)	(0.020)	(0.022)	(0.022)	(0.022)	(0.021)
Married		0.013		0.370***		0.121***		0.197***		0.180***
		(0.020)		(0.142)		(0.021)		(0.020)		(0.022)
Wealth Index: Poorer		0.007		0.053		−0.005		−0.033		0.010
		(0.035)		(0.219)		(0.032)		(0.034)		(0.032)
Wealth Index: Middle		−0.005		−0.038		0.011		−0.006		−0.029
		(0.034)		(0.215)		(0.031)		(0.033)		(0.032)
Wealth Index: Richer		0.038		−0.370*		0.014		0.003		0.021
		(0.033)		(0.217)		(0.032)		(0.033)		(0.032)
Wealth Index: Richest		0.060		0.019		0.064		0.026		0.007
		(0.040)		(0.283)		(0.042)		(0.044)		(0.044)
Have Paid Work		0.013		−0.467***		0.045**		−0.026		−0.014
		(0.018)		(0.125)		(0.019)		(0.020)		(0.019)
Constant			4.437**	4.172**						
			(2.040)	(2.037)						
Observations	2260	2260	2260	2260	1729	1729	2260	2260	2260	2260

Average Marginal Effects are reported. Standard errors are obtained through the delta method and they are shown in parentheses. Linear regression is used for ideal number of children. Significance stars indicate *** p<0.01, ** p<0.05, * p<0.1. Data source: Ethiopian Demographic and Health Survey (DHS) 2011

Table 8: Instrumental Variable Estimation Results for the Effect of Secondary Education on Fertility Behavior.

	Fertility Period		Ideal No. of Children		Contraception Use		Early Marriage		Early Pregnancy	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Secondary Education	0.063***	0.065**	0.018	0.040	−0.066***	−0.080***	0.082***	0.089***	0.088***	0.096***
	(0.024)	(0.032)	(0.400)	(0.481)	(0.028)	(0.024)	(0.011)	(0.013)	(0.007)	(0.007)
Treated Cohort	−0.039	−0.039	−0.316	−0.339	0.178***	0.192***	−0.210***	−0.210***	−0.180***	−0.183***
	(0.071)	(0.081)	(0.730)	(0.814)	(0.057)	(0.052)	(0.055)	(0.052)	(0.050)	(0.048)
Treated Language	0.016	0.012	0.146	0.195	−0.041***	−0.048***	−0.039	−0.043	0.009	0.008
	(0.020)	(0.022)	(0.193)	(0.206)	(0.021)	(0.020)	(0.042)	(0.046)	(0.023)	(0.023)
Age	0.034	0.030	0.012	0.011	0.028	0.022	0.004	−0.009	0.005	−0.004
	(0.025)	(0.026)	(0.212)	(0.210)	(0.033)	(0.030)	(0.027)	(0.026)	(0.026)	(0.025)
Age Square	−0.001	−0.001	0.002	0.001	−0.001	−0.000	−0.000	0.000	−0.000	0.000
	(0.000)	(0.000)	(0.003)	(0.003)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Urban	−0.127	−0.052	−0.933	−0.455	0.374***	0.160***	−0.446***	−0.178***	−0.423***	−0.157***
	(0.154)	(0.073)	(1.722)	(0.030)	(0.084)	(0.038)	(0.025)	(0.034)	(0.025)	(0.033)
Region	0.004	0.005	−0.030	−0.022	−0.003	−0.005	−0.010***	−0.005***	−0.010***	−0.004**
	(0.005)	(0.003)	(0.030)	(0.017)	(0.005)	(0.004)	(0.002)	(0.002)	(0.002)	(0.002)
Christian	−0.038	−0.030	−1.327***	−1.194**	0.130***	0.119***	−0.143***	−0.111***	−0.128***	−0.103***
	(0.045)	(0.045)	(0.500)	(0.473)	(0.024)	(0.020)	(0.020)	(0.018)	(0.018)	(0.017)
Married		0.056		0.554		−0.028		0.201***		0.173***
		(0.048)		(0.569)		(0.061)		(0.040)		(0.031)
Wealth Index: Poorer		−0.013		−0.027		0.039		−0.059***		−0.044**
		(0.036)		(0.312)		(0.026)		(0.020)		(0.019)
Wealth Index: Middle		−0.024		−0.130		0.055**		−0.055***		−0.063***
		(0.036)		(0.333)		(0.024)		(0.021)		(0.018)
Wealth Index: Richer		−0.010		−0.555		0.101***		−0.097***		−0.098***
		(0.061)		(0.536)		(0.029)		(0.024)		(0.021)
Wealth Index: Richest		−0.097		−0.594		0.360***		−0.363***		−0.372***
		(0.171)		(1.753)		(0.060)		(0.041)		(0.033)
Have Paid Work		0.004		−0.500***		0.042**		−0.021		−0.017
		(0.017)		(0.144)		(0.020)		(0.016)		(0.014)
Constant			4.601	4.518						
			(1.165)	(1.213)						
Observations	2260	2260	2260	2260	2260	2260	2260	2260	2260	2260

Average Marginal Effects are reported. Standard errors are obtained through the delta method and they are shown in parentheses. Linear instrumental variable regression is used for ideal number of children. Significance stars indicate *** p<0.01, ** p<0.05, * p<0.1. Data source: Ethiopian Demographic and Health Survey (DHS) 2011