International Journal of Conflict and Violence

urn:nbn:de:0070-ijcv-2010181
IJCV: Vol. 4 (1) 2010, pp. 149 – 168

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Vol. 4 (1) 2010

ISSN: 1864-1385

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Between the mid-1990s and the early part of the new century, the total fertility rate in Eritrea declined by twenty one percent. Even more striking than the magnitude of this decline within a short period is that it occurred in the absence of any improvements in contraceptive use and without any evident reduction in desired family size. In this study, fertility decline and its underlying factors are examined using data from two waves of the Eritrea Demographic and Health Surveys. The central question is whether the recent decline is an outcome of the 1998–2000 border conflict, is related to changes in women's reproductive intentions, or is due to socio-economic transformations. The findings demonstrate that the fertility decline, especially for first births, is the result less of increased demand for family size limitation and more of the border conflict. Although the conflict seems to have played a role in accelerating the decline in higher-order births, the change seems to be a long-term transition that started before the conflict. These findings imply that military conflicts are unlikely to instigate sustainable fertility decline, but may prompt short-term fertility changes among certain groups or modify an ongoing decline.

Until the late 1980s, the a woman in sub-Saharan Africa had six children in her lifetime, which was higher than the average in any other region in the world. During the 1990s, fertility started to decline in most sub-Saharan African countries, marking the beginning of a trend to smaller family size preferences in the region (USAID 2003). Reduction in under-five mortality rates, a rise in use of modern contraceptives, and an increase in age at first marriage are suggested as the major factors associated with fertility decline (Makinwa-Adebusoye 2001). In the Horn of Africa, Eritrean fertility rates declined considerably during a period of border conflict with Ethiopia (1998–2000). According to the Eritrea Demography and Health Survey (EDHS), total fertility rate (TFR) declined from 6.1 in 1995 to 4.8 in 2002, implying a reduction in period fertility of 21 percent over a period of about six years (NSEO and ORC Macro 2003).

The fertility decline in Eritrea has generated much interest in academic and other concerned circles, arising from a belief that Eritrea has witnessed a remarkable reduction in fertility rates despite largely lacking the improvements in family planning and standards of living frequently associated with demographic transition. Increases in contraceptive use and induced abortion, relatively late age at marriage, as well as long periods of post-partum sexual abstinence and post-partum amenorrhea can substantially reduce fertility from its natural maximum (Bongaarts and Potter 1983). However, with the exception of age at first marriage and the proportion of women never married, the proximate variables have not changed sufficiently since 1995 to account for the observed declines in fertility. For instance, the rate of use of any contraceptive practice remained constant at 8 percent between 1995 and 2002. In the case of postpartum variables, the median duration of postpartum abstinence remained

The study was conducted while I was a research fellow at Stockholm University Demography Unit (SUDA). I would like to thank Professor Elizabeth Thomson for providing me this opportunity and Forskningsrådet för Arbetsliv Och Socialvetenskap (FAS) for its financial support of this work. I also would like to thank Gunnar Andersson for his helpful comments and editorial advice.

roughly the same (2.7 months in 1995 and 3.0 months in 2002) (NSEO and ORC Macro 2003). And median duration of insusceptibility changed in a manner that would lead to an increase in fertility, falling from 16.6 months in 1995 to 14.6 months in 2002. Changes in the duration of sexual abstinence and postpartum insusceptibility are, therefore, not likely to be important factors for the recent fertility decline. The median age at first marriage among women aged 20–49 increased slightly from 16.8 in 1995 to 17.7 years in 2002. In Eritrea, statistics on abortion are scarce and unreliable because abortion is illegal unless it is intended to save the mother's life. It is, therefore, difficult to know how prevalent induced abortion is in Eritrea and what contribution it may have made to the recent decline.

Even though there were some improvements in education, health services, and economic status between 1993 and 1997, it cannot be said that progress continued after 1998. Instead, Eritrea experienced severe economic difficulties, high inflation, population displacement and migration, and military mobilization caused by the 1998–2000 border conflict. Although the country has had relative peace since 2000, it has suffered from considerable crisis-induced hardships because of military tensions between Eritrea and Ethiopia, which remain unresolved.

Conventional demographic transition theory predicts that a decline in actual fertility should lag behind decline in desire for more children or in ideal family size. Several classical cases of fertility transition show that as a country develops, the cost of rearing children rises and benefits from having them fall, thus leading couples to want smaller families (Bulatao and Casterline 2001). To implement these preferences, couples use contraception, which in turn leads to lower actual fertility. However, empirical evidence on fertility decline has not always been consistent. It is argued that fertility decline may occur without any evident reduction in desired family size as fertility and fertility desires can be influenced by other non-conventional factors such as war or economic and political crises (Agadjanian and Ndola 2002).

The rapid decline in fertility in Eritrea demands investigation: is the decline an outcome of the border conflict or due to changes in women's reproductive intentions, caused by other factors. The key questions are: How does fertility respond to such war and socio-economic crisis? Can we say that the border conflict initiated or accelerated the decline, producing a negative correlation between socio-economic factors and family limitation as opposed to the positive correlation associated with classical demographic theory? Or does the recent decline in fertility stem from changes in women's demand for large families, with conflict and economic decline neutral in effect? Answers to these questions may have important implications for theories of fertility change and for population programs in the country. More importantly, the fertility response to the border conflict may have practical consequences for future population growth in Eritrea.

Despite such important theoretical and policy implications, there are only two studies of the nature and cause of changes in Eritrean fertility (Blanc 2004; Woldemicael 2008). Using Bongaarts model, Blanc concluded that the recent fertility decline is mainly an outcome of the border conflict mediated by a reduction in the proportion of women exposed to the risk of pregnancy (as a consequence of delayed age at marriage and spousal separation). However, it is not clear whether such effects are evident when other more specific factors such as region of residence, child survival status, historical period, and other socio-economic factors are examined using multivariate models. Using both trend and multivariate analyses, Woldemicael (2008) shows that the fertility decline is partly due to the impact of the border conflict and partly due to the socio-economic transformation pre-dating the conflict. However, although both studies provide some understanding of the impact of the border conflict on the recent fertility decline, several important questions remain unaddressed, including the role of reproductive preferences, spousal separation, and adolescent childbearing in the fertility decline.

The present study extends my previous work in three important ways: First, an important unresolved issue concerns whether changes in reproductive behavior favoring smaller families (i.e., the proportion of women who want no more children) occurred in Eritrea during the inter-survey period

(1995–2002), and if so, what do these changes in reproductive preferences suggest about the recent fertility decline? Classical demographic transition theory understands fertility decline as a direct consequence of a decreased desire for live births. This decreased desire or demand for children is viewed as a response to improved child survival and a result of structural changes in society that reduce the benefits and increase the costs of rearing children (Davis 1963; Hirschman 1994). Other factors, such as military conflict or economic decline, can also lead to low demand for children and crisis-led transition in fertility intentions (Hill 2004). Second, a trend analysis examines whether adolescent childbearing and age at first marriage changed during the conflict period and assesses their relative contribution to the decline. Here, we consider fertility as a potentially important demographic mechanism through which individuals adjust to changes in their environment. Conventional demographic wisdom suggests that in societies like Eritrea, where childbearing and marriage are closely related, the postponement of the onset of childbearing would typically be achieved by delaying marriage (Caldwell 2004). Caldwell argues that entry into marriage is an important path of adjustment; I examine its dynamics in Eritrea. The third important question of interest in this study is whether spousal separation changed during the conflict period and whether this factor contributed to the recent decline.

1. The Background in Eritrea

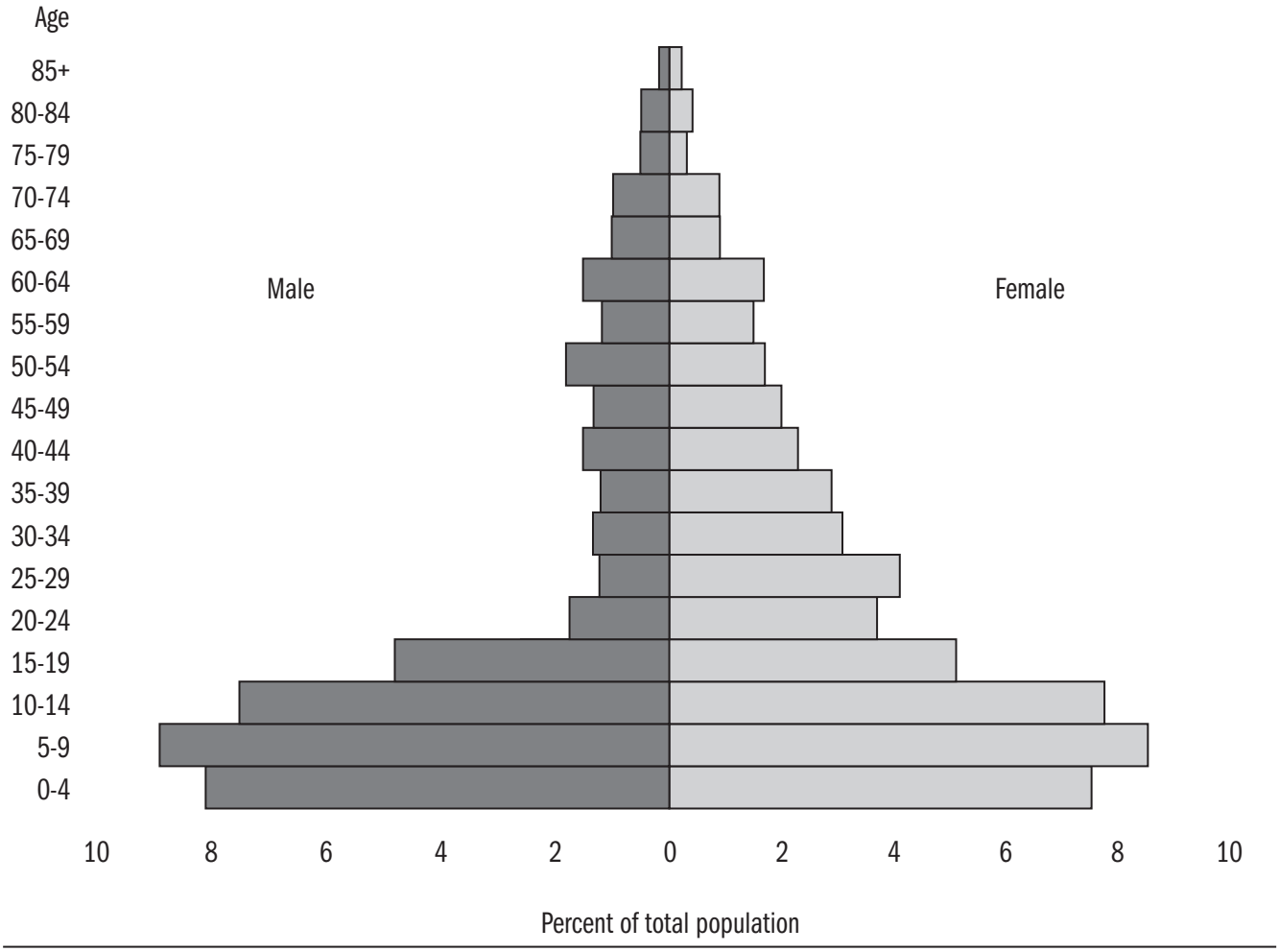
Eritrea is one of the least developed countries in the world with per capita income of about $130 and a Human Development Index ranking of 156 out of 177 countries (Advisory Panel on Country Information 2007). Maternal and child mortality are still high: about 600 maternal deaths per 100,000 live births and more than 50 infant deaths per 1000 live births. More than 60 percent of households have no access to safe drinking water (NSEO and ORC Macro 2003). About 39 percent of males and 52 percent of females have never attended school. The male-female gap in education is still large and most evident at higher levels of education. The country is still characterized by high fertility levels, although they have started to decline.

The country has been in a state of war with Ethiopia for the past five decades or more. The thirty-year struggle for independence (1961–91) and subsequently the 1998–2000 border conflict both had significant socio-economic and demographic impacts on the country. Statistical indicators on socio-economic trends are very limited and those that are available are largely unreliable, as there is very little transparency from the side of the government. The few statistics that are available indicate a negative trend in economic performance and per-capital GDP declining since the outbreak of the border conflict (Bertelsmann Stiftung 2008; Healy 2007). Before the border conflict, the Eritrean economy grew by an average of 7 percent annually between 1994 and 1997. Following the outbreak of war in 1998, GDP growth declined to 4 percent in 1998 and 3 percent in 1999; the economy contracted by 9 percent in 2000 (Alamin 2003). The border conflict devastated the subsistence agricultural sector, on which 80 percent of the population rely, with food production reduced by 62 percent. The delayed demobilization of agriculturalists from military service kept agricultural production well below normal, holding down growth in 2002–2006 (Advisory Panel on Country Information 2007).

The war of liberation and the recent border conflict both had serious repercussions on the country's demographic situation as well. Military mobilization, loss of life, and wartime migration have created several unusual features in the population structure, distorted the population pyramid, and skewed sex ratios. For instance, the average ratio of males to females in rural Eritrea during the struggle for liberation has been estimated at 47 to 53 (Community Development Services 1991). This imbalance in the ratio of men to women, caused mainly by male losses in the liberation struggle, has led to labor shortages, particularly in the agricultural sector (Green and Baden 1994). The population pyramid in Figure 1 is also a clear testimony of the impact of the 1998–2000 border conflict on the age structure of the population. The pyramid is characterized by a broad base and a striking deficit of adults, especially men. The male deficit is mainly between ages 20–54 and to a lesser extent at ages 15–19 and above 55 years. The observed male deficit can be attributed to endless military service, forced conscription, and a mass exodus of youth to neighboring countries and much further afield. Conscription is compulsory for all male and unmarried

female Eritreans aged 18–45 years. Figure 1 also shows that the proportion of the population aged 0–4 is smaller than the proportion aged 5–9, suggesting that there were fewer births during the period of conflict. This age group would have been broader if there had been more married couples living together.

Figure 1: Population pyramid of Eritrea, 2002



Source: National Statistics Office & ORC Macro Inc. 2003. 2002 Demographic and Health Survey Report

The impact of the conflict is also reflected in high proportions of female-headed households and increased spousal separation, factors that are important for fertility change. The EDHS reports show that the proportion of households headed by females increased from 31 percent in 1995 to 47 percent in 2002. Military mobilization for the border conflict also decreased the proportion of married couples living together. A comparison of the proportions of married women residing with their husbands at the time of the 1995 and 2002 EDHS surveys shows a significant decline in all age groups (see Table 1) and particularly at younger ages. For instance, the proportion of married women aged 15–19 who were living with their husband in 2002 is about 50 percent lower than it was in 1995. Moreover, only four in ten

married women aged 20–24 were living with their husband in 2002, while the corresponding figure in 1995 was more than seven in ten. Separation reduces married women's exposure to the risk of pregnancy. A review of fertility response to war and population displacement of women in Sarajevo before and during the Bosnian war in 1992–94 shows that in the short-term fertility fell mainly as a result of temporary separation of couples (Hill 2004).

Table 1: Percent ever married and percent of married women residing with husband by age, 1995 and 2002

Current age	Ever married		Residing with husband	
	1995	2002	1995	2002
15-19	37.6	31.0	60.4	30.5
20-24	78.1	72.7	74.4	42.1
25-29	92.1	88.5	79.1	48.9
30-34	95.8	95.4	84.0	60.6
35-39	98.2	97.8	88.4	72.4
40-44	97.3	99.0	89.0	78.9
45-49	98.1	99.2	90.6	88.0
Total	80.0	76.7	80.9	58.5

The figures are calculated from the 1995 and 2002 EDHS data files

War can also lead to conscious adjustments in fertility behavior because couples are more likely to opt to avoid births during troubled times (CEPED 1998). We expect that in countries like Eritrea, military tensions and the uncertainty of peace will depress the desire for fertility and as a result fertility may decline. Such fertility responses to war are indeed described in some studies, where fertility falls because the stress and uncertainties in people's lives are not conducive to childbearing (Lindstrom and Berhanu 1999; McGinn 2000). Thus, although the data used in this study do not allow any examination of the duration of war-induced change in fertility behavior, the war is likely to have had some impact on fertility behavior. In addition, cultural values or traditions of a society may affect fertility behavior, where traditional societies favor large families and non-traditional societies prefer small families.

2. Data and Variables

The data for this study come from two Eritrea Demographic and Health Surveys conducted in 1995 and 2002. Both surveys are nationally representative of households. Each survey collected information on the characteristics of selected households and from all women of reproductive age (age 15–49). Information on fertility, fertility intentions, contraception, maternal and child health, and other related issues was collected from 5,054 women of reproductive age in 1995 and 8,754 women of the same age in 2002.

Criteria including timing of the fertility decline and regional/provincial response differentials were used to examine the hypothesis that the decline is an outcome of the border conflict. The rationale for using each criterion is given below.

Timing of the fertility decline: Even though there is no established timeframe for examining a fertility response to military conflict or economic decline, the expectation is that it would occur over a relatively short period depending upon the nature, extent, and severity of the crisis (Ashton et al. 1984). Palloni, Hill, and Pinto (1996) show that the impact of economic shock on fertility becomes apparent within one or two years after the onset of the crisis and conclude that the strength of impact depends on the magnitude and duration of crisis. Thus, the characteristic of a crisis-led decline is that fertility change closely follows rather than precedes crisis. Annual TFRs were estimated and plotted over a period of one decade preceding the survey to precisely establish the timing of fertility change in relation to the onset of conflict in the country. Plotting the annual fertility estimates shows visually whether a fertility decline occurred after the onset of conflict in 1998. Age-specific fertility rates (ASFRs) were also estimated to examine how the trend varies by age.

The timing of the fertility decline was also be assessed using multivariate statistical analysis, specifically a Cox regression model. The simpler strategy of measuring crisis in terms of a historical period was adopted. This meant, however, that it was not possible to identify the specific crisis factors responsible for the change (changes in GDP, inflation rates, etc.). Thus, historical period is the key proximate indicator of

conflict in this study and is measured by a categorical variable, defined as before 1990, 1990–92, 1993–95, 1996–98, and 1999–2001: this grouping reflects the past political and economic situation of the country. The period before 1990 and 1990–92 were the time of the liberation struggle and preparation for the independence referendum, 1993–98 was the post-independence period where some progress was made in education, health services, and other infrastructure, while the last period was a time of military mobilization, mass displacement, and economic decline caused by the border conflict which started in mid-1998. The analysis recognizes 1999 as the starting year of social disruption and economic decline due to the conflict. Thus, in the multivariate analysis, the relative probabilities attached to the different categories of historical period indicate how much fertility changed during the crisis period in comparison with the peace period, especially with the reference category (1996–98).

Regional response differentials: If crisis is responsible for initiating the fertility decline, then this decline should be most pronounced among populations with the most severe experience of conflict. Although all regions of the country were affected by the border conflict, two regions—Southern and Gash Barka—were worst hit. Thousands of residents of these regions were displaced. Thus, one would expect a stronger fertility response in these regions. Interaction terms between historical period and region of residence were introduced in a multivariate model to test the hypothesis that fertility responses differ between regions.

Spousal separation was also included as a proxy indicator of the war effect. As described above, the border conflict resulted in general military mobilization, especially of males aged 18–45. It is likely that such separation will have reduced married women's exposure to the risk of pregnancy. However, note that because this variable was measured on the interview date it may not capture the full effect of war-related separation on fertility, due to the cross-sectional nature of the data, and because information on the exact timing of spousal separation is not available; we are thus unable to use duration of spousal separation.

In addition to the independent variables outlined above, we included other demographic and socio-economic variables as control variables. These include age at birth of previous child, age at first marriage, birth order, previous birth interval, and survival status of previous child. Background socio-economic variables include education and childhood residence (rural/urban).

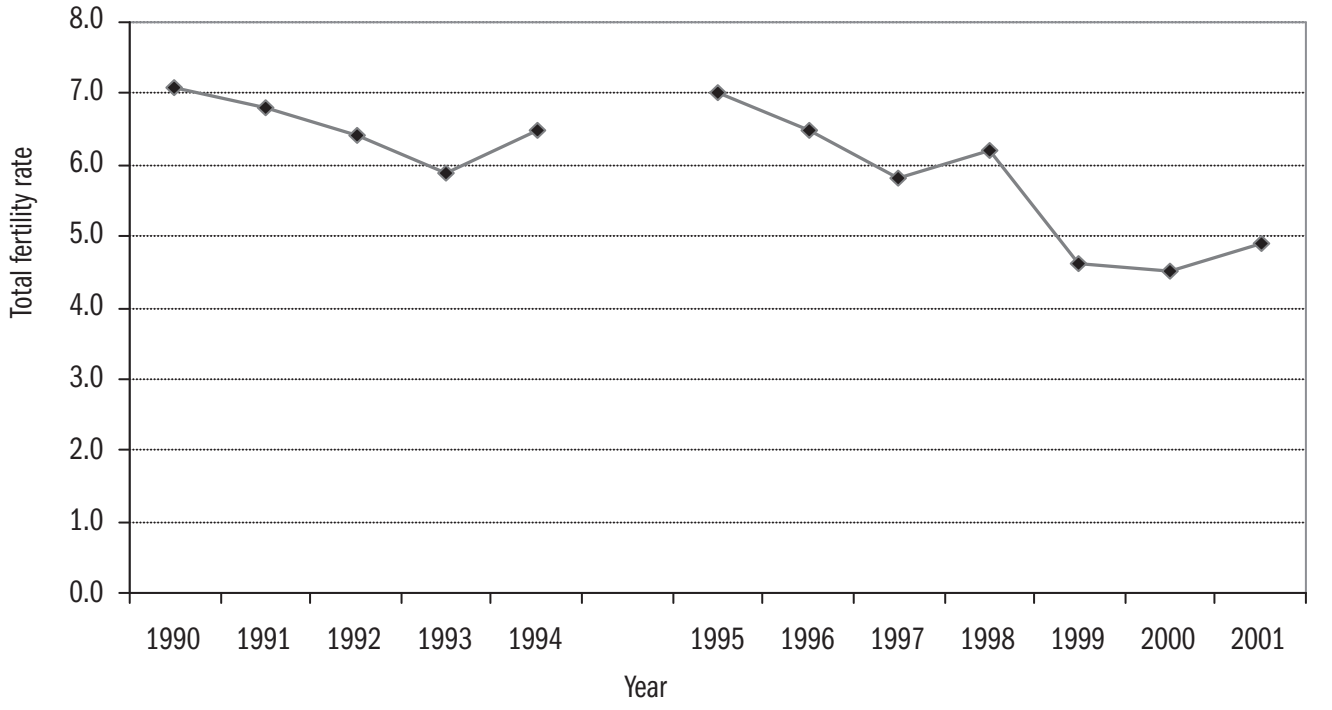
Unfortunately, we were unable to take into account numerous other factors that influence fertility directly or indirectly. Probably one of the most important is HIV/AIDS. Some researchers argue that severe HIV epidemics are likely to exert to downward pressure on fertility (Gregson 1994). Using the Demographic Health Survey of Tanzania, Baschieri (2000) found a greater impact of HIV/AIDS in the higher-prevalence zones (fertility was three to five percent lower than it would be in the absence of HIV/AIDS) than in the lower-prevalence zones (where the impact was less than two percent). An HIV/AIDS epidemic can affect fertility in several ways (Mturi and Hinde 2001): First, men and women with HIV/AIDS may reduce fecundity for a variety of reasons (including reduced coital frequency). Second, age-selective AIDS mortality may reduce the population capable of giving birth, since most deaths from AIDS occur in the childbearing ages. Finally, an HIV/AIDS epidemic can give rise to greater use of contraceptives (especially condoms) which may lead to reduced fertility. Since no detailed information on HIV/AIDS is available in Eritrea, we could not consider this variable in our analyses.

3. Results

3.1. Fertility Trends in Eritrea

To give some idea of the fertility trends in Eritrea, total fertility rate (TFR) and age-specific fertility rates (ASFR) are presented in Figures 2 through 4. Eritrea is at the earliest stage of fertility transition and has an intermediate level of fertility (a TFR of about 5). The TFR was around seven children per woman during the mid-1990s (see Figure 2). Since then it has begun to decrease, with relatively faster decline particularly after 1998. TFR declined from about 6.1 children per woman in 1997/98 to 4.8 in 2001/02. So in about six years, TFR declined by about 1.3 children per woman (or 21 percent). This finding is consistent with the results of the National Statistics and Evaluation Office (NSEO and ORC Macro 2003)

Figure 2: Total fertility rate, 1990–2001



To show the trend in fertility more clearly, fertility rates for five-year age groups were plotted for both surveys (see Figures 3 and 4). The age-specific fertility rates (ASFRs) in Figure 3 show a broad peaked age pattern of fertility that falls slowly with advanced age. This is a characteristic of a population where there is little parity-specific fertility control. With the exception of the oldest age group (45–49), a decline in fertility over the period occurred in all age groups, although most of the fertility decline occurred among ages 20–30.

Figure 3: Age-specific fertility rate per woman, 1995 and 2002

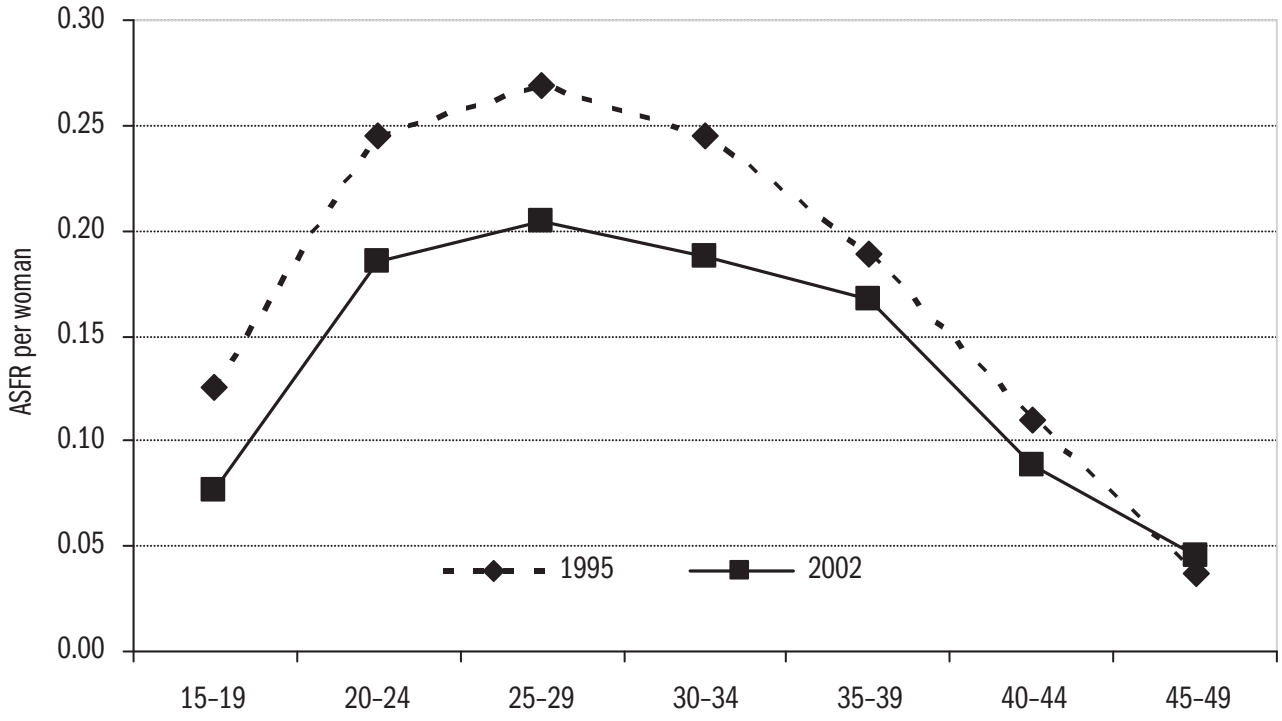
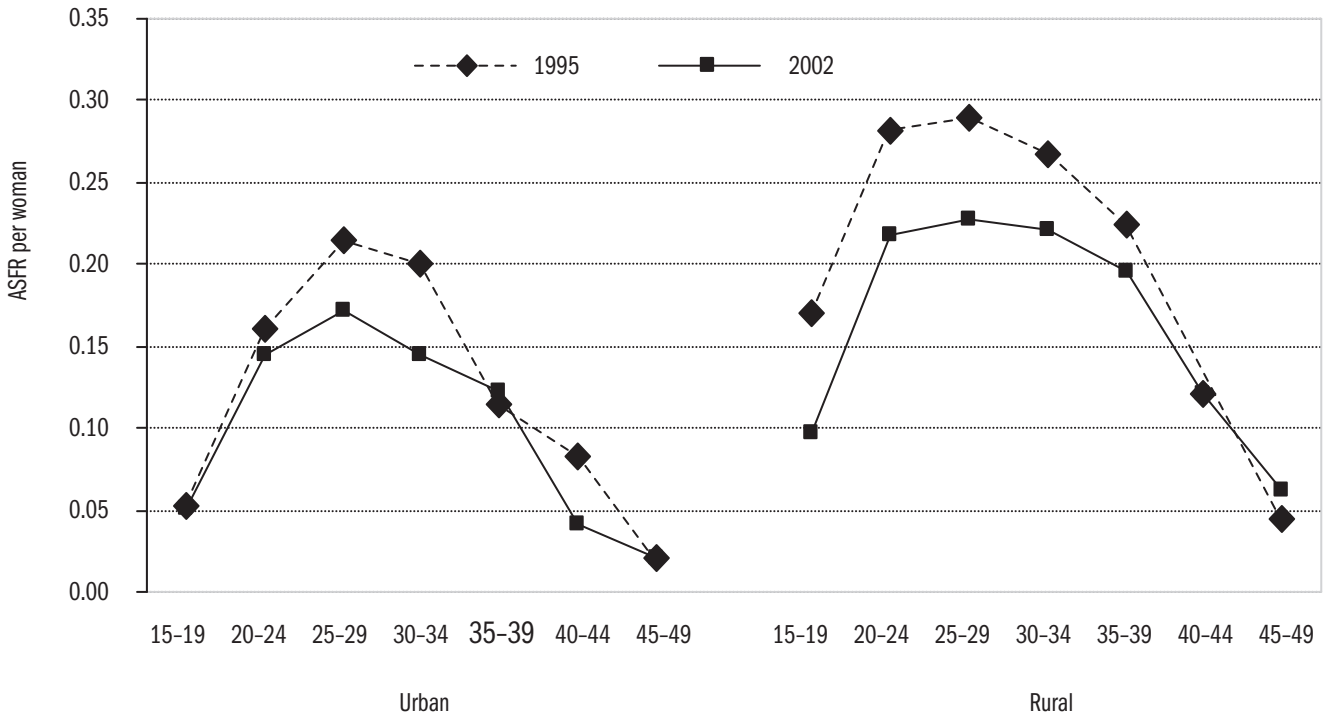


Figure 4 shows that the decline by age in rural areas follows the national trend, where the decline is most marked at ages 30–34 and older. In urban areas, the decline is noticeable at ages 25–34 and 40–44. Regardless of age, fertility is lower in urban areas in both surveys, and the fertility gap between the two surveys is wider in rural areas, suggesting that the decline was stronger in rural areas. Couples' changing attitudes toward desire to reproduce as children become more and more expensive (economic value is declining, more and more children going to school, increasing shortages in housing and other social facilities) are likely to affect fertility, particularly in the urban areas (Teller et al. 2007).

Figure 4: Urban and rural age-specific fertility rate per woman, 1995 and 2002



3.2. Age at Start of Childbearing and Adolescent Fertility

Age at first marriage marks the beginning of the period of potential childbearing and is one of the most important determinants of fertility in societies like Eritrea, where premarital sex and birth out of wedlock are uncommon and stigmatized. Table 2 shows median age at first marriage in Eritrea obtained from the 1995 and 2002 surveys. The data indicate an increase of about one year in median age at first marriage between 1995 and 2002. The data also show an increase in median age at first marriage in each age group, with smaller differences in younger age cohorts. This trend in age at first marriage suggests that war might have hastened fertility reduction by delaying marriage.

Table 2: Median age at first marriage, 1995 and 2002

Age	Median age at first marriage	
	1995	2002
20-24	16.7	17.1
25-29	17.3	18.0
30-34	17.3	17.8
35-39	16.8	18.8
40-44	16.5	18.8
45-49	16.3	17.8
All ages	16.8	17.7

Table 3 presents data on the proportion of teenage women who became pregnant before age 20 in relation to selected variables. Overall, the data show that teenage childbearing in Eritrea declined from 23 percent in 1995 to 14 percent in 2002. Delayed childbearing among adolescent women is likely to lead to fertility decline. It is evident from this table that the proportion of teenage mothers rises steadily with age. As expected, there are differences by educational status in both survey years. The proportion of teenage childbearing among women with no education or just primary education is consistently higher than that of their better-educated counterparts. This finding is consistent with evidence found elsewhere (Gupta and Leite 1999). In addition, urban teenagers are less likely to have ever given birth. Although teenage childbearing declined in rural areas and among less educated women, no such decline was observed among more educated women and urban teenagers. This finding deserves further investigation.

Table 3: Adolescent fertility: Percentage of adolescent women in category who have begun childbearing, 1995 and 2002

	1995		2002	
Age	Percent	Number	Percent	Number
15	3.0	303	2.1	426
16	13.4	217	2.8	424
17	21.6	190	8.0	326
18	40.4	275	24.0	545
19	50.7	144	36.4	280
Place of residence				
Rural	33.8	681	19.3	917
Urban	7.4	448	7.7	1084
Education				
No education	42.1	430	25.4	425
Primary	18.9	350	13.5	996
Secondary or higher	4.6	349	6.6	580
Total	23.3	1129	14.0	2001

3.3. Fertility Intentions

Earlier studies (e.g., Kulkarni and Choe 1998) indicate that unwanted fertility is very low or non-existent at the beginning of the transition process when fertility desires are mostly unrestricted and at the end when couples have nearly complete control over their fertility. In-between these two extremes, many couples would prefer a specific family size but do not control their fertility effectively and hence have unwanted births (Easterlin 1983; Bongaarts 1997). Adetunji (2001) shows that the probability of having unwanted fertility is low in countries with TFR above 6 and below 3 and high among those with a TFR in the range in-between. The low level of unwanted fertility at the start of transition when TFR is maximum and at the last phase

of transition when TFR is minimum on one hand, and the high level of unwanted fertility in the middle phase of the transition to lower fertility, on the other hand, demonstrate how the link between unwanted fertility and TFR exists during fertility transition. Thus, as fertility begins to decline, we should expect to see an increase in the level of unwanted fertility, reflecting of a downward trend in fertility preference. However, until unwanted fertility reaches high levels, prospects for a lasting reduction in total fertility rate are small (Adetunji 2001). The key question here is: Do the findings from Eritrea show the expected trend? That is, does the level of unwanted fertility depend on where Eritrea is in the course of fertility transition?

To answer these questions, first a comparison was made of wanted and unwanted fertility, which are the two components of total fertility. As can be seen from Table 4, the TF shows a decline from 6.2 in 1995 to 4.9 in 2002. Similarly, the wanted total fertility declined substantially, from 5.8 to 4.5 while the unwanted component remained constant at 0.4 children per woman. All other things being equal, as countries move from high to low fertility levels, unwanted fertility levels tend to increase first unless efforts are made to reduce them and then decrease as fertility reaches the lower level (Adetunji 2001). However, contrary to expectations and previous research, unwanted fertility remained constant between the surveys. From these results, we can infer that if unwanted fertility had been prevented, the total fertility rate in 2002 would have declined by only 8 percent (i.e., 4.5 births per woman rather than 4.9). Thus, had women in Eritrea used contraception to avoid their unwanted births, the reduction in overall fertility would not have been significant or would not account for the observed decline.

Table 4 also presents the levels of wanted and unwanted fertility by urban/rural residence, education, and household economic status. Total fertility and total wanted fertility declined in both urban and rural areas, but the decline was much greater in rural areas. Wanted fertility in rural areas is more than double the figure for urban areas in both surveys, while there is no urban-rural difference in unwanted fertility. In terms of education, there are large and consistent differences in wanted fertility between the three groups, with uneducated women wanting more children than women with primary or secondary education. The pattern for unwanted fertility is similar to that of wanted fertility. While in the later survey unwanted fertility decreases consistently as education increases, in the earlier survey it is higher among women with primary education than those with no education. It may be that in the earlier period many women with primary education would like fewer children but are not yet controlling their fertility effectively, thus leading to relatively high levels of unwanted fertility for this group. There is difference in unwanted fertility between women with low and medium household income, while those with high household economic status have the lowest unwanted fertility. It may be that women with higher economic status are more likely to wish to lower their fertility and hence use contraception.

Table 4: Total marital fertility, wanted and unwanted marital fertility, and percentage unwanted, by residence and education, 1995 and 2002

	1995				2002			
Socioeconomic factors	TMF	TWMF	TUMF	% unwanted*	TMF	TWMF	TUMF	% unwanted*
Residence								
Urban	4.2	3.9	0.3	7.1	3.5	3.1	0.4	11.4
Rural	7.0	6.7	0.3	4.3	5.8	5.4	0.4	6.9
Education								
No education	6.8	6.5	0.3	4.4	5.9	5.4	0.5	8.5
Primary	6.1	5.6	0.5	8.2	4.1	3.7	0.4	9.8
Secondary+	2.8	2.8	0.0	0.0	3.0	2.8	0.2	6.7
Household economic status								
Low	6.5	6.1	0.4	6.2	6.0	5.5	0.5	8.3
Medium	6.0	5.6	0.4	6.7	5.0	4.5	0.5	10.0
High	3.4	3.4	0.0	0.0	3.0	2.8	0.2	6.7
Total	6.3	5.8	0.4	6.5	4.9	4.5	0.4	8.2

* Calculated as TUMF/TMF*100.

To obtain further information on whether the desire to have no more children is related to the course of the overall fertility decline in Eritrea, women's desire for more children was examined. Table 5 shows data on currently married women's desire for children broken down by the number of living children. The overall proportion of women who want no more children is very low, and has remained constant at about 18 percent since 1995. Previous studies (e.g., Westoff and Bankole 2002) indicate that in sub-Saharan African countries that have experienced sustained fertility decline the proportion of women who want no more children is within the range of 30 to 50 percent. By comparison the proportion of Eritrean women wanting no more children is much lower. According to Westoff and Bankole, this would imply that Eritrea had not experienced a decline or was at the beginning of fertility transition, whereas in fact the country has experienced a remarkable decline in fertility. So, Westoff and Bankole's thesis is not always consistent. Other factors, for instance, military conflict, economic downturn, and other abnormal situations can lead to low aspirations and crisis-led fertility transitions (Avogo and Agadjanian 2007; Hill 2004; Lindstrom and Berhanu 1999). Table 5 also shows that the desire for another child is strongly related to the number of living children a woman has. As the number of living children increases, the proportion of women who desire to have another child declines while the proportion of women who want no more children increases.

Table 5: Percentage of currently married women who want additional children or no more children, by number of living children, 1995 and 2002

	1995				2002			
Number of living children	% want another child	% want no more children	% undecided	% infecund	% want another child	% want no more children	% undecided	% infecund
0	92.9	1.5	4.3	1.2	94.2	0.8	4.0	1.0
1	93.1	3.5	2.0	1.3	93.7	2.2	3.3	0.8
2	88.8	6.2	3.3	1.7	88.0	5.8	4.4	1.8
3	87.6	7.6	2.6	2.2	83.3	9.9	5.2	1.6
4	77.9	15.1	1.9	5.1	68.0	22.2	7.2	2.6
5	66.3	23.8	3.4	6.5	58.6	26.8	9.9	4.6
6	53.2	32.7	8.5	5.6	45.8	41.0	9.6	3.6
7+	33.5	50.3	7.2	9.0	28.2	55.9	9.8	6.1
Total	73.7	18.1	4.1	4.1	73.8	17.6	6.2	2.5

3.4. War-Related Variation in Eritrean Fertility

So far we have used TFR and ASFR to assess the trends in fertility. But such measures do not capture the impact of changes in other factors contributing to family size limitation. Multivariate analyses including socio-demographic factors were used to control for compositional differences that may have contributed to the fertility decline. Analysis and interpretation of the association between the explanatory variables and fertility was facilitated by estimation of separate models for first and higher-order births. We expected some variables, such as age at first marriage, to be more important for first births while others, such as age at birth of previous child, birth order, and previous birth interval, are only applicable for higher parities. Table 6 presents the multivariate results of first birth analysis. Two models are estimated. Model 1 includes calendar year only and Model 2 adds other socio-demographic factors.

The relative probabilities associated with calendar years indicate how much fertility has changed relative to the reference period level (1996–98). Overall, Model 1 shows significantly lower fertility in the early 1990s and before, higher fertility between 1993 and 1998, and significantly lower fertility after 1998. Although it is difficult to establish a direct causal link between military conflict and fertility, the findings offer some evidence that the changes in fertility coincide with three major historical events in Eritrea: the thirty-year war of independence ending in 1992, the subsequent political stability and peace in 1993–98, and the border conflict with Ethiopia starting in 1998. The lower fertility of first births during the early 1990s may be seen as a response to economic decline and political instability caused by the war of independence. The specific demographic effects of conscription of young adults, separation of married couples due to forced migration and mass displacement, and intentional or unintentional postponement of marriages and childbearing during this period can only be guessed at, but it is clear that these factors can reduce fertility. The increase in fertility during 1993–98 could be a reflection of a boom in marriages and births postponed during the war for liberation. This is consistent with studies of pre-industrial Europe (Hobcraft 1996), which indicate a sharp decline in fertility during war years with a rebound in post-war years. The subsequent fertility decline reflects the effect of the recent border conflict. Although the border conflict started in mid-1998, its effect can be observed in 1999 and after. Even after controlling for the socio-demographic factors, the effects of historical period remain almost the same and statistically significant. Thus, historical period exerts a strong and independent influence over fertility and this clearly suggests that a substantial part of the effect of historical period is channeled through other mechanisms.

The results of Model 2 also show that most of the socio-demographic factors are significantly associated with first birth fertility. As expected, age at marriage has a strong effect on first birth fertility, with women who married later (20 or older) being 75 percent less likely to have their first birth than women who married at 16 years or younger. First birth fertility is also lower among married women who are not living with their husbands. The probability of having a first birth is lower among women with secondary or higher education and those who reside in urban areas. The impact of region of residence seems to be contrary to our expectations. The two regions (Gash Barka and Southern) which are considered to be worst affected by the conflict do not show lower fertility compared with other regions. In fact, the Southern region has the highest fertility.

Table 7 displays the multivariate results for higher-order births. Unlike for first births (Table 6), the probability of a higher-order birth increases linearly up to 1995 and then falls significantly. Thus although the decline is accelerated after the border conflict (1999–2001), it already started sometime between 1996 and 1998. As with the results for first births, the effects of historical period on fertility of higher-order births are unchanged when the socio-demographic factors are held constant. Women whose husbands live away are 15 percent less likely to have a child than women whose husbands live with them. Lindstrom and Berhanu (1999) found spousal separation to be the main mechanism by which civil war affected fertility in Ethiopia. Fertility for higher-order births is more likely to be lower among older women (35 or older) than among younger women. A decline in fertility is also observed at higher birth orders (four and above). The survival status of the previous child has a significant effect on fertility, where fertility is higher if the preceding child dies than it survives until the conception of the next birth. The probability of having a higher-order birth decreases significantly with increasing birth interval. The effects of urban/rural childhood residence and education are in the expected direction and statistically significant, where fertility is lower among women with some education and among those who grew up in urban areas. Fertility of higher-order births is significantly lower in Northern Red Sea and Gash Barka regions than in other regions. The lower fertility in Gash Barka region may be a response to the effect of the conflict, although this was not observed in our first birth analysis. One explanation for the lower fertility in the Northern Red Sea region could be that the population of this region is mostly pastoralist or semi-nomadic. Some studies indicate that African pastoral populations have lower fertility rates than sedentary farming populations or than national average (Swift 1977). Swift's study in Somalia shows that pastoral Somali had a lower birth rate (37/1,000 population) than settled Somali (56/1,000 population). Another study in Senegal also reveals lower fertility for nomadic pastoral populations compared to sedentary farming populations (Lacombe, Lamy, and Vaugelade 1975). The same reason can also be expected to apply in the Northern Red Sea region of Eritrea, though further investigation may be needed.

Table 6: Relative risks of first birth associated with selected variables, 2002

	Model 1	Model 2
Historical period		
Before 1990	0.75***	0.54***
1990–1992	0.85***	0.71***
1993–1995	0.94	0.81***
1996–1998	1	1
1999–2001	0.72***	0.90**
Age at first marriage		
<16	–	1
16–19	–	0.61***
≥20	–	0.25***
Spousal separation		
Husband lives with her	–	1
Husband lives away	–	0.94*
Education		
No education	–	1
Primary	–	1.08**
Secondary or higher	–	0.91
Childhood residence		
Rural	–	1
Urban	–	0.90**
Region of residence		
Southern Red Sea	–	1
Maekel	–	1.05
Northern Red Sea	–	1.04
Anseba	–	1.15***
Gash Barka	–	1.05
Southern	–	1.30***

* p<10%, ** p<5%, *** p<1%

Table 7: Relative risks of higher order births associated with selected socio-demographic variables, 2002

	Model 1	Model 2
Historical period		
Before 1990	1.17***	0.98
1990–1992	1.32***	1.17***
1993–1995	1.30***	1.23***
1996–1998	1	1
1999–2001	0.74***	0.76***
Age at birth of previous child		
<20	–	1
20-24	–	1.09***
25-29	–	1.15***
30-34	–	1.11***
35-39	–	0.91**
40+	–	0.64***
Birth order		
2-3	–	1
4-5	–	0.92***
6-7	–	0.83***
8+	–	0.69***
Survival status of previous child		
Alive		1
Dead		1.27***
Previous birth interval (months)		
Less than 18		1
18-23		0.92***
24-35		0.90***
36-47		0.79***
48+		0.73***
Spousal separation		
Husband lives with her	–	1
Husband lives away	–	0.85***
Education		
No education	–	1
Primary	–	0.89***
Secondary or higher	–	0.65***
Childhood residence		
Rural	–	1
Urban	–	0.92**
Region of residence		
Southern Red Sea	–	1
Maekel	–	0.98
Northern Red Sea	–	0.92***
Anseba	–	1.02
Gash Barka	–	0.93**
Southern	–	1.04

* p<10%, ** p<5%, *** p<1%

To examine more closely whether more affected regions exhibit greater fertility response than less affected regions, we ran an interaction term between calendar year and region of residence (Table 8). The results show that fertility declined in all regions during the conflict period and there was little difference in the decline between the more affected (Gash Barka and Southern) and less affected regions. This is probably because the most affected groups, especially the displaced groups in the two regions, were excluded from the survey, as most of them were living in separate camps for internally displaced persons. It is also possible that the war was not associated with the fertility change in these regions. Research indicates that even if some military conflicts are reported to have resulted in short-term fertility changes, most are not associated with such changes. For instance, a study by Agadjanian and Ndola (2002) on Angolan fertility indicates that contrary to their expectations the capital Luanda, which had least direct experience of conflict during the civil war, had the strongest fertility response, while other regions more affected by the war had weak fertility response.

Table 8: Interaction effects of historical period and region of residence on fertility of higher-order births

	Region of residence					
Period	Southern Red Sea	Central	Northern Red Sea	Anseba	Gask Barka	Southern
Before 1990	1.07	1.18	1.08	0.98	1.03	0.75
1990–1992	1.24	1.30	1.43	1.20	1.03	1.01
1993–1995	1.17	1.26	1.45	1.27	1.23	1.07
1996–1998	1	1	1	1	1	1
1999–2001	0.66	0.79	0.91	0.79	0.73	0.70

Note: relative risks relative to the period 1996–98.

4. Discussion and Conclusion

Our major finding is that the substantial decline in fertility in Eritrea in the period since the mid-1990s was less the result of increased demand for family-size limitation and more the result of the border conflict. In other words, the conflict is the primary explanation for the observed fertility decline, particularly the decline among first births, mainly through delayed age at first marriage and spousal separation. This argument is supported by the finding that when these two variables and other socio-demographic factors were included in the model, the effect of historical period on fertility decreased in both magnitude and statistical significance, especially after 1999. In addition, the findings from the cross-tabulation analysis show a decline in adolescent childbearing from 23 percent in 1995 to 14 percent in 2002. However, the effect of historical period still remains strong and significant after controlling for other factors, suggesting that a substantial part of the period effect is explained by other factors that are not included in our analysis (changes in per capita income, health, nutrition, etc.). During war crises, motivation to reproduce declines due to deteriorating economic conditions or declining family income (Lesthaeghe 1989). Because of diminishing job opportunities during periods of war or economic crisis, potential parents delay the next birth or terminate childbearing (Boserup 1985). Palloni, Hill, and Pinto (1996) also contend that since health and nutritional status of pregnant mothers deteriorate during crisis periods, an immediate reduction in the number of births can be expected to fall still further. Psychological stress associated with decline in nutritional status or standard of living is also likely to reduce fecundity and frequency of intercourse.

Another way of expressing these results is to say that the decline in fertility did not come about primarily through an increase in contraception or satisfaction of unmet need for family planning. Contraception remained constant in Eritrea throughout the period 1995 to 2002. Moreover, reported fertility preferences, which are considered an important factor for fertility change, have changed little. The average desired family size remained the same (NSEO and ORC Macro 2003) and the proportion of women who reported that they want no more children is very low, only 17 percent, compared with 30–50 percent among women in other sub-Saharan African countries that have achieved sustained fertility decline (Westoff and Bankole 2002). In concrete terms, the decline in fertility was not preceded by changes in fertility intentions. Despite Eritrea's declining fertility, its unwanted fertility, and the proportion of women wanting no more children remained almost constant. This means that the level of unwanted fertility does not seem to predict the position Eritrea has in the course

of actual fertility transition. These findings challenge the hypothesis that fertility preference precedes actual fertility decline. Since the number of births can decrease due to war-induced effects without women desiring to have smaller families, it may not always be true that changes in fertility preferences will precede the decline in actual fertility. The uncertainty of peace may depress the desire for children.

Our findings from the analysis of higher order births show that the decline did not follow the onset of the conflict in 1998. Rather, the decline started in the period between 1996 and 1998, well before the outbreak of border conflict. Thus, the post-1998 decline may partly be an extension of a long-term decline that began before 1998 and might have continued even without the eruption of the border conflict. The finding that the decline occurred among older women (35 years or older) and at higher parities (four or higher), further corroborates the argument that the decline partly indicates the onset of a long-term fertility transition. Viewed from the sub-Saharan African perspective, Eritrea's fertility decline in terms of higher-order births and among older women that occurred before the conflict partly reflects the general trend of sub-Saharan Africa. The decline in sub-Saharan Africa is characterized by a concentration of declines at high parities and among older women who have achieved or exceeded their desired family size (van de Walle and Foster 1990). Similar relationships between fertility decline and higher-order births and older women were also observed in Latin American countries in the early 1960s (Rodriguez and Hobcraft 1980). One important exception in the Eritrean case is that the decline occurred without any evident reduction in desired family size; this may imply that the decline is mainly unintentional and war-induced. In particular, the rapid decline during the peak years of the border war (1999–2001), suggests that the conflict accelerated the fertility decline of higher-order births. In addition, the fall in first births is noticeable only after 1998, which indicates that the decline is mainly an outcome of the border conflict. The conflict thus cannot have been neutral in effect on the recent fertility decline in Eritrea.

It can be concluded that Eritrea, with its devastating experience of thirty years of war for liberation (1961–91) and the 1998–2000 border conflict, presents an extreme case of war-led changes in both socio-economic and demographic aspects. Even though Eritrea's war, the longest in sub-Saharan Africa, is distinctively disastrous, it still offers lessons for other African countries that are experiencing similar disruption or remain vulnerable to military conflict. The Eritrean case allowed us to investigate how demographic trends, notably fertility, can be altered or modified by military conflict. The inconsistencies of previous studies on the effect of war and associated economic crisis on fertility prompted the decision to disaggregate by first and higher-order births and to incorporate all the potential socio-demographic factors that are considered to affect fertility, even though the data did not allow us to conduct a more specific analysis of time-varying covariates and proximate determinants of fertility.

Even though this study addresses several important aspects and determinants of the recent changes in fertility in Eritrea, some questions could not be addressed due to the cross-sectional nature of the data. For instance, data limitation prevented further analysis of the effects of socio-economic status, both at individual level and macro-level in different areas of the country. Changes in such economic indicators may affect fertility differently in different periods. But even with these limitations our analysis proved sufficient to supply informative inferences. First, as expected, we found a lower probability of first birth during wartime, both during the peak years of the war of independence (before 1992) and during the border conflict (1999–2001) and a rebound in the periods of peace and political stability (1993–1998). Second, the decline in higher-order births started before the conflict, but accelerated during and after the conflict.

Finally, the cross-sectional analysis of fertility and its determinants does not enable any sound predictions of future trends in fertility to be made. In general, with the data used in this study, any attempt to extrapolate the differences discovered between the periods before and after the conflict would be highly speculative, especially because the political situation remains volatile and the 1998–2000 border conflict is still unresolved and further complicates the country's demographic situation. Studies suggest that war-

related short-term swings in fertility are easily detectable, but long-term effects of war- or crisis-induced distress are more complex to establish (Lindstrom and Berhanu 1999). Nevertheless, although we have no reason to think that the border conflict has caused lasting change in Eritrea's fertility, it is plausible to conclude that it has a clear short-term impact across different socio-economic segments of the population, particularly in terms of first-birth fertility, and that these variations are likely to mark the course of future demographic transition.

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