Levels and Determinants of Fertility in Liberia

Abstract

The main objective of the paper was to study the patterns and determinants of fertility in Liberia in the period 1988 to 2013. The study applied decomposition methods to quantify the effect of the direct and indirect determinants of fertility in Liberia using data from the 1986, 2007 and 2013 Liberia Demographic and Health Surveys. The findings show that Total Fertility Rate declined from 6.5 in 1986 to 4.7 in 2013. Application of the Bongaarts model established that postpartum infectundability followed by marriage and abortion had the strongest inhibiting effect on fertility over the study period. Other decomposition methods revealed that most of the decline in fertility is accounted for by changes in proportion married and marital fertility. Based on these findings the study recommends additional government measures that will increase the age at marriage while at the same time strengthening the family planning services should be implemented.

Key words: Fertility, Liberia, Decomposition, Determinants

Introduction

Liberia is one of the countries in West Africa that has low fertility. Based on estimates of Total Fertility Rate (TFR) provided by the United Nations(1) the countries that have low fertility in West Africa are Cape Verde (2.5), Ghana (4.18), Togo (4.69) and Liberia 4.83). Available evidence from sub-Saharan Africa indicate that fertility has declined in a number of countries (2). However the pace, pattern and determinants of fertility decline have not been uniform. Southern Africa, the region where fertility was earliest, TFR declined from 6.06 in 1950 to around 2.64 in 2015. Over the same period, Northern Africa TFR declined from 6.06 to 2.64. Fertility transition is slowest in Middle Africa where TFR from 6.08 to 5.94 children per woman.

It is documented that demographic parameters are influenced by a wide range of factors. For instance, Crude Birth Rate depend on the fertility of women of childbearing age groups which is normally assumed to be age range 15-49, proportion of women in the population, population of women practicing family planning, proportion of women who are married, divorced, proportion of women working, proportion of women urbanised etc. Demographers tend to preoccupy themselves with establishing which of these factors is

responsible for the patterns of fertility in a certain area. In such situations researchers have utilised a variety of procedures.

Standardisation is one procedure often used to determine how the overall rates would change if one of the factors varied as it did in the two populations, while the other factors were kept at the same levels. The rates obtained in this way are called the standardized rates. Two methods of standardised rates are calculated in demography: direct and indirect methods. Another way of comparing the two overall rates is to break the difference between these two rates into additive components constituting the effects of the factors involved. The effects of the factors obtained in this way are called the decomposed effects and the process is called *decomposition*. These two processes of standardization and decomposition are closely linked because, if they are developed correctly, the difference between the two standardized rates from the two populations corresponding to the only factor that has changed should be equal to the effect of the same factor in the decomposition process. Some of well-known researchers on this subject include Kitagawa (3), Cho and Retherford (4), Das Gupta (5), and Kim and Strobino (6).

One commonly used decomposition method in fertility analysis is a procedure developed by Bongaarts which involves breakdown fertility into components attributed to marriage, contraceptive use, abortion, sterility and breastfeeding (7-9). This method has been widely used in developing countries including in Sub-Saharan Africa(10-15).

In Zambia, marriage and postpartum infecundity accounted for the largest inhibiting effect on natural fertility from its biological maximum of 19.10(10). The findings from Ghana indicated a woman's contraceptive behaviour; marriage status and postpartum infecundability as important predictors of fertility outcomes(12, 13).

Most of the decline in fertility in Sub-Saharan Africa is attributable to increases in the proportions of women unmarried and to a lesser extent increases in contraceptive use [12].

Study done in Sub-Saharan Africa, identified proximate determinants of fertility such as non-marriage, post-partum amenorrhea and contraceptive use as an important factors in inhibiting fertility.

There has been a resurgence in the use of standardisation and decomposition techniques in demographic analysis (16-18). Therefore, in this study, standardisation and decomposition techniques were used to study the levels and determinants of fertility in Liberia.

Data and Methods

Data

Data utilized in this study has been derived from Liberian Demographic and Health Surveys of 1986, 2007 and 2013 (19-21). All these surveys are nationally representative and have provided data of good quality. Each survey collected comprehensive information on women's reproductive health, contraceptive methods, and other socio-demographic characteristics.

Methods

Standardisation and decomposition techniques were used to achieve the study objectives. Both direct and indirect standardization were used to determine the influence of age-sex structure on fertility estimates. As for decomposition two approaches were used. The first approach involved the application of Bongaarts proximate determinants model (7, 22).

$$\boldsymbol{TFR = CmCcCaCiTF}$$

Where TFR and TF represents Total Fertility Rate and Total Fecundity and C_m, C_c, C_a and C_i are the indices of marriage, contraception, abortion and infecundability are calculated as follows:

$$C_m = \frac{\sum m(a)g(a)}{g(m)}$$

where m (a)=age-specific proportion currently married among females. g(a)=age-specific marital fertility rates.

$$C_c = 1.08eu$$

where u=prevalence of current contraceptive use among married women of reproductive age e =average use-effectiveness of contraception. Where the average use-effectiveness 'e', is estimated as the weighted average of the method specific use-effectiveness level, e(m), with the weights equal to the proportion of woman using a given method, u(m):

$$C_a = \frac{TFR}{TFR + 0.4(1+u)xTAR}$$

Where Ca = the index of induced abortion, u = the proportion of all married women who are contracepting, TAR=Total Abortion Rate estimated using regression estimation approach suggested by C. Westoff (2008) as follows:

$$\text{TAR} = 3.63 - 0.033\ (\text{MOD}) + 0.009(\text{TRAD}) - 0.333(\text{TFR})$$

Where MOD = modern method contraceptive prevalence among married women of reproductive age, TRAD = traditional method contraceptive prevalence among married women of reproductive age

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

The second approach involved employing decomposition methods so as to examine the relative contribution of the changing marital structure (changes in the proportions married at different ages) and marital fertility (the fertility of married women) and never married fertility to the changes in total fertility. These decomposition techniques following pioneering work by Kitagawa (3) and later adapted by Retherford (4) and have been used

in demography since the 1980s (16, 23). These techniques were used to examine if the decline in fertility could be attributed to a decline in fertility among married or unmarried women or it is just a decline in the composition of the proportion of the ever married, or an increase in the compositions of the proportion never married.

Results

Table 1 presents various fertility indicators for Liberia calculated from the 1986, 2007 and 2013 LDHSs. As expected, the age-specific fertility rates (ASFRs) start from a low value in age group 15-19 rising to a maximum in age group 25-29 before declining to lowest value in age group 45-49. This pattern is observed in all the data sets.

Table 1 and figure 1 also suggests that the decrease in fertility in Liberia is primarily due to declines in the older age groups (say age groups above 35 years). ASFR at younger age groups (age groups below 30 years) appears to have risen. The shift in the timing of fertility is also indicated by the decline in the mean age of childbearing (m) from 31.3 years in 1986 to 30.8 years in 2013.

On the one hand this observation is consistent with the finding by other researchers who noted that fertility patterns tend to concentrate and shift to younger years as fertility decline (Stover and Kirmeyer, 1999). On the other hand this contradicts the assertion by Caldwell et. Al (1992) that " … the African fertility transition … will be characterised by fertility decline at all ages …". Probably this claim is true at advanced stages of fertility transition and not at early stages as it is the case of Liberia.

Table 1: Selected Measures of fertility for Liberia: 1986, 2007 and 2013

					Percentage change	
	1986	2007	2013		1986-07	2007-13
15-19	0.090	0.059	0.058		-34.5	-2.3
20-24	0.251	0.205	0.203		-18.5	-0.7
25-29	0.284	0.234	0.209		-17.6	-10.7

30-34	0.241	0.214	0.189		-11.1	-11.9
35-39	0.206	0.174	0.150		-15.6	-14.0
40-44	0.141	0.116	0.098		-17.4	-15.8
45-49	0.086	0.061	0.039		-29.9	-36.3
TFR	6.5	5.3	4.7		-18.2	-11.1
GFR	198	158	141		-20.1	-10.8
GFR (D)	285	233	209		-18.4	-10.1
GFR (In)	206	170	151		-17.3	-11.0
M	31.3	31.4	30.8		0.3	-2.0

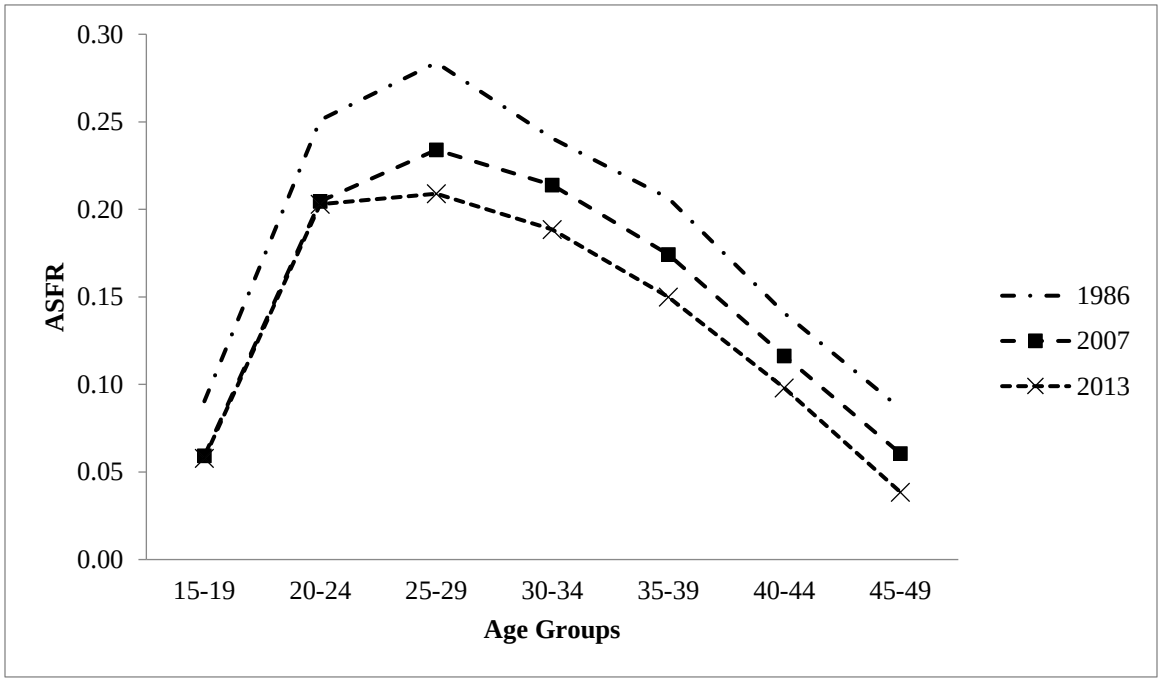
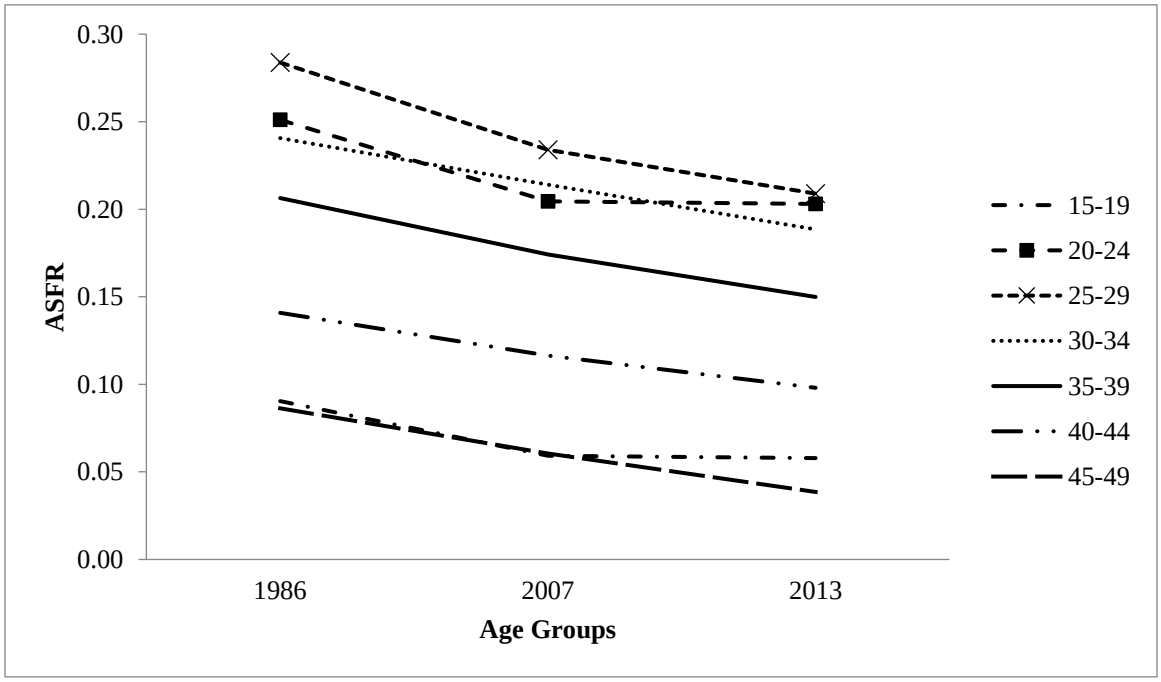


Figure 1: Age Pattern of Fertility in Liberia, 1986-2014


25.00
20.00
15.00
10.00
5.00
0.00
ASFR
15-19
20-24
25-29
30-34
35-39
40-44
45-49
Age Groups
1986
2007
2013

Figure 2:


0.30
0.25
0.20
0.15
0.10
0.05
0.00
ASFR
1986
2007
2013
Age Groups
15-19
20-24
25-29
30-34
35-39
40-44
45-49

The table 1 and figure 1 show that both ASFR and TFR have been continuously decreasing since 1986. Overall, Table 1 indicate that TFR decreased by 18% during the period 1986-2007 and 11% during the period 2007-2013. These percentages suggest that the decrease in fertility was more rapid during the period 1986-2007 than the period 2007-2013. Although the age specific fertility rates of age groups 15-19 and 20-24 have been declining there seem to be an increase or a stagnation between 2007-2013.

Thus, in Liberia the marriage in early age is not still reduced remarkably that's why the fertility rate of this age group is not decreased as comparison to other age groups. The following figure visualizes more clearly about the trends of ASFR. The median age at first marriage among women aged 20-49 has increased from 17.5 in 1986 to 18.4 in 2007 and 18.8 in 2013 (19-21). The increase in the age at first marriage could also be inferred from the increase in the proportion never married in age 15-19. Table 3 indicate that 64.0% of the women aged 15-19 reported that they were never married in 1986. This proportion increased to 79.7% in 2007 and 84.2% in 2014. Similar percentages for age group 20-24 were 24.6%, 38.6% and 41.1% respectively. However, although the mean age at first marriage appears to be increasing in Liberia the results show that the increase is small and many women still marry at an early age and marriage is universal.

More than eight-tenth of the women are married before their twenty-fifth birthday and nearly 98% of the women are married by age group 25-29 and almost all the women are married by age group 30-34.

Proximate determinants of fertility in Liberia

The indices of marriage, contraceptive use, induced abortion, and postpartum infecundability and the TFR and TF as obtained from using Bongaarts model for the years 1986, 2007 and 2013 for Liberia are presented in Table 2 and illustrated in figure x. In analysing these findings, it should be kept in mind that the lower the value of an index, the higher the percentage reduction in the TFR due to that index.

Table 2: Estimates of Selected Fertility Measures, Proximate Determinants and Indexes of Proximate Determinants for Liberia 1986, 2007 and 2013

	1986	2007	2013
TFR	6.5	5.3	4.7
TMFR	7.2	6.4	5.9
U	0.06	0.11	0.20
E	0.06	0.10	0.19
Cm	0.898	0.832	0.804
Cc	0.996	0.987	0.958
Ca	0.912	0.865	0.828
Ci	0.679	0.637	0.631
	1986	2007	2013
Marriage	18.2	23.2	24.0
Contraceptive	0.7	1.6	4.7
Abortion	15.6	18.3	20.7
PPI	65.5	56.9	50.5
	100.0	100.0	100.0
TFR	6.5	5.3	4.7
TMFR	7.2	6.4	5.9
TN	7.3	6.5	6.1
	8.0	7.5	7.4
TF	11.7	11.7	11.8
TFR	8.47	6.92	6.16
TMFR	9.44	8.32	7.67
	9.48	8.43	8.00
TN	10.39	9.74	9.66
TF	15.30	15.30	15.30

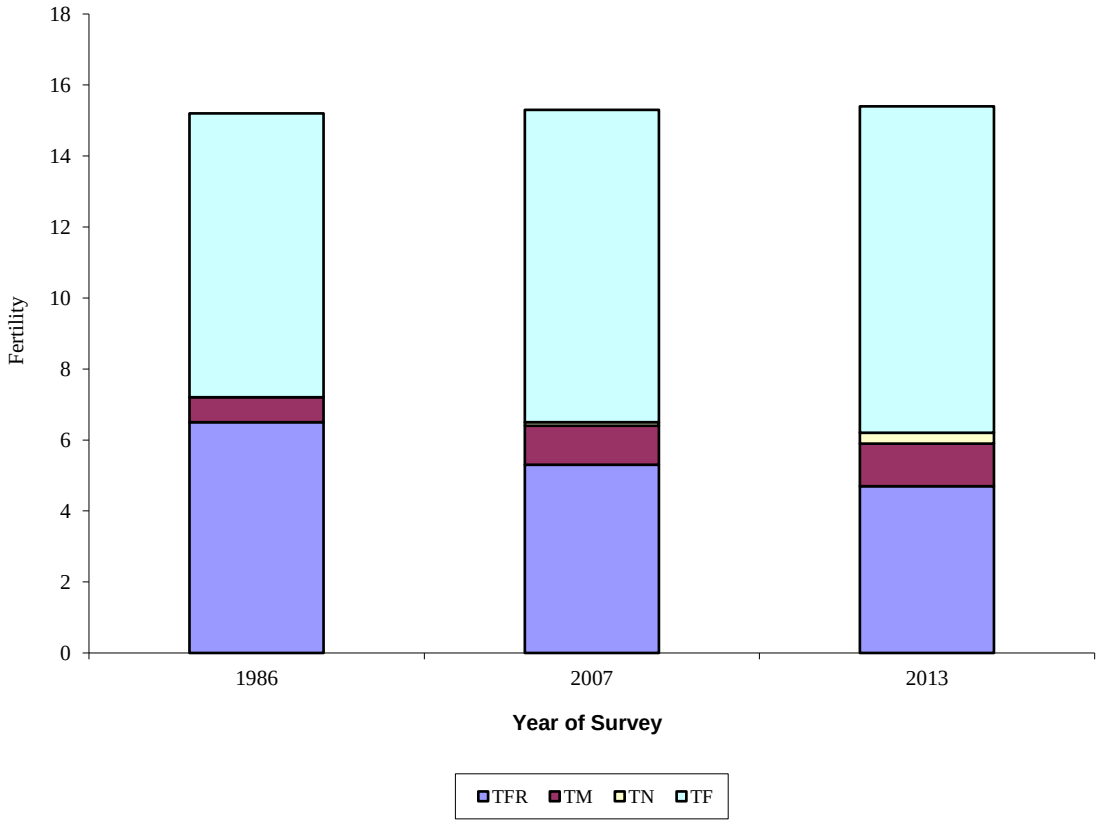


Figure 3:Proximate Determinants of Fertility in Liberia: 1986, 2007 and 2013

In calculating the index of marriage, ever-married women were considered instead of currently married women, because when currently married were used to calculate C_m, the implied TFRs were very low.

It should be noted that the implied TFR in all cases is lower than the observed TFR. This may be due to the fact that the TF used in the model of 15.3 is lower than that found in Liberia.

In all the three surveys the most important index in explaining the level of fertility in Liberia is the index of postpartum infecundability. This is followed by the indices of marriage and contraception, respectively. Postpartum infecundability has had a large effect in reducing fertility at both times, but it has not exhibited as much of a decrease between the two periods as C_c.

As for the index of contraceptive use (C_c), it appears that this factor has changed during the period under review. Cc has decreased from 0.996 in 1986 to 0.987 in 2007 and 0.958 in 2013. This decline in the index of contraception (C_c) may be an important factor in explaining the drop in fertility witnessed in Liberia especially during the period under review. The percentage currently using contraception has increased from 6.0% in 1986 to 11.0% in 2007 and to 20.0% in 2013. It may be noted as well that contraceptive use effectiveness has improved during the period under review.

Conversely, between 1986 and 2007, the index of marriage (Cm) has declined from 0.898 to 0.832. The value of the index declined further to 0.804 in 2013. Thus, the changing patterns of marriage postponement of marriage as a factor in fertility decline in Liberia.

The index of postpartum infecundability (Ci) decreased from 0.679 in 1986 to 0.637 in 2007 and 0.631. The decline in Ci connotes the reduced importance of breastfeeding in determining fertility in Liberia.

Decomposition of the role of the four major determinants on fertility decline between 1986 and 2013

Table 8 indicates the magnitude of the total inhibiting effect being accounted for each proximate determinant at different time points starting from 1986 to 2013. The difference between the total fecundity and the estimated TFR demonstrates the resultant inhibitory effect of each determinant. The total inhibiting effect is prorated by the proportion of the logarithm of each index to the sum of logarithm of all indices.

The results indicate that out of the births that were inhibited in 1986, only 0.8% were due to the effect of contraception, 21.6%) were due to marriage and 77.6% were due to postpartum infecundability. Similarly, in 2007, the three proximate determinants

contraception, marriage, and postpartum infecundability 1.9%, 28.4% and 69.7%, respectively. Similar values were 5.9%, 30.3% and 63.8% in 2013.

The analyses in the preceding paragraph indicate that the impact of breastfeeding on fertility is on the decline as a result of reduced intensity of breastfeeding. The decline in breastfeeding is likely to increase in future as the status of women improves. The impact of marriage is increasing over time. The impact of conception is almost negligible though it has somewhat increased.

Figure 4: Contribution of Proximate Determinants to Fertility

Decomposing TFR

Table 3 and Figure 3 present the result of decomposing TFR using US Census Bureau approach (24). The results indicate that the decline in TFR observed between 1986 and

2007 is attributed to changes in marital fertility (58.9%), changes in proportion married (40.9%) and interaction (0.2%). Between 2007 and 2013 changes in marital fertility contributed (51.7%) and changes in proportion married contributed (47.0%) whereas interaction increased fertility by (1.3%). During both intervals, the results of decomposing TFR indicate that the largest contributing factor is marital fertility followed by proportion married.

Table 3: Decomposition of change in TFR during 1986-2013, Liberia

	1986-2007	2007-2013
marital	58.9	51.7
proportion m	40.9	47.0
I	0.2	1.3

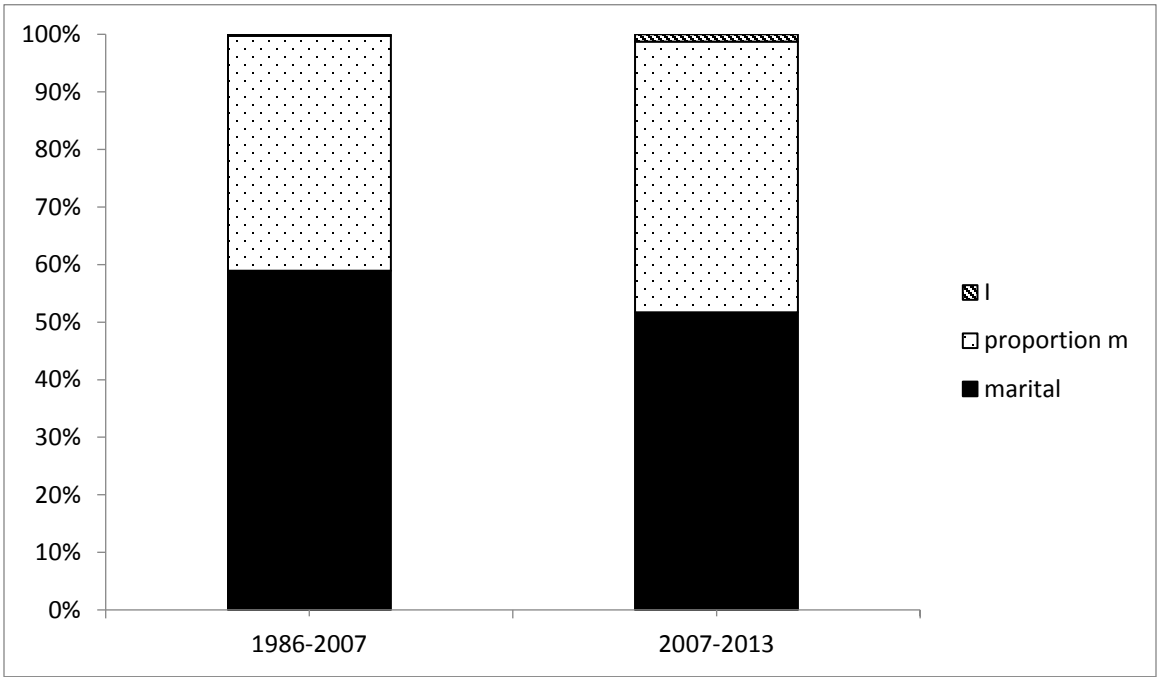


Figure 5: Decomposition of fertility in Liberia, method I

Decomposition 3

The results of the third decomposition method used are presented in Table 3 and illustrated in Figure 4. The results indicate that between 1986 and 2007, the decline in TFR is attributed to changes in marital fertility (65.5%), non-marital fertility (19.1%) and proportion married (28.5%). The decline in TFR between 2007 and 2013 is attributed to changes in proportion married (62.4%), followed by marital fertility (54.3%) and non-marital fertility (11.7%).

Table 4: Decomposition 3

	1986-2007	2007-2013
proportion Married	28.5	62.4
Marital Fertility	65.5	54.3
Non Marital Fertility	19.1	11.7

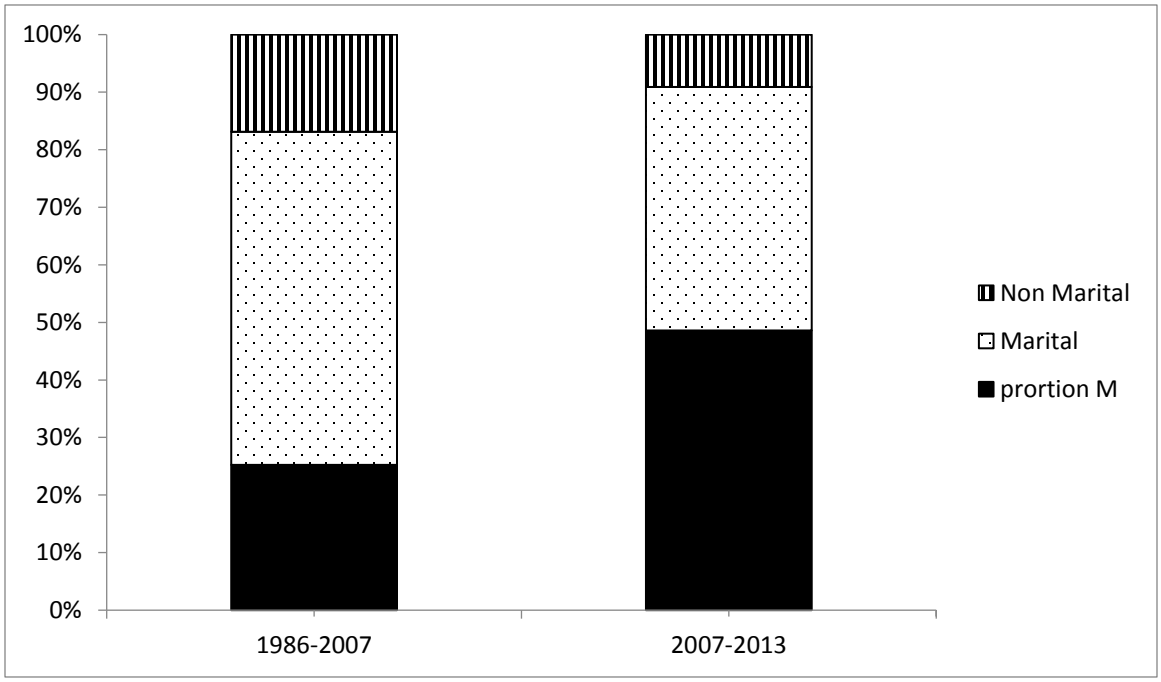


Figure 6: Decomposition Method II

(4)

Conclusions

This study has extended our understanding on the patterns and determinants of fertility among women of childbearing age in Liberia.

In addition, the study found out that of the four proximate determinants, it was the changing patterns of marriage that contributed most to fertility changes in Liberia.

This means that the decline in fertility observed in Liberia was largely explained by the changing patterns of marriage. Although marriage in Liberia remains early and universal, the increased proportions unmarried and the small rise in mean age at marriage contributed in fertility decline in the country. It can also be argues that while changes in marriage patterns have contributed in reducing the level of fertility, it is also possible to argue that these changes have increased the demand for fertility control since an increased number of women are remaining in single state.

However, contraceptive use in Liberia remains low. This finding can be used for developing and strengthening the national family planning programme.

Based on this analysis, this paper calls for more government measures that will publicizing the good aspects of family planning. This approach will go a long way in helping to reduce fertility in Liberia to manageable levels. Economic policies that will further make people shift or defer marriage/childbearing and hence procreation (reproduction) are called for.

The study has also demonstrated that induced abortion is one of the factors responsible for the observed level and trends in fertility in Liberia. Although induced abortion has emerged as an important determinant of fertility in Liberia, but its contribution could not be estimated due to the gap of authentic statistical information from the survey reports.

However, several studies and non-government sources, such as private clinic and hospitals records, etc., reveals that a huge of induced abortion are done under the name of menstrual regulation which is obscured owing to legal and social constraints.

Limitations of the Study

The results of the study should be interpreted with caution considering the few limitations imbedded in the data and methods used in the analyses. First, despite the usefulness of birth histories, DHS surveys are subject to some data quality problems (). One of the most commonly mentioned problems of DHS birth histories is the displacement of births (). Omission of births is another important constraint for birth histories ().

Second, it is well known that induced abortion is practiced in many societies however; reliable information on induced abortion is often lacking and quite limited in DHS surveys. Sometimes it is only country specific and the quality of data also varies across the countries.

Third, the study found that interaction factor arrived while decomposing the TFR in the decomposition analysis varies from one survey to another. Such interaction factors may be due to some ‘unexplained’ variables or other proximate determinants of fertility like potential impact of induced abortion, coital frequency, temporary separations, foetal mortality and secondary sterility which were not captured in the model().

References

1. UN. World Fertility Patterns 2015 – Data Booklet Department of Economic and Social Affairs, Population Division (2015), New York (ST/ESA/ SER.A/370). . 2015.
2. Garenne MM. Fertility changes in Sub-Saharan Africa. 2008.
3. Kitagawa EM. Components of a difference between two rates. Journal of the american statistical association. 1955;50(272):1168-94.
4. Cho L-J, Retherford RD. Comparative analysis of recent fertility trends in East Asia. 1973.
5. Gupta PD. A general method of decomposing a difference between two rates into several components. Demography. 1978;15(1):99-112.
6. Kim YJ, Strobino DM. Decomposition of the difference between two rates with hierarchical factors. Demography. 1984;21(3):361-72.
7. Bongaarts J. A framework for analyzing the proximate determinants of fertility. Population and development review. 1978:105-32.
8. Bongaarts J, Frank O, Lesthaeghe R. The proximate determinants of fertility in sub-Saharan Africa. Population and Development Review. 1984:511-37.
9. Bongaarts J. How exceptional is the pattern of the fertility decline in sub-Saharan Africa. UN Population Division, Expert paper. 2013(2013/4).
10. Chola M, Michelo C. Proximate determinants of fertility in Zambia: Analysis of the 2007 Zambia Demographic and Health Survey. International Journal of Population Research. 2016;2016.
11. Letamo G, Letamo HN. The role of proximate determinants in fertility transition: A comparative study of Botswana, Zambia and Zimbabwe. Southern African Journal of Demography. 2001:29-35.
12. Chuks J. Ghana's reproductive revolution: analysis of the determinants of fertility transition. 2002.
13. Codjoe SNA. The Role of Proximate and other Determinants in Ghana's Fertility Transition. African Population Studies. 2007;22(2).
14. Palamuleni M. Fertility decline in Malawi: an analysis of the proximate determinants. Journal of social development in Africa. 2010;25(1):9-38.
15. Palamuleni ME. Determinants of Fertility Decline in Namibia: An analysis of the Proximate Determinants. Bangladesh e-Journal of Sociology. 2017;14(2):41-63.
16. Palamuleni ME. Decomposition of South African crude birth rates, 1996-2001. Southern African Journal of Demography. 2011;12(1):37-62.
17. Ndagurwa P, Odimegwu C. Decomposition of Zimbabwe's stalled fertility change: a two-sex approach to estimating education and employment effects. Journal of Population Research. 2019;36(1):35-63.
18. Sayi TS. Relationships between fertility and marriage transitions in sub-Saharan Africa. presented at Population Association of America (PAA) Annual Meeting, Boston, USA, 1-3 May 2014.2014.
19. Statistics Bo, International. MoPaEAaI. Liberia Demographic and Health Survey 1986. Monrovia, Liberia: Bureau of Statistics, Ministry of Planning and Economic Affairs and Institute

for Resource Development (IRD), a subsidiary of Westinghouse Electric Corporation. 1988.

20. Liberia Institute of Statistics and Geo-Information Services (LISGIS) MoHaS, Welfare [Liberia] NACPL, and ICF International. Liberia Demographic and Health Survey 2007. Monrovia, Liberia: Liberia Institute of Statistics and Geo-

Information Services (LISGIS) and ICF International. 2008.
21. Liberia Institute of Statistics and Geo-Information Services (LISGIS) MoHaS, Welfare [Liberia] NACPL, and ICF International. Liberia Demographic and Health Survey 2013. Monrovia, Liberia: Liberia Institute of Statistics and Geo-

Information Services (LISGIS) and ICF International. 2014.
22. Bongaarts J. The effect of contraception on fertility: Is sub-Saharan Africa different? Demographic Research. 2017;37:129-46.
23. Lindstrom DP, Woubalem Z. The demographic components of fertility decline in Addis Ababa, Ethiopia: a decomposition analysis. Genus. 2003:147-58.
24. Arriaga EE, Johnson PD, Jamison E. Population analysis with microcomputers: Bureau of the Census; 1994.