

Using the Bongaarts model in explaining fertility decline in Urban areas of Uganda

By

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Abstract

The general objective of the study was to explain factors influencing fertility decline in urban areas while it has remained a constant and high in the rural areas of Uganda for over a half a century.

Fertility in Uganda is quite high and on average it has been consistently above 6 children between 1948 and 2002 (UBOS, 2005). Uganda's TFR of 6.9 is among the highest TFR in Africa and the world. To be more precise the 5th in Africa and the 6th in the world behind Niger (7.1), Guinea Bissau (7.1) Angola and Liberia (6.8) and East Timor (7.0) (World Population Chart, 2007). The current UDHS (2007) has put TFR at 6.7 (UBOS and Macro, 2007). Several surveys have established that fertility in urban areas is lower than the fertility in rural areas all over the world (World Fertility Survey 2005). For instance; Egypt's TFR is 3.0 and 3.8 urban and rural areas respectively; Ethiopia 3.3 in urban and 6.4 in rural areas; similarly in Uganda it is 4.0 and 7.4 in urban and rural areas respectively. Decline in fertility is more noticeable in urban areas than in rural areas. Over the inter-survey period, fertility in urban areas decreased from 5.0 to 4.0 while that in the rural areas just increased from 7.1 to 7.4 (UDHS 2001). Irrespective of a woman's age, Total Fertility Rate (TFR) is lower in urban areas than in rural areas.

This paper is re-analysis of the 1995 and 2001 Uganda demographic and health surveys. These were national surveys covering about ninety five percent of all the districts of Uganda except for a few in Western and Northern Uganda due to insecurity in these places at the time. The datasets used were from the woman questionnaire. A total of 2439 eligible females in 1995 and 2416 in 2001 were interviewed in urban areas of Uganda and they made up the sample for this study. The variables selected included: age structure, educational level, religion, occupation status, region, contraceptive use, breastfeeding, proportion married (Marital status) and age at first marriage.

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The Bongaarts and Porter (1983) aggregate model was used. This model was selected because it quantifies the contribution of each proximate determinant of fertility. Details of the model explained fully in the paper.

It was possible to explain the factors that have lead to fertility decline in urban areas of Uganda between the two inter-survey periods using the Bongaarts and Porter (1983). The model established that the change in the proportion married and postpartum infecundability due to breastfeeding had the greatest inhibiting effect on fertility in urban areas of Uganda. Contraception use contributes the least. It was established that there were wide variations in the degree of influence of the socio-economic factors that operate through the proximate determinants in influencing fertility. The most influencing socio-economic variables are education, religion and occupation.

It is recommended that promotion of contraceptive use, prolonged breastfeeding habits, female education hence employment and general reproductive health education are important if the fertility in Uganda is to decrease.

Background to the study

Several surveys have established that fertility in urban areas is lower than the fertility in rural areas all over the world (World Fertility Survey 2005). For instance; Egypt's fertility is 3.0 in urban areas and 3.8 in rural areas; Ethiopia has a TFR of 3.3 in urban areas and 6.4 in rural areas; Kenya's fertility is 3.1 in urban areas and 5.1 in rural areas, and Uganda's TFR is 4.0 in urban areas and 7.1 in rural areas (EDHS 2001, EDHS 2000, KDHS 2004 and UDHS 2001). In general, fertility in Uganda is quite high and on average it has been consistently above 6 children since 1948 to 2002 (UBOS, 2005). Uganda's TFR of 6.9 is among the highest Total Fertility Rates in Africa and probably in the world. However Uganda's urbanization level is estimated at 12 percent indicating that majority population in the country lives in rural areas (UBOS, 2005).

Uganda is experiencing a high Total Fertility Rate of over 6.9, which is considered to be contributing to the country's high population growth rate of 3.3 percent per annum. The Uganda Demographic and Health Surveys of 1995 and 2001 indicate that fertility in rural areas increased and is higher than fertility in urban areas. However the Uganda Demographic and Health Survey reports of 1988, 1995 and 2001 indicate that fertility in urban areas of Uganda is steadily declining.

The three previous UDHS showed that fertility in urban areas of Uganda was 5.7 in 1988 Ministry of Health (1989), which reduced to 5.0 in 1995 Ministry of Finance Planning and Economic Development (1996) and eventually reduced to 4.0 in 2001 (UBOS, 2001). This shows that women in urban areas of Uganda experience some unique factors, which are not experienced by their rural counterparts.

Objective of the study

The objective of the study was to find out what are factors that influencing fertility decline in the urban areas of Uganda when overall fertility in the country remain high and constant. Specifically, the study tried to:

1. To establish the extent to which the change in proximate determinants; proportion married, age at first marriage, contraception and postpartum infecundability promoted fertility decline in urban areas of Uganda.
2. To investigate the role of the selected socio-economic variables in influencing proximate variables.

Data Sources

The sources of data used were the Uganda demographic and Health surveys of 1995 and 2001. A total of 2439 eligible females in 1995 and 2416 in 2001 were interviewed in urban areas of Uganda and they made up the sample for this study. It should be noted that in terms of regional variation, most of the urban population was enumerated in Kampala district which geographically is equivalent to Kampala city. The variables selected included: age structure, educational level, religion, occupation status, region, contraceptive use, breastfeeding, proportion married (Marital status) and age at first marriage. One important variable was not captured by these dataset namely abortion.

Methodology

The following section presents a detailed analysis of a fertility differential model that quantifies the negative and positive effects of each of the socio-economic and cultural factors on fertility through various intermediate fertility variables. For illustration, the model is used to explain the observed socio-economic differentials in fertility during the 1995 and 2001 Uganda and Demographic survey among the urban women of reproductive age.

The Bongaarts fertility differential Model

The following equations summarize the basic structure of the Bongaarts' model by relating the fertility measures to the proximate determinants.

$$TFR = C_m \times C_c \times C_a \times C_i \times TF \quad (1)$$

$$TM = C_c \times C_a \times C_i \times TF \quad (2)$$

$$TN = C_i \times TF \quad (3)$$

Where

TFR is the total fertility rate,

TM is the total marital fertility rate

TN is the total natural marital fertility rate,

TF is the total fecundity rate

and C_m , C_c , C_a and C_i are the indices of marriage, contraception, induced abortion, and postpartum fecundability respectively. The indices can only take values between 0 and 1. When there is no fertility-inhibiting effect of a given intermediate fertility variable, the corresponding

index equals 1, if the fertility inhibition is complete, the index equals 0. These indices can be estimated from measures of the proximate variables and these estimates are given below

Estimation of the index of marriage (C_m)

The index of marriage measures the inhibiting effect of marriage on fertility in the population. It has to be noted that the higher the level of marriage in the population the less the inhibiting effect and the reverse is true. The index of marriage is estimated using the formula;

$$C_m = \sum m(a)g(a) / \sum g(a)$$

Where C_m = Index of marriage. $m(a)$ = Age specific proportions of married females, $m(a)$ is got by dividing the number of married women of a particular age group by the number of women in the same age group.

$g(a)$ = Age specific marital fertility rates, $g(a)$ is got by dividing the births of a particular age group by the number of women in the same age group. For instance Table 2.1 below shows the estimation of the index of marriage.

Estimation of the index of contraception (C_c)

The index of contraception in the model measures the inhibiting effect of contraception on fertility in the population. The higher the level of contraception in the population, the higher the inhibiting effect due to contraception and the lower the level of contraception the lower the inhibiting effect. The index of contraception is estimated using the formula;

$$C_c = 1 - 1.08 * u * e$$

Where u = Proportion using contraception among married women of reproductive age (15-49 years). e = Average use effectiveness of contraception. The coefficient 1.08 represents an adjustment for the fact that women do not use contraception if they know that they are sterile. The indices of use effectiveness proposed for particular contraceptives are; pill = 0.90, IUD = 0.95, sterilization = 1.00 and others = 0.70 (Bongaarts, 1983).

Estimation of the index of abortion (C_a)

The index of abortion measures the inhibiting effect of abortion on fertility in the population. In this study the index of abortion was set at 1.0 due to lack of data. The index of abortion is estimated using the formula below;

$C_a = \frac{TFR}{TFR + b * TA} = \frac{TFR}{TFR + 0.4 * (1 + u) * TA}$ Where u = Prevalence contraceptive use. b = Average number of births averted per induced abortion and $b = 0.4 (1 + u)$. $b = 0.4$ when $u = 0$ and $b = 0.8$ when $u = 1.0$. TA = Total abortion (Average number of induced abortions per woman at the end of the reproductive period if induced abortion rates remains at prevailing levels throughout the reproductive period. $C_a = 1.0$ if the TA is 0. Therefore the Total Abortion rate in this study is 1.0.

Estimation of the index of postpartum infecundability (C_i)

The index of postpartum infecundability measures the inhibiting effect of breastfeeding or abstinence on fertility in the population. The index of postpartum infecundability in the model is estimated using the effect of breastfeeding (lactation amenorrhea) or postpartum abstinence. The ratio of natural fertility in the presence and absence of postpartum infecundability therefore equals the ratio of the average birth interval without and with postpartum infecundability. If no breastfeeding and postpartum abstinence are practiced, the birth interval averages about 20 months, which is the sum of;

- i) 1.5 months of minimum postpartum anovulation.
- ii) 7.5 months of waiting time to conception.
- iii) 2 months of time added by spontaneous intrauterine mortality.
- iv) 9 months for a full term pregnancy.

Bongaarts and Potter (1983) states that, in the presence of breastfeeding and postpartum abstinence, the average birth interval equals approximately 18.5 months (7.5 + 2 + 9) plus the duration of postpartum infecundability. The index of postpartum infecundability (C_i) is estimated as;

$$C_i = \frac{20}{18.5 + i}$$

Where C_i = The index of postpartum infecundability. i = Average duration of postpartum infecundability caused by breastfeeding or postpartum abstinence. In this study, the index of postpartum infecundability was estimated using the mean duration of breastfeeding and this was obtained from a question, which aimed at establishing the duration the most recent child was breastfed.

Determinants of fertility

In this study, the Total Fertility Rates in urban areas of Uganda were estimated to identify the factors fuelling fertility decline in urban areas of Uganda. The indices for marriage, contraception and postpartum infecundability were estimated and the results are presented in Table 1 below. Using the model with the observed total fecundity (TF) of 15.3, the total fertility rate in urban areas of Uganda in 1995 was 5.9 and 5.3 in 2001 as shown in Table. The results confirmed that fertility in urban areas of Uganda is steadily declining. The index of abortion in the model was set at 1.0 due to lack of data as recommended by (Bongaarts, 1983).

Table 1 Estimated Indices of the Proximate Determinants and Total Fertility Rates of the selected variables over the survey periods

YEAR/ VARIABLES	INDICES OF PROXIMATE DETERMINANTS					TFR
	C_m	C_c	C_a	C_i	TF	
1995	0.631	0.971	1.0	0.623	15.3	5.9
Urban						
Education						
No education	0.687	0.872	1.0	0.628	15.3	5.7
Primary	0.644	0.961	1.0	0.615	15.3	5.8
Secondary+	0.586	0.896	1.0	0.519	15.3	4.2
Religion						
Catholic	0.640	0.948	1.0	0.632	15.3	5.9
Protestant	0.620	0.934	1.0	0.597	15.3	5.3
Muslim	0.612	0.955	1.0	0.634	15.3	5.7
Others	0.583	0.954	1.0	0.615	15.3	5.2
Occupation						
Unemployed	0.744	0.966	1.0	0.655	15.3	7.2
Non professional	0.639	0.936	1.0	0.591	15.3	5.4
Professional	0.503	0.838	1.0	0.612	15.3	3.9
2001	0.608	0.954	1.0	0.608	15.3	5.3
Urban						
Education						
No education	0.585	0.977	1.0	0.597	15.3	5.2
Primary	0.639	0.860	1.0	0.609	15.3	5.1
Secondary+	0.603	0.879	1.0	0.597	15.3	4.8
Religion						
Catholic	0.587	0.905	1.0	0.615	15.3	5.0
Protestant	0.597	0.888	1.0	0.606	15.3	5.0
Muslim	0.660	0.908	1.0	0.597	15.3	5.5
Others	0.566	0.925	1.0	0.579	15.3	5.0
Occupation						
Unemployed	0.673	0.939	1.0	0.645	15.3	6.2
Non professional	0.569	0.888	1.0	0.614	15.3	4.7
Professional	0.705	0.763	1.0	0.597	15.3	4.9

Results of the Bongaarts model proximate determinants at reducing fertility in urban areas

Introduction

It has to be noted that when there is no fertility-inhibiting effect of a given intermediate fertility variable, the corresponding index equals 1; if the fertility inhibition is complete, the index equals 0. Therefore in this study, the net inhibiting effect of the proximate determinants on fertility in urban areas of Uganda was got by subtracting the indices from 1.0, which is the inverse of 0 that

is taken to be 100 percent effectiveness. The subsequent session will indicate the variation in the contribution of the Bongaarts (1983) proximate determinants and some selected background factors which work through the proximate determinants to have either negatively or positively effect on fertility reduction.

Marriage

The index of marriage had the greatest inhibiting effect on fertility in urban areas of Uganda. The estimates of the index of marriage were 0.631 in 1995 and 0.608 in 2001. This indicates that the inhibiting effect of marriage on fertility increased from 0.369 to 0.392. The high contribution of the index of marriage was due to delayed entry of women into marriage due to acquisition of higher levels of education.

Breastfeeding

The mean duration of breastfeeding rose from 13.6 months in 1995 to 14.4 months in 2001. Therefore the index of postpartum infecundability was 0.623 in 1995 and 0.608 in 2001. This reveals that the net effect of postpartum infecundability increased from 0.377 to 0.392. The study established that breastfeeding was practiced across all education, religious and occupational categories and also across regions. Again there was an increase in the proportion that breastfed for 19+ months from 14 percent in 1995 to 21 percent in 2001.

Contraception

It was established that contraception had the least effect at influencing fertility reduction in urban areas of Uganda. The index of contraception was 0.969 in 1995 and 0.955 in 2001. Therefore the net inhibiting effect on fertility due to contraception decreased from 0.04 to 0.03. This could be attributed to the fact that once you attain high levels, you either maintain them or you begin lowering. Contraception in Uganda is higher in Urban areas low levels of contraceptive use in the urban areas and the country at large. For instance the national contraceptive prevalence rate is estimated at 23 percent.

Background factors

In order to fully conclude that fertility in urban areas is decreasing significantly than in rural areas of Uganda, additional analysis was done on some selected factors. These included region of interview, educational level of the respondent, religion and occupation.

Regional variation in fertility decline UDHS 1995 and 2001

Introduction

During the 1995 and 2001, Uganda was divided into 4 statistical regions for purposes of comparing and showing variations within different geographical areas on certain behaviours. These regions are Central, Eastern, Northern and Western.

Central region

As indicated in Table 1 above the index of marriage in the Central region was 0.678 in 1995 and 0.584 in 2001. This led to the net effect of marriage in the region to increase from 0.322 to 0.416. The findings indicate that the increase of the effect of marriage was due to a reduction in the proportion of the married category from 56 percent in 1995 to 51 percent in 2001. Contraceptive use was another contributing factor at reducing fertility in urban areas in the Central region of

Uganda. The results in Table 1 show that the index of contraception was 0.959 in 1995 and 0.943 in 2001, which led to the net effect of contraception to increase from 0.04 to 0.05. This was due to the increase in the proportion of the married category that used contraceptives.

The findings revealed that postpartum infecundability also contributed to fertility decline in urban areas in the Central region between 1995 and 2001. The index of postpartum infecundability was 0.576 in 1995 and 0.597 in 2001. However the net effect of postpartum infecundability due to breastfeeding reduced from 0.424 in 1995 to 0.403 in 2001. *TFR* in urban areas in the Central region reduced from 5.7 to 5.0.a

Eastern Region

The index of marriage for the Eastern region as indicated in Table 1 above was 0.635 in 1995 and 0.706 in 2001. The net effect of marriage in the Eastern region reduced from 0.367 to 0.294. The findings indicate that this enhanced fertility in the region from 5.6 to 6.6. The results further show that the index of contraception was 0.978 in 1995 and 0.97 in 2001. This led to the net effect of contraception to increase from 0.022 to 0.057.

Furthermore findings show that the index of postpartum infecundability was 0.593 and 0.634 over the survey periods. Therefore the net effect of postpartum infecundability due to breastfeeding in the Eastern region reduced from 0.407 in 1995 to 0.366 in 2001. This further explains why fertility in urban areas in the Eastern region increased from 5.6 to 6.6.

Northern region

In the Northern region the index of marriage was fundamental at reducing fertility. For instance the index of marriage was 0.729 in 1995 and 0.595 in 2001. Thus the net effect of marriage on fertility in the region increased from 0.271 to 0.405. The results show that the index of contraception was 0.979 in 1995 and 0.97 in 2001. Therefore the net effect of contraception in the region increased from 0.021 to 0.03. The index of postpartum infecundability due to breastfeeding in the Northern region was 0.601 in 1995 and 0.552 in 2001. This prompted the net effect of postpartum infecundability in the region to increase from 0.399 in 1995 to 0.448 in 2001. These factors contributed effectively to fertility decline in the region from 6.6 in 1995 to 4.9 in 2001.

Western Region

In the Western region, the index of marriage was 0.640 in 1995 and 0.631 in 2001. Thus the net effect of marriage on fertility increased from 0.36 to 0.369. The index of contraception was 0.968 and 0.95 over the survey periods. This prompted the net effect of contraception to increase from 0.032 to 0.05. The index of postpartum infecundability was 0.612 in 1995 and 0.597 in 2001. The net effect of postpartum infecundability due to breastfeeding increased from 0.388 to 0.403. All these factors were fundamental at reducing fertility in the region from 5.8 in 1995 to 5.4 in 2001.

Fertility variations by educational levels within urban areas UDHS 1995 and 2001

The education categories, which were considered in this study are; No education, Primary and Secondary+ education categories. Overall, fertility for the No education category reduced from 5.7 in 1995 to 4.2 in 2001. The relative contributions of the different proximate determinants are

explained below. The index of marriage for the No education category increased from 0.687 to 0.584. This prompted the net effect of marriage to increase from 0.313 in 1995 to 0.416 in 2001. In regard to contraception among the no education category, the contribution of contraception was least and it moved from 0.128 to 0.216 while the net effect of postpartum infecundability changed from 0.372 to 0.403.

Fertility of the Primary education category in urban areas in 1995 and 2001 reduced from 5.8 to 5.1. This was due to the changes in the different indexes of the proximate determinants. The index of marriage for women with Primary education was 0.644 in 1995 and 0.639 in 2001. This caused the net effect of marriage to increase from 0.356 to 0.361. The decline in fertility of this education category was also due to the increase in the net effect of contraception from 0.039 to 0.14 and the net effect of postpartum infecundability from 0.385 to 0.391 as a result, fertility reduced among those with primary education from 5.8 to 5.1.

The education category which contributed to fertility decline negatively was Post primary. The fertility rate for post primary (Secondary+) in urban areas increased from 4.2 in 1995 to 4.7 in 2001. This was due to the reduction in the net effect of marriage from 0.414 in 1995 to 0.398 in 2001, a reduction in the net effect of postpartum infecundability from 0.481 to 0.403 and a reduction in the mean duration of breastfeeding from 20 months to 15 months over the survey periods. The indexes showed a reduction.

Fertility variations by religious denomination in urban areas UDHS 1995 and 2001

It is well documented how different religious denomination react to use of modern contraception hence fertility regulation. Whereas there are currently many religious denominations in Uganda, four categories were considered. These were: Catholic (Roman Catholic), Protestants (Anglican and Pentecostal Christians), Muslim and Others. All religious denominations had a decrease in the fertility over the inter survey period.

Fertility rate for the Catholic category in urban areas reduced from 5.9 to 5.0. The net effect of index of marriage was increased from 0.36 to 0.413, the net effect of contraception from 0.052 to 0.095 and the net effect of postpartum infecundability increased from 0.368 to 0.385 over the survey periods. This may be contradictory to the Catholic Church teachings.

The other denominations fertility for the Protestants category reduced from 5.3 to 5.0, while for the Muslim category it reduced from 5.7 to 5.5 over the same survey periods. The category indicated as other, fertility reduced from 5.2 in 1995 to 5.0 in 2001. Table 1 above shows the relative contributions of each of the proximate determinants.

Fertility variations by occupation within urban areas UDHS 1995 and 2001

Three occupation categories, which were considered namely; unemployed, professional and non-professional. Fertility among the unemployed category reduced from 7.2 to 6.2. Of the three indexes, the index of marriage contributed the greatest decline in fertility within this category. Similarly, fertility among the non- professional category reduced from 5.4 to 4.7. Only effect of marriage and contraception contributed to this decrease. The net effect of postpartum

infecundability reduced instead was contributing to an increase in fertility among the non professionals.

On the contrary, the fertility for the professional category increased from 3.8 to 4.9. This was mainly due to the increase in proportion married from 60 percent in 1995 to 65 percent in 2001(not showed in this paper). This prompted the net effect of marriage to reduce from 0.521 in 1995 to 0.297 in 2001. However the net effect of contraception for this occupation category increased slightly from 0.161 in 1995 to 0.235 in 2001 and the net effect of postpartum infecundability increased from 0.389 to 0.403. This was due to the increase in the mean duration of breastfeeding from 14.2 months to 15 months over the survey periods.

Discussion of results

Based on the Bongaarts and Potter (1983) Aggregate Fertility Model, it was possible to use the three proximate determinants in explaining fertility decline in urban areas of Uganda. The results in the model showed that the index of marriage had the highest reducing effect on fertility in urban areas of Uganda. The index of contraceptive was also fundamental at influencing fertility decline in urban areas of Uganda though its effect was not as high as that of marriage. In addition the index postpartum infecundability due to breastfeeding contributed a lot to fertility decline. Finally the index of abortion was set at 1.0 in the model due to lack of data. It was discovered that background factors like region, education, religion, and occupation worked through the proximate determinants in affecting fertility either by reduction or increasing it. For example, at regional level the Northern region urban centers had the highest fertility decline from 6.6 to 4.9, followed by the Central region from 5.7 to 5.0, fertility in the Western region reduced from 5.8 to 5.4 and in the Eastern region fertility increased from 5.6 to 6.6. The regions where fertility reduced the index of marriage had the highest effect followed by postpartum infecundability and contraceptive use.

References

- Bongaarts. J and G.R. Potter, (1983): **Fertility, Biology and Behavior: An Analysis of the Proximate determinants**, Academic press, New York.
- Central Bureau of Statistics, Ministry of Health, National Council for Population and Development and ORC Macro Calverton(2004) **Kenya Demographic and Health Survey**, Nairobi
- Central Statistical Authority (Ethiopia) and ORC Macro (2000). **Ethiopian Demographic and Health Survey** Addis Ababa, Ethiopia.
- Ministry of Finance Planning and Economic Development and ORC Macro 1996 Calverton, Maryland, U.S.A: **Uganda Demographic and Health Survey**. Kampala
- Ministry of Health and Population, National Population Council and ORC Macro (2001) **Egypt Demographic and Health Survey**, Cairo
- Population Reference Bureau (2007), **2007 World population datasheet**, www.prb.org.
- Uganda Bureau of Statistics (2005): **2002 Uganda Population and Housing Census Main report**, Kampala Uganda
- Uganda Bureau of Statistics (UBOS) and ORC Macro Calverton, Maryland,(2001). **Uganda Demographic and Health Survey 2000-2001**. Kampala Uganda