

MICROEFFECTS OF WOMEN'S EDUCATION ON CONTRACEPTIVE USE AND FERTILITY: THE CASE OF UGANDA

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Abstract: This article uses the Uganda Demographic and Health Survey (2006), which links an individual woman's fertility outcomes to her education level. Thus, in this study, an attempt has been made to investigate the relationships between women's education, contraceptive use, and fertility rates in Uganda. The findings indicate that women's education and social-economic factors are important in explaining reproductive behavior. Fertility findings show that higher education levels are consistently associated with lower fertility rates and positively associated with contraceptive use. The major implication of these results is that raising women's education improves their economic opportunities, and the behavioral responses in fertility will lead to the decline in population by reducing the willingness to engage in unprotected sex and subsequent fall in fertility. Copyright © 2013 John Wiley & Sons, Ltd.

Keywords: women's education; contraceptive use; fertility; Uganda

1 INTRODUCTION

Despite the great strides the government of Uganda has made in its attempt to meet the targets set out in the Poverty Eradication Action Plan and the Millennium Development Goals by 2015 (Republic of Uganda, 2004), huge challenges still remain. A high population growth rate of 3.4% and a mortality rate of 8% is a big challenge to government coupled with poverty at 36% and low life expectancy of 46 years (Uganda Bureau of Statistics, 2004, 2008). There is consensus that education is one of the most important means to improve the quality of life and that increased education is an integral component

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of social and economic development, as it leads to a better use of the available resources and to realize potential development both at individual and societal levels, reduces fertility, and promotes human health and independence. Furthermore, education is a powerful instrument for acquiring new values and an important instrument of socioeconomic change and the environment. Education creates choices and opportunities for people, reduces the twin burdens of poverty and diseases, and gives a stronger voice to the vulnerable in society. Therefore, in Uganda, the government's education program is centered on the Universal Primary Education and the Universal Secondary Education, aimed at improving quality and access to education by reducing distance walked to schools (USD, 2004, 2008). In conflict-affected and hard-to-reach areas, the government has supported children with school uniforms, exercise books, and other classroom equipment.

Although education is considered to be an important instrument that affects population trends, it is necessary to know what type of education can play this role. For the relationship between contraception/fertility and education to generate policy implications, it is necessary to know what particular characteristics of education increase or decrease contraceptive use and fertility and their relative importance in urban and rural Uganda. Thus, a full understanding of the education–fertility/contraceptive use relationship is important for national social and development planning because education can be directly influenced by government policy. In Uganda, high fertility is considered an obstacle to both individual and national development, and detailed knowledge of the education–fertility relationship would doubtlessly facilitate social and economic development. Thus, both individuals and policy makers require a better understanding of the circumstances in which women schooling is likely to promote desires of small family sizes, demand for maternal health, and increased contraception, all which may results in a quality labor force and a stable population growth rate that can be supported by the country's economic growth rate.

The reproductive career of some Ugandan women starts early as low as 12 years, and one pregnancy follows another with little thought of child spacing (Uganda Demographic and Health Survey [UDHS], 2006). The male-oriented family structure and the expectations that women are in charge of all household chores absorb their energy and limit their participation in economic and political activities. Female education is an important factor accounting for fertility differences and the desire to have fewer children by families and hence reduction in population growth (Cochrane, 1979). Thus, education is a main force in changing family relations and ultimately fertility, and it is a powerful modernization agent in an economy.

This article provides answers to the following pertinent questions. First, controlling for other socioeconomic characteristics, does the level of education acquired by women affect contraceptive use and fertility rates differently in urban and rural areas? If so, what level of a woman's schooling has a significant effect on contraceptive use and fertility in urban and rural Uganda? This implies that understanding the effect of woman's education per se on contraceptive use and child bearing is not enough; the differential effect of various education levels in urban and rural areas can provide more meaningful insights. Second, is the partner's schooling equally important for contraceptive use and fertility among urban and rural Ugandans? We hypothesize that women's education positively influences contraceptive use but negatively influence family size differently in urban and rural Uganda. In addition, there exists differences in the partner's preferences for boys and girls in urban and rural areas.

The results of this article not only contribute to the body of knowledge considering the changing nature of the social–economic environment but also inform policy makers and other stakeholders on the different effects of woman's education on contraceptive use

and fertility in urban and rural areas. The findings consider the effect of this change upon the evolution of Ugandan labor market participation and family sizes. This study extends the earlier work on the effect of women's education on mortality in Uganda by examining the factors that affect differential contraceptive use and the determinants of the number of children born in urban and rural communities in Uganda. Previous studies in Uganda, such as those of Bbaale and Buyinza (2012) and Bbaale and Mpuga (2011), used the ordinary least squares technique to estimate factors that affect the number of children born. The number of children born, however, is a count variable that makes results based on the standard ordinary least squares technique to be biased (Hammer and Landau, 1981). This study improves on the previous work on Uganda by employing the negative binomial technique, which is more appropriate for the analysis of count data (Cameron and Trivedi, 1986). In addition, the present study undertook a rural and urban disaggregation to ascertain whether there are any discernible differences in the child-bearing behavior in rural and urban areas. The results show that contraceptive use has a large effect on fertility and explains a large part of the fertility differentials across education groups, such that more urban-educated women are more likely to use contraceptives, have fewer children, participate in formal employment, and make independent health decisions. The effect of background factors such as age, location, and religion are mediated by education as well as these other proximal mechanisms.

Section 1 entails a brief introduction and rationale of the relationship between women's education, contraceptive use, and fertility. Section 2 presents the related literature reviewed. The empirical model of the determinants of contraceptive use and fertility and data are presented in Section 3. This is followed by a discussion of results in Section 4, and Section 5 provides the concluding remarks.

2 SELECTED LITERATURE

There is a large theoretical and empirical knowledge on the relationships between women's schooling, use of contraceptives, and fertility. Evidence shows that more educated women behave rationally when choosing their family sizes by producing fewer children, which affect the overall fertility (Schultz, 1993; Cochrane, 1979; Saleem and Bobak, 2005; Bertrand *et al.*, 1993; Al Riyami *et al.*, 2004; Ainsworth *et al.*, 1996; Adanu *et al.*, 2009; Behrman, 1991; Jain and Nag, 1986; Martin and Juarez, 1995; Maglad, 1993; Adanu *et al.*, 2009). In addition, personal cultural traits such as preference for sons over daughters and the number of siblings influence contraceptive use and overall fertility behavior and owing to a complex interplay of economic and sociocultural factors (Khan and Parveen, 2000; Hank and Kohler, 2002). Other factors that affect contraceptive use and fertility are influenced by female participation in the labor force and income levels and residential status (Lam and Duryea, 1999).

3 DATA AND EMPIRICAL STRATEGY

3.1 Data

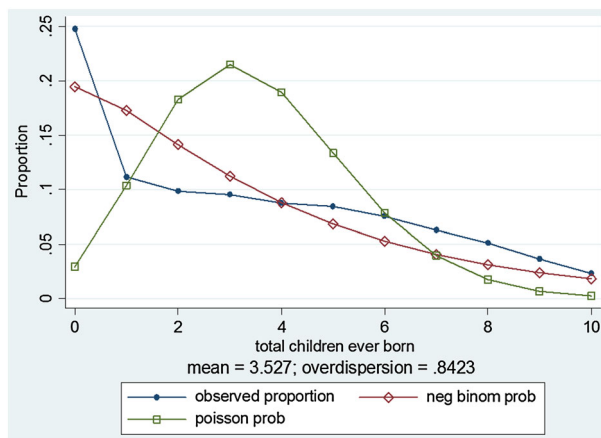
The empirical analysis is based on the data drawn from the UDHS (2006) collected by Macro International on behalf of the Uganda Bureau of Statistics (2006). The data set

covers social–economic characteristics of the Ugandan women population. Specifically, one is able to identify whether an educated woman has fewer children born or not, uses contraceptive or not, married women or older women bear fewer children or not, and whether a woman residence is urban or rural. Our analysis draws on fertility histories of women in the reproductive ages 15–49 years old to examine the effect of mother’s education on contraceptive use and fertility in Uganda.

Figure 1 graphs observed proportions of children ever born by women along with the Poisson and negative binomial probabilities. The Poisson probabilities are computed using an estimate of the Poisson mean. On the other hand, the negative binomial probabilities use the same mean, and an estimate of the overdispersion parameter indicates that approximately 22% of women produce approximately three children, and less than 10% produce more than six children. However, the observed proportion plot indicates that approximately 10% of women desire more than one child, which may indicate a high desire for large families. The negative binomial plot reveals that the desire for large families is approximately 5%. The drawback of using fertility rates is that they may in some cases pick up “temp effects,” and total fertility rates may fall or increase in the short run if women change the timing of their birth without changing their desired fertility.

3.2 Empirical Strategy

Figure 2 presents a conceptual framework that we put forward to explore the pathways for educational effects on contraceptive use. The development of this framework is based on the results from the review of studies presented earlier. It includes relevant determinants and outcomes for contraceptive decision making that ultimately affect fertility. The study takes into account not only demographic background variables but also contraceptive and sexual background as well. This encompasses previous experiences with contraception, sexual behavior, and child desires. Free *et al.* (2005) note that contraceptive decision making is not a once-in-a-lifetime phenomenon but a dynamic process dependent on life stage, situation,



Source: Author’s computation from UDHS (2006)

Figure 1. Observed proportion, Poisson, and negative binomial probabilities

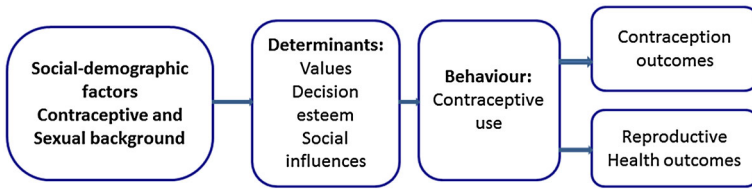


Figure 2. Conceptual framework of the determinants and outcomes of women's contraceptive decision making

experiences, knowledge, and new information. These experiences are taken into account when a woman decides on a course of action regarding birth control. Also, individual decisional esteem, a form of self-efficacy with regard to contraceptive decision making, is considered. Unlike the theory of reasoned action, this model does not have behavior as its end point but outcomes with regard to contraception and reproductive health.

To understand the relationship between women's education, contraceptive use, and fertility in Uganda, first, a probit model (Equation (1)) is estimated to examine the effect of women's education and other determinants of contraceptive use in the rural and urban areas of Uganda.

$$\text{contra}_{ij} = \theta_0 + \theta \text{educ}_{ij} + \varphi X'_{ij} + \varepsilon_{ij} \text{ for } j = 1, 2 \tag{1}$$

From Equation (1), contraceptive use is a binary dependent variable taking the value of 1 if the woman used contraceptives and 0 otherwise. The variable "educ" is a measure of women's education level in both rural and urban areas, and X'_{ij} is a set of other explanatory variables like woman's age at first birth, religious beliefs, partner's desire for children, partner's education level, and women's wealth status, among others. The last term, ε_{ij} , is an error term.

Second, the standard model for fertility (Equation (2)) is estimated and discussed with both the woman's own education level as well as with all the variables in the contraceptive model. This is important in understanding the social-economic effect on the children born by a woman.

$$\text{ferti}_i = \alpha_0 + \beta \text{educ}_i + \sigma X'_i + \varepsilon_i \tag{2}$$

From Equation (2), the fertility variable "ferti" is measured by total children ever born by the woman. The woman's education level is a categorical variable. Women's education status is included as an explanatory variable, as it has been found to influence the behavioral reaction to child-bearing and health campaigns (de Walque, 2007). X'_i is a vector of other controls (age, religious belief, type of the place of delivery, the woman's ovulatory knowledge, child breast-feeding by the mother, wealth quintile, owns a radio, television, partner's education levels and desire for children, and preference of sons over daughters by the couple), and ε_{ij} is a random error term.

4 RESULTS

This section presents the results of the relationship between mother's education, contraceptive use, and fertility in Uganda. First, a discussion of the descriptive evidence is provided as a foundation for the quantitative analysis.

4.1 Descriptive Evidence

Table 1 presents the selected women's background characteristics based on the contextual factors identifying that according to the contraceptive use by age and according to female education, more urban women use contraceptives compared with rural women.

From Table 1, the highest contraceptive use is observed in urban areas for women with no education (54%) between 30 and 39 years, primary education (73%) that are between 30 and 39 years, secondary education (81%) between 30 and 39 years and postsecondary education (88%) between 30 and 39 years. On the other hand, the highest contraceptive use among rural women is observed for women with no education (27%) between 30 and 39 years, primary education (50%) between 30 and 39 years, secondary education (72%) between 20 and 29 years, and postsecondary education (85%) between 30 and 39 years.

Table 1 indicates that a highest proportion of urban women married is observed with no education (44%) that are less than 20 years, primary education (55%) that are between 20 and 29 years, secondary education (49%) between 30 and 39 years, and postsecondary education (30%) between 40 and 49 years. Among rural women, the highest proportion is observed for women with no education (69%) when less than 20 years, primary education (64%) that are between 20 and 29 years, secondary education (47%) between 30 and 39 years, and postsecondary education (16%) between 30 and 39 years. On the other hand, the lowest proportions of women who married at the lowest age are observed in urban areas.

Furthermore, our results show that approximately 33% and 45% of urban women with no education and primary education, respectively, had their first birth when they were less than 20 years, 42% with secondary education had their first birth between the ages of 20 and 29 years, and 52% with postsecondary education produced their first born when they

Table 1. Selected background characteristics for women of reproductive age (15–49 years)

Variable	Urban				Total	Rural				Total
	<20	20–29	30–39	40–49		<20	20–29	30–39	40–49	
Women's contraceptive use by age cohorts										
No education: Yes	33	44	54	33	41	7	23	27	22	20
Primary: Yes	25	72	83	61	60	13	47	50	48	40
Secondary: Yes	31	80	87	74	68	26	72	67	51	55
Postsecondary: Yes	67	77	89	75	77	38	41	86	73	60
Women's age of marriage by age cohorts										
No education	44	10	10	21	21	69	17	16	16	30
Primary	38	55	30	31	39	16	64	26	31	34
Secondary	15	28	49	18	28	12	11	47	43	28
Postsecondary	3	7	11	30	13	3	8	11	10	8
Women's age at first birth by age cohorts										
No education	38	11	10	0	19	36	10	6	0	17
Primary	45	22	20	0	29	55	34	22	0	37
Secondary	14	42	20	0	25	8	48	34	0	31
Postsecondary	3	25	52	0	27	1	8	38	0	15

Source: Author's computation from UDHS (2006).

are in the age range of 30–39 years. On the other hand, 36% and 55% of rural women with no education and primary education, respectively, had their first birth when they are less than 20 years, 48% with secondary education had their first birth between 20 and 29 years, and 38% with postsecondary education produced their first born when they are in the age range of 30–39 years. The results in Table 1 reveal that 53% of the women accomplish primary school when they are already mothers in urban areas, whereas 55% of rural women get their first child before accomplishing primary education level.

Table 2 presents the proportional distribution of women's family size and desired number of children by education levels. Most of the women (approximately 83%) stay in rural areas, whereas only 17% of their counterparts are living in urban areas. According to family size by urban women, 57% of women with no education have at least five children, 55% of women with primary education have three to four children, and 34% and 9% of women with secondary and postsecondary education, respectively, have an ideal family size of one to two children. On the other hand, Table 2 reveals that 61% of rural women with no education have at least five children, 63% of women with primary education have three to four children, 19% of women with secondary have at least five children, and only 14% of rural women with postsecondary have an ideal family size of one to two children. This pattern shows that it's above primary education when education exhibits a downturn in fertility.

Furthermore, Table 2 shows that 33% and 48% of urban couples with no education and primary education desire to have one to two and three to four children, respectively, whereas 31% and 10% of urban couples with secondary and postsecondary education desire to have one to two children. In rural areas, 53% and 43% of the couples with no education and with primary education, respectively, desire to have three to four children, whereas 38% and 2% of rural women with secondary and postsecondary education, respectively, desire to have one to two children. This finding indicates that some differences in family size preferences are apparent by educational level as family size preference contrasts markedly between the couple's education levels.

4.2 Empirical Results

4.2.1 Determinants of contraceptive use in Uganda

Table 3 presents findings from the contraceptive use model. Our findings articulate the importance of female education in influencing the probability of contraceptive use in both urban and rural areas. Having primary education, compared with counterparts that have no

Table 2. Family size and desired number of children according to women's education level

Variable	Urban			Urban			Rural			Rural		
	1–2	3–4	5+	1–2	3–4	5+	1–2	3–4	5+	1–2	3–4	5+
	Family size			Desired children			Family size			Desired children		
No education	50	13	57	11	33	0	26	21	61	30	53	51
Primary	7	55	23	48	43	0	41	63	34	30	43	38
Secondary	34	27	19	31	19	0	19	6	12	38	4	11
Postsecondary	9	5	1	10	5	0	14	9	7	2	0	0

Source: Author's computation from UDHS (2006).

Table 3. Determinants of contraceptive use by women (probit analysis: marginal effects)

Variable	Model 1		Model 2		Urban		Rural	
	ME	p-value	ME	p-value	ME	p-value	ME	p-value
Women's education								
No education (RC)	—	—	—	—	—	—	—	—
Primary (d)	0.154	(0.028)**	0.088	(0.192)	0.150	(0.000)***	0.157	(0.000)***
Secondary (d)	0.216	(0.001)***	0.174	(0.001)***	0.316	(0.000)***	0.343	(0.000)***
Postsecondary	0.181	(0.000)***	0.138	(0.001)***	0.366	(0.000)***	0.353	(0.000)***
Desire for children								
Both want same (RC)	—	—	—	—	—	—	—	—
Husband wants more (d)	-0.000	(0.992)	-0.023	(0.637)	-0.047	(0.041)**	-0.052	(0.030)**
Husband wants few (d)	0.053	(0.322)	0.026	(0.648)	0.076	(0.028)**	0.072	(0.047)**
5-Year age cohort								
15-19(RC)	—	—	—	—	—	—	—	—
20-24 (d)	0.178	(0.002)***	0.148	(0.003)***	0.097	(0.057)*	0.112	(0.039)**
25-29 (d)	0.139	(0.024)**	0.163	(0.011)**	0.100	(0.055)*	0.123	(0.024)**
30-34 (d)	0.107	(0.091)*	0.121	(0.033)**	0.137	(0.007)***	0.155	(0.003)***
35-39 (d)	0.148	(0.000)***	0.129	(0.002)***	0.169	(0.001)***	0.178	(0.001)***
40-44 (d)	0.134	(0.001)***	0.105	(0.012)**	0.023	(0.701)	0.051	(0.412)
45-49 (d)	0.007	(0.956)	0.027	(0.788)	0.016	(0.800)	0.027	(0.682)
Wealth status								
Poor (RC)	—	—	—	—	—	—	—	—
Non-poor (d)	0.130	(0.242)	0.102	(0.339)	0.145	(0.000)***	0.137	(0.000)***
Knowledge of Ovulation								
No ovulatory knowledge (RC)	—	—	—	—	—	—	—	—
Ovulatory knowledge (d)	0.248	(0.005)***	0.123	(0.131)	0.113	(0.000)***	0.120	(0.000)***
Partner's education								
No education (RC)	—	—	—	—	—	—	—	—
Primary (d)	0.076	(0.241)	0.117	(0.060)*	0.049	(0.171)	0.055	(0.143)
Secondary (d)	0.034	(0.640)	0.058	(0.422)	0.117	(0.005)***	0.119	(0.006)***
Postsecondary (d)	-0.063	(0.552)	-0.008	(0.938)	0.141	(0.013)**	0.164	(0.005)***

Mortality rate	-0.215	(0.040)**	-0.111	(0.237)	-0.282	(0.000)***	-0.287	(0.000)***
Child sex preference								
Girl child (RC)	-	-	-	-	-	-	-	-
Son preference (d)	-0.019	(0.651)	-0.029	(0.514)	-0.004	(0.852)	0.003	(0.898)
Religion								
Catholic (RC)	-	-	-	-	-	-	-	-
Protestant (d)	0.047	(0.262)	0.065	(0.122)	0.046	(0.043)**	0.044	(0.060)*
Muslim (d)	-0.019	(0.722)	0.053	(0.233)	0.088	(0.016)**	0.085	(0.026)**
Mass media								
Has no media (RC)	-	-	-	-	-	-	-	-
Has television (d)	0.062	(0.171)	-0.022	(0.709)	0.153	(0.042)**	0.172	(0.030)**
Has radio (d)	0.018	(0.697)	0.031	(0.575)	0.052	(0.027)**	0.042	(0.083)*
Breast-feeding								
Not-breast-feeding (RC)	-	-	-	-	-	-	-	-
Currently bread feeding (d)	-0.155	(0.002)***	-0.115	(0.028)**	-0.127	(0.000)***	-0.114	(0.000)***
Place of birth								
Home (RC)	-	-	-	-	-	-	-	-
Government Hospital (d)	-0.043	(0.413)	-0.078	(0.202)	-0.003	(0.902)	-0.013	(0.640)
Private Hospital (d)	0.115	(0.006)***	0.030	(0.685)	-0.018	(0.644)	-0.026	(0.532)
Employment type								
All year (RC)	-	-	-	-	-	-	-	-
Seasonal (d)			-0.123	(0.055)*			-0.07	(0.002)***
Occasional (d)			0.102	(0.009)***			0.091	(0.085)*
N	404		278		2945		2790	
Log-likelihood	-155.09		-92.37		-1780.41		-1670.16	
Wald χ^2	83.81		59.88		370.31		392.03	
Pseudo R ²	25		27		25		27	

The standard errors are given in parentheses. * $p < 0.1$ ** $p < 0.05$ *** $p < 0.01$

*Discrete change of dummy variable from 0 to 1.

RC, reference category; d, dummy variable.

education, increases the probability of contraception by approximately 15%–17% and 15%–16% in urban and rural areas, respectively. In addition, women with secondary education and postsecondary education, compared with counterparts with no education, increase the probability to use contraceptives by 22%–23% and 14%–23% in urban areas and by 31%–34% and 35%–37% in rural areas, respectively. This finding is in line with that of Bertrand *et al.* (1993), in which increased women's education increases family planning use that subsequently affect women's fertility. Furthermore, the findings show the significance a husband's desire for children. When a woman is married to a man who wants more children compared with counterparts that are married to the man who want same number of children, this reduces contraceptive use by 5%–7% in rural areas and by approximately 3% in urban areas. However, when a woman is married to a man who desires fewer children compared with women married to men who want same number of children, this increases contraceptive use by 3% among rural women.

Our findings indicate that women with ovulatory knowledge compared with those with no knowledge of their ovulatory cycle increase probability of contraceptive use by 25% in urban areas and by 12% in rural areas. 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, which consequently reduce getting unwanted babies and improves child spacing and child healthcare management. In addition, the results show that being non-poor compared with poor women increases contraceptive use by 8% in urban areas and between 13% and 15% in rural areas. This result implies that policy makers should focus on poverty reduction measures.

As expected, a partner's education level significantly influences the probability of contraceptive use. Women married to partners with secondary and postsecondary education compared with counterparts married to partners with no education increase contraception by 8% and 12%–16% in urban and rural areas, respectively. These results confirm that partner's education increases receptivity of awareness and contraceptive use to control fertility. Also, preference for sons over daughters reduces contraceptive use by 11% in rural areas.

The 5-year age cohorts are used as proxy for the sexual behavior of women. Findings revealed that women in the age cohorts 20–24 and 40–44 years in urban areas have a probability of contraceptive use between 10.5% and 17.6% in both models higher than their counterparts in the base category (15–19 years). In addition, rural women in the age cohorts 20–24 and 35–39 years have a probability of contraceptive use between 9.7% and 16.9% higher than their counterparts in the base category (15–19 years). However, age cohort 45–49 in urban areas and 40–44 and 45–49 in rural areas are not significant in influencing contraceptive use. Furthermore, the mortality rate significantly reduces the probability of contraceptive use by 21.5% and 28.7% among urban and rural women, respectively. In addition, women of the Protestant and Muslim faith compared with the Catholics increase the probability of contraceptive use by approximately 4.6% and 8.8% among rural women.

In addition, a woman owning a radio or a television compared with women who do not own either increases the probability of contraception by 4.2%–5.2% and 15.3%–17.2% in rural areas. This result is consistent with the findings of Westoff and Rodríguez (1995). The effect of owning a television on contraception exceeds that for a radio because many people who can afford television sets are educated and non-poor. The results further indicate that the place of birth significantly influences the probability of contraception. A

woman who delivers in a private hospital compared with counterparts who deliver at home increases the probability of contraception by 11.5% among urban women. Also, breast-feeding mothers compared with non-breast-feeding mothers reduces the probability of contraception by 4.2%–5.2% in rural areas. This is because breast-feeding mothers are less likely to get pregnant and may not be eager to use contraceptives. Furthermore, employed women on a seasonal basis compared with women employed all year reduce the probability of contraception by 12.3% and 7% in urban and rural areas, respectively. However, women employed occasionally increase contraception by 10% and 9% among urban and rural women, respectively. Therefore, women emancipation and gender equality programs, education access, and their entry into formal employment are likely to increase contraceptive use and subsequently reduce fertility.

4.2.2 Determinants of fertility in Uganda

The results of the negative binomial are presented in Table 4 (Long, 1997). Results for the four models show that the estimated effects of female education levels (primary, secondary, and postsecondary) compared with no education were all statistically significant in rural and urban Uganda. The marginal effects for each category of education in rural and urban Uganda show that in relation to the mean fertility of the comparison category, a woman with no education, the fertility rate declined by an increasing factor with exposure to each additional threshold of formal education. The results are consistent with previous findings (Ainsworth *et al.*, 1996; Martin and Juarez, 1995; Adelman, 1963). In addition, the marginal effects for the age cohort at first birth at the age of 21–25, 26–30, and 31–35 years relative to the comparison category, women younger than 15–19 years, expected children born declined by 0.124–0.127 and 0.193–0.209, respectively, as women become older, other factors held constant. This implies that there is a need for government and other stakeholders to advocate for late marriages.

In addition, the marginal effects for a woman belonging to a Protestant or Muslim faith relative to the comparison category, Catholic faith, increase fertility by 0.420–0.046 and 0.074–0.091 U among urban and rural women, respectively, all other factors held constant. Also, holding other factors constant, the marginal effects of a woman delivering in public or private hospital relative to the comparison category, women delivering at home, increase the fertility between 0.149 and 0.665 U among urban women and between 0.119 and 0.272 U among rural women. Also, the marginal effects for health decisions are if made by the partner alone or by both relative to the comparison category, health decision made by woman alone, cumulative reduces fertility by 0.233 unit and increases fertility by 0.345 among urban women, respectively, whereas fertility falls by 0.234–0.456 U among rural women, other factors being constant. This means that more independent women opt to have a small family. Thus, there is need for government to increase the means of empowering women in the country. Also, holding other factors constant, women married to a partner with secondary or postsecondary education increase fertility relative to the comparison category; women married to partners with no education decrease fertility between 0.147 and 0.182 U and by 0.234 U among urban and rural woman, respectively. This finding shows that women who are married to more educated partners beyond primary level use contraceptives, which subsequently affect women's fertility.

Furthermore, holding other factors constant, the marginal effects of the wealth index suggest that as wealth increases (poor, middle, richer, and richest), fertility declines in rural Uganda in comparison to the poorest by 0.34, 0.345, 0.234, and 0.56 U, respectively, with exposure to each additional threshold of wealth status. Holding other factors constant, the

Table 4. Determinants of fertility (negative binomial analysis: marginal probabilities)

Variable	Model 1		Model 2		Urban		Rural	
	ME	<i>p</i> -value	ME	<i>p</i> -value	ME	<i>p</i> -value	ME	<i>p</i> -value
Women's education								
No education (RC)	—	—	—	—	—	—	—	—
Primary	-0.373	(0.000)***	-0.354	(0.024)***	-0.215	(0.000)***	-0.214	(0.000)***
Secondary	-0.651	(0.000)***	-0.662	(0.000)***	-0.505	(0.000)***	-0.487	(0.000)***
Postsecondary	-0.601	(0.000)***	-0.675	(0.000)***	-0.572	(0.000)***	-0.576	(0.000)***
Age at first birth cohort								
Less than 16 years(RC)	—	—	—	—	—	—	—	—
16–20	-0.129	(0.061)*	-0.184	(0.024)***	-0.122	(0.000)***	-0.123	(0.000)***
21–25	-0.476	(0.022)**	-0.576	(0.015)**	-0.137	(0.064)*	-0.158	(0.035)**
26–30	-0.490	(0.114)	-0.539	(0.101)	-0.112	(0.607)	-0.137	(0.559)
31–35	0.060	(0.371)	0.015	(0.849)	0.028	(0.188)	0.027	(0.208)
36+	0.036	(0.654)	0.023	(0.808)	0.054	(0.119)	0.060	(0.095)*
Health decisions								
Wife alone (RC)	—	—	—	—	—	—	—	—
Husband alone	-0.162	(0.037)**	-0.118	(0.160)	-0.123	(0.000)***	-0.116	(0.000)***
Both	0.261	(0.001)***	-0.236	(0.009)***	-0.162	(0.000)***	-0.151	(0.000)***
Currently breast-feeding	-0.278	(0.000)***	-0.175	(0.037)**	-0.145	(0.000)***	-0.139	(0.000)***
Partner's education								
No education (RC)	—	—	—	—	—	—	—	—
Primary	0.023	(0.837)	0.034	(0.816)	-0.044	(0.153)	-0.054	(0.087)*
Secondary	-0.021	(0.853)	0.015	(0.922)	-0.187	(0.000)***	-0.198	(0.000)***
Postsecondary	0.055	(0.694)	0.139	(0.423)	-0.055	(0.324)	-0.077	(0.178)
Desire for children								
Both want same (RC)	—	—	—	—	—	—	—	—
Husband wants more	0.092	(0.154)	0.016	(0.838)	-0.009	(0.672)	-0.013	(0.543)
Husband wants few	0.083	(0.357)	0.038	(0.718)	-0.112	(0.001)***	-0.111	(0.002)***
Male house head (RC)	—	—	—	—	—	—	—	—
Female house head (d)	-0.122	(0.144)	-0.142	(0.130)	0.038	(0.155)	0.036	(0.186)
Mortality rate	0.035	(0.824)	-0.036	(0.843)	0.446	(0.000)***	0.462	(0.000)***
Girl child (RC)	—	—	—	—	—	—	—	—

Son preference (d)	-0.037	(0.540)	0.010	(0.882)	0.068	(0.001)***	0.067	(0.001)***
Don't use contraceptives (RC)	—	—	—	—	—	—	—	—
Use contraceptives	-0.359	(0.000)***	-0.364	(0.000)***	-0.250	(0.000)***	-0.214	(0.000)***
Wealth status								
Very poor (RC)	—	—	—	—	—	—	—	—
Poor	0.175	(0.565)	-0.013	(0.967)	0.050	(0.090)*	0.043	(0.149)
Middle	0.052	(0.869)	0.131	(0.684)	0.148	(0.000)***	0.136	(0.000)***
Richer	0.301	(0.308)	0.328	(0.281)	0.220	(0.000)***	0.211	(0.000)***
Richest	0.340	(0.263)	0.408	(0.199)	0.229	(0.000)***	0.228	(0.000)***
Place of birth								
Home (RC)	—	—	—	—	—	—	—	—
Government hospital	0.212	(0.003)***	0.149	(0.090)*	0.122	(0.000)***	0.119	(0.000)***
Private hospital	0.665	(0.000)***	0.575	(0.000)***	0.272	(0.000)***	0.270	(0.000)***
Employment type								
All year (RC)	—	—	—	—	—	—	—	—
Seasonal	—	—	-0.068	(0.467)	—	—	-0.008	(0.703)
Occasional	—	—	-0.068	(0.629)	—	—	-0.203	(0.000)***
N		384		262		2834		2687
Log-likelihood		-722.07		-504.97		-6574.01		-6242.98
Pseudo R ²		158.4548		106.1498		572.0841		537.8279
df		25		27		26		28

The standard errors are given in parentheses * $p < 0.1$ ** $p < 0.05$ *** $p < 0.01$

(*) Discrete change of dummy variable from 0 to 1.

d, dummy variable.

marginal effects of the partner's desires for children (more and few) in comparison with partners who desire the same number of children increase fertility by 0.34 for partners desiring more children and decreases by 0.56 U for partners desiring fewer children in rural Uganda. Also the marginal effects for the preference of a son over a daughter as a comparison category increase fertility by 0.068 U among rural women. This finding is consistent with that of Hank and Kohler (2002). Also, the marginal effects for mortality rate increase fertility by 0.068 U among rural women while holding other variables constant. This finding is consistent with previous authors Rutenberg *et al.* (1991) and Bongaarts *et al.* (1990). Finally, the marginal effects for the occasionally working woman relative to the comparison category, working all year, reduce fertility by 0.34 U in rural Uganda. Hence, working women are associated with lower fertility.

5 CONCLUDING REMARKS

We use probit and negative binomial models to analyze the effect of a mother's education on the differences in contraceptive use and fertility among urban and rural Ugandan using UDHS (2006) data. The hypothesis that education is fundamental in increasing contraception and reducing fertility is confirmed. It is noteworthy that the effect of the partner's education on contraceptive use and fertility is less than that of women's education. Other factors significant in influencing both contraceptive use and fertility include age at first birth, place of birth, breastfeeding, mass media, partner's desire for children, ovulatory knowledge, child mortality rates, type of employment, women's say on health decision, and preference of sons over daughters, among others.

The findings suggest that efforts to increase contraceptive use and reduced fertility need to target measures that aim to educate women and to keep them in school. The government education program to educate citizens beyond primary schools will prepare women to engage in gainful employment and act as a catalyst in changing attitudes that currently favor larger family sizes. In addition, government needs to consider strong educational campaigns to educate and persuade the population to accept the benefits of small family sizes affordable to all the different social-economic groups. Also, measures need to be put in place to minimize the factors that may lead early school drop out by girls, including improving the quality of schools, teaching and ensuring that all schools have separate sanitary facilities for girls and boys.

In addition, individuals and couples need to be provided with more information and services to determine freely and responsibly the number and spacing of their children consistently with their needs, economic possibilities, and aspirations. To reduce the high levels of fertility, government needs to review age at marriage and pass legislation to increase the age at which people get married given its strong effect to lower fertility. In addition, child health and family planning services should be integrated, wherever possible, in other sectoral areas within the framework of rural and urban development programs. Special attention should be given to birth spacing and to a significant reduction of infant and child mortality, which are important determinants of fertility. Finally, it's important that policy makers need

to improve the women's social status to enable them to participate at all levels in the socioeconomic development activities of a country.

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