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YALE UNIVERSITY

Box 1987, Yale Station
27 Hillhouse Avenue
New Haven, Connecticut 06520

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A COMPARATIVE STUDY OF FERTILITY DETERMINANTS IN TOGO AND UGANDA: A HAZARD MODEL ANALYSIS

Namkee Ahn
Yale University

Abusaleh Shariff
Yale University
and
The Gujarat Institute of Development Research

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Note: Center Discussion Papers are preliminary materials circulated to stimulate discussions and critical comments. Namkee Ahn is a Postdoctoral Research Fellow and Abusaleh Shariff is a Visiting Fellow at the Economic Growth Center. Comments may be sent to Dr. Shariff, Associate Professor at the Gujarat Institute of Development Research, Gota, (Dist.) Ahmedabad - 382 481, India.

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ABSTRACT

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This paper presents a comparative study of the human fertility between Togo and Uganda using recent Demographic and Health Survey Program's data sets. Hazard models are used to estimate progression rates to the first and to subsequent births. The primary aim of this analysis is to find out the effect of socioeconomic and demographic factors on fertility and how their effects differ between the countries. The highlights of this research are as follows. (a) Substantial delay in timing of the first birth is noticed among the women living in urban areas and those who are educated beyond primary level in both countries. Besides, younger women (less than 25 years) delay their first birth compared to older women. The differentials in fertility by socioeconomic characteristics are more prominent in Togo than in Uganda. (b) In Togo mother's education shows an increasing and large negative effect on the progression to subsequent births, beginning from four years of schooling, with a big jump at 7 years of schooling, where as, in Uganda, it shows almost no effect. Considering a substantially higher level of education in Uganda than in Togo this finding is interesting. (c) Death of previous child has a large positive effect on the birth of a subsequent child, and this effect is considerably larger in Togo than in Uganda. Furthermore, the community level infant mortality in Togo shows a substantial positive effect on fertility suggesting parental concern to ensure the survival of desired number of children when faced with high mortality environment. There is a suggestion in Togo of a voluntary control of fertility among the younger, those with secondary education and living in urban areas, possibly by the use of contraception.

KEY WORDS: Fertility, Hazards Model Analysis, Parity Progression Ratios, Sub-Saharan Africa

I. INTRODUCTION

Human fertility in many contemporary African countries is relatively high when compared with the other parts of the world. Although evidence of a fall in death rate in young ages is emerging, the evidence for a decrease in fertility is not yet apparent. Modern contraceptives are rarely used and the desire for family limitation does not seem to exist. Many studies, however, highlight the role of traditional practices, such as, sexual abstinence and longer breastfeeding in inhibiting fertility from reaching the biological maximum, especially in the Sub-Saharan Africa (Caldwell and Caldwell 1981, Page and Lesthaeghe 1981). Existing differences in fertility across Sub-Saharan countries are mostly attributed to these proximate determinants (Bongaarts et al. 1990). But, very little is known about the effects of socioeconomic and demographic factors on human fertility in African countries.

Studies using most recent data indicate that a few countries in Sub-Saharan Africa may be experiencing a decline in fertility while in a few other countries fertility may be stable or increasing (Hill 1990). Togo is an example of the former and Uganda of the latter. In Togo the total fertility rate declined from 7.2 during 1977-84 to 6.2 during 1984-88 (Arnold and Blanc 1990:12). On the other hand, Uganda showed a slight increase during the same period, with the total fertility rate remaining higher than 7 per woman. Togo also records a relatively higher contraceptive use rate than Uganda. According to the DHS about 33 per cent of women aged 14-49 years in Togo reported contraceptive use (any method) at the time of interview, while the corresponding figure in Uganda was only 5 per cent.[1] Although it is still not apparent if Togo has started the fertility transition, it is helpful to know what has contributed to the recent fertility decline. The comparison between Togo and Uganda becomes more

interesting in the light of not only a larger education enrollment rate of women, but also a higher level of adult attainment of education in Uganda than in Togo. This study uses the DHS data for Togo and Uganda to investigate the determinants of childbearing and the differences, if any, between the two countries. In particular, an attempt is made to identify socioeconomic and demographic groups who might have started fertility control.

The purpose of this paper, therefore, is to answer the following questions:

1. What are the determinants of fertility in Togo and Uganda? How do they differ between countries?
2. What effect do woman's age, place of residence and her education have on the timing of first birth and progression to the subsequent birth at each parity?
3. How does the death of a previous child and the mortality environment affect the risk of births?
4. What are the determinants of the use of contraception?

II. THE DATA

The DHS program is a rich source of data on human fertility and mortality for many developing countries. The nationally representative sample surveys of 3360 women in Togo and 4730 in Uganda were undertaken during 1988-89. Information on a total of 9861 live births in Togo and 14,387 live births in Uganda is the basis of the hazard analyses undertaken in this paper.

Both Togo and Uganda are relatively small countries in the Sub-Saharan Africa. The former became independent from the French in 1960 and the latter from the British in 1962. With a population of about 3 and 15 million in 1985 they have a density of 62 and 53 persons per square kilometer respectively. Both

are predominantly rural societies (urbanization rate is lower than 20 per cent in both countries) constituting a number of region specific tribes with low levels of income. Togo's real GDP in terms of the Purchasing Power Parity (PPP) dollars was 752 and Uganda's 499 during 1989 period (UNDP 1992:135). A composite human development index computed by the UNDP is about the same, 0.218 for Togo and 0.192 for Uganda. After the so called golden years of prosperity of the 1960s, in Uganda, the civil war and political unrest during the 1970s and 1980s seems to have interrupted economic and social improvements of its people (Dodge, 1990). Both Togo and Uganda show low levels of education, particularly for women. The proportion of women without any schooling is over 70 per cent in Togo and about 50 per cent in Uganda. The life expectancy at birth is about the same at about 54 years in Togo and 52 years in Uganda (UNDP, 1992) and the under five year mortality is about 16 and 18 per cent respectively (Demographic and Health Surveys, 1991:12).

III. THE MODEL AND METHOD

Usually, the total fertility rate, mean children ever born to women or average closed birth intervals are examined as measures in fertility analyses. These are inadequate measures to understand the complexities of fertility which are determined both by spacing and stopping behaviors, through both biological and behavioral factors, such as, fecundity, breastfeeding and contraception. For example, the closed birth interval analysis cannot distinguish the spacers from stoppers. The data estimating the total fertility rate, children ever born, and birth intervals typically include women still in childbearing ages, which necessitates arbitrary assumptions on their future fertility schedule. Table 1 presents the mean duration of closed birth intervals in Togo and Uganda to

describe the data used in this analysis. The mean interval length is longer in Togo than in Uganda by about 5 months at all parities. This difference may be attributed partly to the differences in duration of breastfeeding. The mean duration of breastfeeding is recorded as 22.6 months in Togo and 18.6 months in Uganda. Secondly, in Uganda the birth intervals show small variations by education. In fact, women with 4-7 years of schooling show slightly shorter birth intervals than less educated women, suggesting shorter breastfeeding and post-natal sexual abstinence. In Togo, on the other hand, educated women show longer birth intervals at low parities than less educated women, although the difference is small and not consistent at higher parities.

(Table 1)

The ultimate fertility of a woman is determined by the age at first birth and the birth interval at each subsequent parity. First, therefore, the age at first birth is examined and then the timing of the progression to subsequent births at each parity are analyzed. The focus is on the socioeconomic and demographic factors which explain the observed fertility pattern.[2] To avoid the problem imbedded in the analysis of closed birth intervals, a procedure to incorporate open interval periods is considered. The hazard model analysis incorporates the open interval periods in the computations and thus eliminates a major limitation of the closed birth interval analysis.

In the following, the sample progression rate at each parity (PPR) is compared by women's education, place of residence, and the survival status of last child. The PPR from parity j in duration t is defined as the proportion of women who progress to parity $j+1$ by time t since the previous birth.[3] This is estimated as the complement of the Kaplan-Meier survival rate estimate (see, for example, Lawless 1982). In a discrete time framework, we can consider the sample

hazard rate at period t from the origin parity j, $h_j(t)$, as the proportion of the sample who progress to the parity $j+1$ at t^{th} period of the interval among those who had not progressed during the first $t-1$ periods. The sample survival rate by period t, $S_j(t)$, then is the product of one minus hazard rate up to the period t. The parity progression rate is just the complement of the sample survival rate, that is,

$$PPR_j(t) = 1 - S_j(t) = 1 - \prod_{k=1}^{t} [1-h_j(k)] \qquad (1)$$

This analysis includes the Kaplan-Meier estimates of the cumulative probabilities of first birth by age, as well as, the estimates of subsequent birth at durations, 20, 30, 40, 50 and 80 months, since the previous birth.

Although the sample parity progression ratios provide useful comparisons by the strata used, it only suggests bivariate relationships while the effects of other correlated variables are not controlled for. The multivariate hazard analysis is introduced in order to evaluate the effect of each of the variables of interests while controlling for all the other variables. A proportional hazard regression method introduced by Cox (1972) with Breslow (1974) modifications for tied durations of event occurrence has been chosen as the model of analyses. One advantage of the proportional hazard method is that it does not impose functional forms on the baseline hazard, therefore avoiding the potential bias arising if the imposed functional form is not true.

To undertake the hazard analysis data are rearranged. In this analysis of first birth, each woman serves as an observation, while in the analysis of subsequent births each birth is treated as an observation. The minimum age at child birth and the time of each birth are the starting points in the analyses of first birth and subsequent births respectively.[4] The hazard function at time

t is assumed to take a proportional hazard form

$$h_i(t,z_i(t)) = h_0(t)\exp(z_i(t)'\beta) \qquad (2)$$

where $h_0(t)$ is an unknown time-specific baseline hazard, $z_i(t)$ is a vector of covariates and β is the corresponding parameter vector which is unknown. The covariates included in this analysis are women's characteristics, such as age, education, place of residence; husband's education; child's age, birth order, sex, survival status and its birth as a twin.[5] The cluster level averages of infant and child mortality, incidence of diarrhea, service utilization (tetanus injection and assisted delivery), quality of housing and radio are also included as regressors to represent the community characteristics. The parameter vector β is estimated by the maximum likelihood method implemented in SAS (SAS Institute Inc., 1986). For the convenience of discussion the relative risks are computed by taking the exponent of β estimates.

IV. DETERMINANTS OF AGE AT FIRST BIRTH

As described above the age at first birth is estimated using the Kaplan-Meier method for three selected strata namely, education, age and place of residence. The fertility schedules of a total of 3360 and 4727 women in Togo and Uganda have been considered in this analysis.[6] Panel (i) in Table 2 presents the summary results of the timing of first birth by current age of woman, place of residence and education. On average, women in Uganda progress to have their first birth slightly earlier than in Togo. For example, by the age of 16 and 19 years, 12.7 and 46.3 per cent in Togo and 17.7 and 56.1 per cent in Uganda had their first child.

In both countries, however, the younger women are having their first birth at a relatively later age than those who are over 25 years old. For example, in

Togo only 8.9 per cent of those currently aged less than 25 had their first child by the time they were 16 years old, whereas 15.0 and 15.8 per cent had their first child by that age among those who now belong to the 25-34 and 35+ age groups respectively. The pattern is similar in Uganda, where the respective percentages are 12.5, 20.9 and 23.6. The figures indicate that in Togo the probability of having a first child by ages 16 and 19 years are relatively lower by 6 and 9 per cent for the younger women (15-24 years). Similarly, 3 to 4 per cent lower are the probabilities of having a first child for women in less than 25 and 35 and above age groups when compared with those in 25-34 years age group. This shift suggest that the age at marriage or unprotected sexual union is getting delayed over time. On the other hand, in Uganda, the progression ratio to the first child by age 22 reaches almost the same level for all the age groups. Ugandan women in the youngest age group who have shown a delay for first birth during early teens are apparently catching up during the late teens and early 20s.

(Table 2)

Compared to rural residents, those in urban areas in both the countries have a lower progression rate to first birth at any given age. This gap is about 17 per cent in Togo and 8 per cent in Uganda by 19 years of age. This difference persists up to the mid 20s. In Togo, by age 22, the progression rates are 81 per cent in rural and 63 per cent in urban areas, and in Uganda they are 83 and 72 per cent respectively.

Overall, education has a large and significant effect in delaying the first birth in both countries. For example, in Togo while about 15 per cent of 0-3

years educated women beget their first child by the age of 16, only 8.1 and 4.8 per cent of those who are 4-7 years and more than 7 years educated respectively, do so. However, the differentials in probability of having the first birth decreases among the first three education groups as age advances, while the women with more than 7 years of schooling maintain a considerably lower progression rate even when age increases. For example, in Togo by age 22 more than 72 per cent of women educated less than 8 years have their first birth while only 46 per cent of those educated above 7 years had their first birth by the same age. A similar pattern is observed in Uganda although the absolute level of the progression rate is higher by about 10 per cent.

Panel (ii) of Table 2 presents the effect of education by the current age group of women and rural-urban residence. Overall, the effect of all the education categories is prominent in the youngest age group, whereas, among the older age groups, the differentials between the first three education categories disappear, retaining a decisive difference only between up to 7 years and 8 and more years of education. Thus the decisive level of education to affect fertility seem to emerge only at the beginning of secondary level of education in both Togo and Uganda. It also appears that the effect of education is relatively larger in Togo than in Uganda although the overall education rates for women are higher in Uganda. It is found, however, that the effect of woman's education is similar in the rural and urban areas of Togo and Uganda. The multivariate analysis of the timing of the first birth reinforce these findings (see Table 3).

(Table 3)

V. DETERMINANTS OF RELATIVE RISKS TO SUBSEQUENT BIRTHS

Given the age at first birth, fertility is determined by the tempo of subsequent child births. Table 4 presents the Kaplan-Meier parity progression ratios by age, education, place of residence and by the survival and twin status of previous birth. In Uganda, the dominant variables affecting subsequent birth risks are biological factors. For example, the probability of having a subsequent birth by the 20^{th} month since the previous birth is 40 per cent for a woman who lost her last child within a year, compared to only 18 per cent if she did not. As expected, a twin birth reduces the risk of subsequent birth considerably;[7] the probability of having a birth by the 40^{th} month after a twin birth is 66 per cent, compared to 77 per cent after a single birth. Socioeconomic characteristics, such as woman's education and place of residence, show no significant effects in the determination of subsequent births in Uganda. In Togo, on the other hand, both education and urban residence have significant negative effects on subsequent births. For example, about 70 per cent of women with less than 4 years of schooling had next child by the 40^{th} month since last birth, compared to 57 and 47 per cent among those with 4-7 and more than 7 years of schooling respectively.

(Table 4)

As discussed earlier, the multivariate hazards estimation is required to evaluate the effect of each variable more accurately when many factors are simultaneously affecting the timing of the subsequent birth. Table 5 reports the estimation results and the relative risks of subsequent live birth by the

selected socioeconomic and demographic characteristics. The current age of women at the time of survey presents a cross-section of the age profile. This as a control variable in the regression captures the effect due to time trend caused by events, such as, development, change in tastes, and decline in traditional influences during a period. The current age is included in six five-year groups beginning from less than 20 years to 40 years and over. The relative risk among women aged over 25 does not show a variation. However, in Togo, the risk of birth is 27 and 17 per cent lower for currently teenagers and for those in the 20-25 age group, respectively, compared with those currently aged over 25. It appears that the younger women are beginning to restrict their fertility. Whether this is a secular fall in fertility is an issue to be further explored. The risk of subsequent birth reaches its maximum when the age of mother at previous birth was about 22 years in Togo and 20 years in Uganda. This variable is used as an essential control in the hazard estimations.

(Table 5)

Parental Education

Estimating the effect of mother's education on fertility is one of the priority objectives of this research. A fairly large sample size in both countries enables us to categorize education in single year dummies up to 7 years of schooling. A review of past literature suggested a strong negative relationship between each additional year of schooling with fertility (Cochrane 1983) in many parts of the world as well as in Africa (Ainsworth and Nyamete 1992).

The present analysis, however, reveals significant effects of education on fertility in Togo but not in Uganda. Although, in Togo, the first three years of schooling do not show any association, from the 4th year onward the effect is a consistent and significant fall in the birth hazard, the largest fall being about 34 per cent for those who are educated more than 7 years. The point to underscore is a fall in fertility with every additional year of schooling from 3 to 7 years, with the magnitude of 11, 1, 7 and 16 per cent, respectively. It is likely that the first few (in this case three) years of schooling are very elementary and preliminary in nature and those who are out of school before 4 years of schooling may revert back to illiteracy losing the future effect of education. Secondly, the fourth and seventh years of schooling appear to be the examination thresholds in the schooling system in Togo and, therefore, may carry over a distinct status which may get reflected in many types of behaviors including the choice of contraception and childbearing. The father's education, on the other hand, shows a significant negative effect at the level below 4 years of schooling and the magnitude is about 9 per cent. The father's education effect is complex to explain because of the confounding income effects.[8] In Uganda, mother's education shows no significant relationship, but father's education is positive and significant at 4+ and 7+ level of schooling, with a 5 and 7 per cent magnitude, respectively.

In Togo a woman's work and her living in a polygamous marriage does not affect fertility in any significant way. It may well be that wives in polygamous associations compete for childbearing and end up having similar levels of fertility. These findings have to be interpreted with caution because these variables depict current status but the fertility measured here is an aggregation of the past experience. Moreover, both work and polygamy can be treated as

endogenous generating simultaneous effects. In Uganda, a woman's work has a 6 per cent negative and significant effect on subsequent births.

Child Factors

The sex of the previous child does not seem to influence the course of subsequent birth in any way both in Togo and Uganda, thus showing no sex preference. The tempo of the progression to subsequent birth is similar at all birth orders both in Togo and Uganda. The only exception observed is in the progression from the fifth and higher birth order in Uganda, which shows a 10 per cent larger risk to subsequent birth compared with the earlier birth orders.

Twin births could affect subsequent fertility negatively in two ways: (a) the possible extended and intensive breastfeeding of twins could suppress subsequent ovulation, and (b) an unexpected birth of an additional child may retard the desire to have another child sooner. The birth of twins has large and negative effect, 26 per cent in Togo and 22 per cent in Uganda, on subsequent birth risks.

Effect of Mortality on Fertility

The effect of mortality of existing children on the risk of subsequent birth is most likely to be positive. First, the shortened duration of breastfeeding caused by the death of a previous infant may facilitate the onset of the woman's ovulation, in the absence of birth control, resulting in another birth sooner. Second, parents who have lost a child may also try to replace with another child. Indeed, in both Togo and Uganda the death of the previous child increases the risk of subsequent birth substantially. In Togo the risk of birth among women who lost the previous child within the first year is more than twice

of those whose last child is still alive. On the other hand, if a child died older than a year, the increase in the risks of subsequent birth is only 24 per cent. In Uganda, the increase in birth risks due to child mortality is 47 per cent if the death of the last child was within the first two months, 27 per cent if the death is between 3 and 12 months, and 7 per cent if the dead child was older than a year. A much larger difference in birth risks by child mortality in Togo compared with Uganda suggests that, parents in Togo are resorting to birth control relatively more efficiently than in Uganda. That is, while the increase in birth risks following child mortality may be mostly due to biological factors in Uganda, in Togo parents seems to try harder to replace a dead child presumably by altering their fertility behavior, such as by stopping their current use of contraception.

Community Factors

In addition to the individual mortality experience, the community level mortality rate is included in the regression. This measure is expected to capture the differential fertility behaviors between parents who are faced with different mortality environments. Parents in a high mortality environment would try to have another child sooner at each parity to secure the desired number of surviving children than those in a lower mortality environment. The Togo estimates supports this hypothesis. The community level infant mortality rate shows a large and significant positive effect on the probability of birth. For example, parents faced with 20 per cent community level infant mortality have 19 per cent higher risks of birth compared to those residing in a community with zero per cent infant mortality. However, it is fair to say that the effect of community level mortality might be picking up the effect due to omitted variables

which are correlated with both mortality and fertility. For example, hospitals or health clinics present in a community are likely to lower the mortality rate in the community while also to provide family planning services. In this case, the effect of access to contraception on fertility is compounded in the effect of mortality, leading to an overestimation. However, in this paper the community level prenatal care, such as the proportion of children who had tetanus injections and the proportion of children delivered by trained persons, are expected to correct this bias to some extent.

The community level child mortality does not show a significant effect in Togo. In Uganda, on the other hand, the community level child mortality shows significant but negative effect while infant mortality is not significant at all. Considering that the use of birth control in Uganda in general is low, this suggests the existence of some unknown factors (which take different values across communities) which affect fertility and are correlated with the mortality environment. The exploration of this issue is outside the scope of the DHS data and thus this paper. Other community level variables, such as, the proportion of radio ownership, cement floor housing, and prenatal child care did not show any effect on fertility in both Togo and Uganda.

Owning a radio at household level also does not show any significant effect in Togo, but in Uganda it has significant positive effect (12 per cent) on birth risks. The radio ownership might be picking up the income effect. This issue also needs further investigation. Urban residence is expected to have a negative effect on fertility. A lower value (higher costs) of children in urban areas, weakened traditional practices (such as, postpartum abstinence), and easier access to and lower cost of birth control could be the main contributors in reducing the fertility rate in urban areas. Both countries show expected

results: urban residence reduce the birth risk by 15 per cent in Togo and 12 per cent in Uganda. Table 5 also contain coefficients by the geographic regions within a country. There is considerable variation among the regions, however, these variables are included as essential control in this analysis. The interaction effect of education with place of residence are estimated in a separate regression (not reported). They were not significant in either countries indicating the similar effect of education on fertility in both urban and rural areas.

VI. CONTRACEPTIVE USE

The previous two sections suggest a wider use of birth control, and larger differentials in the use between different education groups and between urban and rural areas in Togo than in Uganda. In support of these findings this section presents the data on ever use of contraceptive methods by current age of woman, place of residence and education for Togo and Uganda. Overall the ever use rate of any methods in Togo is about 66 per cent and 16 per cent for modern contraceptives. In Uganda the ever use rate is only 23 per cent and 10 for modern contraceptives. The main difference between the two countries as shown in Table 6 is that Togo has a much larger percentage of women reporting practice of traditional methods than that in Uganda (56 per cent in Togo as opposed to only 14 per cent in Uganda).

(Table 6)

The use pattern of both traditional and modern methods by age, place of residence and education are similar in both countries. There is no major

difference in the level of practice by age groups within countries. However, younger women may record a higher proportion of ever use given the same duration of exposure. The differential in ever use rate of modern contraception by place of residence is substantial in both countries. Evidence suggests that women in urban areas are practicing modern contraception in increasing proportions thus lowering their levels of fertility. This lends credence to the discussion on Table 5 where the relative risk of child birth in urban areas in both Togo and Uganda are significantly lower than the rural areas.

A similar pattern emerges with respect to woman's education; a significant and large jump in practice of modern contraception occurs at 8 years of schooling. Thus women who are educated beyond the primary level and those living in urban areas are the innovators as far as use of contraception and reduction of fertility rates are concerned. The differentials by education have been found to be almost the same in both the rural and urban areas in both countries.

Although the level of modern contraception is similar in both the countries, there is evidence of a decline in fertility only in Togo and not in Uganda. This difference can be explained by the sheer difference in the level of use of traditional methods or more efficient contraceptive use in Togo than in Uganda.

VII. SUMMARY AND CONCLUSIONS

A comparative study of fertility transition in Togo and Uganda is presented in this paper. Recent data from the DHS Program are used for this analysis. A hazard model is appropriate to analyze (i) the determination of the timing of first birth and (ii) the timing of subsequent births. The primary aim

of this research is to investigate the effect of socioeconomic and demographic factors on fertility and how their effects differ between the two countries.

This analysis indicates a substantial delay in timing of the first birth among women who are younger than 25 years, living in urban areas, and those who are educated beyond the primary level. Similar associations were found in the case of the timing of subsequent births. In addition, the death of a previous child has a large and positive effect on the birth of a subsequent child, this effect is considerably larger in Togo than in Uganda. There is a suggestion of a voluntary control of fertility in Togo, possibly by the use of contraception. Uganda seems to be lagging in this regard. Interestingly, the community level of infant mortality in Togo has a substantial positive effect on fertility, suggesting a concern of parents facing high mortality environment to ensure survival of a minimum desired number of children.

Women's education and place of residence in Togo show a relatively greater effect in determining the timing and tempo of child births than in Uganda. In both countries, however, the younger women, those living in urban areas and educated beyond seven years of schooling are beginning to show delays in their first childbearing. A similar pattern is found in the case of the timing of subsequent births, but the effect of education is marginal in Uganda, while it is substantial in Togo.

It is often emphasized that fertility differentials in many Sub-Saharan African countries are largely due to the variations in the birth-inhibiting proximate variables, such as, age at marriage, sterility, duration of breastfeeding and practice of sexual abstinence. But our analysis of the recent data highlights a substantial fertility inhibiting effect emanating from the socioeconomic factors in Togo. In Togo women's education and urban residence

shows substantial negative effect on the risk of birth at all parities while these variables do not show effects in Uganda. This interpretation is supported by the corresponding differences in contraceptive use (both modern and traditional) across the education and residence groups between the countries. It seems that a fertility transition led by women who are educated and those in urban areas is taking place in Togo, whereas Uganda has yet to show the signs of a transition.

END NOTES

1.Only 3 per cent of all couples or about 10 per cent users were using modern contraceptives in Togo (Agounke et.al., 1989:45-47). In Uganda the current use of any method was only 5 per cent, 50 per cent of whom were using modern methods. This constitute only 2.5 per cent of all women in the sample in Uganda (Kaijuka et. al., 1989:34).

2. A familiar approach to fertility study is to examine the determinants of the proximate variables (Bongaarts and Potter, 1983). This method investigates the determinants of proximate variables which in turn decide the fertility outcome. However, this approach requires detailed information about the proximate variables such as age at entry to sexual union, marriage, sterility, foetal loses, breastfeeding, amenorrhea, sexual abstinence and contraception. Such data are sparse and also subject to measurement and reporting errors.

3. Patity j can take a value of zero, thus $j+1$ will represent the first birth of a woman.

4. Different individual women reach the reproductive capacity at different ages. Since data on the timing of the onset of childbearing capability is not available, this aspect is not discussed in the subsequent analysis. However, if this unobserved characteristic is not randomly distributed in population with respect to the covariates included in the regression, the coefficients may compound the effect of the unobserved factor.

5. Husband's education and the previous child characteristics are not used in the analysis of timing of the first birth.

6. In this analysis no effort has been made to identify and exclude the sterile women from computations. It is assumed that sterility is randomly distributed independent of other included covariates and, therefore, its non-exclusion is not expected to affect the interpretations and conclusions of this paper.

7. All the multiple births are included here. However, twin births represent more than 90 per cent of all multiple births in both countries.

8. It is normally observed that adult male education and household income are positively correlated. Therefore, if the income is not controlled in the estimation, it is likely that the coefficient of husband's education compounds the effect of income as well.

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Table 1: Average Closed Birth Interval (months) by Women's Education in Togo and Uganda

Parity	Education level				All
	None	1-3 yrs.	4-7 yrs.	8+ yrs.	
			TOGO		
1 to 2	34.99 (1434)	36.35 (162)	36.84 (298)	42.92 (118)	37.50 (2012)
2 to 3	34.06 (1223)	33.04 (120)	37.28 (208)	35.95 (62)	36.26 (1613)
3 to 4	33.64 (1020)	34.03 (92)	38.17 (144)	34.29 (35)	35.64 (1291)
4 to 5	35.87 (842)	33.72 (67)	37.63 (99)	51.00 (20)	39.95 (1028)
5 to 6	33.31 (622)	34.30 (50)	34.53 (58)	33.50 (8)	34.82 (738)
6 to 7	34.33 (452)	40.79 (29)	35.71 (41)	51.67 (3)	36.64 (525)
7 to 8	34.51 (293)	31.69 (16)	29.18 (17)	47.00 (2)	39.18 (328)
8 to 9	34.31 (183)	30.40 (10)	35.75 (8)	---	34.04 (201)
All	34.43 (6069)	34.71 (546)	36.89 (873)	40.52 (248)	34.92 (7736)
			UGANDA		
1 to 2	30.14 (1132)	30.44 (475)	29.72 (870)	30.48 (268)	30.09 (2745)
2 to 3	30.47 (995)	30.19 (392)	28.14 (688)	28.37 (187)	29.54 (2262)
3 to 4	29.95 (845)	28.56 (323)	28.01 (545)	28.95 (130)	29.06 (1843)
4 to 5	30.49 (727)	29.23 (251)	29.30 (432)	29.95 (96)	29.90 (1506)
5 to 6	29.92 (583)	30.13 (149)	28.77 (327)	28.48 (71)	29.55 (1180)
6 to 7	32.56 (474)	30.72 (149)	28.72 (238)	30.95 (40)	31.17 (901)
7 to 8	30.29 (336)	32.28 (105)	30.38 (165)	28.48 (23)	30.58 (629)
8 to 9	29.78 (235)	29.04 (72)	31.53 (97)	31.62 (13)	30.12 (417)
All	30.40 (5327)	29.68 (1966)	28.99 (3362)	29.52 (828)	29.80 (11483)

Note: Figures in parentheses are the number of births.

Table 2: Kaplan-Meier Estimates of Probability to have a First Birth in Togo and Uganda

		TOGO					UGANDA				
			Probability of first birth by age					Probability of first birth by age			
		N	16	19	22	24	N	16	19	22	24
Panel (i): PPRs to parity one by age, place of residence and education											
All	All	3360	12.7	46.3	74.7	84.7	4727	17.7	56.1	80.7	87.8
Age at Survey	15-24	1385	8.9	42.4	74.4	82.6	3657	12.5	52.2	80.2	88.1
	25-34	1099	15.0	51.1	77.4	86.4	1476	20.9	58.9	81.8	88.7
	35-49	876	15.8	45.4	72.8	84.1	1070	23.6	59.2	81.6	87.8
Residence	Rural	2178	14.7	52.3	80.8	88.5	3763	18.3	57.7	82.7	89.1
	Urban	1182	9.1	35.0	62.5	77.0	964	15.1	49.7	72.4	82.1
Education	0 yr	1971	15.2	51.3	79.1	88.0	1631	22.9	59.2	83.1	89.2
	1-3 yrs	343	15.5	46.4	72.1	79.3	801	19.4	62.4	84.9	91.4
	4-7 yrs	731	8.1	41.7	75.8	86.7	1692	16.1	58.8	84.4	89.3
	8+ yrs	315	4.8	24.2	45.9	62.9	603	5.6	32.3	58.1	74.3
Panel (ii): PPRs to parity one by education for each age and residence group											
Age at Survey: 15-24	All	1385	8.9	42.4	74.4	82.6	3657	12.5	52.2	80.2	88.1
	0 yr	574	12.7	53.5	85.2	88.1	486	19.1	61.9	87.4	91.3
	1-3 yrs	197	9.4	40.4	72.8	76.6	379	14.0	60.4	89.5	93.9
	4-7 yrs	457	6.1	38.5	76.0	89.7	968	11.6	54.4	84.1	88.7
	8+ yrs	157	2.0	17.7	39.0	54.1	348	4.2	26.2	57.8	76.6
Age at Survey: 25-34	All	1099	15.0	51.1	77.4	86.4	1476	20.9	58.9	81.8	88.7
	0 yr	690	16.5	56.5	82.5	90.3	550	23.3	58.2	82.9	90.0
	1-3 yrs	94	21.3	46.8	72.3	81.9	250	24.4	65.2	83.6	90.4
	4-7 yrs	184	10.9	47.3	81.0	87.5	482	22.2	64.3	86.5	91.1
	8+ yrs	131	8.4	31.3	49.6	67.2	194	6.2	39.2	64.4	76.8
Age at Survey: 35-49	All	876	15.8	45.4	72.8	84.1	1070	23.6	59.2	81.6	87.8
	0 yr	707	15.8	45.3	73.7	85.0	595	25.6	59.2	81.9	87.6
	1-3 yrs	52	26.9	64.4	76.9	80.8	172	23.3	62.8	83.3	91.3
	4-7 yrs	90	12.2	43.3	76.0	85.6	242	21.9	62.0	84.3	88.8
	8+ yrs	27	3.7	22.2	51.9	63.0	61	11.5	37.7	60.7	75.4
Rural	All	2178	14.7	52.3	80.5	88.5	3763	18.3	57.7	82.7	89.1
	0 yr	1528	16.2	54.3	81.9	89.8	1502	21.6	59.6	83.5	89.5
	1-3 yrs	204	15.4	50.3	74.6	79.0	702	18.7	62.2	84.8	91.5
	4-7 yrs	352	10.1	49.5	85.5	92.7	1326	15.1	57.2	83.8	88.7
	8+ yrs	94	5.6	33.5	58.0	66.4	233	6.1	35.6	63.9	80.7
Urban	All	1182	9.1	35.0	62.5	77.0	964	15.1	49.7	72.4	82.1
	0 yr	443	11.8	41.1	69.6	81.8	129	22.8	55.3	77.2	84.5
	1-3 yrs	139	15.8	40.4	68.2	80.4	99	23.6	64.6	86.8	90.6
	4-7 yrs	379	6.2	34.0	65.3	80.2	366	20.0	64.7	86.5	91.4
	8+ yrs	221	4.6	20.4	41.1	61.1	370	5.2	30.4	54.9	70.9

Note: χ^2-statistics are obtained by taking twice the difference in log-likelihood between the unrestricted and the restricted model. The restricted model estimates progression rates to first birth for the total sample for each strata. Therefore, the statistics can be used as tests of the equality in progression rates across all the subgroups within each stratus. In all cases, chi-square statistics (not reported) are significant at less than 1% level.

Table 3: Hazard Estimation of Age at First Birth in Togo and Uganda

	TOGO			UGANDA		
	Mean (std.)	Beta (Chi-sq.)	Rel. Risk	Mean (std.)	Beta (Chi-sq)	Rel. Risk
Woman's age at survey:						
< 24	0.41 (0.49)	0.03 (0.22)	1.03	0.46 (0.50)	-0.06 (1.42)	0.95
25-34	0.33 (0.47)	0.19 (15.5)	1.21	0.31 (0.46)	0.10 (6.08)	1.11
35+	0.26 (0.44)	reference	1.00	0.23 (0.42)	reference	1.00
Woman's education:						
None	0.59 (0.49)	reference	1.00	0.34 (0.48)	reference	1.00
1-3 year	0.10 (0.30)	-0.10 (1.72)	0.91	0.17 (0.38)	0.04 (0.63)	1.04
4-6 years	0.19 (0.39)	0.03 (0.23)	1.03	0.26 (0.44)	-0.02 (0.19)	0.98
7-9 years	0.07 (0.26)	-0.35 (12.3)	0.71	0.15 (0.35)	-0.22 (14.3)	0.80
10+ years	0.05 (0.21)	-0.72 (43.4)	0.48	0.07 (0.26)	-0.96 (128.)	0.38
Community Characteristics (%):						
Own radio[a]	0.52 (0.26)	-0.33 (5.70)	0.72	0.34 (0.26)	-0.30 (6.23)	0.74
Cement Floor[a]	0.96 (0.10)	-0.12 (0.24)	0.89	0.21 (0.31)	0.02 (0.03)	1.02
Tetanus Inject.[b]	0.75 (0.22)	0.37 (8.51)	1.44	0.58 (0.22)	-0.08 (0.63)	0.92
Trained Delivery[b]	0.51 (0.33)	-0.22 (4.05)	0.80	0.42 (0.31)	0.46 (19.4)	1.58
Diarrhea[b]	0.29 (0.14)	0.11 (0.41)	1.12	0.25 (0.14)	-0.07 (0.26)	0.94
Infant Mortality[b]	0.09 (0.05)	-0.33 (0.44)	0.72	0.10 (0.04)	0.36 (0.84)	1.44
Child Mortality[b]	0.09 (0.05)	0.46 (1.03)	1.58	0.08 (0.04)	1.03 (4.50)	2.81
Urban	0.35 (0.48)	-0.14 (4.34)	0.87	0.20 (0.40)	-0.00 (0.00)	1.00
Region 1	0.45 (0.50)	-0.43 (25.8)	0.65	0.03 (0.18)	-0.14 (1.12)	0.87
Region 2	0.23 (0.42)	-0.21 (5.51)	0.81	0.18 (0.39)	0.02 (0.03)	1.02
Region 3	0.09 (0.29)	0.01 (0.01)	1.01	0.29 (0.46)	0.05 (0.27)	1.05
Region 4	0.12 (0.33)	-0.16 (2.63)	0.85	0.04 (0.18)	0.10 (0.61)	1.10
Region 5	0.11 (0.32)	reference	1.00	0.34 (0.47)	-0.22 (5.27)	0.80
Region 6				0.11 (0.31)	reference	1.00
N		3360			4727	
Log-likelihood		-17863			-26671	

[a]: The proportion of household in each village cluster.
[b]: The proportion of births in each village cluster.

Table 4: Kaplan-Meier Parity Progression Ratios to Subsequent Birth in Togo and Uganda

Strata			Months since last birth					χ^2-stat.
			20	30	40	50	80	
				TOGO				
Age	< 20	2333	0.13	0.39	0.67	0.81	0.93	117.14
	20-24	5400	0.13	0.41	0.70	0.83	0.93	
	25-34	1360	0.10	0.34	0.60	0.75	0.88	
	35-49	798	0.08	0.27	0.47	0.59	0.69	
Education	0	7499	0.13	0.40	0.69	0.81	0.92	86.74
	1-3	721	0.09	0.40	0.68	0.81	0.91	
	4-7	1263	0.09	0.34	0.57	0.73	0.88	
	8+	408	0.08	0.29	0.49	0.62	0.76	
Residence	urban	2502	0.13	0.41	0.69	0.82	0.93	64.08
	rural	7389	0.09	0.34	0.59	0.72	0.86	
Last child dead	no	9033	0.09	0.36	0.65	0.79	0.91	114.73
	yes	858	0.44	0.71	0.83	0.89	0.93	
Last child twin	no	9661	0.12	0.39	0.67	0.80	0.91	1.87
	yes	230	0.13	0.35	0.54	0.73	0.90	
				UGANDA				
Age	< 20	4226	0.21	0.61	0.79	0.86	0.93	195.51
	20-24	7892	0.21	0.61	0.79	0.87	0.94	
	25-34	1640	0.15	0.49	0.70	0.79	0.88	
	35-49	714	0.11	0.42	0.57	0.64	0.71	
Education	0	6523	0.20	0.59	0.77	0.85	0.92	5.06
	1-3	2501	0.18	0.58	0.77	0.86	0.92	
	4-7	4329	0.20	0.60	0.78	0.85	0.93	
	8+	1119	0.21	0.58	0.73	0.81	0.91	
Residence	urban	2296	0.22	0.57	0.73	0.81	0.89	11.99
	rural	12176	0.19	0.59	0.78	0.86	0.93	
Last child dead	no	13109	0.18	0.58	0.77	0.85	0.92	33.43
	yes	1363	0.40	0.71	0.82	0.86	0.92	
Last child twin	no	14284	0.20	0.59	0.77	0.85	0.92	4.54
	yes	188	0.17	0.49	0.66	0.79	0.88	

Note: 1. χ^2-statistics are obtained by taking twice the difference in log-likelihood between the unrestricted and the restricted model. The restricted model estimates parity progression rates for the total sample for each. Therefore, the statistics can be used as tests of the equality in progression rates across all the subgroups within each stratus.

2. All births recording birth order higher than ten have been excluded from this analysis.

Table 5: Hazard Estimation of the Progression to Subsequent Birth in Togo and Uganda

	TOGO			UGANDA		
	Mean	Beta (Chi-sq.)	Rel. Risk	Mean	Beta (Chi-sq.)	Rel. Risk
Woman's age at survey:						
< 20 yr	0.01	-0.31 (2.69)	0.73	0.02	-0.29 (8.44)	0.74
20-24 yr	0.08	-0.19 (10.1)	0.83	0.11	-0.25 (35.0)	0.78
25-29 yr	0.17	-0.02 (0.29)	0.98	0.21	-0.12 (15.2)	0.89
30-34 yr	0.21	0.01 (0.03)	1.01	0.20	-0.14 (23.5)	0.87
35-39 yr	0.20	-0.00 (0.01)	1.00	0.19	-0.06 (5.41)	0.94
40 yr and over	0.33	reference	1.00	0.27	reference	1.00
Age at prev. birth	25.01	0.14 (68.5)	1.15	23.86	0.11 (58.1)	1.12
Age at prev. birth^2	665.4	-0.00 (105.)	1.00	603.75	-0.00 (104.)	1.00
Polygamous marr.	0.53	-0.01 (0.22)	0.99	0.28	-0.03 (1.46)	0.97
Own Radio	0.46	0.03 (1.67)	1.03	0.28	0.12 (23.1)	1.12
Currently working	0.78	-0.01 (0.04)	0.99	0.12	-0.06 (3.93)	0.94
Woman's education:						
None	0.76	reference	1.00	0.45	reference	1.00
1 year	0.01	0.03 (0.08)	1.03	0.02	-0.02 (0.13)	0.98
2 years	0.03	-0.03 (0.20)	0.97	0.07	-0.06 (2.07)	0.95
3 years	0.03	0.01 (0.01)	1.01	0.09	-0.02 (0.28)	0.98
4 years	0.03	-0.11 (2.56)	0.89	0.08	0.02 (0.47)	1.03
5 years	0.03	-0.12 (2.89)	0.88	0.07	-0.01 (0.09)	0.99
6 years	0.06	-0.20 (12.2)	0.82	0.08	-0.01 (0.03)	0.99
7 years and above	0.04	-0.42 (32.3)	0.66	0.08	-0.02 (0.15)	0.98
Husband's education:						
None	0.52	reference	1.00	0.20	reference	1.00
1-3 years	0.17	-0.09 (6.60)	0.91	0.12	-0.04 (1.26)	0.96
4-7 years	0.18	-0.03 (0.74)	0.97	0.29	0.05 (3.34)	1.05
7 years and above	0.13	-0.05 (1.30)	0.95	0.38	0.07 (6.16)	1.07
Previous child characteristics:						
Girl	0.49	-0.00 (0.02)	1.00	0.50	0.02 (1.52)	1.02
1st birth	0.24	reference	1.00	0.23	reference	1.00
2nd birth	0.20	0.04 (1.52)	1.04	0.19	0.04 (1.36)	1.04
3rd birth	0.16	0.04 (0.92)	1.04	0.15	0.06 (3.05)	1.06
4th birth	0.13	-0.00 (0.00)	1.00	0.13	0.05 (1.58)	1.05
5th+ birth	0.27	0.07 (1.69)	1.07	0.31	0.10 (5.57)	1.10
Twin	0.02	-0.30 (14.6)	0.74	0.01	-0.25 (28.4)	0.78
Mortality of previous child:						
0-2 mths	0.05	0.70 (202.)	2.02	0.06	0.39 (92.5)	1.47
3-11 mths	0.03	0.75 (143.)	2.11	0.04	0.24 (23.4)	1.27
12 mths and above	0.10	0.22 (33.6)	1.24	0.09	0.07 (4.22)	1.07
Alive	0.82	reference	1.00	0.81	reference	1.00
Community Characteristics (%):						
Own radio[a]	0.47	-0.06 (0.56)	0.94	0.31	-0.06 (0.78)	0.94
Cement Floor[a]	0.95	0.02 (0.04)	1.02	0.17	-0.01 (0.01)	0.99
Tetanus Inject.[b]	0.72	0.00 (0.00)	1.00	0.56	-0.02 (0.15)	0.98
Trained Delivery[b]	0.46	0.03 (0.15)	1.03	0.39	-0.09 (2.03)	0.92
Diarrhea[b]	0.30	0.03 (0.09)	1.03	0.25	-0.03 (0.18)	0.97
Infant Mortality[b]	0.09	0.85 (8.56)	2.34	0.10	-0.29 (1.55)	0.75
Child Mortality[b]	0.09	0.07 (0.08)	1.08	0.09	-0.63 (5.20)	0.53
Urban	0.25	-0.16 (17.5)	0.85	0.16	-0.12 (6.60)	0.88
N		9861			14387	
Log-likelihood		-63220			-99881	

[a]: The proportion of household in each village cluster. [b]: The proportion of births in each village cluster.

Note: A covariate namely 'region' (not presented in the table) is included in this regression as an essential control variable.

Table 6: Ever Use of Contraceptive Methods in Togo and Uganda According to the Respective DHS Surveys

	Togo		Uganda	
	Traditional Methods	Modern Methods	Traditional Methods	Modern Methods
All	55.9	10.7	13.6	9.6
(i) By woman's current age				
Less than 25 years	40.9	10.1	12.2	6.9
25-34 years	65.7	12.4	15.6	13.5
35 years and over	67.1	9.5	13.7	10.0
(ii) By place of residence				
Rural	61.5	6.4	12.9	6.9
Urban	45.5	18.5	16.3	30.3
(iii) By woman's education				
No Education	62.1	5.0	8.7	2.5
1-3 years	47.2	11.4	13.1	4.5
4-7 years	47.6	15.9	17.6	9.9
8 years and above	45.7	33.3	16.2	35.3