Effects of Women's Schooling on Contraceptive Use and Fertility in Tanzania

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Abstract

This study explores the economic relationships between women's schooling, fertility rates, and contraceptive use in Tanzania where population growth and fertility rates are among the highest in the world and aggravate the already ailing economy. Two models are used: fertility and contraceptive use. This study covers women ages 15 to 49. Drawing on 1996 data from the Demographic and Health Surveys (DHS), the study finds that women's schooling and other socioeconomic variables are important in explaining reproductive behavior. The fertility model indicates that higher education levels are consistently associated with lower fertility rates. Likewise, the contraceptive use model indicates that more education is positively associated with contraceptive use. Both models show that the relations become stronger with higher levels of schooling. The findings indicate that raising women's education levels improves their economic opportunities, increasing the value of their time and, in turn reducing their desire for large families.

Introduction

On October 12th, 1999, the United Nations announced that global population had reached the 6 billion mark, just 12 years after passing 5 billion (World Population Data Sheet, 2002). Based on the United Nations Population Division's most recent projections, the global population could reach the 7 billion mark as early as 2011 or as late as 2015. Most of the increases in population growth can be attributed to developing countries especially in Sub-Saharan Africa (SSA) countries where fertility rates are very high. Even though population trends remain difficult to predict, it is beyond doubt that understanding global population projections requires an analysis of fertility rates.

High fertility rates could be one of the major deterrents to sustained economic growth in SSA countries. The ill-effects of population growth can be examined at macro and micro levels. At a macro level, high population growth combined with stagnant income can result in growing income inequalities, lack of economic opportunities and high level of unemployment. In SSA countries where productivity level is low, food production cannot keep up with population growth, which leads to food insecurity. SSA countries are predominantly agricultural based which puts pressure on land used. Densely populated area results in limited arable land for production and consumption.

Another problem created by high population growth is congestion and rapid depletion of resources, especially in developing countries where property rights governing access to the resources are not well-defined. This leads to overexploitation of resources, pollution, and degradation of the environment. Moreover, pressure on limited land availability in the rural areas due to high population growth has contributed to a massive migration of peasants to urban centers. Indeed, migration to the city has led to the mushrooming of slums in the cities, which has exacerbated the problems of unemployment, lack of proper hygiene, and education opportunities.

At the micro level, high population growth leads to a more serious issue of poverty. Poorer families, especially women and marginalized groups, bear the burden of a large number of children with fewer resources per child, further adding to the spiral of poverty and deterioration in the status of women. Low levels of income among the poorer families with many children leads to inadequate food availability, which perpetuates malnutrition, which in turn accelerates high levels of infant and maternal morbidity and mortality. Studies by Ernst and Angst (1983), Rodgers (1984), and King (1985) have widely reviewed the relationship between family size, mean education and the health of children. Among poorer families, beyond a certain family size, additional children are usually associated with lower average educational attainment and reduced levels of child health as measured by nutritional status, morbidity and mortality.

Problems posed by high fertility rates and population growth in developing countries have sparked studies of the factors determining fertility rates. Holsinger and Kasarda (1976), Cochrane (1979) and (1983), Graff (1979), United Nations (1987), Cleland and Rodriguez (1988), Jejeebhoy (1992) and (1995) have examined the relationship between female education and fertility. Generally, these studies found that fertility fell uniformly with increased levels of women's education. Moreover, in their research in SSA and Latin America, Jejeebhoy (1995) and Martin (1995) showed that the inverse relationship between education and fertility can be enhanced only after relatively high levels of education have been attained.

This study explores the relationships between women's schooling, fertility rates, and contraceptive use in Tanzania. The choice of Tanzania has been facilitated by the fact that previous research has tended to aggregate observations from many countries, and not much has been written specifically about Tanzania. Also, Tanzania is the largest of the East African nations with as much cultural and economic diversity as can be found in almost the entire region. Therefore, the results could be similar and indicative of the whole region. Results may also be different and specific to Tanzania. It is important for policy makers to know how Tanzania is similar to or different from other parts of Africa.

In exploring the effects of women's schooling on fertility and contraceptive use in Tanzania, two components will be examined. One component of the study measures the probability of controlling fertility rate due to women's schooling. I propose that women's schooling levels will eventually lead to lower fertility rates in Tanzania. The second component of the study will measure the probability that women's schooling will lead to contraceptive use.

Like most of previous studies in the analysis of fertility, this study uses the field data from Demographic and Health Survey (DHS) conducted in 1996. The Demographic and Health Surveys program is funded by USAID and implemented by Macro International Inc. MEASURE *DHS*+ assists developing countries worldwide in the collection and use of data to monitor and evaluate population, health, and nutrition programs. The survey data provide information on family planning, maternal and child health, child survival, HIV/AIDS/STIs (sexually transmitted infections), and reproductive health.

Two models are used in the analysis. First, a logit model is used to estimate the relationship between women's schooling levels and contraceptive use. The second model is the negative binomial regression that estimates the probability that increasing women's schooling levels lowers fertility rates in Tanzania. This study investigates two hypotheses concerning women's reproductive behavior: (1) that more educated women exhibit lower fertility, and (2) more educated women are more likely to use contraceptives.

Literature Review

There is a large theoretical literature on the relationships between female education, fertility, and contraceptive use. Generally, the results are consistent with predictions of utility theory, showing that women with more schooling behaved rationally when considering their family sizes by having fewer children. However, there is little empirical studies tying together women's schooling, fertility, and contraceptive use. While advancing the understanding of the determinants of fertility and contraceptive use, previous studies have focused on only a few variables. For example, they have neglected to examine the role of other important factors such as cultural traits in fertility and contraceptive use decisions.

The Relationship between Education and Fertility

The association between education and fertility has a long history in the fields of economics and demography. Numerous studies relating national or regional levels of education and fertility showed a significant inverse relationship between the two. Cochrane (1979) argues that earlier economists such as Malthus and his successors have proposed theories about why more education is inversely related with fertility. However, the relationship between education and fertility is much more complex than suggested. Though the underlying pattern most commonly known shows a negative relationship, there are instances where positive relationships at very low and very high levels of schooling have been found. Bledsoe, Johnson-Kuhn and Haaga (1999) suggest that understanding the nature and strength of the relationship between education and fertility remains a central challenge both for researchers seeking to elucidate demographic and social changes and for policy makers who must decide on the allocation of scarce public resources.

The negative effect of education on fertility deserves further analysis. According to Martin and Juarez (1995, pp. 53), education is a "source" of knowledge transmission, "vehicle" of socioeconomic advancement, and a "transformer" of attitudes. In the contemporary world, any development depends on the effective transmission of new information. As a source of knowledge transmission, Martin and Juarez discuss that schooling imparts literacy skills, which enable people to process a wide range of information and arouse cognitive change that shape individuals' interaction with their surrounding environment.

As a vehicle of socioeconomic development, the authors hypothesized that education not only enhances cognitive abilities, but also it opens up economic opportunities and social mobility. In the contemporary world, education credentials open the door for formal employment and for sorting individuals into the hierarchy of occupations.

Martin and Juarez (1995) explain that as a transformer of attitudes, schooling's role in attitude formation goes far beyond the enhancement of conceptual reasoning and may lead to crucial transformations in aspirations and, eventually, to questioning traditional beliefs and authority of structures. Education transforms individual attitudes and values from traditional toward modern and thereby enhancing modernization, which is essential and reliable to regulate fertility.

Educated women are more likely to exercise the "quality-quantity trade-off" of their children. Most of these women are likely to see the benefit of their schooling; they may develop higher aspirations for their own children's schooling. It is obvious that as the number of children increases, familial resources available to an individual child decrease. Restricting the number of children is the best solution in order to have better-educated children and more familial resources per child. It would be advantageous for a woman to have fewer children that she can afford to pay for the tuition and other related fees associated with schooling, hence the trade-off between quality and quantity of children. Ainsworth, Beegle and Nyamete (1996) found that the trade-off is not a new phenomenon in most of the developed society, but it is a recent trend that can be seen in some parts of the SSA countries.

Other Determinants

Besides education, a large number of variables can affect fertility and contraceptive use. For example, Bongaarts, Frank, and Lesthaeghe (1984) consider two groups of variables: socioeconomic variables and proximate variables. Socioeconomic variables include education, social, cultural, economic, and health variables whereas proximate variables include biological and behavioral variables such as contraception and age of a woman. Davis and Blake (1956) and Bongaarts and Potter (1983) hypothesize that in order for the socioeconomic variables to affect fertility, they must operate through proximate determinants.

Cultural traits such as son preference and number of siblings are important to explain fertility behavior in a traditional society such as Tanzania, therefore, they deserves to be looked in detail. Son preference is not an uncommon phenomenon among SSA countries. Khan and Khanum (2000) found that sons are generally preferred over daughters owing to a complex interplay of economic and socio-cultural factors. Hank and Hans-Peter (2000) suggest that son preference is embedded in cultural and religious traditions and community norms as well as economical factors, shaping individual attitudes and behavior. In most developing countries where women are economically and socially dependent on men, male offspring are presumed to have greater economic net utility than female offspring. The argument is that sons can help to provide old age support to their parents. This is particularly important in most developing countries where there is no other form of old-age security. Hank and Hans-Kohler (2002) suggest that sex preferences for children might have implications for a couple's fertility behavior, where parents who desire one or more children of a certain sex should tend to have larger families than would otherwise be the case.

Studies by Duncan, Freedman, Coble and Slesinger (1965), Axinn, Clarkberg, and Thornton, (1994) have found a direct relationship between the number of children born to a family and the number of children within the couple's (husband and/or wife) family. In other words, a couple from larger families is more likely to mimic the sexual behavior of their parents hence breeding intergenerational inheritance of family size.

Methodology

The first model analyzes the determinants of contraceptive use, while the second model deals with fertility. These two models are dependent upon socioeconomic, demographic and proximate variables. Table 3 in the appendix gives definition and coding of the variables.

The contraceptive use model, the logit technique is used because the dependent variable is dichotomous. The logit equation of the contraceptive use is as given in equation 1:

$$P(contr) = \alpha_0 + \alpha_1 edprimar + \alpha_2 edsecond + \alpha_3 knows + \alpha_4 green + \alpha_5 lnage + \alpha_6 urban + \alpha_7 tv + \alpha_8 sibl + \alpha_9 mored + e_1 \quad \text{(eq. 1)}$$

The dependent variable is the probability a woman uses contraceptive before her first child, while the independent variables are similar with those of the fertility model, with the exception that in this model contraceptive use is a dependent variable. Another exception is the exclusion of higher education variable because almost every woman who has higher education uses contraceptives.

For the fertility model assumes that women attempt to maximize their level of utility given all goods and services, including non-market goods. Accordingly, we specify the following: The negative binomial equation for fertility is as given in equation 2:

$$fert = ß_0 + ß_1 edprimar + ß_2 edsecond + ß_3 edhigher + ß_4 knows + ß_5 contr + ß_6 green + ß_7 lnage + ß_8 urban + ß_9 tv + ß_{10} mored + ß_{11} Sibl + e_2 \quad \text{(eq. 2)}$$

The dependent variable is the number of children per a woman. The independent variables include woman's schooling levels, her knowledge of ovulatory cycle, contraception, family planning, age, place of residence (urban vs rural), income, son preference and number of her siblings. For the fertility model, this study uses maximum likelihood negative binomial regression model. Long (1997, pp. 217) posits that "the use of linear regression model for count data can result in inefficient, inconsistent, and biased estimates." For that reason the negative binomial regression technique is used in lieu of linear regression technique for the fertility model which measures count data.

As Ainsworth et al. (1996) hypothesize, all of the exogenous (except contraceptive use which in the case of the contraceptive use model is the dependant variable) variables leading women to have fewer children should result in a positive association in a contraceptive use model. In other words the coefficients of the independent variables for the two models will be opposite to each other. Therefore, for simplicity, the following discussion of the expected signs of the coefficients is centered on the fertility model. If an independent variable in the fertility model has a positive sign, the same variable is expected to have a negative sign in the contraceptive use model and vice versa.

Women's schooling is incorporated in the study in three distinct ways: primary education level (*edprimar*), secondary (*edsecond*) and higher education (*edhigher*). No education was used as a reference variable. It is expected that women's schooling will have a negative coefficient. Given the opportunity costs of childrearing (which is time-intensive), the utility of the woman will be maximized by reducing the number of children to reproduce and spend more time in other earnings-activities.

The knowledge of ovulatory cycle may also affect the probability of a woman to have fewer children. This is especially important in developing countries such as Tanzania where the number of unwanted births is very high partly because of women not knowing their reproductive cycle. The variable (*know*) was measured by asking a woman at what time during her menstrual cycle she is likely to get pregnant. It is expected that the variable will have a negative coefficient.

The use of contraceptive is measured by coding the variable *contr* 1 if a woman used contraceptive before her first child; otherwise the variable is coded zero. Contraceptive use is one of the important determinants of fertility control. The variable is expected to have a negative coefficient suggesting that efficient contraceptive use reduces the number of children born per woman.

The variable *green* is used in this study to see the influence of family planning knowledge on number of children born per a woman. The variable is measured by asking women if they ever heard a local family planning program in Tanzania. It is expected that the variable will have a negative coefficient to indicate that knowledge of family planning decreases the number of children a woman may have.

The probability for a woman to have many children also depends on her age. During the survey women were asked their age. This study uses *lnage* which is age in natural log form to reduce the magnitude of the variable. The survey used in this study covers women aged 15 to 49. The mean age of the respondent was 28. This means that most of the respondents were in their childbearing age. Therefore, the coefficient of the age variable is expected to be positive.

The variable for urbanization (*urban*) is 1 if a woman lives in the city. The coefficient on the variable *urban* is expected to be negative suggesting that women who live in urban areas will have fewer children than their counterparts in the rural areas.

The coefficient of variable *tv* which is proxy for income is expected to be negative which suggests that women with relatively high income tend to have fewer children so that they can have more time to spend on income-generating activities. Another reason is that women who have more income would rather have fewer children than many in order to have more expenditure per child which improves the quality of children as opposed to the quantity of children.

The coefficients of the cultural trait variables; son preference (*mored*) and number of siblings (*sibl*) are expected to be positive. This suggests that son preference has a higher probability in increasing the number of children especially when couple gets a child of a different sex from what they expected. Ceteris paribus the number of siblings a woman has does have a direct influence on her reproductive behavior, which means, the more siblings a woman has, the more children she will bear.

Regression Results of the Contraceptive Use Model

Empirical results regarding the use of contraceptive reinforce the expectation of the variables in the model. The variables e*dprimar, edsecond, knows, green, lnage,* and *urban* are all statistically significant at the one percent level, while *mored* is statistically significant at the five percent level. The variables *tv* and *sibl* are also important but not statistically significant.

The results show that women's schooling significantly impacts the probability of using contraceptives. The coefficient on the primary education is positive, indicating that women's primary education increases the chances of using contraceptive. The marginal effects show that if a woman has primary education, the likelihood of contraceptive use increases by a factor of 0.043, holding all other variables constant at their mean. The contraceptive use model also show that women's secondary education is positive, indicating that if a woman has secondary education the likelihood of contraceptive use increases by a factor of 0.073, holding all other variables constant at their mean. The results of women's schooling on contraceptive use are consistent with the a priori expectations, contraception is directly associated with the levels of women's education.

As the results show, women's schooling is positive and statistically significant at the one percent level on both primary and secondary education levels. The magnitudes of the coefficients increase with the increase of women's education level. The results also confirm that women's education increases receptivity of awareness and contraceptive use to control fertility. This supports the study done by Bertrand et al. (1993) who found that education affect the distribution of authority within households, whereby women may increase their authority with husbands, and affect fertility and use of family planning.

Table 1: Regression Results: Contraceptive Use Model-Logit

Dependent variable (*contr*) is 1 contraceptive used and 0 otherwise

Variable	Coefficient	Marginal Probability	Standard Error
Edprimar	1.258**	0.043	0.293
Edsecond	2.135**	0.073	0.322
Knows	0.654**	0.022	0.143
Green	0.927**	0.032	0.138
Lnage	-1.772**	-0.061	0.234
Urban	0.564**	0.019	0.131
Tv	0.079	0.003	0.233
Sibl	-0.015	-0.001	0.023
Mored	-0.393*	-0.013	0.162
Intercept	0.523		0.794

Notes: **significant at 1 percent level. *significant at 5 percent level.

Correct knowledge of a woman's ovulatory cycle as measured by the variable *knows,* is positive and statistically significant at the one percent level. Its marginal effect suggests that if a woman has knowledge of ovulatory cycle, the likelihood of contraceptive use increases by a factor of 0.022. This suggests that women who know when they are likely to conceive are more likely to exercise contraception in case they do not intend to get pregnant.

The awareness of local family planning program (g*reen*) significantly impacts the probability of contraceptive use. The coefficient on family planning program variable is positive and statistically significant at the one percent level. The marginal probability shows that if a woman is aware of a family planning program, the likelihood of contraceptive increases by a factor of 0.032, holding all other variables constant at their mean. This indicates that local dissemination of family planning knowledge is important to explain contraception. However, as mentioned in the previous section, the local family planning program was launched just three years before the survey was conducted. Therefore, the finding should be interpreted with a caveat because the dependent variable (contraceptive use) was measured as the use of contraceptive before a first child was born. In the fertility model, this variable was not significant; its significance in the contraceptive use model may be due the fact that people adjust more quickly on contraceptive use than on the fertility issue. Another reason may also be that most of the family planning programs not only disseminate information on family planning but also on the sexual transmitted diseases. Therefore, people may opt to use contraceptive such condom for the sake of having safe intimacy and not controlling fertility.

The model results indicate that woman's age is a strong indicator of likelihood of using contraceptive. The coefficient that controls woman's age is statistically significant at the one percent level. Since age (in natural log) is a continuous variable, the resulting coefficient shows the relation to the average age of respondents in the sample. The negative effect can be explained by the fact that the mean age of surveyed women is 28, which means that most of these women were in their childbearing age. Its marginal effect suggests that age's responsiveness decreases the likelihood of contraceptive use by a factor of 0.061, holding all other variables constant at their mean.

The results show that urbanization significantly impacts the probability that an urban-based woman is more likely to use contraceptive than the rural based woman. The coefficient on *urban* is positive, indicating that an urban resident is more likely to use contraceptive. The marginal probability shows that being an urban resident increases the likelihood of, contraceptive use by a factor of 0.019, holding all other variables constant at their mean. This supports Bertrand et al. (1993) who found modern contraceptive use is higher in urban the in the rural areas. Hamill, Tsui, and Thapa (1990) attribute the more use in modern contraceptive among urban couples to the desire for smaller families. This also suggests that urban women may be more likely to use contraceptive (especially modern contraceptive methods) than rural women because of greater access to modern methods and medical care as well as other social amenities in urban areas.

Household income as measured by the dummy of asset ownership (t*v*) is positive which is consistent with a priori expectations. Its marginal effect indicates that if a woman owns a television set the likelihood of contraceptive use increases by a factor of 0.003, holding all other variables constant at their mean. However, the coefficient is not statistically significant; the reason may be that this is a poor measure of income. Unfortunately, DHS does not collect data on income or household resources. This problem of poor measurement of income will persist and as a result will not be possible to address precisely and with confidence the effect of income on contraception in otherwise extremely rich DHS survey data.

The result shows that women with many siblings are less likely to exercise contraception as shown by the negative sign of the coefficient *sibl*. However, the coefficient is not different from zero, which suggests that there is no evidence of a relationship between the number of siblings and contraception and the exact reason is far from clear.

The results also suggest that son preference is one of the major obstacles in using contraceptives making it difficult to curb the fertility growth. The coefficient for son preference (*mored*) is negative and statistically significant at the five percent level. Its marginal effect suggests that son's preference decreases the likelihood of contraceptive use by a factor of 0.013, holding all other variables constant at their mean. This is consistent with a priori expectation that women who have a son preference will not use contraceptive as long as they bear only daughters. They will continue that trend until they are satisfied by having their desired number of sons. If they do not have a son at all they will keep on bearing children until they reach menopause.

Regression Results of the Fertility Model

Table 2: Regression Results: Fertility Model-Negative Binomial

Dependent variable (*fert*) is the number of children born per a woman.

Variable	Coefficient	Marginal Probability	Standard Error
Edprimar	-0.040*	0.961	0.016
Edsecond	-0.238**	0.788	0.040
Edhigher	-0.560	0.571	0.398
Knows	0.076**	1.079	0.019
Contr	-0.712**	0.491	0.069
Green	0.011	1.012	0.016
Lnage	2.500**	12.186	0.028
Urban	-0.144**	0.866	0.019
Tv	-0.203**	0.816	0.056
Mored	0.149**	1.160	0.015
Sibl	0.016**	1.016	0.002
Intercept	-7.496**	0.001	0.102
R-squared	0.583		
Adjusted R-squared	0.582		

Notes: ** significant at 1 percent level. *significant at 5 percent level.

The results of the negative binomial regression model as well as marginal probabilities of the coefficients. In general, the empirical results regarding the fertility model are consistent with existing findings. The variables *edsecond,* *knows, contr, lnage, urban, tv, mored,* and *sibl* are statistically significant at the one percent level. The variable e*dprimar* is statistically significant at the five percent level but the variables *edhigher* and *green* are not statistically significant. However, even though the variable *knows* is statistically significant at one percent level, it has an unexpected sign. Interpretation of the count data model using marginal probabilities makes more sense (See, Long 1997, pp. 224) because "the partial derivative cannot be interpreted as the change in the expected count for a unit change" in an independent variable.

The results show that women's schooling significantly reduces the number of children born per woman. All the measures of women's schooling are strongly significant and the coefficients are negative. The marginal probabilities of education variables show that if a woman has only primary education, the expected number of children born decreases by a factor of 0.961, holding all other variables constant. If a woman has secondary education, the expected number of children born decreases by a factor of 0.788 and if a woman has higher education, the expected number of children born decreases by a factor of 0.571, holding all other variables constant. The results are consistent with previous studies (e.g. Ainsworth et al. (1996), Martin and Juarez (1995) and Adelman (1963).

Higher education is however, not statistically significant, but the negative magnitude of the coefficient is higher than those of women's primary and secondary schoolings. Notice that the negative effect of women's education on fertility gets larger and larger with the increase in education levels. The insignificance of higher education coefficient may be explained by the fact that only 0.05 percent of the surveyed women have higher education beyond secondary school. More data may be needed to significantly capture this effect. Unfortunately, such data are not available from the Tanzania Demographic and Health Survey.

The coefficient of knowledge of ovulatory cycle (*knows*) is positive and statistically significant at the one percent level indicating that if a woman has knowledge of ovulatory cycle, the number of children born will increase. The marginal effect of the coefficient shows that if a woman has knowledge of ovulatory cycle the expected number of children born increases by a factor of 1.079 holding all other variables constant. However, this is inconsistent with the model prediction even after performing two-stage least squares (2SLS) to see if there is a problem with endogeneity between the variable *knows* and fertility. The inconsistency might be due to the fact that only about 16 percent of the women know their reproductive behavior. Also, it is possible that a majority of those who know their reproductive cycle use the knowledge to have more children if they prefer a large family size.

The use of contraceptive also significantly lowers number of children born per woman. The coefficient on the contraception variable is negative and statistically significant at the one percent level, indicating that as contraceptive use increases, the number of children born per woman decreases. A change $[\partial P(fert)/\partial contr < 0]$ gives a decrease in the expected number of children born by a factor of 0.491, holding all other variables constant. This suggests that women used contraceptive before their first child was born, they used contraceptive efficiently and effectively. This finding is consistent with the studies done by Rutenberg, Ayad, Ochoa and Wilknson (1991) and Bongaarts, Mauldin and Phillips (1990). These studies found that the increased use of effective family planning methods is the primary cause of dramatic fertility declines in many developing countries.

Family planning programs are very important in explaining a country's fertility rate and are expected to have a negative effect on fertility. However, the coefficient is positive, but not significantly different from zero. So the result shows there is no correlation. One possible explanation for this peculiar finding could be that the local family planning program was launched officially in mid 1993 and the survey on which this study is based was conducted just three years later (1996) so the effect of the plan had not yet materialized. It also makes sense to assume that when the program was launched, most of the surveyed women had a higher fertility rate already. This suggests that the benefits of this family planning program are not supported by the model, but may be supported by more timely data.

Women's age in natural log form is statistically significant and has a positive sign which is consistent with the earlier prediction. Given that the mean age of the surveyed women is 28, suggesting that most of the women are in their childbearing age. The marginal probability shows that the responsiveness of a woman's age increases the expected number of children born by a factor of 12.186, holding all other variables constant.

The model results indicate that urbanization significantly impact the probability of reducing the number of children born per woman. The coefficient of *urban* is negative and statistically significant at the one percent level, denoting a negative relationship between women who live in urban areas and the number of children born per woman. The marginal probability suggests that if a woman resides in an urban area, the expected number of children born per woman decreases by a factor of 0.866, holding all other variables constant. This is supported by Ainsworth et al. (1996), who determined that urban women have lower fertility than rural women. The finding is also consistent with Sharlin (1979) who hypothesized that the population that lives in urban areas is associated with fundamental revolution in economic basis. The results also support Adelman (1963, pp.322), who found out that "socioeconomic phenomena associated with the urbanization process tend to reduce birth rates in the long run."

The results show if a woman lives in a household that has a television set (income proxy) is more likely to have fewer number of children born. The coefficient for the variable is negative and statistically significant at the one percent level. The marginal probability shows that if a woman has television set, the expected number of children born decreases by a factor of 0.816, holding all other variables constant. This finding reflects the stronger impact of mother's income on the time cost of children. The results support Becker (1965, pp 510) who hypothesized that "child care would seem to be a time-intensive activity that is not productive (in terms of earnings) and uses many hours that could be used at work" which is "earnings-intensive activity." Becker predicted that the opportunity cost of childbearing is higher to higher income families. This association between household income and number of children born per woman is probably the most important economic explanation of decreasing fertility rates.

The data also suggest that cultural trait of son preference represented by *mored* is also statistically significant at the one percent level. This indicates that if a woman has son preference, the expected number of children born increases by a factor of 1.160, holding all other variables constant. This shows that women who have son preference will continue to reproduce until they get a desired number of sons. The finding is consistent with the study of Hank and Hans-Kohler (2002) who suggested that parents who desire one or more children of a certain sex should tend to have larger families than would otherwise be the case.

Lastly, the variable *sibl* also has a significant impact on the number of children born per a woman. The coefficient on s*ibl* is statistically significant at the one percent level and positive indicating that intergenerational inheritance of family size preference has a direct influence on fertility. The marginal probability indicates that number of siblings increases the expected number of children born by a factor of 1.016, holding all other variables constant. This also implies that women are more likely to mimic the reproductive behavior of their parents. This is supported by Duncan et al. (1965), Axinn et al. (1994) who determined the direct relationship between the number of children born to a family and the number of children within the couple's (husband and/or wife) family.

Conclusion

This study has examined the effects of women's schooling and other socioeconomic and demographic factors on fertility and contraceptive use in Tanzania. The study finds strong support for the negative correlation between women's schooling and cumulative fertility. The findings answer very important questions of how women's schooling, which rarely addresses issues directly relevant to sexual, reproductive and contraceptive behavior, influences fertility and contraceptive use decisions. Also, the study provides evidence of an established positive relationship between female's schooling and contraceptive behavior.

The findings also substantiate that other explanatory variables such as cultural factors are important in dealing with the question of controlling fertility. As discussed in this study and various other studies, the indirect effects of female's education on fertility and contraceptive use are much higher than the direct effects. One of the indirect applications of education is to empower women with decision-making and counteract cultures and norms that are associated with low prevalence of contraceptive use and increased fertility rate.

According to Becker (1992, pp.45) women's education raises their labor participation which in turn raises their earnings, "and hence greater investment in market-oriented skills" which increases women's time value. Failure to recognize the crucial indirect effects of education on fertility and contraception is to undermine the role of female education.

Still unknown from this study: "Does the inter-relatedness between female's schooling, fertility, and contraception depend on the quality of education?" Unfortunately, exogenous measures of the quality of education are not among those available in the individual DHS data set. The unavailability of that information, forces this study and previous studies to use either years of schooling or education levels to capture the impact of education on fertility and contraception. The quality of education depends on a variety of factors including a country's education system. Given this caveat, one has to be careful in generalizing the results of this paper to other countries. Additional research is needed to take a closer look at how different education qualities behave differently in explaining fertility and contraception in developing countries where there is much diversity in the quality of education.

This study suggests that investment in women's education should be a practical priority. Investment in primary education is necessary, but both fertility and contraception models show that the impact (magnitude) of education increases with education level. Therefore, the Tanzanian government should also invest heavily on women schooling beyond primary school. Investment in females' education in secondary and higher education will foster economic growth and also promotes smaller families, increase modern contraceptive use, and improve child health.

Appendix

Table 3: Variables Used for Both Models and their Definitions

Variable	Definition
fert	Total number of children ever born per woman
edprimar	1 if a woman has primary education level 0 otherwise
edsecond	1 if a woman has secondary education level 0 otherwise
edhigher	1 if a woman has higher education level 0 otherwise
knows	1 if a woman has a knowledge of ovulatory cycle 0 otherwise
contr	1 if a woman use contraceptive before first child 0 otherwise
green	1 if a woman ever heard of a local family planning 0 otherwise
lnage	a woman's age in log form
urban	1 if a woman lives in urban residency 0 otherwise
tv (income proxy)	1 if a woman has television set 0 otherwise
mored	1 if a woman has more daughters over sons 0 otherwise
sibl	number of siblings a woman has

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