Greater Than Expected Fertility Decline in Ghana

An Examination of the Evidence

National Population Council Secretariat

Macro International Inc.

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The GDHS further analysis project is part of the MEASURE *DHS+* programme designed to collect, analyse, and disseminate data on fertility, family planning, and maternal and child health. Additional information about the MEASURE *DHS+* programme may be obtained by writing to MEASURE *DHS+*, Macro International Inc., 11785 Beltsville Drive, Calverton, MD 20705 USA (Telephone 301-572-0200; Fax 301-572-0999).

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1 Background

On the basis of evidence accumulated over several decades of fertility research, it has been well established that a strong correlation exists at the national level between contraceptive use and fertility rates. The relationship can be summarised statistically using a linear regression of the contraceptive prevalence rate (CPR) on the total fertility rate (TFR). A recent version of this regression based on more than 100 observations indicates that for every increase of 15 percentage points in the use of contraception among married women, a decline of one child in the total fertility rate may be expected (Ross and Frankenberg, 1993). Significant deviations from this expectation, mostly in sub-Saharan Africa, have been noted in a number of studies (e.g., Blanc and Poukouta, 1997; Brown, 1996; Curtis and Diamond, 1995; Thomas and Mercer, 1995) In this study, we examine fertility decline in Ghana that is larger than expected on the basis of contraceptive use. Our primary sources of data are three Demographic and Health Surveys conducted in the country in 1988, 1993, and 1998.

We examine the evidence for three possible explanations of the TFR-CPR inconsistency:

- The decline in fertility rates derived from the surveys may be overestimated. This overestimation could have occurred as a result of the omission of births in one or more surveys or other inaccuracies in the birth history data.
- The increase in contraceptive prevalence rates may be underestimated. This underestimation could have occurred as a result of inaccuracies in the contraceptive use data in one or more surveys.
- Both fertility and contraceptive use are correctly estimated and the seeming inconsistency between the two results from trends in determinants of fertility other than contraceptive use. If this is true, it implies that the TFR-CPR relationship in Ghana does not fit the international pattern.

First, we consider the joint trends in fertility and contraceptive prevalence in Ghana and compare them to the trends that would be expected on the basis of prior research. We find that the survey estimates of fertility decline in Ghana are substantially greater than would be expected on the basis of recorded increases in contraceptive prevalence. Next, we attempt to uncover the explanation behind this unexpected finding. We look at measures of the quality of the survey data as well as trends in the proximate determinants of fertility: contraceptive use, marriage and sexual activity, postpartum insusceptibility, and abortion. Finally, we consider the possibility that couples use adjustments in their coital frequency to obtain their fertility desires, behaviour that would influence fertility rates but would not be captured by conventional measures of the proximate determinants of fertility.

2 Data

Ghana has conducted three surveys under the Demographic and Health Surveys programme (GSS and IRD, 1989; GSS and MI, 1994; GSS and MI, 1999). The surveys were conducted at five-year intervals in 1988, 1993, and 1998. All of the surveys are nationally representative and include data for women age 15-49. The sample sizes range from 4,488 women in 1988 to 4,843 women in 1998. The two latter surveys also included smaller sub-samples of men age 15-59. In the 1988 and 1993 surveys, a full live birth history was collected from all women, whereas in 1998, a full pregnancy history (i.e., live and non-live births) was obtained. The fertility rates used in this paper are calculated using the birth history data for various periods prior to the survey. Information on contraceptive use was also collected in all three surveys using questions that were identical across the surveys.

3 Trends in Fertility and Contraceptive Use, 1988-1998

Trends in Fertility

According to the estimates derived from the GDHS surveys, the total fertility rate in Ghana declined from 6.4 children per woman in the late eighties to 5.5 in the early nineties. By the mid-nineties, a further drop of 0.9 children per woman to 4.6 was recorded (Table 1). Confidence intervals around the estimates do not overlap, indicating that the declines are statistically significant.

Table 1 Age-specific and total fertility rates for the five years preceding the survey, and confidence intervals, 1988-1998

	Age-specific fertility rate (/1000)		
Age group	1988	1993	1998
15-19	124	119	90
20-24	258	231	192
25-29	278	244	206
30-34	248	215	183
35-39	195	163	143
40-44	117	99	79
45-49	60	29	16
Total fertility rate	6.4	5.5	4.6
Confidence interval (+/- 2SE)	6.2-6.6	5.2-5.7	4.3-4.8

The largest percentage decline in the period between the 1988 and 1993 surveys occurred in the age group 45-49 and the smallest decline occurred among 15-19 year olds (Figure 1). Among five-year age groups from age 20 to 44, the percentage declines were similar, ranging from 11 to 16 percent. Between the 1993 and 1998 surveys, the pattern of decline was different. In this period, the largest percentage declines occurred among 15-19 year olds and among women age 40 and older. Among the age groups from 20-39, the percentage declines were slightly larger than in the previous period, ranging from 12 to 17 percent.

Although fertility decline has occurred in all regions of Ghana, the pace and magnitude of the decline has varied (Table 2). In Greater Accra, where the total fertility rate was already 4.6 in the late eighties, the rate 10 years later was almost two children lower (41 percent) at 2.7. A decline of slightly more than one third, amounting to more than two children per woman, occurred in the Eastern region over the 10-year period. The TFR fell by between 22 and 27 percent in the Western, Central, Volta, and Brong-Ahafo regions and by 19 percent in Ashanti. The smallest decline was recorded in the northernmost regions of the country (Northern, Upper East, Upper West) where fertility was high in the late eighties at 6.8 children per woman and declined by 13 percent over the decade to 5.9.[1]

[1] The sample for the 1988 survey was not designed to provide separate estimates for Northern, Upper East, and Upper West so they have been combined here. The samples for the two subsequent surveys were designed to support separate estimates for the three regions.

Figure 1 Age-Specific Fertility Rates in Ghana, 1988-1998

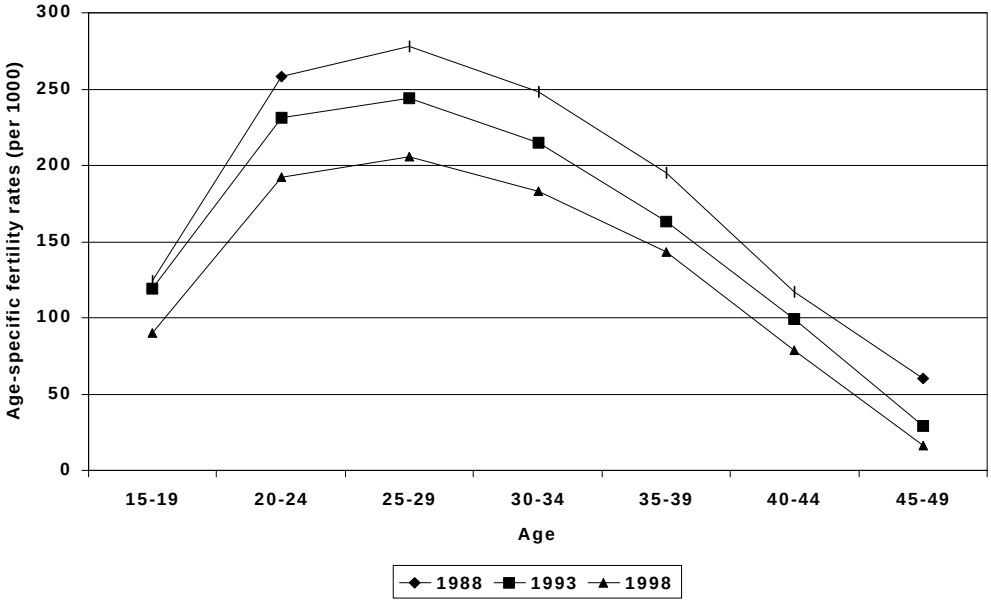


Table 2 Total fertility rates for the five years preceding the survey, and percent change and absolute change in the total fertility rate, by region

Region	Total fertility rate			Percent change			Absolute change 1988-1998
	1988	1993	1998	1988-1993	1993-1998	1988-1998	
Western	6.1	5.5	4.7	-9.8	-14.6	-23.0	-1.4
Central	6.6	5.6	4.8	-15.2	-14.3	-27.3	-1.8
Greater Accra	4.6	3.6	2.7	-21.7	-25.0	-41.3	-1.9
Volta	5.7	5.4	4.4	-5.3	-18.5	-22.8	-1.3
Eastern	6.7	5.1	4.4	-23.9	-13.7	-34.3	-2.3
Ashanti	5.9	5.6	4.8	-5.1	-14.3	-18.6	-1.1
Brong-Ahafo	6.9	5.5	5.4	-20.3	-1.8	-21.7	-1.5
Northern, Upper West, East	6.8	6.8	5.9	0.0	-13.2	-13.2	-0.9
Northern	U	7.4	7.0	-	-5.4	-	-
Upper West	U	6.0	6.1	-	+1.7	-	-
Upper East	U	6.4	5.0	-	-21.9	-	-

U = Unknown (not available)

Trends in Contraceptive Use

Total contraceptive prevalence among married women increased by 7.4 percentage points from 12.9 percent in 1988 to 20.3 percent in 1993. This increase represents a 57.4 percent change between the two surveys. From 1993 to 1998 however there was only an 8.4 percent change (a 1.7 percentage point increase). In all three surveys, periodic abstinence accounts for the largest share of contraceptive use, followed by the pill (Table 3).

During the 1988-1993 period, condom use increased more than sevenfold, from 0.3 percent to 2.2 percent, injectables increased more than fivefold, from 0.3 percent to 1.6 percent, withdrawal increased by 133 percent, and the pill increased by 78 percent. The corresponding changes between 1993 and 1998 were much lower. Injectables increased by a 94 percent while other methods increased by less than 25 percent. Use of withdrawal actually decreased from 2.1 percent to 1.5 percent.

The prevalence rate for men in both 1993 and 1998 was higher than that for women for most methods except female sterilisation. Particularly striking is the high prevalence of condom use in the two surveys (10.4 percent in 1993 and 8.2 percent in 1998) as opposed to the prevalence reported for the same method by women. The difference between the two figures may be attributed to men using the condom with women who are not their regular partners or to women underreporting condom use with their partners (Becker et al., 2000).

Table 3 Method-specific and overall contraceptive prevalence rates among currently married women and men, 1988-1998

		1993		1998	
Method	1988	Women	Men	Women	Men
Pill	1.8	3.2	4.7	3.9	5.0
IUD	0.5	0.9	1.1	0.7	0.9
Injectables	0.3	1.6	0.9	3.1	3.7
Diaphragm/foam/jelly	1.3	1.2	2.1	0.9	0.4
Condom	0.3	2.2	10.4	2.7	8.2
Female sterilisation	1.0	0.9	0.7	1.3	1.1
Male sterilisation	-	-	-	0.0	0.1
Implant	-	0.0	-	0.1	0.1
LAM	-	-	-	0.5	0.3
Periodic abstinence	6.2	7.5	9.1	6.6	8.4
Withdrawal	0.9	2.1	4.0	1.5	2.5
Other methods	0.6	0.5	0.5	0.6	0.6
Total	12.9	20.3	33.5	22.0	31.5
Confidence interval (+/- 2SE)	11.5-14.2	18.7-21.9	U	20.3-23.6	28.1-34.9

LAM = Lactational amenorrhoea method
U = Unknown (not available)

The Greater Accra region consistently had the highest level of contraceptive prevalence over the ten-year period (Table 4). The Eastern, Brong-Ahafo, and Volta regions have also been consistently higher than the other regions. The Western, Central, and three northern regions tend to have the lowest prevalence rates, although the Western region experienced a strong surge in contraceptive use between 1988 and 1993, which pushed its prevalence rate to second behind Greater Accra. By 1998, however, prevalence in the Western region had actually declined by 8 percentage points, resulting in the second lowest CPR. The largest percent change over the ten-year period was recorded in the Ashanti region (144 percent), followed by the Western region (123 percent). The three northernmost regions recorded a 5.6 percent drop in the CPR over the same period.

Table 4 Percentage of married women using contraception, and percent change and absolute change in contraceptive prevalence, by region, 1988-1998

Region	Contraceptive prevalence			Percent change			Absolute change
	1988	1993	1998	1988-1993	1993-1998	1988-1998	1988-1998
Western	8.2	26.4	18.3	+222.0	-30.7	+123.2	+10.1
Central	9.7	15.6	19.3	+60.8	+23.7	+99.0	+9.6
Greater Accra	27.2	36.8	32.2	+35.3	-12.5	+18.4	+5.0
Volta	11.4	25.2	21.1	+121.1	-16.3	+85.1	+9.7
Eastern	14.6	25.9	26.6	+77.4	+2.7	+82.2	+12.0
Ashanti	10.1	13.7	24.6	+35.6	+79.6	+143.6	+14.5
Brong-Ahafo	12.0	25.4	24.7	+111.7	-2.8	+105.8	+12.7
Northern, Upper West, East	10.7	10.0	10.1	-6.5	+1.0	-5.6	-0.6
Northern	U	11.2	10.0	-	-10.7	-	-
Upper West	U	6.6	11.9	-	+80.3	-	-
Upper East	U	10.2	9.0	-	-11.8	-	-

U = Unknown (not available)

The 15-19 age group experienced a more than threefold increase (317 percent) in the CPR over the 1988-1998 period, followed by the 45-49 age group with a slightly more than 100 percent change. This result is broadly consistent with the age pattern of fertility decline over the period. The smallest change (4.9 percent) was in the 40-44 age group (Table 5).

Table 5 Percentage of married women using contraception and percent change and absolute change in contraceptive prevalence, by age, 1998-1998

Age group	Contraceptive prevalence			Percent change			Absolute change
	1988	1993	1998	1988-1993	1993-1998	1988-1998	1988-1998
15-19	4.6	13.0	19.2	+182.6	+47.7	+317.4	14.6
20-24	11.1	16.9	20.7	+52.3	+22.5	+86.5	9.6
25-29	13.2	21.1	22.2	+59.8	+5.2	+68.2	9.0
30-34	14.4	20.5	24.8	+42.4	+21.0	+72.2	10.4
35-39	15.2	26.0	26.3	+71.1	+1.2	+73.0	11.1
40-44	18.4	23.2	19.3	+26.1	-16.8	+4.9	0.9
45-49	7.7	14.3	15.8	+85.7	+10.5	+105.2	8.1
Total	12.9	20.3	22.0	+57.4	+8.4	+70.5	9.1

The TFR-CPR Relationship

In Figure 2, the total fertility rate and contraceptive prevalence rate are plotted for 30 sub-Saharan surveys. The solid line represents a regression line based on approximately 100 surveys from developing countries. The equation that defines the line [TFR = 7.29 - .070CPR] indicates that in the absence of contraceptive use (CPR = 0), the total fertility rate would be 7.29 and that a one percentage point increase in the CPR is associated with a 0.07 decrease in the TFR. The CPR explains a large proportion of the variation in the TFR: the R^2 for the equation is 0.88. The data point for the 1988 survey in Ghana falls exactly on this line. For the second survey, the point falls below the line and for the third survey, the point falls even further below the line. For the most recent survey, the expected total fertility rate is 5.75, while the actual TFR is 4.60, a difference of almost 1.2 children per woman.

The dashed line in Figure 2 represents a regression line based only on the data points shown in the graph (i.e., only sub-Saharan countries). The intercept decreases to 6.69, the slope decreases by about half to 0.035, and the R^2 declines to 0.31. This suggests that fertility in the absence of contraception is lower in sub-Saharan Africa than elsewhere, probably due to longer durations of breastfeeding and postpartum abstinence. The effect of contraception on fertility also appears to be less in these countries since a one percentage point increase in the CPR is associated with a 0.035 decrease in the TFR. This weaker association may be due to the greater use of less-effective methods of contraception.

In Figure 3, the *change* in the TFR is plotted against the *change* in the CPR for three periods in Ghana and for several other countries for comparative purposes. The solid line is based on the regression line for all countries. For the first period in Ghana (1979 to 1988)[2], the point is actually above the line, indicating that fertility declined slightly less than would be expected on the basis of the increase in contraceptive prevalence. For the period from 1988 to 1993, the 7.4 percentage point increase in the CPR was expected to be associated with a 0.5 child decline in the TFR; however, the actual decline in the TFR was 0.9. Most dramatically, in the latest period, the expected TFR exceeds the actual TFR by about 0.8 children per woman.

The discrepancy between the TFR and the CPR is evident in both urban and rural areas, but it is more pronounced in urban areas (Figure 4). The point representing the period from 1993 to 1998 in urban areas is particularly puzzling since the recorded CPR was virtually unchanged during the period, yet a decline occurred in the TFR of about one child per woman.

This discrepancy also varies by region (Figure 5). Between the earliest and latest surveys, the CPR in the combined Northern, Upper West, Upper East region stayed practically constant, yet the TFR declined by 0.9 children. The discrepancies are particularly large in the Greater Accra, Central, and Eastern regions. These three regions are contiguous geographic areas in the southern and most urbanised part of the country. Discrepancies that are smaller but in the same direction are found in the Volta, Western, and Brong-Ahafo regions. Ashanti is the only region in which the decline in the TFR is within half a child of that expected.

[2] The fertility estimate for 1979 is taken from the Ghana World Fertility Survey.

Figure 2 Total Fertility Rate and Contraceptive Prevalence

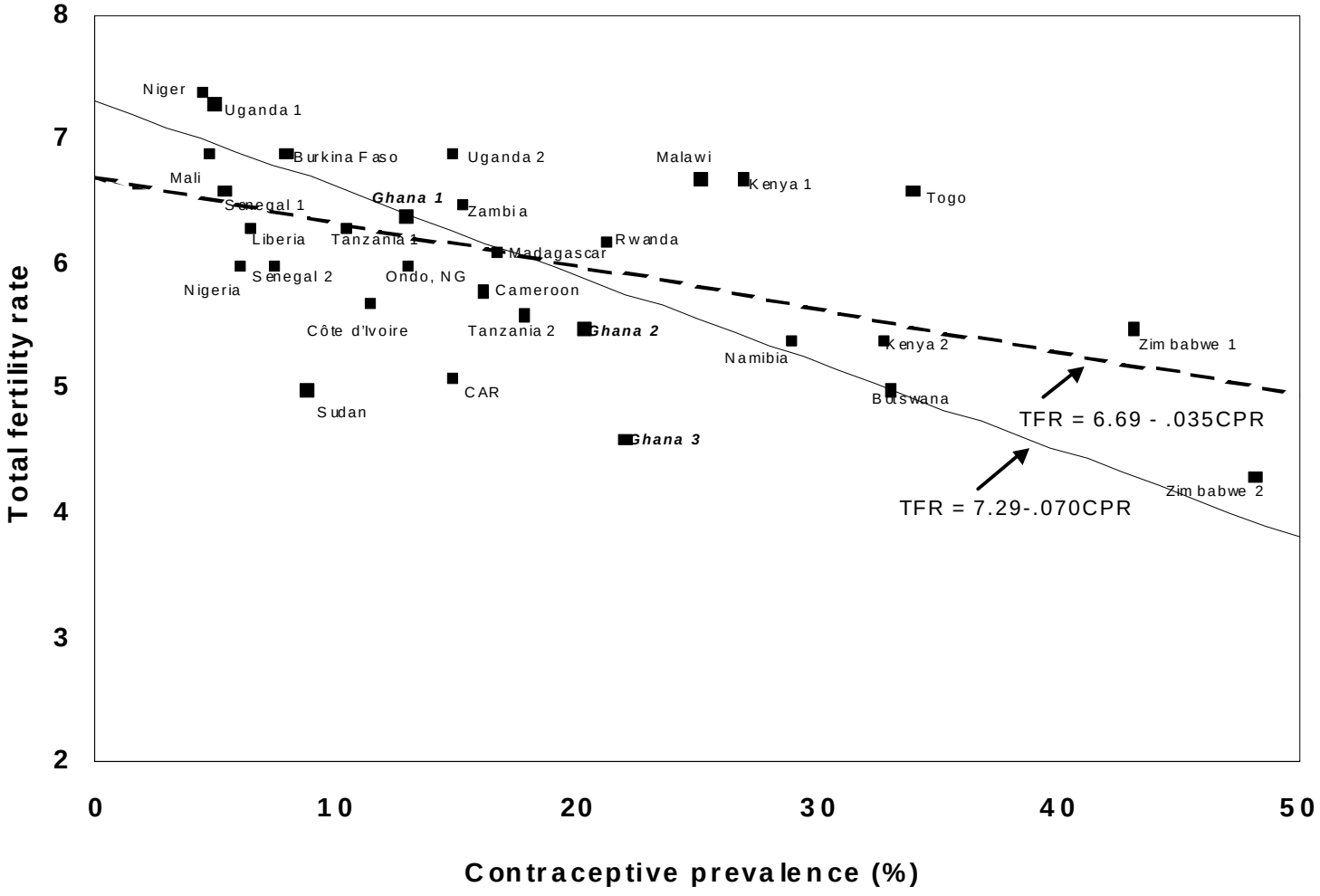


Figure 3 CPR Increase and Corresponding TFR Decrease, 1988-1998

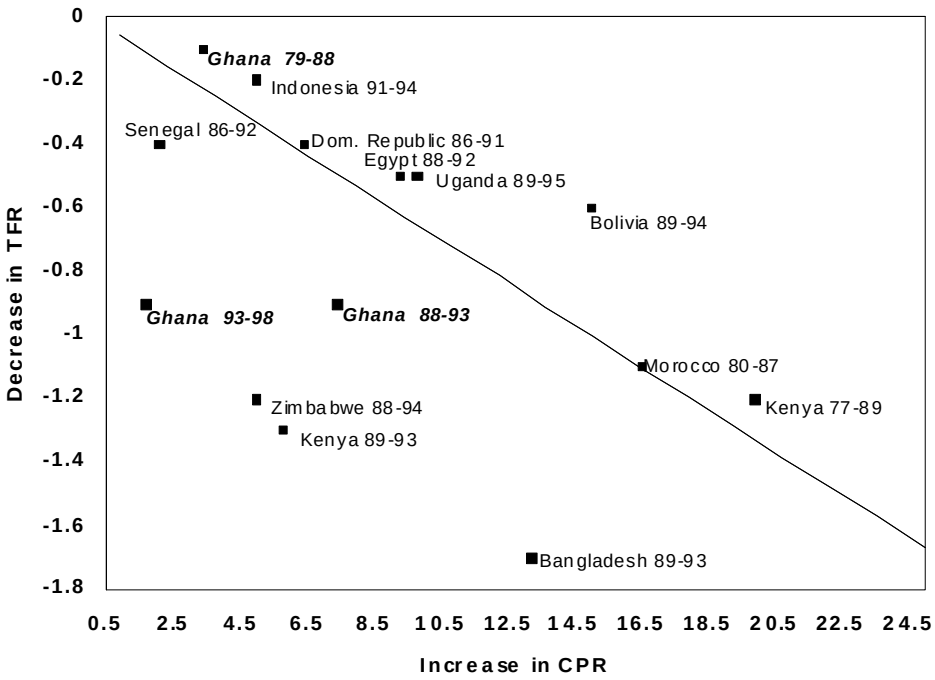


Figure 4 CPR Increase and Corresponding TFR Decrease in Urban and Rural Areas, 1988-1998

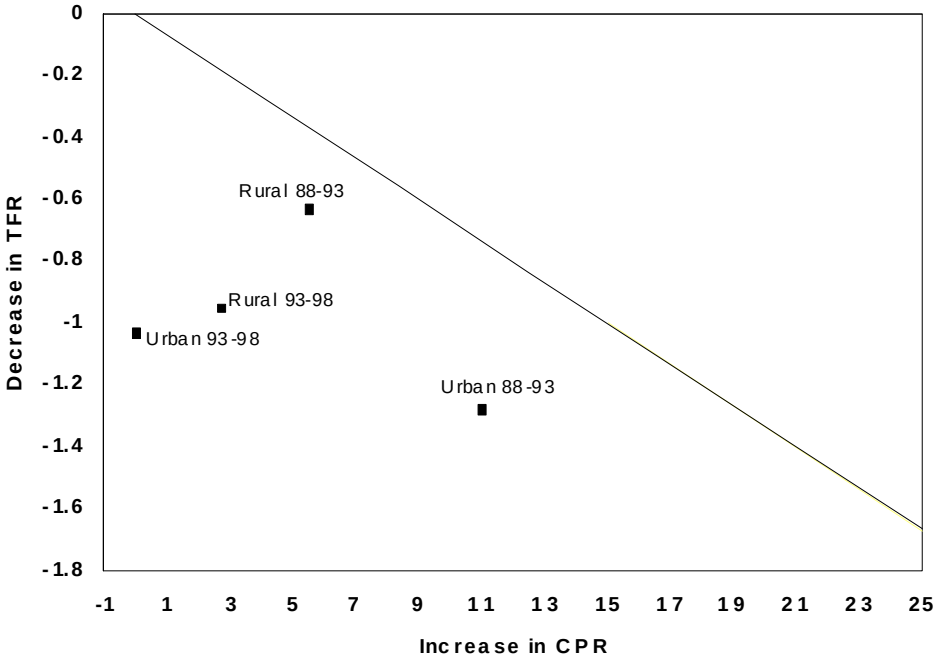
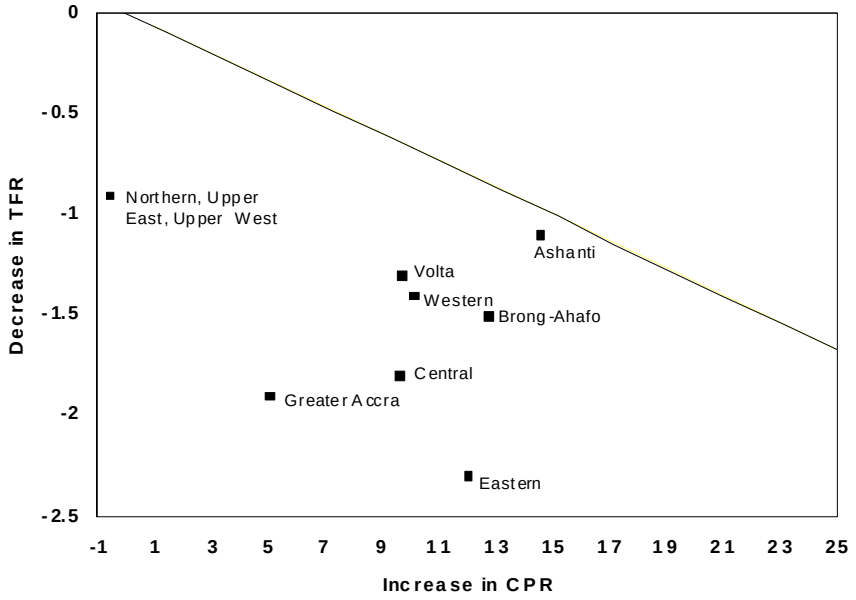


Figure 5 CPR Increase and Corresponding TFR Decrease by Region, 1979-1998



4 Data Quality

Inaccuracies in the birth history data that are used to calculate fertility rates are potentially significant factors in the TFR-CPR inconsistency. The most common inaccuracies are underreporting of births and incorrect reporting of the timing of births. In order for these data problems to influence the consistency between the change in fertility compared with the change in contraceptive prevalence, they would have to be more severe in each subsequent survey. If the level of underreporting was the same in each survey, the TFR-CPR inconsistency may still exist, but the change calculated on the basis of two subsequent surveys would be consistent with expectations.

As shown in Table 6, a simple measure of data quality—the percentage of births in the past 15 years with both month and year reported—suggests an improvement in data quality across the three surveys. This percentage increased from 79 in 1988 to 87 in 1998.

Table 6 Percentage of births in the 15 years preceding the survey with month and year reported

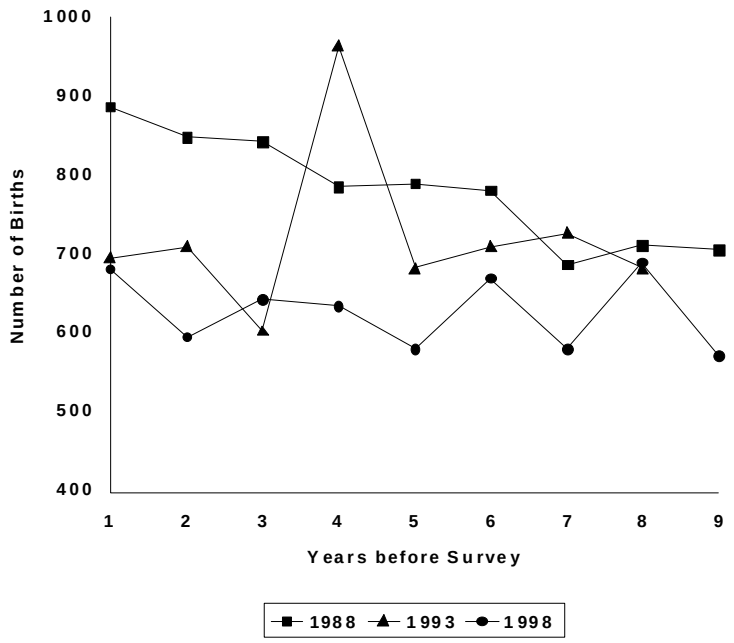
	1988	1993	1998
Percent of births with month and year reported	79.4	82.1	86.7

A particular form of misreporting of birth dates that has been detected in some DHS surveys is birth displacement. Specifically, the DHS surveys contain a lengthy series of questions referring to children born in the five calendar years prior to the survey. The evidence suggests that interviewers may shift some births back in time in order to avoid asking these questions (Arnold, 1990; Marckwardt and Rutstein, 1996). For Ghana, the 1988 and 1998 questionnaires included a five-year cutoff point for these questions. The 1993 questionnaire, however, included a three-year cutoff as part of a DHS-wide attempt to reduce the displacement problem by reducing the number of children about whom the long set of questions was asked.

The number of births reported in each of the nine complete calendar years prior to the survey are plotted in Figure 6. (The year of the survey is excluded because it represents an incomplete year.) In the absence of displacement, the number of births will be relatively smooth across the years. The displacement problem in the 1993 survey is obvious. A deficit of births in the third calendar year prior to the survey is followed by a large excess in the fourth calendar year. A total fertility rate based on the births in the three years prior to the survey would clearly underestimate fertility. A rate based on births in the five years prior to the survey, as we have used in this paper, would presumably include the displaced births since most of them will have been shifted from the third to the fourth year prior to the survey, both of which are included in the five-year TFR. In 1998, there is also some evidence of displacement from the fifth to the sixth year prior to the survey, although the magnitude is much less than in 1993. This displacement would have the effect of underestimating the TFR for the five years prior to the survey but its effect would be small and certainly not enough to explain the TFR-CPR inconsistency.

Omission of children is much harder to detect than displacement, but it mostly affects reporting of recent births. This effect is evident in some countries in a drop in the number of births in the years just prior to the survey. On the basis of this criterion, there is no evidence that significant omission of births has occurred in any of the three surveys in Ghana.

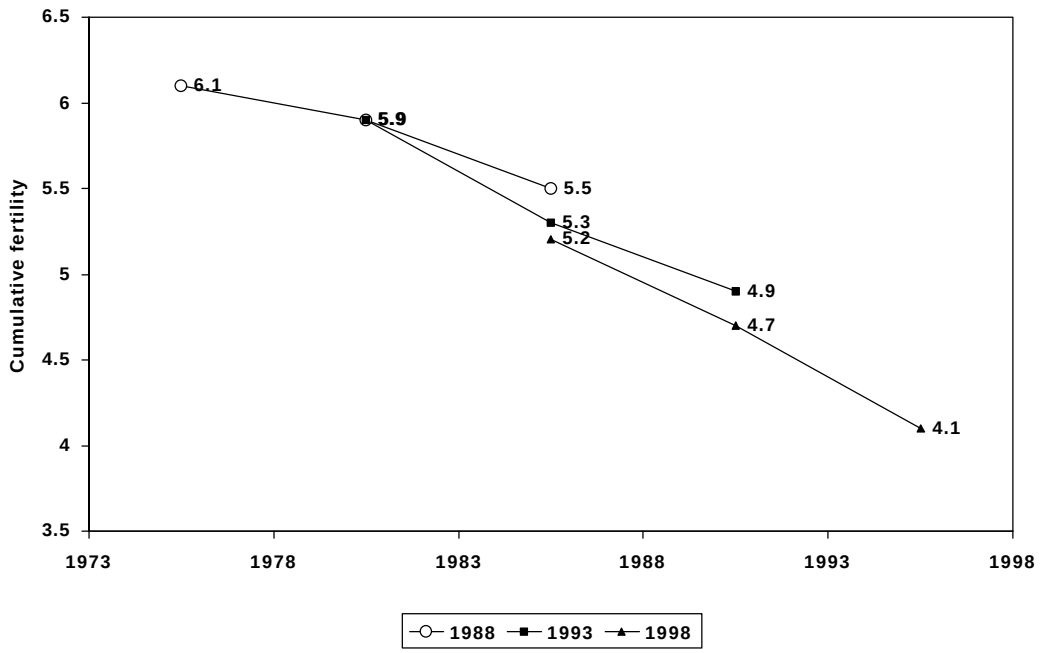
Figure 6 Number of Births by Calendar Year Before Survey



Another means of evaluating the birth history data is to compare the consistency of estimates derived from different surveys for overlapping periods. In Figure 7, cumulative fertility rates for women age 15-39 are shown for the periods 0-4, 5-9, and 10-14 years prior to the survey as calculated from the three surveys. The rates are cumulated only up to age 39 because age truncation occurs as one moves further back in time (i.e., there are no women in the survey who were older than age 39 ten years prior to the survey). The rates are remarkably consistent across surveys. For the period in which all three surveys overlap, the rates vary in a narrow range between 5.2 and 5.5 births per woman. Where two of the surveys overlap, the differences between the estimates are even narrower. Overall, there is little evidence

that the birth history data have produced underestimates of the total fertility rates. To the extent that it is possible to judge, the quality of the birth history data has not deteriorated over time. Given the difficulty of detecting fertility underestimation, however, this explanation cannot be ruled out entirely with the evidence at hand.

Figure 7 Cumulative Fertility Rates (Age 15-39) from Three Surveys



5 Proximate Determinants

Contraceptive Use

Empirical data from countries around the world indicate that an acceleration of fertility decline can be achieved through a shift to more effective, modern, and long-term contraceptive methods. The statistical relationship that has been established between total fertility and contraceptive prevalence incorporates the effects of the method mix in each country. If the method mix in Ghana had a higher than average concentration of the most effective methods, this could account for the TFR-CPR inconsistency.

Table 7 presents the distribution of contraceptive users (women and men) by type of method used (modern or traditional) for the three surveys as well as Ross and Frankenberg's (1993) calculation of the average distribution of contraceptive use across 167 countries. There has been an approximate 10 percentage point increase during each five-year period between surveys in the share of modern contraceptive methods among women. However, the shift from the use of traditional methods to the use of modern methods by currently married contraceptive users (contraceptors)—from 40 to 50 percent between 1988 and 1993—falls short of the 60 percent average among countries at the same level of prevalence. In 1998, there was a further shift to 61 percent of contraceptors using modern methods. However, this increase was still not sufficient to match the expected 75 percent calculated for countries with similar levels of prevalence.

Table 7 Percent distribution of contraceptive users by type of method, 1988-1998

Method	1988	1993 Women	1993 Men	1998 Women	1998 Men	Average across 167 surveys by overall prevalence[a]			
Modern	40.3	50.0	59.4	60.5	63.5	60.0	75.0	76.0	85.0
Traditional	59.7	50.0	40.6	39.5	36.5	40.0	25.0	24.0	15.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Prevalence	12.9	20.3	33.5	22.0	31.5	< 20	20-39	40-59	60+

[a] Ross and Frankenberg, 1993:12

Evidence from Table 8 shows that over the ten-year period there has been a gradual shift by contraceptors from use for spacing to use for limiting. Use for limiting purposes is expected to have a greater impact on fertility decline through more effective and longer duration of use. Although use for limiting among women has increased from 38 percent in 1988 to 44 percent in 1998, it still falls slightly below the 48 percent average for sub-Saharan countries and further below the 75 percent average for the non-sub-Saharan countries. The data for men reveal that their use of contraception for limiting purposes has not changed much, having increased by only 0.5 percentage points between 1993 and 1998. The figure for 1998 (39 percent) is far below the average for both sub-Saharan countries and for non-sub-Saharan countries.

Table 8 Percent distribution of contraceptive users by fertility intention, 1988-1998

Fertility intention	1988	1993 Women	1993 Men	1998 Women	1998 Men	Average[1] 23 sub-Saharan surveys	Average[1] 29 non-sub-Saharan surveys
Using for spacing	62.1	51.9	61.4	55.8	60.8	52.3	25.4
Using for limiting	37.9	48.1	38.7	44.2	39.2	47.7	74.6
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

[1] Westoff and Bankole, 1995

Marriage and First Sex

Marriage patterns affect fertility through their association with exposure to sexual intercourse. In settings in which sexual intercourse (and childbirth) occurs exclusively within marriage, marital status is an adequate proxy for exposure. In settings like Ghana, however, where exposure to sexual intercourse also occurs outside of marriage, it is important to examine information that directly measures sexual behaviour, although this information may be less reliable than the information on marriage. A trend toward delayed initiation of sex and later age at marriage would, all else being equal, contribute to reduced fertility.

Table 9 presents the median age at first sexual intercourse and median age at first marriage for women in five-year groups of current age. In 1988, the median age at first sex was less than 17 years for all age groups from 20-49. By 1998, the median was 17.5 years or higher in all age groups. The overall median for women age 20-49 increased from 16.6 in 1988 to 17.0 in 1993 and to 17.6 in 1998.

A similar but slightly smaller shift upwards in marriage age has occurred over the ten-year period. The median age at marriage increased by about 0.8 years between the 1988 and 1998 surveys. The gap between age at first sex and age at first marriage has varied from 1.5 to 1.9 years across the three surveys.

Calculation of the median presented in Table 9 relies on women's reporting of their date of first marriage and age at first sex (date of first sex is not collected). Data of this type are subject to certain types of errors (Gage, 1995). In particular, women often report higher ages at marriage as they get older. This pattern is evident in the data in Table 9. For example, women who were age 25-29 in 1988 reported a median age at marriage of 18.5 years. Five years later, in 1993, the same cohort of women (who were then age 30-34) reported a median age at marriage of 18.6 and five years after that they reported a median of 19.4.[3] A similar pattern can be seen for the reporting of age at first sex within age cohorts.

Table 9 Median age at first sex and first marriage for women by current age, 1988-1998

	1988		1993		1998	
	First sex	First marriage	First sex	First marriage	First sex	First marriage
20-24	16.8	18.7	16.9	19.0	17.5	19.3
25-29	16.7	18.5	17.0	18.9	18.0	19.6
30-34	16.4	18.1	16.8	18.6	17.7	18.7
35-39	16.6	18.1	17.1	19.0	17.6	19.4
49-44	16.4	17.6	17.4	18.7	17.5	18.7
45-49	16.5	17.8	17.6	19.0	17.5	18.7
20-49	16.6	18.3	17.0	18.9	17.6	19.1

Simpler measures of the timing of first sex and first marriage that do not rely on the reporting of dates or ages are shown in Table 10. The percentage of women age 20-24 who ever had sex decreased from 96 percent in 1988 to 91 percent in 1998. This decline has occurred almost entirely within urban areas and since 1993. In contrast, the shift downward in the overall percentage ever married from 77 percent to 71 percent is the result of declines in both urban and rural areas. The decline in urban areas occurred entirely between 1988 and 1993, while the decline in rural areas occurred between 1993 and 1998. Overall, the data suggest that there has been a relatively modest shift toward later initiation of first sex and later age at marriage in Ghana over the ten-year period. It is likely that this shift has contributed to the trend toward lower fertility. The contribution of marriage and patterns of sexual exposure to fertility rates will be examined in a later section of the paper.

Table 10 Percentage of women age 20-24 who have ever had sex and ever been married, by urban-rural residence, 1988-1998

	1988		1993		1998	
Residence	Ever had sex	Ever been married	Ever had sex	Ever been married	Ever had sex	Ever been married
Urban	93.1	65.8	93.2	56.9	85.2	57.2
Rural	97.7	83.7	97.4	87.1	95.1	79.3
Total	96.1	77.4	95.8	75.3	91.4	71.0

[3] Since the fieldwork for the surveys was not exactly 60 months apart, the comparison is not exact but it is very close.

Postpartum Insusceptibility

Besides marriage and initiation of sex, women's exposure to the risk of pregnancy is determined by postpartum behaviour. Postpartum amenorrhoea—which is largely determined by the duration and intensity of breastfeeding—and postpartum abstinence determine the length of postpartum insusceptibility. The overall duration of insusceptibility remained almost constant between 1988 and 1993 but fell by about two months by the time of the 1998 survey (Table 11). The duration of breastfeeding and postpartum abstinence have also remained almost unchanged over the three surveys while the period of amenorrhoea has decreased from 15 to 11 months. These changes imply that, all else being equal, women in Ghana experienced about the same or slightly shorter periods of insusceptibility to pregnancy risk following a birth over the ten-year period.

Table 11 Median duration of breastfeeding, postpartum amenorrhoea, postpartum abstinence and postpartum insusceptibility (in months), 1988-1998

	1988	1993	1998
Breastfeeding	21.5	21.4	21.5
Postpartum amenorrhoea	14.7	13.0	10.9
Postpartum abstinence	8.8	9.0	8.5
Postpartum insusceptibility	16.8	16.2	14.0

Studies have suggested that, at a given level of contraceptive use, a reduction in 'redundant use' (i.e., the proportion of currently married contraceptive users who are either amenorrhoeic or abstaining) could result in a sharp drop in fertility (Adamchak and Mbvizo, 1990; Sambisa and Curtis, 1997). A reduction in the level of redundant use can result either from shorter durations of breastfeeding or postpartum abstinence, or from women initiating contraceptive use at longer durations postpartum. In effect, for the same level of contraceptive use, a drop in redundant use creates a larger fertility effect because a greater proportion of users is fecund. Table 12 shows that the overall proportion of contraceptive users who are amenorrhoeic or abstaining declined sharply from 22 percent in 1988 to 11 percent in 1993. There was only a one percentage point reduction in 1998 over the 1993 figure. The size of the decline in the overlap between postpartum abstinence and contraceptive use has been greater than the size of the decline in the overlap between amenorrhoea and contraceptive use.

Table 12 Redundant use: proportion of contraceptive users who are amenorrhoeic or abstaining, 1988-1998

	1988	1993	1998
Amenorrhoeic	16.5	8.1	7.0
Abstaining	15.4	5.8	5.2
Either amenorrhoeic or abstaining	21.6	10.9	9.7

To further understand the role of exposure to pregnancy in the TFR-CPR question, data on the proportion of women currently separated or divorced and the proportion who have had sex in the past four weeks is examined in Table 13. The proportion of women separated remained almost constant at around 3 percent between 1988 and 1993 but increased to 5 percent in 1998. The proportion divorced, which also remained stable at 6 percent over the period 1988-1993, declined slightly to 5 percent in 1998. Recent sexual activity increased to 51 percent over the 1988 figure of 42 percent and subsequently decreased to 49 percent in 1998.

If sexual intercourse occurs only within marriage, then the increasing proportion of separated women should contribute to fertility decline, all else being equal. The proportion of separated women is, however, very small and its effect on fertility decline is probably negligible. Similarly, there has not been a consistent trend in the proportion of women who have had sex within the past four weeks.

Table 13 Exposure to pregnancy: proportion of separated women whose partner usually stays elsewhere, proportion of divorced women, and proportion of women who had sex in the past 4 weeks, 1988-1998

	1988	1993	1998
Separated	2.7	2.9	5.3
Divorced	5.6	5.6	4.6
Had sex in past 4 weeks	41.9	50.6	48.7

Abortion

In some countries, a substantial percentage of pregnancies are terminated by an induced abortion (Henshaw et al., 1999). In order to quantify the contribution of induced abortion to observed fertility decline, it would be necessary to calculate or estimate indirectly an abortion rate. Unfortunately, although a number of studies of abortion in Ghana have been conducted, none contains the data required to calculate such an induced abortion rate at the national level. Induced abortion is legal in Ghana only in cases in which the mother's life is at risk, the pregnancy is the result of incest or rape, or there is evidence of foetal impairment (AGI, 1999). It is, therefore, not surprising that quantitative data on the extent of the practice are rare and difficult to obtain. Nevertheless, the information that can be extracted from existing studies implies that induced abortion is commonly practised (Table 14).

Findings from these and other studies suggest that abortions are most common among young women, especially to prevent a first and premarital pregnancy (Lamptey et al., 1985), and that most are performed outside of health institutions, sometimes by the women themselves (Lassey, 1995). One study of abortion patients in hospitals found that 54 percent of the pregnancies were aborted because they were non-marital. About one-fourth of the women in the study stated that they had decided to abort the pregnancy to achieve better spacing between their children. Most of the women in the study knew about contraception but did not use it because they were wary of health risks or thought contraception was messy, complicated, or difficult to use (WHO, 1994).

Data on induced abortion are not available in the GDHS surveys conducted in Ghana. However, the 1998 GDHS included a full pregnancy history in which women were asked to identify stillbirths (i.e., babies born dead) and early pregnancy losses. They were not asked to further identify early pregnancy losses as induced or spontaneous abortions so an induced abortion rate cannot be derived from these data. Nevertheless, it can be informative to examine the results on early pregnancy loss (which should include induced abortions). A total pregnancy loss rate can be calculated for the five-year period prior to the survey. This rate is analogous to the total fertility rate except that all pregnancy losses are counted in the numerator instead of live births. The total pregnancy loss rate for the five-year period prior to the 1998 GDHS is 0.72 pregnancies per woman. After removing lost pregnancies identified as still births, the total rate of early pregnancy loss is reduced to 0.65. This number indicates that, at current rates, a woman would have 0.65 early pregnancy losses during her reproductive years (and 4.55 births according to the total fertility rate for the same period). At the rates prevailing during the five years prior to the survey, early pregnancy losses therefore accounted for approximately 12 percent of the total number of pregnancies. This estimate is used in the next section to assess the potential contribution of pregnancy loss to the observed fertility rate.

Table 14 Estimates of the prevalence of induced abortion, various sources and years			
Source	Year of estimate	Estimate	Type of data
Bleek and Asante-Darko, 1986	1973	• About 15 percent of pregnancies in the lineage were terminated by an abortion. • More than half of the women had had at least one induced abortion.	A matrilineage[1] in a rural town in southern Ghana (42 women)
Lamptey et al., 1985	1981-82	• Twenty-five percent of women reported at least one induced abortion prior to the current hospitalisation. • One-third of women with only one previous pregnancy reported that their pregnancy ended in an abortion.	A random sample of 4,990 women hospitalised for a birth at Korle-Bu hospital in Accra
Nabila and Fayorsey, 1996	1990-91	The percentage of all maternal deaths due to abortion at the major referral hospitals in the country increased from 9 percent in 1990 to 13 percent in 1991 (world-wide average estimated by WHO is 13 percent [AGI, 1999])	Hospital records
Taylor and Abbey, 1994	1990-92	Twenty percent of hospital admissions between 1990 and 1992 were due to abortion-related complications.	Hospital records in a hospital in the Eastern region
Government of Ghana, 1999	1998	• Abortion rate estimated at 33 per 1000 women • Nearly 7 in 10 women had had an induced abortion in their reproductive lives. • Women aged 20-24 years had aborted one in four pregnancies.	Four regions
Alan Guttmacher Institute, 1999	1999	Average abortion rate for West Africa estimated at 37 per 1000 women	Various sources

[1] Kin group in which descent is traced through the maternal side of the family.

Estimation of Bongaarts' Proximate Determinants Model

The contribution of each of the proximate determinants to observed fertility levels can be summarised by computing indices from the Bongaarts' proximate determinants model (see Bongaarts, 1978). The model provides quantitative estimates of the fertility-reducing effects of marriage, postpartum infecundability, contraceptive use, and induced abortion on maximum biological fertility. The model is written as

$$TFR = TF \times C_m \times C_c \times C_i \times C_a$$

Where TFR = the total fertility rate
TF = the total fecundity rate
C_m = index of marriage
C_c = index of contraception
C_i = index of infecundability
C_a = index of abortion.

The value of the indices can vary from 0 to 1. Since the model is multiplicative, the closer the value of an index is to 0, the greater effect it has on reducing fertility from its biological maximum (the total fecundity rate).

The values of the first three indices derived from each of the surveys are shown in Table 15. As in a previous study of the proximate determinants in sub-Saharan Africa (Blanc and Poukouta, 1997), C_e—the index of exposure to sexual intercourse—was also calculated. The index is based on a fertility rate that divides all births to women who ever had sexual intercourse by all exposure subsequent to first intercourse. It equals one if all women are exposed to sexual intercourse continuously from age 15 to age 49. We calculate this index as an alternative to the index of marriage because the calculation of C_m incorporates the assumption that all childbearing takes place within marriage, an assumption that is clearly inaccurate in Ghana. C_e is probably an underestimate and C_m an overestimate of the effect of non-exposure to the risk of pregnancy.

Table 15 Bongaarts' model indices

Index	1988	1993	1998
Insusceptibility - C_i	0.57	0.58	0.62
Index of contraception - C_c	0.87	0.80	0.78
Index of marriage - C_m	0.84	0.80	0.77
Index of exposure - C_e	0.98	0.95	0.92
Predicted fertility using C_m	6.4	5.7	5.7
Predicted fertility using C_e	7.4	6.7	6.8
Actual fertility	6.4	5.5	4.6

The value of C_i increases slightly from 1988 to 1998, which is consistent with trends in the duration of breastfeeding and abstinence. While the effect of postpartum insusceptibility has diminished over time, it is still the proximate determinant with the largest effect on the reduction of fertility from its biological maximum.

The index of contraception, C_c, incorporates both increases in contraceptive prevalence and shifts in the average method effectiveness that result from changes in the mix of methods. The value of the index has declined from 0.87 to 0.78 over the ten-year period. This decline signals an increasing role for contraception in fertility reduction.

Both C_m and C_e fell over the course of the three surveys, a result of the shift toward later ages at first sex and first marriage. The index of marriage—which most likely overestimates the fertility effect of non-exposure to pregnancy—is of roughly the same magnitude as the index of contraception. The index of non-exposure to sexual intercourse is larger, suggesting that the overall effect of non-exposure is less important than either the effect of postpartum insusceptibility or contraception.

In the bottom panel of Table 15, the values of the indices are used to calculate a 'predicted' fertility level based on the equation TFR = 15.3 H C_m H C_c H C_i. Two predicted values are presented; one using C_m and one using C_e. In 1988, the actual fertility rate is equal to the value predicted using C_m, which is the lower limit. In 1993, the actual value is below both of the predicted values, and in 1998 the actual value is more than one child lower than the predicted values. These results indicate that the proximate determinants measured in the model do not fully account for the reduction in fertility from its maximum biological value and that the gap between the predicted value from the Bongaarts' model and the actual value has become larger over time.

The remaining proximate determinant that has not been included in the model is induced abortion. As described above, there are no data on this topic in the two earlier surveys. On the basis of the pregnancy history in the 1998 survey, however, a total early pregnancy loss rate of 0.65 has been calculated. If *all* of these early pregnancy losses were induced abortions, then the value of C_a would be 0.88 and the predicted fertility value for 1998 would be 5.0 using C_m and 6.0 using C_e. Both of these values are still well above the actual fertility rate. The data on early pregnancy loss may underestimate

the actual level of early pregnancy loss, since, in some cultures and societies, a pregnancy loss may never be reported. The data probably underestimates induced abortion to an even greater degree. Unfortunately, it is not possible to determine from these data the extent of underestimation, but, based on the existing data, early pregnancy loss does not fully account for the gap between the predicted and actual fertility rates.

6 Sexual Behaviour and Fertility Preferences

Our examination of standard measures of the proximate determinants has yielded some clues but has not fully explained the puzzle of the TFR-CPR inconsistency in Ghana. In this section, we consider the possibility that couples practise fertility-regulating behaviour that is not contraceptive use and is not captured by the standard measures of the proximate determinants. Specifically, we look at reduced coital frequency as a fertility-regulating behaviour. This analysis draws heavily on a previous study of the TFR-CPR inconsistency in four sub-Saharan countries (Blanc and Poukouta, 1997)

The notion of regulating fertility through modifications in sexual behaviour is not a new one in sub-Saharan Africa. Postpartum abstinence to ensure birth spacing is a traditional and nearly universal practice in the region. We hypothesise that couples may adapt the practice of postpartum abstinence in order to prolong the length of birth intervals or to avoid additional births. They may do so by abstaining from sexual intercourse for periods of varying length without systematically practising periodic abstinence or the rhythm method. If this practice were occurring, we would expect coital frequency to vary predictably according to fertility preferences. Specifically, we would expect those who want to have a birth soon to have higher coital frequency and those who want to delay or avoid a birth to have lower coital frequency. A larger than expected decline in fertility could occur if this practice is substantial and if it becomes more pronounced over time. Even if the practice did not become more pronounced over time, however, an unexpectedly large fertility decline could occur if fertility preferences shifted so that more women wanted to delay or avoid births.

In order to assess the hypothesis that women adjust coital frequency in accordance with fertility desires, we estimated linear regression models in which the dependent variable was the number of days since last intercourse. Under the assumption that the probability of coitus is constant throughout any given month, the greater the number of days since last intercourse, the lower the frequency of coitus (Leridon, 1993). We limit the analysis to women who are exposed to the risk of pregnancy[4] and who had sexual intercourse at least once in the 12 months preceding the survey.[5] The models are estimated separately for women who are not using contraception, among whom we expect a relationship between fertility preferences and coital frequency, and for women who are using a modern method of contraception, among whom we do not expect a relationship. Controls for other variables that are thought to be related to coital frequency are included (see Table 16).

The regression coefficients for the fertility preference variables are shown in Table 16. Women who want a child soon (i.e., within the next two years) are the omitted category. The results show that in all three surveys, among women who are not using contraception, fertility preferences are significantly related to coital frequency. Women who want to delay or avoid a birth or who are undecided had sexual intercourse less recently than women who want a birth soon. In contrast, as expected, there is no evidence that women who are using modern methods of contraception adjust their coital frequency according to their fertility preferences.

[4] 'Exposed' women are those who are currently married or living together, not pregnant, not amenorrhoeic, and who did not declare themselves infecund when asked about future fertility preferences.

[5] We also excluded women who said they last had sex prior to their last birth, in order to eliminate those who are abstaining postpartum and those who are married but not regularly cohabiting with their partner.

Table 16 Linear regression coefficients from model of days since last intercourse among exposed women who had sex in the last 12 months, by fertility preferences and use of contraception, 1988-1998

	Not using contraception			Using a modern method		
Fertility preferences	1988	1993	1998	1988	1993	1998
Wants in 2+ years	13.7**	33.0**	29.9**	-3.6	2.8	1.6
Undecided	22.4**	21.8*	15.6	3.3	2.1	22.7
Wants no more	24.1**	29.7**	26.5**	13.8	0.2	-0.3
R^2	6.2	6.6	6.8	14.7	7.2	8.5
N (unweighted)	1,099	1,077	1,197	128	275	358

Note: ** $p < .01$, * $p < .05$. Omitted category is 'wants another child within 2 years'. Model includes controls for age, number of children ever born, polygynous/monogamous union, ethnicity, level of education, urban-rural residence, and age at first sex.

Table 17 shows the predicted number of days since last intercourse among exposed women who are not using contraception by fertility preference. The predicted values are calculated by holding each of the independent variables at its mean. Thus, the predicted values incorporate effects of both the changes in the size of the coefficients over time as well as shifts of women across categories of fertility preferences. The results show that, in every survey, women who want a child soon (within 2 years) have had sex most recently, followed by women who are undecided, those who want to delay the next birth, and those who want no more children. These results are strong evidence that women who are not using contraception modify their coital frequency in accordance with their fertility desires. Whether the effect of fertility desires on coital frequency has become stronger over time is more difficult to assess. The difference in the number of days since last intercourse between those who want a child soon and those who want no more children increased from five days in 1988 to almost ten days in 1993 and nine days in 1998. The results for 1993 and 1998 are very similar, suggesting that the relationship did not change much in the five years between the two later surveys.

Table 17 Predicted number of days since last intercourse among women who are not using contraception, by fertility preferences, 1988-1998

Fertility preferences	1988	1993	1998
Wants within 2 years (1)	26.5	16.5	16.6
Undecided (2)	27.6	17.7	17.5
Wants in 2+ years (3)	31.0	25.4	23.2
Wants no more (4)	31.5	26.1	25.9
(4) – (1)	5.0	9.6	9.3

7 Discussion and Conclusion

Estimates of fertility decline derived from three DHS surveys in Ghana (1988 GDHS, 1993 GDHS, and 1998 GDHS) are substantially greater than would be expected on the basis of recorded increases in contraceptive prevalence. From the late 1980s to the mid-1990s, the total fertility rate (TFR) in Ghana dropped from 6.4 to 4.6. Over the same period, the contraceptive prevalence rate (CPR) among married women increased from approximately 13 percent to 22 percent. Based on a linear regression equation representing international experience, the decline in the TFR that would be expected in Ghana as a result of the nine percentage point increase in contraceptive prevalence is about 0.6 children, as opposed to the observed decline of 1.8 children. The TFR-CPR inconsistency is greater in urban than in rural areas, and in the Greater Accra, Central, and Eastern regions than in other regions.

In this analysis we have attempted to explore the reasons for the greater than expected fall in fertility. An examination of various measures of the quality of the birth history data did not reveal any major problems that would lead to overestimates of the fertility decline. These measures, however, are only able to detect gross inaccuracies in the data, and some level of underestimation of fertility cannot wholly be ruled out as an explanation.

On the basis of the differentials in reporting of contraceptive use among women and men and in previous research in Ghana and elsewhere (Phillips et al., 1997; Becker et al., 2000), it seems probable that some underreporting of method use (especially condoms) may have occurred among women. On the other hand, it is also possible that men overreported condom use. It is not possible to determine whether the reporting of contraceptive use has improved or deteriorated over time but, for all three surveys, the actual level of contraceptive prevalence probably lies somewhere between that reported by women and that reported by men. This may be the case for several countries in sub-Saharan Africa and may partially account for the TFR-CPR gap.

A number of changes in the composition and dynamics of contraceptive use have occurred over the ten-year period that would contribute to an increasingly strong effect of contraceptive prevalence on fertility reduction. First, there has been a marked shift in Ghana from traditional methods towards the use of modern contraceptives. Second, we have observed a moderate reallocation from the use of contraception for birth spacing towards the use of contraception for the limitation of births, a change which implies longer average durations of use. Finally, there has also been a substantial reduction in "redundant" use or the overlap between postpartum insusceptibility and contraceptive use. Thus, at the same overall level of contraceptive prevalence, a larger fertility reduction will occur because greater proportions of contraceptive users are exposed to the risk of pregnancy.

Increases in age at first marriage and age at first sexual activity have taken place in the country over the past decade. There is also a consistent decline in the proportion of young women who have ever had sex or who have ever been married. This prolongation of the period prior to initiation of sex and marriage has been a factor in the fertility decline in Ghana, but it is not unusual relative to other countries and does not seem a likely explanation for the TFR-CPR inconsistency.

The contribution of postpartum insusceptibility to fertility decline was also examined. We observe that while the duration of breastfeeding has remained relatively unchanged over the decade and postpartum abstinence has also not declined appreciably, there has been an overall reduction in postpartum insusceptibility due to a decline in the duration of amenorrhoea. This trend would have the effect of increasing fertility in the absence of compensating changes in the other proximate determinants.

We have tried to explore the extent to which the prevalence of induced abortion has contributed to an understanding of the TFR-CPR debate. Although pieces of information abound that suggest that the practice is common and that it occurs most frequently among young women, who also experienced large

declines in fertility rates, we are unable to calculate a reliable quantitative estimate of its contribution to the decline in fertility.

Since standard measures of the proximate determinants are unable to fully explain the reasons for the unexpectedly large decline in fertility in Ghana, we hypothesise that, as the desire for more children has declined over time, couples who are not using a method of contraception modify their coital frequency such that those who want to delay or avoid a birth have sex less frequently than those who want to have a birth soon. Although this change in behaviour is a form of abstinence, it would not be captured by standard DHS questions on contraceptive use. Using multivariate regression models, we find strong evidence that couples who are not using contraception adjust their coital frequency in accordance with their fertility desires in all three surveys. We are not able to assess, however, whether the effect of fertility preferences on coital frequency has become stronger over time or whether the effect would be large enough to explain the TFR-CPR inconsistency.

The question of why fertility decline in Ghana has exceeded expectations based on the increase in contraceptive prevalence is only partially answered by this analysis. Although we have been able to eliminate a number of possible explanations, we have not pinpointed a single, clear reason for the apparent inconsistency between fertility and contraceptive use. A number of factors are undoubtedly responsible. Further research on the reporting of contraceptive use and its relationship to the social and cultural setting would be useful. Although a difficult methodological challenge, research on the prevalence and characteristics of induced abortion would allow a more reliable quantitative estimate of its role in fertility decline.

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