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Fertility in Northern Sudan (1979-1999):Levels, Trends and Determinants

By:

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Abstract:

This paper aims to investigate the trend of fertility in Northern Sudan during the period (1979-1999), and to address the multiplicity of factors which affect fertility decline during the same period. The paper is based on data from the Sudan Fertility Survey 1979, the Sudan Demographic and Health Survey 1990 and the Safe Motherhood Survey1999 . During the periods 1975/79 and 1985/90 the TFR has declined by 18.6% from 6.02 live births to 4.90. The analysis indicates that changes in marriage are awesomely responsible for the decline during the periods 1975/79 and 1995/99 . The decomposition of components of decline in TFR showed that 22.5% of the decline in TFR is attributed to a decrease in proportion married. There has been an increase in age at first marriage, in the same period, the SMAM of females has increased by more than two years. Also the increase in education opportunities seems to be a factor that affects fertility in Sudan.

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1. Introduction

Fertility rates are still higher in Sub-Saharan Africa than other major regions of the world. Analysis of Demographic and Health Surveys (DHS) data collected between 1990 and 1995 suggests that most of the countries in Sub-Saharan Africa have a total fertility rate (TFR) of more than six children per women (Mboup and Saha, 1998). Despite these high rates, fertility declines have recently been documented in a number of African countries (Cohen, 1993).

Sudan is one of the countries which experienced fertility decline. Recent evidence showed that the total fertility rate has fallen from six births per women in 1979 Sudan Fertility Survey (SFS), to about five children in the 1990 Sudan Demographic and Health Survey (SDHS). This trend of decline was confirmed by the 1993 Fourth Sudanese Population and Housing Census, which show analogous level to that of SDHS (TFR 5.0 children).

In contrast to the majority of African countries, fertility decline in Sudan is not associated with contraceptive use, since Sudan is predominantly, a non-contracepting population. According to the Sudan Maternal and Child Health Survey (SMCH,1993), the percentage of women who have ever used any modern method of contraception was 9.9%, while the current users proportion was 5%. Comparing those levels to the 1979 Sudan Fertility Survey (SFS), there is a drop in both levels; 12.3% had ever used any method, and 6.4% of the exposed women were current users.

The main objectives of this paper are to make use of the available secondary data to summaries the existing knowledge on levels and trends in achieved fertility in Northern Sudan during the period from1979 to 1999 and second to address the multiplicity of factors underling Sudan's fertility decline during the same period.

The next section provides a profile on the demography of the Sudan. The data and methodology are presented in section three, section four gives fertility levels and trends while section five explores the relative roles of the proximate determinants of fertility and their contribution to fertility change between 1979 and 1999 using Bongaarts model. The final section examines in descriptive term the background and the socio-economic factors that affect fertility decline in the country.

2. Sudan: Basic Demographic Features

The first national census which was carried out in 1955/56 reported a total population of 10.3 million. The second census, which was conducted in 1973, reported a population of 14.8 million. The intercensal growth rate was 2.2% per annum. The 1983 census reported a total population of 19.09 million. The estimated intercensal rate of growth, 1973-1983 was 2.8% per annum. The fourth population census was carried in 1993 and reported a total population of 24.24 million. The estimated intercensal growth rate 1983-1993 was 2.4% per year.

The four national censuses reported a young age structure with about 45% of the population under age fifteen and 3% of age 60 and over. Table (1) shows a good indicator of prevalence of high fertility. Regarding the dependency ratio, the four censuses reported respectively 105, 102, 98.8 and 102.

The first census showed a crude birth rate of 51.7. The second population census reported a crude birth rate of 48.8 for the whole country 4.8 a mean number of children ever born to women (15-49), and a total fertility rate of a 7.3 births per woman. The second and third population censuses reported a 6.7 and 6.8 TFRs respectively. The fourth census showed mean number of children ever born to all women 6.5 and a total fertility rate 5 per woman.

Sudan has been characterized by high mortality rates. The first census reported a crude death rate of 18.8 per 1000 and infant mortality rate of 93.6 per 1000. While the second national census reported a crude death rate of 21 per 1000 and infant mortality rate of 96 per 1000. In the third population census the crude death rate was 19 per 1000 and infant mortality rate was 96 per 1000. The fourth census showed a crude death rate of 16 per 1000 and infant mortality rate of 110 per 1000.

Table (1) : Some Demographic Indicators For the Sudan (1956-1993)

	1955/56 Census	*1973 Census*	*1983 Census*	*1993 Census*
Population (million)	10.3	14.3	20.6	24
Under 15%	45	46	44	44.9
(15-59)%	52	51	53	49.9
60 + %	03	03	03	5
% of Urban population	8.3	18.5	20.5	25
% of Rural population	78	70	68.5	66.3
% of Nomadic	13.7	11.5	11	8.7
Naptuiality & Fertility				
SMAM (Male)		25.8		29.4
SMAM (Female)		18.7		22.7
CBR	51.7	48	49	
TFR	7.3	6.7	6.8	5.0
Mortality				
CDR	18.5	21	14.4	16
IMR	93.5	96		110
Life Expectancy at Birth				
Male		46	53	52.5
Female		50	55	55

Source:. Department of Statistics**,** 1985 and 1995, Volume I & II Khartoum.

3. Data and Methods

The data are collected from the Sudan Fertility Survey (SFS) in (1979), the Sudan Demographic and Health Survey (SDHS) which was carried out in (1989/90) and the Safe Motherhood Survey in 1999 (SMS). The SFS covered 3,115 ever- married women aged (15-49), and the SDHS 6,131 ever-married women at reproductive age, while the SMS enumerated (16,075) women aged (15-49).

All the above mentioned surveys have collected detailed birth history data, as well as data on the demographic and socio-economic backgrounds. The surveys were similar in coverage (Northern Sudan only), which made easy comparisons across surveys. Southern Sudan could not be included all the three surveys, because of the civil war.

Northern Sudan included the six Northern states namely, Khartoum, Northern, Eastern, Central, Kordofan and Darfur. According to the 1993 census the population of the northern Sudan was 19.5 million.

The common type of errors in both surveys was recall errors. So to minimize the impact of the recall errors, the analysis of fertility trends will be limited to birth during five-years preceding each of the three surveys.

According to Davis and Blake (1956), the factors affecting fertility can be classified into two groups, background variables and intermediate or proximate variables. The former includes cultural, psychological, economic, social, health, and environmental factors, while the latter refers to those factors that have a direct effect on fertility. The background factors operate through the proximate determinants to influence fertility.

Following this method, this paper examines the proximate determinants of fertility during the period 1979-1999 and their contribution to the over all change in fertility during the specified period. To study the proximate determinants of fertility and their contribution to fertility decline, the study uses the widely used Bongaarts model of proximate fertility determinants. The analysis of fertility levels and trends in the first part, will be descriptive using conventional fertility measures mainly age specific fertility rate and the total fertility rate.

4. Fertility Levels and Trends in the Sudan

The estimates of the ASFRs and the TFRs presented in Table (2) indicate that, during the period 1975- 79 and 1986-1990 , the TFR has declined by 17.6 % (from 6.02 children to 4.96 children). For the same period and with the exception of women in the age groups (35-39) there has been a decline in fertility among women in the rest of the age cohorts (see Figure (1)). Among all age cohorts, the largest decline in fertility was experienced by women in the age groups (15-19) years 39.5 %, and women in the age group (20-24) years 0.7 %.

If we consider the period 1986-1990 and 1994-1999, we find that there is slight fertility decline notable for the four age groups (25-29),(30-34),(35-39) and (40-45) years. On the other hand the fertility decline is apparent during the period 1975- 79 and 1995-1999, since the ASFR's of the SFS-1979 are less than SMS-99 except the age group (35-39) years. The overall decline in TFR was 18.6%.

Figure (1) : ASFR's Northern Sudan, SFS- 79,SDHS - 90 and SMS - 99

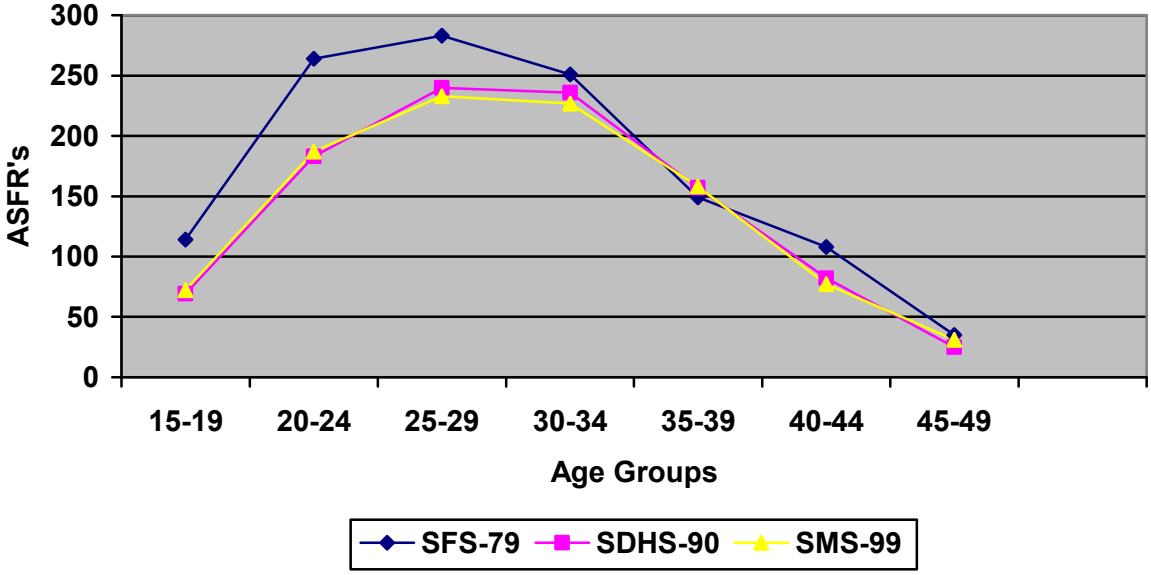

Table (2) : ASFRs and TFRs estimated for five –years period preceding SFS-79, SDHS-90 and SMS- 1999 in Northern Sudan

Age groups	*SFS 1979*	*SDHS 1990*	*SMS 1999*	*% Change 1979-1990*	*% Change 1990-1999*	*% Change 1979-1999*
15-19	114	69	72	-39.5	4.3	-36.8
20-24	264	183	187	-30.7	2.2	-29.2
25-29	283	240	233	-15.2	-2.9	-17.7
30-34	251	236	227	-6.0	-3.8	-9.6
35-39	149	157	158	5.4	-0.6	6.0
40-44	108	82	77	-24.1	-7.2	-28.7
45-49	35	25	31	-28.6	24	-11.4
TFR (15-49)	***6.0***	***4.96***	***4.90***	***-17.6***	**0.0**	**-18.6**

Source: 1979 SFS Principal Report I ,1990 SDHS Report I and 1999 SMS Report.

The decline in TFR was experienced by both urban and rural women, and by all women throughout the northern Sudan, as shown in Table (3). The extent of this decline is relatively larger in urban areas 19.6% and among women residing in both

Khartoum and Northern Regions 20.4%. The largest fertility decline was experienced by Central Region women (from 6.6 children to 5.0 children) about 24.2%. While women in Eastern Region experienced slight fertility decline 8.3%, Darfur and Kordofan Regions recorded the least fertility decline 6.3% and 6.8% respectively. These regional fertility differentials could be explained by variations in environment, socioeconomic and proximate determinants of fertility in the different regions.

Table (3) : TFRs estimated for five years period preceding the SFS-79 and SDHS-90 according to mode of living and regions of northern Sudan

Age groups	*SFS(1979)*	*SDHS(1990)*	*%Change*
Area			
Urban	5.1	4.1	-19.6
Rural	6.4	5.6	-12.5
Region			
Khartoum	4.9	3.9	-20.4
Northern	5.4	4.3	-20.4
Eastern	6.0	5.5	-8.30
Central	6.6	5.0	-24.2
Kordofan	5.9	5.5	-6.80
Darfur	6.3	5.9	-6.30

Source: 1979 SFS Principal Report I and 1990 SDHS Report I.

5. The Proximate Determinants of Fertility

They are defined as the biological and behavioral factors that directly influence fertility. Social, economic, and other factors operate through these intermediate variables. Bongaarts(1978) has shown four proximate determinants that account for most observed variation in fertility worldwide: marital patterns, contraception, induced abortion, and postpartum non susceptibility, mainly due to breastfeeding. The analysis will review these factors and will quantify their effects in-order to investigate these effects on overall change in fertility decline.

Consider the four factors in Sudan, first: the change in nuptiality patterns can be held responsible for changing reproductive outcomes. This is true for many reasons, first: marriage in Northern Sudan is almost universal, and it is the only union through which stable cohabitation of couples takes place. The incidence of children born outside marriage is extremely rare. Second and based on different sources the mean age at first marriage has increased from 18.7 years for female in 1973 census to 21.3

years in 1983 census and to 23.2 years in the 1990. Also statistically if mean age at marriage is criticized by its sensitivity to extreme value, median age at first marriage support our argument.

According to table (4), the median age at first marriage had increased for the different age groups during the two periods. The trend across cohorts suggests substantial increase in age at first marriage for the three age groups (20-24), (25-29), and (30-34) . Increase in the median age at first marriage is an indicator to the reduction in the exposure to the risk of pregnancy and hence to reduction in the completed family size.

Table (4) : Median Age at First Marriage by Current Age SFS-79 ,SDHS-90 and SMS-99

Current Age	*SFS(1979)*	*SDHS(1990)*	*SMS(1999)*
20-24	18.6	20.0	*
25-29	17.0	20.5	*
30-34	15.7	18.1	18.8
35-39	16.2	16.4	17.9
40-44	15.9	15.8	17.1
45-49	16.2	16.3	16.6

***** *Not computed because the marriage experience has been truncated*
Source:. 1979 SFS Principal Report I ,1990 SDHS Report I and 1999 SMS Report

Strong evidence for fertility decline is marriage delay in northern Sudan. A comparison of data on proportions of single female for the different cohorts in SFS, SDHS-90 and SMS suggest that across the three surveys, there has been a consistent increase in the proportion reported single among all age cohorts of women, see Table (4). For example among the (20-24) age groups, the proportion of single females increased by 17.2% (see table 5A).

Table (5A) : Percentages of Women Who are Single SFS-79 ,SDHS-90 and SMS-99

Current Age	*SFS(1979)*	*SDHS(1990)*	*SMS(1999)*
15-19	78.2	84.1	84.3
20-24	36.4	54.2	53.9
25-29	11.0	27.8	28.4
30-34	4.3	13.2	15.4
35-39	2.0	5.4	6.7
40-44	1.5	3.0	4.2
45-49	0.8	1.3	1.8
Total (15-49)	28.0	40.0	38.1
SMAM	21.7	24.1	24.2

Source: 1979 SFS Principal Report I ,1990 SDHS Report I and 1999 SMS Report

According to the same table for women aged (15-19), the proportion never married increased by 12% points between the SFS-79 and SDHS-90. Information from the 1983 and 1993 census support this fact. According to table (5B) from every 100 women in age group (10-14) one women marries before age 15, this trend indicates the existence of child bearing in North Sudan but the percentage decreased during the period (1983-1993). The percentage of women married in age group (15-19) decreased from 28% in 1983 to 20% in 1993. About three fourths of female in age group (25-29) get marriage in North Sudan. The percentages of married females increase with age, by age group (45+) four fifths of female population married, the percentage married by this age group not experienced any significant change during the period (1983-1993).

Table (5B) Percentages of females by marital status according to age group in North Sudan (1983-1993)

Age Groups	**Single**		**Married**		**Widowed**		**Divorce**	
	1983	1993	1983	1993	1983	1993	1983	1993
10-14	97.8	98.8	2.1	1.1	00	00	0.1	0.1
15-19	70.7	79.4	28.2	19.7	0.2	0.2	0.9	0.7
20-24	33.7	44.6	63.3	52.1	0.6	0.6	2.4	2.7
25-29	11.2	19.7	84.5	75.6	1.3	1.4	3	3.3
30-34	4.3	10.3	89.8	83.1	2.3	2.6	3.5	4.0
35-39	2.1	4.0	89.3	87.2	4.6	4.7	4	4.1
40-44	1.5	2.3	83.5	83.5	9.8	9.3	5.2	4.5
45-49	1.1	1.6	78.3	79.2	15	14.1	5.6	5.1
Total	-	35.3	-	53.6	-	8.2	-	3.2

Source: CBS, 1995.

Under the simple assumption that a woman who fails to marry till age 50 will never marry, 1.6% of women will lose their chance being mothers. The percentage is small but indicates a new trend in nupiality pattern. The percentage of the population who are single (never married) increased from 35.8% in 1983 to 43.3% in 1993. By comparing single women percentages in censuses 1993 and 1983 women marry earlier in 1983 than 1993.

Marriage disturbance in North Sudan caused either by widowhood or divorce. According to 1993 census 8% of female aged 10 and over are widowed. The disturbance caused by widowhood decreases the duration of reproductive span of female in North Sudan and negatively related to the fertility. The percentage of female widowhood increases as the age increases, till it reaches its peak in age group 45 and over in which 14% of female are widowed. About 3% of women in North Sudan considered divorce. The study expects that, the impact of divorce and widowhood is not significant on fertility in North Sudan for three reasons first the percentage itself not high and second divorce and widowhood take place at late ages when fecundity is low and finally in such Islamic societies the remarriage is motivated and can take place within short period.

The delay in the age at first marriage of females over time can be measured by changes in the Singulate Mean Age at First Marriage (SMAM). SMAM is an estimate of the average number of years lived in the single state by those how marry before age fifty (Hajnal , 1953). This statistic is an age standardized statistic like (TFR) and is a period measure displaying the behavior of a hypothetical, synthetic cohort. Table (5) indicates that, during the period 1979-1999, the SMAM of females has increased by more than two years.

The second proximate determinant of fertility is postpartum nonsusceptibility to pregnancy which does not figure remarkably in the fertility declining. No significant changes in the frequency and duration of breastfeeding have been reported. Both the SFS-79 and the SDHS-90 investigated breastfeeding practices. These data showed that breastfeeding has had little influence on Sudanese fertility decline. The average duration of breastfeeding had slightly increased between the two surveys. The SFS

-79 reported 17.2 months, while the SDHS-90 reported 19.5 months and the SFS-79 21 months .

Among the proximate determinants of fertility, the practice of birth control also does not figure in the fertility decline. Sudanese women are non- contracepting population. The percentage of women currently using any method of contraception had increased from 4.6% during SFS to 8.7% during the SDHS-90 and declined to 7.2% during SMS. While the percentage of women not currently using any method increased from 91.3% in SFS-79 to 95.4% during the SDHS-90.

Regarding the question on how prevalent is abortion in Sudan? Its role has not been yet discussed, partly because of the lack of reliable data either national or regional. Since induced abortion is not legal in Sudan, except in the case of rape or risk to the mother's life, it is rarely performed in public institutions. Hence we did not consider it to affect fertility change.

5.1 The Bongaarts Model

To quantify the relative effects of the proximate determinants of fertility, the study uses the model developed by Bongaarts and Potter (1983). The model quantifies the effects of the six proximate determinants that have the most important influences on fertility levels. These are union pattern, contraception, lactational amenorrhea and postpartum abstinence, pathological sterility, and abortion. The analysis of fertility in this section is based on that model.

The model relates total fertility rate to total potential fertility reduced by a series of indices each of, which reflects the fertility reducing effect of proximate determinant. An index ranges between 0 and 1 for the proximate determinant. If it has a value of zero, it implies the strongest effect on fertility reduction (fertility equal zero), a value of one has the weakest effect on fertility (the proximate determinant has no fertility limiting effect). The lower the index, the more influential the proximate determinant is in reducing the total fecundity rate (TF), that is the level of fertility that would occur in the absence of all of the proximate determinants. Thus the proximate determinants can be thought of as inhibitors of fertility. The description of the proximate determinants used in this analysis and the computational procedure used to estimate the indices are given in the appendix of the paper.

The basic Bongaarts model could be expressed as follows:

TFR = TF (Cm.Cc.Ci.Ca)

Where TFR is the Total Fertility Rate, TF is the Total Fecundity Rate, Cm, Cc, C_i and Ca are indices measuring the fertility inhibiting effect of marriage, contraception, postpartum infecundability and abortion respectively.

The analysis of Bongaarts model, does not include abortion because of lack of data in Sudan. Examining the results of the SFS-79, the proximate determinants having the greatest fertility-inhibiting effect are postpartum nonsusceptible period. The practice of spacing children for the health of the child and mother still continues to exhibit on powerful fertility reducing effect during the three surveys. It has led to a reduction in fertility by 37, 40 and 38 percent respectively. The second most powerful proximate determinant in inhibiting fertility is marriage pattern , which led to a 20 percent reduction during SFS-99 32 and 38 during SDHS-90 and SMS-99 respectively , see table (6).

Table (6) : Bongaarts Indices and Their Contributions Change in TFR between 1979 and 1990

Indices	*SFS(1979)*	*SDHS(1990)*	*SMS(1999)*	*% Change Between SFS and SMS*	
TFR	6.02	4.96	4.90	Pt	-18.60
C*m*	0.80	0.68	0.62	Pm	-22.50
C*c*	0.96	0.94	0.94	Pc	-2.08
C*i*	0.63	0.60	0.64	Pi	1.59
C*r*	0.81	0.84	0.84	Pr	3.70
Interaction				I	0.38

Source: 1979 SFS Principal Report , 1990 SDHS Report and 1999 SMS Report.

According to the same table weakest index, which has a negligible role in reducing fertility during the three surveys, is contraception usage. It reduced fertility by only 4 percent during the period 1975-79. This is true since the SFS-79 showed that only 6.4% of the surveyed women were current users of contraceptives. Moreover it led to a 6 percent reduction in TFR during both SDHS-90 and SMS-99.

5.2 The Relative Contribution of The Proximate Variables to Fertility Change

Having examined the proximate determinants of fertility using the SFS-79 and the SDHS-90 results in the above section, interest shifts next to dig deeper and assess the

relative contribution of the proximate fertility variables to fertility change between 1979 and 1999. The decomposition equation for the differences between TFR in 1979 and TFR' in 1999 can be written by the following equation:

$$(TFR/TFR') = (Cm/Cm') * (Cc/Cc') * (Ci/Ci') * (Cu/Cu') * (TFR/TFR')$$

(C*m*), (C*c*), and (C*i*) represent Bongaarts indices of proportion married, contraception and lactational infecundability respectively, (C*r*) represents an index of set of all other proximate variables such as intrauterine mortality, sterility, abstinence, abortion etc., for the two periods.

Defining further **:**

Pt = percentage change in TFR

Pm = percentage of change in TFR due to change in Marriage.

Pi = percentage of change in TFR due to change in postpartum infecundability.

Pc= percentage of change in TFR due to change in contraception.

Pr = percentage of change in TFR due to change in other proximate determinants.

The contribution of the change in each of the marriage pattern, contraceptive use, lactational infecundability and other unmeasured proximate variables to the change in TFR between 1979 and 1999 for Northern Sudan are presented in Table (6). The observed decline in TFR (1.12) live birth, a 18.6 % decline can be decomposed into a 22.5 % decline due to a decrease in proportion of women married, a 2.08 % decline due to increase the duration of breastfeeding . It is interesting to note that the remaining proximate determinants contribute to 1.59 % increase in the TFR, while the interaction factor contributes to an increase in TFR by 0.38%. As expected contraceptive use did not figure to fertility decline, since there is drop in the number of current user during the period 1979 and 1999. Thus change in marriage pattern has the strongest effect in reducing fertility in Northern Sudan between the two periods.

6. The Background Factors Influencing Fertility Decline in Sudan

This section investigates the roles played by some factors: education, employment and urbanization in fertility decline during the period 1979 and 1999.

6.1 Female Education

Taking into account the results of SFS and the SDHS-90, education has a great effect on fertility. According to Table (7) in 1979 SFS-79 the standardized mean number of children ever born was (4.2), (4.4) and (3.0) for the three categories in ascending order no education, incomplete primary and primary and over. This is further supported by the results of SDHS-90, where the number of children to women age (40-49), were 7.4, 6.9 and 4.8 for the three categories no education, primary and secondary and above respectively. Khalifa (1986) mentioned that, rural women, women with no education and those married to uneducated husbands showed rapid parity progression and its cumulative effects on fertility, which are consistent over all birth intervals. In fact education affects fertility through median age at first marriage, since it affects the overall span of reproductively, the results of the SFS-79 showed that the median was 17.2 years for those with no schooling and 19.8 years, for those who did not complete primary and 24.0 years for those with primary and over. In general one can conclude that there is an inverse relationship between education of women and fertility.

Table (7) : Mean Number of Children Born to Women Who Have Been Continuously in the Marriage State During That Interval According to Background Characteristics, SFS-1979

Background Characteristics	***Unstandardized Mean***	***Standardized Mean***
Level of Education		
No Schooling	4.4	4.2
Incomplete Primary	3.6	4.4
Primary and over	2.4	3.0
Pattern of Work		
Before and after marriage	4.0	3.7
After marriage only	4.5	4.0
Before Marriage only	3.9	4.3
Never worked	4.3	4.4

Source: 1979 SFS Survey Principal Report I.

Regarding female education in Sudan, historically, the general attitude towards female education has been negative. During the first 60 years of the of the twentieth century, education for girls developed more slowly and only as a by-product of the expansion of boys schools. However, the enrollment situation improved significantly during the 1980's as table (8) illustrates.

Table(8) : School Enrollments by Level, Sex, and Year (1956-1983)

	Elementary			*Intermediate*			*Secondary*		
Year	Female	Male	(F/M)%	Female	Male	(F/M)%	Female	Male	(F/M)%
1956	33.0	146.0	22.6	7.0	39.0	17.9	4.0	22.0	18.2
1967	156.2	315.0	49.6	22.0	67.4	32.6	5.4	23.7	22.6
1977	491.7	815.3	60.3	74.2	144.4	51.4	22.2	47.3	46.9
1983	643.4	935.8	68.8	137.7	193.3	71.2	60.5	99.2	61.0

Source: Bedri and Burchinal (1985).

The expansion of female education was not restricted in to basic education, there was increase in the numbers of girls attending universities and higher institutes. The statistics of the Ministry of High Education showed that during the academic year 1980/1981 the percentages of female attending universities and higher institutes are 40% of the total number of student accepted (William and Adham, 1994). During the 90's Sudan's government embarked the " Higher Educational Revolution" which let to double the intake of the higher education admissions and establishment of a number of new universities. This new act increases the number of female attending higher education in Sudan.

6.2 Female Employment

There is a clear relationship between pattern of work and cumulative fertility. According to the SFS results, fertility was highest among women who never worked, the standardized mean number of children ever born was 4.4, or who worked only after marriage 4.0, and lowest among women who worked both before and after marriage 3.7, see Table (7). Saghyroun (1985) found that women who report no work experiences have the highest fertility, while those who are self employed or are family workers have an intermediate level of fertility; on the other hand women who work for others have the lowest fertility. He concluded that as the status of women shifts to perceptions based on education and gainful employment, fertility will decline.

If we examine the employment status of women in Sudan, we find that women participation in economic activities was limited during the 1960's and 1970's and the gender gap in favor of males. The ILO (1976) argued that perhaps only one urban woman in ten was in labor force, in northern Sudan. This low ratio may be attributed to the women's limited education at that time and the educational selection process at those times, which discourages female education. According to Hamza 2005, the period (1978-1989) has witnessed a significant increase of females in the labor force

participation. This may be due to the slight increase in female education during that time.

6.3 The Urbanization

Although urbanization is an integral part of modernization theory's explanation of fertility decline, it has been largely ignored in the literature on Sudanese fertility studies. Urban growth in Sudan started earlier compared with other African countries. The 1955/56 census reported 8.3% of the population as urban population, while 1973 census showed 18.5%. This percentage increased to 20% in 1983 census. The 1993 census showed 25.2% for urban population which indicates a growing urbanization process during the period between the two censuses.

Given rural /urban fertility differentials, a country with fast urban growth is more likely to experience fertility decline. According to, Johnson (1994), fertility in Korea and Taiwan felled quickly, by, comparisons to China, in part because they had rapid rates of urbanization. Urbanization contributed to the fertility decline in Sudan because it is associated with a wide range of social, economic, and political changes during that period.

6.4: Economic hardship

Economic hardship has been cited by numerous studies (e.g.,SDHS 1990; Eltigani 2001a) as a major, if not the major, factor behind the decline of fertility in Arab countries. According to these studies, the tough economic conditions experienced by most Arab countries led to the delay in marriage and to a decline of fertility within marriage.

The economic hardship experienced by Sudan in recent years has not been a transient phenomenon related to cyclical fluctuations of output, prices, income, and employment. Rather, it is the outcome of profound changes in economic policies.

Since 1980's Sudan has experienced what is called economic crises, (Ali, 1985) which is reflected by mounting external debts and declining economic growth, poor management, and deteriorating public services, political instability, weak, poor, and inequitable socioeconomic development policies, weak resource base, and unfavorable terms of trade. Famines and war in Western and Southern Sudan complicate all this respectively.

Economic hardship affected fertility negatively through two mechanisms. First unfavorable economic conditions hindered the entry to the marriage institution.

Second even for those who are married increasing cost of children affected their decision to have additional children.

7. Conclusion

This paper could be concluded by the following points. First there is a fertility decline in Sudan, the TFR has declined by 18.6 % during the period 1979 -1999. Secondly, it is agreed that there is a regional fertility differential associated with social and economic development in the different regions. Thirdly, nuptiality appears to have played an important role in reduction of fertility during the specified period. The (Cm) index of marriage was 0.80 during SFS-79, 0.68 during the SDHS-90, and 0.60 during SMS-99 resulting in overall fertility reduction by 22.5 % .Fourth, postpartum infecundability has a large effect in reducing fertility during both surveys, but it did not exhibit much decrease between the two surveys. Fifth, contraception is not widely prevalent and not affecting fertility change significantly (contraceptive use was very low at the time of three surveys 4.5% in SFS-79, 8.7% in the SDHS-90 and 7.2 during SMS-99, the low prevalence of contraceptive use in Sudan needs a further research. Sixth increase in female education, especially higher education; seem to have a great affect since it delays marriage. Finally one can expect that fertility would decline in the future since all variables which are affecting fertility are growing and functioning in the opposite direction.

8. Remarks and Recommendations:

From the topic that have been covered some policy and research recommendation can be drown. First a word of caution in handling retrospective data and in the ways that they have been collected and manipulated is in order. Second the levels of Sudanese fertility perhaps were characterized as one of the worlds highest. Better understanding of the reasons of its decline necessitates conceptualizing the determinants and discerning the relative importance of each determinant on fertility reduction. Third there is an acute need for suitable educational policy. More governmental expenditure on education and greater participation of female in the labor force will lead to more reduction in fertility. Fourth family planning services most be made available to every interested family and advocacy must be launched in order that it becomes a social routine mix in family life. Finally there is urgent need for a comprehensive population policy in which all country strategies (education, health, etc) are included.

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Appendix

1. Index of Marriage is calculated as follows:

Cm = Total Fertility Rate (TFR)/Total Marital fertility Rate (TMFR)

2. Index of Contraception is calculated as

Cc = 1- 1.08 ue,

Where u is the current contraceptive use prevalence are among women in sexual union, and e the average use-effectiveness of contraception.

3. Index of Postpartum Infecundability is calculated as:

Ci = 20/(18.5 + I),

Where I is the mean number of months of postpartum infecundability (*estimated by using the prevalence/incidence method*) In this analysis, I is the period of nonsusceptibility, calculated as the number of mothers either amenorrheic or abstaining at the time of the survey (*prevalence*) divided by the average number of births per month over the last 36 month (*incidence*).

4. The decomposition equation for the differences between TFR in 1979 and TFR' in 1990 can be written by the following equation:

$$(TFR/TFR') = (Cm/Cm') * (Cc/Cc') * (Ci/Ci') * (Cu/Cu') * (TFR/TFR')$$

Defining further:

$Pt = ((TFR/TFR') - 1) * 100 =$ percentage change in TFR

$Pm = ((Cm/Cm') - 1) * 100$ = percentage of change in TFR due to change in Marriage.

Pi = $((Ci/Ci') - 1) * 100$ = percentage of change in TFR due to change in postpartum infecundability.

P*c*= $((Cc/Cc') - 1) * 100$ = percentage of change in TFR due to change in contraception.

Pr = $((Cu/Cu') - 1) * 100$ = percentage of change in TFR due to change in other proximate determinants.